

Programme and Abstracts



sefs-5

symposium for european freshwater sciences

Palermo, July 8 - 13, 2007



Convened by the **European Federation for Freshwater Sciences (EFFS)**

With the contribution of:
The President of the Sicilian Region



Organizing Committee

Luigi **Naselli-Flores** (Italy)
Rossella **Barone** (Italy)
Riccardo **de Bernardi** (Italy)
Alan **Hildrew** (UK)
Judit **Padisák** (Hungary)
Francesco M. **Raimondo** (Italy)
Colin S. **Reynolds** (UK)
Enzo **Saggiomo** (Italy)
Roger **Sweeting** (UK)

Under the auspices of:
Municipality of Palermo
Faculty of Sciences of the
University of Palermo
Sicilian Region

organised by:
Department of Botanical Sciences – Botanical Garden
University of Palermo
Italian Association for Limnology and Oceanography (AIOL)
Freshwater Biological Association (FBA)

Supported by sponsorship from:



Ecology of
FRESHWATER FISH



sponsored the session
Biological Interactions

Freshwater Biology

sponsored the session
Structure-function relationship in running water ecosystems: from theory to application

CONTENTS

	Page
Welcome and Information.....	3
Programme.....	7
Abstracts.....	27
Index to Authors of Oral & Poster Presentations.....	274
List of participants.....	281

WELCOME & INFORMATION

Welcome

The Organizing Committee welcome you to the Fifth Symposium for European Freshwater Sciences (SEFS5) hosted by the Department of Botanical Sciences, University of Palermo, in its Botanical Garden, from 8 to 13 July 2007. The meeting is organised in cooperation with the Freshwater Biological Association (FBA) and the Italian Association of Oceanology and Limnology (AIOL).

These Symposia, coordinated by the FBA in collaboration with other European freshwater and limnological Associations, are held every two years: the first took place in Antwerp (Belgium) in 1999, the second in Toulouse (France) in 2001, the third in Edinburgh (Scotland) in 2003 and the fourth in Krakow (Poland) in 2005. The FBA and these associations have the wish to create a stronger European Federation for Freshwater Sciences (EFFS), whose goals were summarised in a constitution which was presented at the SEFS4 held in Krakow.

Like the previous Symposia, SEFS5 will be devoted to basic questions in freshwater biology and various aspects of applied freshwater science. We would like to bring together all European scientists working on freshwater organisms, freshwater habitats, and freshwater systems. Special attention is devoted to students and young scientists who are at the beginning of their career: the Symposium is an ideal occasion to meet their colleagues and look for reciprocal inspiration, share knowledge, exchange experience and ideas about freshwater ecosystems in the broadest sense and...last but not least, have a nice time.

We hope you enjoy the programme, but also that you have the opportunity to visit something of Palermo and Sicily.

Humans were present in Palermo at the end of the Pleistocene Epoch, about 10,000 years ago. Cave

drawings confirm a presence by 6000 BC, if not earlier, and there is no evidence to suggest anything but a continuous presence since that period. In any case, Palermo is one of the few cities in the world that has preserved considerable traces of the culture of its successive conquerors: from the Phoenicians to the Romans and the Byzantines, from the Arabs to the Normans, from the Swabians to the French, from the Spaniards to the Austrians, they have all left unmistakable marks of their passing; and these are invaluable testimonies, since this convergence of different styles and shapes and cultures, from the North of Europe to Africa, from the Middle Ages to the Baroque period, has given birth to a variety of absolutely original artistic, architectural, and decorative creations as well as to...a peculiar gastronomy.

Moreover, Palermo is linked to freshwater sciences through the very famous paper by G.E. Hutchinson "Homage to Santa Rosalia or why are there so many kind of animals" (The American Naturalist, 1959, 93:145-159) where he writes that "we may take Santa Rosalia as the patroness of evolutionary studies".

Actually, Santa Rosalia is the chief patroness of Palermo and a big celebration in her honour takes place in mid-July every year, since 1624. The fame of the Festino - as the festivity is called by the local population - is due to the sense of magnificence that the civil and religious authorities, expressing the wish of the people, desired to create in their intent to demonstrate Palermo's profound gratitude to the Saint who had saved the city from a great pestilence in the year 1624.

General information

Travel to Palermo is easy. Its airport is well connected to Milan and Rome, and there is a train and bus service connecting the airport to the city centre.

Plenary lectures and Session A will be held at the *San Mattia ai Crociferi* auditorium. *San Mattia* is an ex church belonging to the Municipality of Palermo and it is located in *Via Torremuzza, 20*. The Symposium sessions B, C and D will be held in the facilities of the Botanical Garden (*Orto Botanico - Via Lincoln, 2/b*) within a few minutes' walk from the historical centre of the city and from the hotels. Urban bus service also connects the hotels and the Botanical Garden. Tickets are available at every news stand and tobacconist; the fare is 1 Euro.

Registration

Upon arrival, please register at the SEFS5 registration desk at the Botanical Garden at *Via Lincoln 2*. Collect your delegate pack and your name badge. You are requested to wear your name badge at all times. The registration desk will be open on Sunday 8 July, 15:00-20:00. From Monday 9 July to Friday 13 July the desk will be open from 8:00 to the end of the last session, with a lunch-time break. On Wednesday 11 July the desk will be open 7:30-9:30.

Welcome reception

On Sunday 8 July, at 18:30 a get-together party will take place at the Botanical Garden, *Via Lincoln 2/b*.

Symposium dinner

Palazzo Butera (*Via Butera, 8*), one of the most beautiful residential buildings in the historical centre of Palermo, will host the symposium dinner on Friday 13 July at 19:30. The palace is located in front of the sea, close to the Botanical Garden and to "Porta Felice" one of the main gates to the old city, and has a large terrace facing the Gulf of Palermo. It was built at the beginning of the XVII century in the Arabic "Kalsa" quarter ("al-halisah" that means "the elected one" in Arabic), and was called "Domus magna" for its great dimensions. Dishes from the traditional Sicilian cuisine, accompanied by baroque music, will be served on its terrace.

Scientific Sessions

Oral presentations are scheduled to last 20 minutes, 15 minutes of presentation and 5 minutes for questions. Plenary lectures are scheduled to last 40 minutes with 5 minutes for questions. Chairs of sessions will be asked to keep strictly to the published schedule, so please keep your talk to 15 or 35 minutes as appropriate. Facilities will be available for *Powerpoint* presentations (PC with CD-Rom drive and USB-port, but with no floppy or zip drive and unzipping software). Those who need to project slides

or overheads are kindly requested to contact the Secretary of the Symposium.

To avoid confusion, *Powerpoint* files should be named with your surname and initials in the format *SmithAB.ppt*. Speakers should deposit their presentations with the Volunteer Audio-Video Helpers in the appropriate Lecture Room between 7:30 to 8:30 for morning and between 12:30 and 13:30 for afternoon sessions. Presentations will be loaded onto the hard drive of the computer in the appropriate Lecture Room before your session and will be removed afterwards.

Poster presentations

Posters should be prepared in A0 format (119 x 84 cm, portrait orientation). Poster boards will be labelled with number of your poster (to be found in Poster listed by session and topic, see page 21). Posters can be affixed with double sided tape. Delegates presenting a poster are kindly asked to bring fixings with them. Posters should be mounted before the relevant poster session and authors are kindly asked to be present by their poster during the allocated session. Please remember to bring enough A4 handouts of your poster. The "pockets" to stack them will be available at each poster stand.

Posters for Poster session 1 should be mounted by 14:00 on Monday 9 July: this can be done either on Sunday 8 July between 14:00 and 19:00, or at any time from 8:00 onwards on Monday. All posters from session 1 should be removed by 20:00 on Tuesday evening, at the latest. Poster for session 2 should be mounted by 14:00 on Thursday 12 July: this can be done on Wednesday 11 July in the morning or at any time from 8:00 onwards. All posters should be removed by 16:30 on Friday 13 July.

Student prizes

Prizes will be awarded at the closing meeting on Friday 13 July, for the best oral paper and the best poster presented by students.

Special Session

Structure-function relationship in running water ecosystems: from theory to application

Convenors: Angelo Solimini¹ and Leonard Sandin²

¹ - EC - Joint Research Centre, 21020 Ispra - Italy

² - Swedish University of Agricultural Sciences, 750 07 Uppsala - Sweden

This session, with 26 oral presentations, will take place on Monday 9 and Tuesday 10 July. See page

141 and the programme at the pages 8 and 12 for more details.

Evening Workshop

Changes in ecology of Mediterranean shallow lakes at the face of climate change

Convenor: Meryem Beklioglu

Biology Department, Middle East Technical University, 06531 Ankara - Turkey

(Workshop is scheduled on Tuesday 10 at 7.00 pm, room B).

Workshop Outline:

Mediterranean climate, with dry sub-tropical summers, dominates regions from 32° to 40° north and south of the Equator. It covers five significant regions among which that bordering the Mediterranean Sea is the focal point of this workshop. In Mediterranean regions there is a segregation of two well-separated seasons, a wet winter, during which most of the precipitation is concentrated, and an arid summer with no precipitation. Summer drought places a great deal of stress on the hydrology of freshwaters, especially shallow lakes. Changes in hydrological regimes may especially affect growth rates, timing of reproduction, balance of photosynthesis and respiration, rates of mineralization, with local to large-scale regional effects. The Mediterranean region is considered as one of the most sensitive areas regarding global warming and extreme climate changes. The predicted trend of mean precipitation for the Mediterranean zone is of significantly decreasing seasonal precipitation with important fluctuations. Furthermore, the daily temperature range is anticipated to be larger than at present, and extreme cold and hot days are expected to increase in frequency with a higher overall increase of 0.1 to 0.4 °C decade⁻¹, which is twice that of northern Europe. According to general circulation models, the mean annual precipitation is expected to decrease south of 45° N. Winter precipitation is expected to fall, due to less rain and snow, and earlier snowmelt (e.g. shifting to January, February and March). Consequently, shortage of rainfall is expected to accentuate water level fluctuations in shallow Mediterranean lakes (SMLs). Prolonged drought periods in SMLs may emphasise the issue of increased salinity and conductivity, enhancing internal nutrient recycling and affecting communities as mentioned above. This would favour eutrophication and particularly outbreaks of inedible and possibly toxic algae. Possible alterations in major ions and nutrient dynamics are likely to affect distinctly the state of shallow lakes and food webs, maybe in some of the ways aforementioned. In some of our minds there is the idea that many of our SMLs will become temporary lakes with increased salinity level in the future.

Practical information

Meals

The registration fee does not include lunch, but this can be purchased in many places nearby at a reasonable price. Coffee/tea will be served during the Symposium in a Coffee corner located inside the Botanical Garden.

Noticeboard

There will be a Noticeboard in front of the Reception Desk for conference announcements and for delegates to place messages for each other. Please refer to this noticeboard for any changes in the conference programme or arrangements during the Symposium

Internet

Free internet access is available to delegates. Please, ask the Registration Desk for more information.

Banks & Money exchange

Official currency is Euro. 1 Euro is approx 1.35 USD, You can change money in one of countless exchange offices in the city centre, in banks and in hotels.

There is a Cashline machine (*Bancomat*) inside the Rectorate of the University, Palazzo Steri, *Piazza Marina 61*. There are also numerous banks and cash machines elsewhere in the city centre.

Opening times

Banks: open 8.20 am-15.45 pm, Monday-Friday

Shops: usually open 9 am-1 pm and 4 pm-8 pm, Monday-Saturday

Pharmacies: as the shops; closed on Saturday

Post Offices: open 8.15 am-1.30 pm, Monday-Friday closed on Saturday

Useful telephone numbers

Italian area code: + 39

Palermo area code: 091 (+ 39 091 from abroad)

Police: 113

Carabinieri: 112

Health emergency: 118

Fire Brigade: 115

Excursions

Wednesday is the day of the mid-symposium excursion. We offer you three options, each one presenting natural and archaeological aspects of Sicily. The price (Euro 40) includes bus transportation,

entrance to museums, lunch and an English-speaking guide. Comfortable shoes, light clothes and eventually hats, sunglasses and creams will be needed. All excursions are open for pre-booked persons only. We regret that we can no longer assure any further bookings, but we advise you to check with the Symposium Secretariat at the Registration desk whether you can join one of the three excursions. All excursions will depart from the Botanical Garden at 7:30. Return is planned at 19:00.

The Valley of the Temples and the Garden of the Kolymbetra

The archaeological area known as the Valley of the Temples is one of the most important archeological sites in the world and a UNESCO world heritage site since 1998. It is located close to the city of Agrigento, the ancient Akragas, which at its heyday, was a flourishing cultural centre: it gave the world Empedocles, the pre-socratic philosopher, whose concept of matter as divided into four elements- Earth, Air, Fire and Water- was the foundation of science for many centuries to come. The city attracted poets like Simonides and Pyndar who described it as "the most beautiful of mortal cities". Along a long rocky scarp, chosen as the southern limit of the town, are still sited the great temples of ancient Akragas: Hera (Juno) Lacinia, Concordia, Heracles (Hercules), Olympian Zeus (Jupiter), Castor and Pollux (Dioscuri) and Hephaistos (Vulcan). At the mouth of the river there was the harbour and emporion (trading-post) of the ancient city. Lunch will be served at the garden of the Kolymbetra, an archeological and agricultural site located in a narrow valley close to the Greek temples. It is a small jewel with an extraordinary landscape that has been recently re-discovered and open to the public.

Trapani saltworks and Erice village

Located on high ground overlooking the northern coast of western Sicily, ancient Eryce was a prosperous Elymian city, Eryx, famous for its temple to a fertility goddess, Astarte, later identified with Venus and worshipped by the Romans. The city owes its name to Eryx, mythical ruler of the Elymi. The Phoenicians, Carthaginians and Romans, in turn, conquered the city, which never developed a particularly strong Greek culture except for that of the medieval Byzantines of the Eastern Roman Empire. To the Saracens, Erice was an important foothold known as Gebel Hamed, which the Normans named "Monte San Giuliano", a name by which it was known

until 1934, when it was given its older Latin nomenclature.

Looking down from Erice towards the Egadi Islands, the huge extension of water below presents a geometrical design of darker intersecting lines: these are the salt-works of Trapani. Idris, a famous Arab traveller, reports his testimony on the salt-works, already during the Norman period (XII century). Under the reign of Frederick of Swabia they became a government monopoly as well as during the domination of the French Anjou. The hard task of the salt workers went on exploited and monopolised through the various dominations, and the landscape hardly changed, with the same stones (tufa), the windmills that relieved the men from hard work and the spectacular colours that the waters take at sunset, according to the different salt concentrations: amaranth, vermilion, purple, ruby. The war of the Vesper and the supremacy of the Aragonese crown, which took over the island, marked the return to private property. Hard work went on. The men sweat under the hot sun of Trapani during the period when the salt is collected, by hand, with archaic means of collection and transport.

Selinunte and River Belice Natural Reserve

Selinunte (from Selinon, the wild celery) is an ancient Greek city, with ruins of an acropolis and numerous temples. Today, the city is included in the largest archeological park in Europe. The city was founded in the seventh century BC, and destroyed by the Carthaginians in 409 BC. Although Selinunte only lasted for a period of about two centuries, it was one of the most progressive Greek cities in Sicily, famous throughout Magna Graecia.

It is located by the Mediterranean Sea in the southwest coast of Sicily and was founded by Doric Greeks from the Sicilian Greek settlement of Megara Hyblea on Sicily's east coast. Thanks to its strategic position and through the development of an exceptional trading network, Selinunte grew rapidly up and became one of the most important cities of Greek Sicily and of Magna Graecia, second in importance only to Syracuse.

The River Belice is one of the few permanent rivers in Sicily. Its mouth is located close to Selinunte and is included in a coastal natural reserve which preserves the dunal environment typical of the sandy coast of Southern Sicily.

PROGRAMME**Sunday 8 July 2007**

- 14.00 Registration, mounting posters (Session 1) and setting up of exhibition stands (to 20.00)
18.30 **Welcome Party** (the Botanical Garden)

Monday 9 July 2007

- 7.30 AV testing & loading for morning speakers in the appropriate room (A, B, C or D)
8.00 Registration, mounting posters (Session 1)
9.00 **Welcome (San Mattia ai Crociferi - Session A)**
9.00 Welcome Addresses and announcements
9.05 Francesco M. Raimondo: Dean of the Faculty of Science and Director of the Botanical Garden
9.10 Enzo Saggiomo: Chairman of the Italian Association of Oceanology and Limnology (AIOL)
9.15 Colin S. Reynolds: Chairman of the European Federation for Freshwater Sciences (EFFS)
9.20 *Plenary lecture 1* (see next page)

Monday 09 July 2007

7.30 AV testing & loading for morning speakers in the appropriate room (A, B, C or D)

8.00 Registration, mounting posters (Session 1)

Session A (San Mattia ai Crociferi)

- 9.20 **Plenary lecture 1** Chair: *Colin S. Reynolds*
Vera Istvánovics
 The role of biota in P cycle in aquatic environments
- 10.00 **Plenary lecture 2** Chair: *Colin S. Reynolds*
Eva S. Lindström
 Structure and diversity of bacterial communities, does it matter for lake ecosystems?
- 10.40 COFFEE/TEA
- Structure-function relationship in running water ecosystems: from theory to application 1** Chair: *A. Solimini*
- 11.10 *J.I. Jones, F.K. Edwards, R.B. Lauridsen, A. Ibbotson, C.E. Davies, G. Woodward, M. Emmerson, A.G. Hildrew*
 The structure and functioning of a manipulated stream ecosystem
- 11.30 *Russell Death, Zoe Dewson, Alex James*
 Is structure or function a better measure of the effects of water abstraction on ecosystem integrity?
- 11.50 *Regis Cereghino, Antonio Ruggiero*
 Influence of intermittent disturbance on the diversity, secondary production and trophic relationships of macroinvertebrates in a mountain stream
- 12.10 *Arturo Elosegi, Oihana Izagirre, Alba Argerich, Eugenia Marti*
 Impact of water diversion for hydropower on nutrient retention in streams
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 3** Chair: *Luigi Naselli-Flores*
Rainer Kurmayer
 Cyanobacteria and toxin production in freshwater: research priorities from a limnological perspective
- Structure-function relationship in running water ecosystems: from theory to application 2** Chair: *A. Solimini*
- 14.50 *Brendan G. McKie, Björn Malmqvist*
 Assessing the effects of forest management on stream ecosystem integrity: differential responses of structural and functional measures
- 15.10 *P. Usseglio-Polatera, V. Archambault, P. Pinto, M. Morais, B. Bis, K. Gritzalis, I. Karaouzas*
 Invertebrate traits for the biomonitoring of European rivers: assessing the effects of various stressors
- 15.30 *John S. Richardson, Trent M. Hoover, Antoine Lecerf*
 Organic matter dynamics in small streams: linking function to structural changes caused by catchment land-uses
- 15.50 *Leonard Sandin, Jenny Bergfur*
 Leafs or bugs? Are leaf litter breakdown a better indicator of eutrophication than community composition of the biota
- 16.10 COFFEE/TEA
- Structure-function relationship in running water ecosystems: from theory to application 3** Chair: *Martin Pusch*
- 16.40 *E. Marti, F. Sabater, T. J. Battin, J. L. Riera, S. Gafny, B. Gücker, P. Guilherme, M. T. Pusch, A. Solimini, P. Vervier, C. Voreadou*
 Effects of stoichiometry and source of nutrient inputs on retention of multiple nutrients in streams
- 17.00 *Björn Gücker, Iola G. Boechat*
 Impacts of agricultural land-use on ecosystem structure and function of tropical Cerrado streams
- 17.20 *Alexander Milner, Chris Fastie, Terry Chappin*
 Interactions and linkages between streams and other ecosystems during landscape evolution
- 17.40 *Christian K. Dang, Michael M. Sturt, Marcel A.K. Jansen, Paul S. Giller, Simon Harrison*
 An intriguing link between macroinvertebrate elemental composition and pollution tolerance
- 18.00 *Helmut Fischer, Annette Becker, Volker Kirchesch, Andreas Schoel*
 Dynamics of algae and nutrients along a lowland river continuum from its middle section to the estuary

Monday

Session B

- 9.20 **Plenary lecture 1** *Chair: Colin S. Reynolds*
Vera Istvánovics
The role of biota in P cycle in aquatic environments
- 10.00 **Plenary lecture 2** *Chair: Colin S. Reynolds*
Eva S. Lindström
Structure and diversity of bacterial communities, does it matter for lake ecosystems?
- 10.40 COFFEE/TEA
- Microbial Systems 1** *Chair: Beatriz Modenutti*
- 11.10 **Tomasz ADAMCZEWSKI, Ryszard Jan CHRÓST**
[How the concentration and availability of organic matter and nutrients affects the bacterial community composition in lakes? - Long-term *in situ* and mesocosm investigations \(Mazurian Lake District, Northeastern Poland\)](#)
- 11.30 **Roberto BERTONI, Cristiana CALLIERI, Esteban BALSEIRO, Beatriz MODENUTTI**
Susceptibility of bacterioplankton to nutrient and substrate addition in ultraoligotrophic Patagonian lakes
- 11.50 **M.COCI, P.L.E. BODELIER, H.J. LAANBROEK**
[Ecology of ammonia-oxidising bacteria in freshwater shallow lakes](#)
- 12.10 **C. CALLIERI, B. MODENUTTI, E. CARAVATI, G. CORNO, E. BALSEIRO, R. BERTONI**
Picophytoplankton of Andine deep ultraoligotrophic lakes: a comparison with the oligo- mesotrophic subalpine Lake Maggiore
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 3** *Chair: Luigi Naselli-Flores*
Rainer Kurmayer
Cyanobacteria and toxin production in freshwater: research priorities from a limnological perspective
- Microbial Systems 2** *Chair: Roberto Bertoni*
- 14.50 **Maria Carolina SOARES, Miquel LÜRLING, Vera HUSZAR**
Effect of temperature, light and nutrients on growth of and competition between *Cylindrospermopsis raciborskii* and *Microcystis aeruginosa*
- 15.10 **Anne ROLLAND, Frédéric BERTRAND, Stéphan JACQUET**
[Phytoplankton Structure and Succession in the Reservoir Marne \(Seine Catchment Area, France\): A Multitable Approach](#)
- 15.30 **Beatriz MODENUTTI, Esteban BALSEIRO, Cristiana CALLIERI, Roberto BERTONI**
Light and resource supplies as factors modulating niche partitioning in two pelagic mixotrophic ciliates
- 15.50 **Adeline WALL, Michel MAGNY, Daniel GILBERT**
The role of testate amoebae in benthic microbial communities in lakes (Jura, France) : ecological and paleo-ecological studies
- 16.10 COFFEE/TEA
- Temporary and Permanent Wetlands and Ponds** *Chair: Andy Green*
- 16.40 **S. ANGELIBERT, B. OERTLI, D. AUDERSET JOYE, E. CASTELLA, R. JUGE, J.-B. LACHAVANNE**
Differences between abiotic and biotic typologies of Swiss ponds
- 17.00 **Liesbet BOVEN, Luc BRENDONCK**
[Cladoceran succession in hydrologically different temporary pools](#)
- 17.20 **Jan HERRMANN**
Can artificial wetlands favour biodiversity?
- 17.40 **Jenny DAVIS**
Wetlands need water: the influence of interannual variability in rainfall on wetland macroinvertebrate communities
- 18.00 **Davis GRUBERTS**
The flood pulse concept in the ecology of floodplain lakes of the middle Daugava river
- 18.20 **Amael PAILLEX, Sylvain DOLÉDÉC, Emmanuel CASTELLA, Sylvie MÉRIGOUX**
[Invertebrate metrics for assessing lateral connectivity and food resources in a large alluvial floodplain](#)

Session C

- 9.20 **Plenary lecture 1** Chair: Colin S. Reynolds
Vera Istvánovics
The role of biota in P cycle in aquatic environments
- 10.00 **Plenary lecture 2** Chair: Colin S. Reynolds
Eva S. Lindström
Structure and diversity of bacterial communities, does it matter for lake ecosystems?
- 10.40 **COFFEE/TEA**
- 11.10 **Biological Interactions 1** Chair: Martin Dokulil
Joséphine LEFLAIVE, Yvan NICAISE, Loïc TEN-HAGE
[Allelopathic interactions between two green algae, the benthic *Uronema confervicolum* and the planktonic *Scenedesmus quadricapsa*](#)
- 11.30 **Johan Vande VOORDE, Maria Betânia G. SOUZA, Miquel LÜRLING, Petra VISSER, Hans MATTHIJS, Jef HUISMAN**
The green beats the blue: allelopathy between *Monoraphidium minutum* and *Planktothrix agardhii*
- 11.50 **R.B. LAURIDSEN, F. K. EDWARDS, J.I. JONES, M. BOWES, G. WOODWARD, A.G. HILDREW**
[Stoichiometric constraints on secondary production in a headwater stream food web](#)
- 12.10 **F.K. EDWARDS, R.B. LAURIDSEN, J.I. JONES, A. IBBOTSON, W. BEAUMONT, C.E. DAVIES, G. WOODWARD, A.G. HILDREW**
Making space for the newcomer: trophic niche separation in an invaded food web
- 12.30 **LUNCH** (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 3** Chair: Luigi Naselli-Flores
Rainer Kurmayer
Cyanobacteria and toxin production in freshwater: research priorities from a limnological perspective
- Large Lakes** Chair: Judit Padisák
- 14.50 **Giuseppe MORABITO**
Changing patterns of phytoplankton succession in Lago Maggiore across 25 years: spring diatoms vs. summer cyanobacteria and the role of the local climate
- 15.10 **Anna VISCONTI, Marina MANCA, Riccardo DE BERNARDI**
[Implications of temperature increase for the zooplankton of Lake Maggiore](#)
- 15.30 **Jean-Pierre DESCY, Hugo SARMENTO, François DARCHAMBEAU, Mwapu ISUMBISHO**
Plankton ecology of Lake Kivu and the consequences of a planktivore introduction
- 15.50 **Nadezhda BEREZINA**
New state of benthos in large lakes of European Russia as a result of human-mediated stresses
- 16.10 **COFFEE/TEA**
- Life Histories** Chair: Giampaolo Rossetti
- 16.40 **Jochen VANDEKERKHOVE, Tadeusz NAMIOTKO, Francesc MEZQUITA, Giampaolo ROSSETTI**
Longevity of sexual and asexual females of *Eucypris virens* (Crustacea: Ostracoda) in the presence and absence of males
- 17.00 **Maria Joao MARTINS, Jochen VANDEKERKHOVE, Tadeusz NAMIOTKO, Giampaolo ROSSETTI**
[Differences in egg tolerance, hatching success and postembryonic development between sexual and asexual lineages of the geographic parthenogen *Eucypris virens* under contrasting laboratory conditions](#)
- 17.20 **Jean-Nicolas BEISEL, Vincent MEDOC**
Host manipulation by an acanthocephalan parasite (*Polymorphus minutus*): escape performance of an intermediate host (*Gammarus roeseli*) against non-host predators
- 17.40 **Núria CID, Carles IBÁÑEZ, Narcís PRAT**
[Life history and production of the burrowing mayfly *Ephoron virgo* \(Ephemeroptera: Polymitarcidae\) in the lower Ebro river \(NE Spain\): a comparison after 18 years](#)
- 18.00 **Tomás DERKA, Marek SVITOK**
Population dynamics of mayflies (Ephemeroptera) in Carpathian mountain stream
- 18.20 **Isabel PARDO, Liliána GARCÍA, Maruxa ÁLVAREZ**
Temperature and food quality induces changes on life-history parameters in a dominant detritivore: *Brillia bifida* (Diptera: Chironomidae)

Monday

Session D

- 9.20 **Plenary lecture 1** *Chair: Colin S. Reynolds*
Vera Istvánovics
 The role of biota in P cycle in aquatic environments
- 10.00 **Plenary lecture 2** *Chair: Colin S. Reynolds*
Eva S. Lindström
 Structure and diversity of bacterial communities, does it matter for lake ecosystems?
- 10.40 COFFEE/TEA
- Conservation and Management of Freshwaters 1** *Chair: Bruno Maiolini*
Ian POMIAN-SRZEDNICKI, Pascale M. NIREL
 Influence of Groundwater on surface Water Chemistry: a Geochemical Attesting Tool
- 11.10 **Cayelan C. CAREY, Kathryn L. COTTINGHAM, Kathleen C. WEATHERS**
[Increased phosphorus concentrations at the sediment-water interface trigger cyanobacterial blooms in an oligotrophic lake](#)
- 11.30 **M. DIAZ, F. PEDROZO, C.S. REYNOLDS, P. TEMPORETTI**
 Oligotrophy in Patagonian Lakes: the case for nitrogen regulation
- 11.50
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 3** *Chair: Luigi Naselli-Flores*
Rainer Kurmayer
 Cyanobacteria and toxin production in freshwater: research priorities from a limnological perspective
- Conservation and Management of Freshwaters 2** *Chair: Bruno Maiolini*
Joanna MANKIEWICZ-BOCZEK, Katarzyna IZYDORCZYK Tomasz JURCZAK
 Occurrence of microcystin-producing cyanobacterial in Polish water bodies and associations with environmental factors
- 14.50
- 15.10 **Corinne GRAC, Florence LE BER, Michèle TRÉMOLIÈRES**
 Response of biological indices to pressures in the running waters of the Alsace floodplain (Eastern France).
 Towards a proposal of a new tool to assess ecological status of waterbodies
- 15.30 **F.E. Matheson, A.M. Dugdale, R.D.S. Wells, A. Taumoepeau, J.P. Smith**
 Efficacy of saltwater solutions to kill invasive freshwater species in New Zealand
- 16.10 COFFEE/TEA
- High Mountain Ecosystems** *Chair: Martin Dokulil*
Michela ROGORA, Aldo MARCHETTO, Rosario MOSELLO, Gabriele TARTARI, Julieta MASSAFERRO
 The nitrogen status of remote lakes in different regions of the globe: the Italian Alps compared to Andes, Himalaya and the Svalbard Islands
- 16.40 **Roberta PISCIA, Patrizia COMOLI, Marina MANCA**
[Daphnia's egg bank in the small Himalayan Lake Piramide Inferiore \(LPI\)](#)
- 17.00 **Silvia TAVERNINI, Raul PRIMICERIO, Giampaolo ROSSETTI**
 Zooplankton assembly in lentic waters is primarily driven by local processes
- 17.20

Tuesday 10 July 2007

7.30 AV Testing & loading for morning speakers in the appropriate lecture room (A, B, C or D)

Session A (San Mattia ai Crociferi)

- 8.30 **Plenary lecture 4** Chair: Alan G. Hildrew
Luc De Meester
 Evolution and our understanding of the ecology of aquatic ecosystems
- 9.20 **Structure-function relationship in running water ecosystems: from theory to application 4** Chair: K. Tockner
 Alan Hildrew, Ian Sanders, James Pretty, Mark Trimmer
 Are our rivers healthy? Community structure and ecosystem function in UK chalk streams
- 9.40 J. Artigas, A.M. Romani, S. Sabater, A. Gaudes, I. Muñoz
Benthic structure and metabolism in a Mediterranean stream: from the biological communities to the whole stream ecosystem function
- 10.00 Monica Pinardi, Marco Bartoli, Pierluigi Viaroli
Nutrient and organic matter balances in fluvial segments characterized by different ecological integrity: external supply, macrophytes uptake and bacterial processes
- 10.20 COFFEE/TEA
- 10.50 **Structure-function relationship in running water ecosystems: from theory to application 5** Chair: K. Tockner
 John Schade, Steve Thomas, Jill Welter
 Coupling nitrogen and phosphorus spiraling in streams: organism > stoichiometry and the relative use of nutrients
- 11.10 Trey Simmons, Charles P. Hawkins
 Functional assessment of stream ecosystems using leaf litter breakdown rates: how well can we account for natural variability among streams?
- 11.30 Wouter van de Bund, Angelo Solimini
 Structural and functional indicators in Water Framework Directive assessment methods
- 11.50 M. T. Pusch, B. Gücker, A. Solimini, E. Martí, M. Morais, F. Sabater, M. Gerino, C. Voreadou
 Effects of wastewater discharge on ecosystem metabolism of European streams: an intersite comparison
- 12.10 Roger Young, Kevin Collier
 Contrasting responses to catchment modification among a range of functional and structural indicators of river ecosystem health
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 5** Chair: Alan G. Hildrew
Anja Rubach
 Habitat complexity affects resource versus consumer control in benthic food webs
- 14.50 **Structure-function relationship in running water ecosystems: from theory to application 6** Chair: L. Sandin
 Steven A. Thomas, John Schade, Camille McNeely, Jill Welter
 Towards the use of ecosystem-scale variables in stream bioassessment
- 15.10 Klement Tockner
 Environmental heterogeneity as a controller of biodiversity and ecosystem processes in riverine landscapes
- 15.30 Nikolai Friberg, John B. Christensen, Jon S. Olafsson, Gisli Mar Gíslon
 Relationships between structure and function in streams contrasting in temperature: possible impacts of climate change on running water ecosystems
- 15.50 Guy Woodward
 Biodiversity, ecosystem functioning and food webs in freshwaters: assembling the jigsaw puzzle
- 16.10 Angelo G. Solimini, Leonard Sandin
 Structure-function relationship in running water ecosystems: from theory to application: Concluding remarks
- 16.30 COFFEE/TEA
- 16.50 **POSTER SESSION 1**
- 19.00 **EVENING WORKSHOP (Room B)**
 Changes in ecology of mediterranean shallow lakes at the face of climate change
 Convenor: Meryem Beklioglu

Tuesday

Session B

- 8.30 **Plenary lecture 4** Chair: Alan G. Hildrew
Luc De Meester
 Evolution and our understanding of the ecology of aquatic ecosystems
- Biological Interactions 2** Chair: Esteban Balseiro
 9.20 *H.M. Vincent, J.F. Murphy, A.M. Milner, M.E. Ledger*
[Herbivory among algal mosaics in a chalk stream](#)
- 9.40 *Jonas PERSSON, Tobias VREDE, Staffan HOLMGREN*
 Food quality and quantity effects on zooplankton populations: responses to whole lake enrichments in an oligotrophic sub-alpine lake
- 10.00 *Nicoletta RICCARDI, Gianluigi GIUSSANI*
 Long term variation of the zooplankton assemblage in a shallow eutrophic lake
- 10.20 COFFEE/TEA
- Biological Interactions 3** Chair: Björn Malmqvist
 10.50 *Gideon GAL, Tamar BSOR*
 The role of zooplankton as a nutrient source in a meso-eutrophic lake: merging observations and modeling results
- 11.10 *Esteban BALSEIRO, Beatriz MODENUTTI*
Daphnia distribution in Andean Patagonian Lakes: Effect of low food quality and fish predation
- 11.30 *Roger JONES, Jonathan GREY*
 Converting to biogas - the chironomids' tale
- 11.50 *Alain MAASRI, Stephanie FAYOLLE, Evelyne FRANQUET*
[Grazing selectivity of *Eukiefferiella claripennis* \(Chironomidae: Orthoclaadiinae\) on two different epilithic algal assemblages](#)
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 5** Chair: Alan G. Hildrew
Anja Rubach
 Habitat complexity affects resource versus consumer control in benthic food webs
- Biological Interactions 4** Chair: Nicoletta Riccardi
 14.50 *Andy J. GREEN, Marta I. SANCHEZ, J. FIGUEROLA*
 Spatial and temporal patterns in the dispersal of anostracans by waterbirds
- 15.10 *Björn MALMQVIST, Darius STRASEVICIUS*
 Aquatic insects play important roles in terrestrial processes
- 15.30 *Jari SYVÄRANTA, Roger I. JONES*
[Stable isotopes indicate changes in feeding niche widths of perch \(*Perca fluviatilis*\) and roach \(*Rutilus rutilus*\) after competitive release](#)
- 15.50 *H. JOUSHIDE, J. IMANPOUR, H. KHARA*
 Study of feeding regime of the Persian sturgeon (*Acipenser persicus* Borodin- 1897) of the Caspian Sea in different age classes
- 16.30 COFFEE/TEA
- 16.50 **POSTER SESSION 1**
- 19.00 **EVENING WORKSHOP**
 Changes in ecology of mediterranean shallow lakes at the face of climate change
 Convenor: *Meryem Beklioglu*

Session C

- 8.30 **Plenary lecture 4** Chair: Alan G. Hildrew
Luc De Meester
Evolution and our understanding of the ecology of aquatic ecosystems
- Physical Constraints 1** Chair: Meryem Beklioglu
9.20 *J. Alex ELLIOTT, Ian D. JONES*
Modelling the effects of changing retention time on phytoplankton
- 9.40 *Stephen THACKERAY, Ian JONES, Stephen MABERLY*
Long-term change in the timing of phytoplankton blooms in Windermere
- 10.00 *Mark HONTI, Vera ISTVANOVICS*
[Modeling submerged macrophyte distribution and abundance as a function of water level fluctuations in shallow Lake Balaton](#)
- 10.20 COFFEE/TEA
- Physical Constraints 2** Chair: Meryem Beklioglu
10.50 *Martin DOKULIL*
The impact of climate change on lakes in Central Europe
- 11.10 *Peeter NÖGES*
Observed climate change impact on phytoplankton in lakes in Europe
- 11.30 *Mike SCARSBROOK, Graham FENWICK, Thibault DATRY*
Temporal variability in shallow groundwater communities along a New Zealand gravel-bed river
- 11.50 *Hélène DESBROSSES, Pierre SAGNES, Sylvie MERIGOUX, Thibault DATRY*
Morphology and physical habitat use in a lotic macroinvertebrate community
- 12.10 *Nicolas LAMOUREUX, Sylvie MERIGOUX, Hervé CAPRA, Sylvain DOLÉDEC*
Hydraulic preferences of freshwater taxa observed in multiple sites: some critical issues
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 5** Chair: Alan G. Hildrew
Anja Rubach
Habitat complexity affects resource versus consumer control in benthic food webs
- Bodysize and Food Web Interactions** Chair: Giuseppe Morabito
14.50 *Iwona JASSER, Iwona KOSTRZEWSKA-SZLAKOWSKA, Jolanta EJSMONT-KARABIN, Krystyna KALINOWSKA, Teresa WEGLEŃSKA*
Stability or lack of it of the microbial food web in a humic lake - Results from mesocosms experiment
- 15.10 *Yury KAMENIR*
The quasi-stochastic phytoplankton of Lake Kinneret under environmental change conditions
- 15.30 *Helen AGASILD, Priit ZINGEL, Ilmar TÖNNO, Tiina NÖGES*
[The role of zooplankton grazing in shallow eutrophic lake ecosystems in Estonia](#)
- 15.50 *Richard J. O'CALLAGHAN, Simon S. C. HARRISON*
[Effects of lake trophy on invertebrate body size spectra and decomposition rates of leaf litter in lake littorals](#)
- 16.10 *Bruno MAIOLINI, Luana SILVERI, J. Manuel TIERNO DE FIGUEROA*
Life cycles and trophic role of some Perlodidae and Chloroperlidae species in the hyporheic macroinvertebrate community of an Alpine stream (Noce Bianco, Trentino, Italy)
- 16.30 COFFEE/TEA
- 16.50 **POSTER SESSION 1**
- 19.00 **EVENING WORKSHOP (Room B)**
Changes in ecology of mediterranean shallow lakes at the face of climate change
Convenor: *Meryem Beklioglu*

Tuesday

Session D

- 8.30 **Plenary lecture 4** Chair: Alan G. Hildrew
Luc De Meester
 Evolution and our understanding of the ecology of aquatic ecosystems
- Paleolimnology** Chair: Luigi Naselli-Flores
- 9.20 **Mihály BRAUN, István PAPP, Imre SZALÓKI, Martine LEERMAKERS, János KORPONAI**
 Century scale pollution history of River Tisza (Hungary) reconstructed by sediment chemistry of oxbow lakes
- 9.40 **István GYULAI, Mihály BRAUN, Dénes GÓR, Gyula LAKATOS, and János KORPONAI**
 Comparative examination of Cladocera remains, which were found in the sediment of Keszthely- and Siófok-bay (Lake Balaton, Hungary)
- 10.00
- 10.20 COFFEE/TEA
- Habitat Heterogeneity** Chair: Iwona Jasser
- 10.50 **Barbara HANCOCK, Anne ROBERTSON, Peter SHAW**
 Experimental evidence shows that substrate size affects density and taxon richness in meiofaunal assemblages
- 11.10 **Mariusz PELECHATY, Andrzej PUKACZ, Aleksandra PELECHATA**
 Do the diversity of phytoplankton structure and habitat properties reflect the differential development of charophyte vegetation in the lakes? Case studies from mid-Western Poland
- 11.30 **Michal STRAKA, Jan HELESIC**
 Distribution of benthic invertebrates in a small stream
- 11.50 **Jan SYCHRA, Zdeněk ADÁMEK, Karla PETŘIVALSKÁ**
 Inner horizontal distribution and diversity of phytophilous aquatic macroinvertebrates in wide reed (*Phragmites australis*) beds of pond littoral
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 5** Chair: Alan G. Hildrew
Anja Rubach
 Habitat complexity affects resource versus consumer control in benthic food webs
- 16.30 COFFEE/TEA
- 16.50 **POSTER SESSION 1**
- 19.00 **EVENING WORKSHOP (Room B)**
 Changes in ecology of mediterranean shallow lakes at the face of climate change
 Convenor: *Meryem Beklioglu*

Wednesday 11 July 2007

Mid-symposium excursions

- 7.30 **The Valley of the Temples**
- 7.30 **Erice and Trapani saltworks**
- 7.30 **Selinunte and River Belice Natural Reserve**

Thursday 12 July 2007

7.30 AV Testing & loading for morning speakers in the appropriate lecture room (A, B, C or D)

7.30 Mounting posters (Session 2)

Session A (San Mattia ai Crociferi)

- 8.30 **Plenary lecture 6** *Chair: Roger Sweeting*
Sergi Sabater
 Local and global disturbances in rivers. Effects on structure and functioning, and implications for management
- 9.20 **River and Stream Ecology and Management 1** *Chair: François Darchambeau*
Leopold FÜREDER, Wasantha S. WELIANGE, Maria LEICHTFRIED, Upali AMARASINGHE
 The IRESA Project: Catchment properties, habitat conditions and functional organization of key species in tropical rivers
- 9.40 *Maria LEICHTFRIED, Leopold FÜREDER, Wasantha S. WELIANGE, Upali AMARASINGHE*
 The IRESA Project: Bed sediments - what role they play in tropical low order stream ecosystems in dry and wet zones?
- 10.00 *Wasantha S. WELIANGE, P.P. Ajith PRASANATHA, Upali S. AMARASINGHE, Maria LEICHTFRIED, Leopold FÜREDER*
 The IRESA Project: Can colonization success of *Chitala ornata*, an accidentally introduced exotic fish species, be predicted from the body-shape indices of stream fish assemblages in Sri Lanka?
- 10.20 COFFEE/TEA
- 10.50 **River and Stream Ecology and Management 2** *Chair: François Darchambeau*
M. ÁLVAREZ PÉREZ, F. SABATER I COMAS, A. BUTTURINI, L. PROIA, A. RUGGIERO, G. CARCHINI
 Comparison of "constant rate" and "slug" addition methods in the study of nutrient retention in rivers
- 11.10 *Antonella CATTANEO, Christiane HUDON*
 Benthic cyanobacteria in the St. Lawrence River (Quebec, Canada)
- 11.30 *Teresa FERREIRA, Francisca AGUIAR, Patricia RODRIGUEZ-GONZALEZ, António ALBUQUERQUE*
 Using community structure to assess ecological quality of riparian vegetation
- 11.50 *Andrea ENCALADA, Juan CALLES, Veronica FERREIRA, Manuel GRAÇA*
 Effect of riparian land use on leaf litter breakdown and invertebrate community composition in tropical montane forest streams
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 7** *Chair: Roger Sweeting*
Tiina Nöges
 Ecology of large lakes - how much size really matters?
- 14.50 **River and Stream Ecology and Management 3** *Chair: Antonella Cattaneo*
François DARCHAMBEAU, Hélène GLEMET, Tommy BELANGER, Andréanne PARIS, Stéphane CAMPEAU, Gilbert CABANA
 Evidence of food quality limitation in benthic river insects
- 15.10 *Sylvie MERIGOUX, Nicolas LAMOUREUX, Jean-Michel OLIVIER, Sylvain DOLEDEC*
 Predicted impacts of discharge management on benthic invertebrates in large rivers
- 15.30 *Elisa BOTTAZZI, Gaetano GENTILI, Giampaolo ROSSETTI*
 Impacts of hydropower production on the macrobenthic communities in mountain streams
- 15.50 *Heike ZIMMERMANN-TIMM*
 Too much water - too little water: precipitation extremes and their effects on the structure and function of the Elbe
- 16.10 *Gorazd URBANIČ, Špela AMBROŽIČ*
 Assessment of the organic pollution of rivers based on benthic invertebrates according to European Union Water Framework Directive; adaptation of the saprobic system in Slovenia
- 16.50 COFFEE/TEA
- 17.10 **POSTER SESSION 2**

Session B

- 8.30 **Plenary lecture 6** Chair: Roger Sweeting
Sergi Sabater
 Local and global disturbances in rivers. Effects on structure and functioning, and implications for management
- Aquatic biodiversity 1** Chair: Eric Pattee
- 9.20 *J.F. Murphy, J. Davy-Bowker, S.J. Ormerod*
 Biomonitoring acid streams: factoring out confounding variables improves discrimination
- 9.40 *Gabrielle THIÉBAUT, Fiorant DI NINO, Serge MULLER*
 Phenotypic variation of *Elodea nuttallii* (Planch.) H. St John in the North-East of France
- 10.00 *Isabelle COMBROUX, Photis NOBELIS, Michèle TREMOLIERES*
 Relationships between Biodiversity, Stability and Invasibility in river ecosystems
- 10.20 COFFEE/TEA
- Aquatic Biodiversity 2** Chair: Eric Pattee
- 10.50 *M. TREMOLIERES, M.-H. BARRAT SEGRETAIN, G. THIEBAUT, I. COMBROUX, G. HAAN-ARCHIPOFF*
 The invasiveness of two macrophytes species in waterbodies, *Elodea nuttallii* (Planch.) St John and *E. canadensis* Michaux. Adaptive species strategy and key factors controlling habitat invasibility ?
- 11.10 *O.V. BABANAZAROVA, S.I. SIDILEV, S.V. SHISHELEVA*
 Characterization of the development of Cyanobacteria functional group (*Plankothrixetum*) in the highly eutrophic Lake Nero (Russia)
- 11.30 *John F. O'DRISCOLL, Simon S.C. HARRISON, Paul S.GILLER*
 Effects of small-scale spatial changes in riparian vegetation on algal and invertebrate communities in upland streams
- 11.50 *Gael GRENOUILLET, Sébastien BROSSE, Loïc TUDESQUE, Sovan LEK, Geraldine LOOT*
 Spatial autocorrelation and concordance among stream assemblages along a fragmented gradient
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 7** Chair: Roger Sweeting
Tiina Nöges
 Ecology of large lakes - how much size really matters?
- Aquatic Biodiversity 3** Chair: Rossella Barone
- 14.50 *Jindřiska BOJKOVA, Marketa OMELKOVA, Jan HELESIC, Michal HORSÁK*
 Structure and species richness of benthic macroinvertebrate assemblages in the Western Carpathian spring fens
- 15.10 *Laëtitia BUISSON, Gael GRENOUILLET, Puy LIM*
 The potential impacts of climate warming on spatial patterns of stream fish assemblages
- 15.30 *Fabien LEPRIEUR, Olivier BEAUCHARD, Bernard HUGUENY Gaël GRENOUILLET, Sébastien BROSSE*
 Changes in community similarity among the 25 major European river basins following freshwater fish introductions: a null model approach
- 15.50 *Jiri MUSIL, S.M. Hadi ALAVI*
 Ecology, reproductive biology and conservation of *Acipenser persicus* (Borodin, 1897) in the South of Caspian Sea, Iran
- 16.10 *Zlatko PETRIN, Björn MALMQVIST*
 Diversity and function in naturally acidic streams: is there evidence of adaptation?
- 16.50 COFFEE/TEA
- 17.10 **POSTER SESSION 2**

Session C

- 8.30 **Plenary lecture 6** Chair: Roger Sweeting
Sergi Sabater
Local and global disturbances in rivers. Effects on structure and functioning, and implications for management
- 9.20 **Mediterranean Limnology 1** Chair: Narcís Prat
Paula FONOLLÀ, Eugènia MARTÍ, Francesc SABATER
[Variability in stream nutrient retention and metabolism along an altitudinal calcareous gradient](#)
- 9.40 *Meryem BEKLIOGLU*
Effect of global climate change on the role of hydrology and nutrients in the ecology of shallow lakes in Mediterranean Turkey
- 10.00 *Miguel CAÑEDO-ARGÜELLES IGLESIAS, María RIERADEVALL SANT*
[Epiphytic macroinvertebrate communities on *Phragmites australis* in the coastal lagoons of the Llobregat's river deltaic plain \(Barcelona, Spain\)](#)
- 10.20 COFFEE/TEA
- 10.50 **Mediterranean Limnology 2** Chair: Isabel Pardo
Tura PUNTI, María RIERADEVALL, Narcís PRAT
[Chironomidae assemblages in Mediterranean streams reference conditions](#)
- 11.10 *Samantha Jane HUGHES, Maria Teresa FERREIRA, José Maria SANTOS, Ana MENDES*
Response of four riverine biological assemblages to human pressures: Identifying sentinels of change for restoration in a Mediterranean system of Southern Portugal
- 11.30 *Núria BONADA, Carmen ZAMORA-MUÑOZ, Cesc MÚRRIA, Narcís PRAT, Majida EL ALAMI*
Past events explaining caddisfly biodiversity and distribution in the Western Mediterranean: from communities to populations
- 11.50 *Vassilia ARTEMIADOU, Maria LAZARIDOU*
Creation of a predictive model for small mountainous Mediterranean streams (R-M4 type) and comparison of its performance with biotic and multimetric indices
- 12.10 *Federico MARRONE, Sabrina LO BRUTTO, Marco ARCULEO*
[First contribute to the systematics and phylogeography of the *roubaui*-group of the genus *Hemidiaptomus* \(Copepoda, Calanoida, Diaptomidae\)](#)
- 12.30 *C. MÚRRIA, N. BONADA, C. ZAMORA-MUÑOZ, A.P. VOGLER, N. PRAT*
[Molecular diversity patterns of *Hydropsyche* \(Trichoptera\) in the western Mediterranean Basin: geological and ecological influences](#)
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 7** Chair: Roger Sweeting
Tiina Nöges
Ecology of large lakes - how much size really matters?
- 14.50 **Reservoir Limnology** Chair: Luigi Naselli-Flores
Pilar LOPEZ, Rafael MARCÉ, Enrique MORENO-OSTOS, Joan ARMENGOL
CO₂ dynamics in a Mediterranean eutrophic reservoir
- 15.10 *Luciano CAPUTO, Manuel LEIRA, Joan ARMENGOL*
[Diatom assemblages responses to environmental gradient on Catalan reservoirs of different trophic; Catalunya \(NE, Spain\). A practical application of Diatom Indexes of water quality](#)
- 15.30 *Panagoula ANTONOPOULOU, Catherina VOREADOU, Mihalis DRETAKIS*
Artificial wetlands of Crete. A study on their rate of biological succession based on the structure of their macroinvertebrate communities
- 15.50 *Ivona UVIROVÁ, Vladimír UVÍRA, Evzen TOSENOVSKÝ, Alena VLÁČILOVÁ*
Influence of environmental factors on growth rate of zebra mussel (*Dreissena polymorpha*) in small manmade water bodies in the Central Moravia (Czech Republic)
- 16.50 COFFEE/TEA
- 17.10 **POSTER SESSION 2**

Session D

- 8.30 **Plenary lecture 6** Chair: Roger Sweeting
Sergi Sabater
 Local and global disturbances in rivers. Effects on structure and functioning, and implications for management
- Ecotoxicology 1** Chair: Cristiana Callieri
- 9.20 *Emanuela VIAGGIU, Neil T.W. ELLWOOD, Rosario MOSELLO, Renato FUNICELLO, Patrizia ALBERTANO*
 Seasonal dynamics of *Planktothrix rubescens* and toxin production in lake Albano (Rome, Italy)
- 9.40 *Theodoti PAPANIMITRIOU, Ifigenia KAGALOU, Ioannis LEONARDOS*
 Occurrence of Microcystins in Lake Pamvotis (Greece) and tissue distribution in the fish species, *Carassius gibelio* (Bloch)
- 10.00 *Florence D. HULOT, Guillaume SAPIEL*
 Allelopathic interactions between plankton species: Where lie the costs of toxin production?
- 10.20 COFFEE/TEA
- Ecotoxicology 2** Chair: Cristiana Callieri
- 10.50 *Anne-Hélène LE JEUNE, Marie CHARPIN, Véronique DELUCHAT, Denis SARGOS, Jean-Claude ROMAGOUX, Michel BAUDU, Christian AMBLARD*
 Effect of copper sulphate treatment on planktonic communities
- 11.10 *Manuel A.S. GRAÇA, Adriana O. MEDEIROS, Paula ROCHA*
 Mine run-off affects sporulation of aquatic hyphomycetes and feeding rates of shredders
- 11.30 *Oscar RAVERA*
 An attempt to quantify the potential influence of a mussel population on the metal cycles in its habitat
- 11.50 *Aurélien VILLENEUVE, Agnès BOUCHEZ, Bernard MONTUELLE*
 Impact of pesticides (Diuron and Azoxystrobin) on microbial aquatic biodiversity and functions. An experimental study
- 12.10 *Bernard MONTUELLE, Romain GRANIER, Bernardette VOLAT, Laura SANCHEZ, Bernard MOTTE, Marie-Claude ROGER*
 Dynamics of leaf litter degradation in a small stream impacted by pesticides
- 12.30 LUNCH (12.30-13.30: AV for afternoon speakers)
- 14.00 **Plenary lecture 7** Chair: Roger Sweeting
Tiina Nõges
 Ecology of large lakes - how much size really matters?
- Ecohydrology** Chair: Narcis Prat
- 14.50 *Vicenç ACUÑA, Cliff DAHM*
 Spatial and temporal surface water chemistry variation in a semiarid river network during the monsoonal floods pulse
- 15.10 *Alba ARGERICH, Eugènia MARTÍ, Roy HAGGERTY, Francesc SABATER, Miquel RIBOT*
 Changes in transient storage and nutrient retention related to channel manipulations
- 15.30 *Thibault DATRY, Scott LARNED, Mike SCARSBROOK, Graham FENWICK*
 Responses of hyporheic invertebrate community to large-scale variation in flow permanence and surface-subsurface exchange
- 16.50 COFFEE/TEA
- 17.10 **POSTER SESSION 2**

Friday 13 July 2007

7.30 AV Testing & loading for morning speakers in the lecture room A

Session A (San Mattia ai Crociferi)9.00 **Plenary lecture 8** Chair: Alan G. Hildrew**Colin Townsend**

The individual and combined responses of stream ecosystems to multiple stressors

10.00 COFFEE/TEA

River and Stream Ecology and Management 4 Chair: Sergi Sabater10.30 Rui Manuel VITOR CORTES, Simone VARANDAS OLIVEIRA, Marco MAGALHÃES, Samantha Jane HUGHES
A biological relevant habitat index derived of the River Habitat Survey for portuguese running waters

10.50 Christoph MATTHAEI, Jeremy PIGGOTT, Colin TOWNSEND

Effects of sediment addition, nutrient enrichment and water abstraction on agricultural streams: a multiple-stressor experiment

11.10 Milan NOVIKMEC, Marek SVITOK, Marek ČILIAK

Structure and longitudinal distribution of caddisfly (Trichoptera) communities of the West Carpathian River

11.30 C.T. GRAHAM, S.S.C. HARRISON, P. PHELAN, P.S. GILLER, R.I. JONES

[The effect of sewage effluent on the ecology of a salmonid river](#)

11.50 Jane KAVANAGH, Simon S.C. HARRISON

[Faunal zonation in agricultural drainage ditches](#)

12.10 Maëlle RAMBAUD, Isabelle COMBROUX, Jacques MORET

[The use of multiple communities to assess river's ecological status](#)

12.30 Ton SNELDER, Hervé PELLA, Jean-Gabriel WASSON, André CHANDESRIS

Large scale environmental classification systems for rivers

12.50 LUNCH

14.30 **Closing Session – Award of Student Prizez**19.30 **SYMPOSIUM DINNER**

POSTER SESSION 1 Tuesday 10 July 2007

ECOTOXICOLOGY

- P1 *O. Adam, F. Degiorgi, G. Crini, P-M Badot*
Active and passive bio-indication of a pesticide contamination by *Gammarus fossarum* (K.)
- P2 *Ursula DORIGO, Annette BERARD, Bernard MOTTE, Bernardette VOLAT, Agnes BOUCHEZ, Bernard MONTUELLE*
Responses of pesticide impacted biofilms in a translocation experiment in river
- P3 *Joséphine LEFLAIVE, Evelyne BUFFAN-DUBAU, Yvan NICAISE, Loïc TEN-HAGE*
Effects of algal products on oxygen dynamic in artificial phototrophic biofilms
- P4 *Majja BALODE, Ieva BARDA, Ingrida PURINA*
Ecological problems in the shallow eutrophic Latvian lakes
- P5 *P.J. OBERHOLSTER, A.-M. BOTHA*
Use of PCR based technologies for risk assessment of a cyanobacterial bloom in Lake Midmar, South Africa
- P6 *Dasa UMYSOVA, Irena DOUSKOVA, Milada VITOVA, Jiri MACHAT, Jiri DOUCHA, Vilem ZACHLEDER*
Toxicity and accumulation of Selenium in *Scenedesmus quadricauda*
- P7 *Sara Banu AKKAS, Gizem BEZIRCI, Meryem BEKLIOGLU*
Impact of pesticide Cypermethrin and fish kairomone on the life history traits of *Daphnia pulex*
- P8 *Gizem BEZIRCI, Banu AKKAS, Meryem BEKLIOGLU, Feriha YILDIRIM*
Effects of salinity and fish predation pressure on *Daphnia pulex* life history traits
- P9 *S.L. LARROZE, D.B.P. PICKFORD, D.R.P. LEONARD*
Validation of a three-week amphibian metamorphosis study assaying the African Clawed frog (*Xenopus laevis*) for the detection of thyroid active substances
- P10 *Y.S. PARK, C.W. Ji, E.Y. CHA, T.-S. CHON, S.K. LEE*
Patterning Response Behaviour of Medaka (*Oryzias latipes*) to Toxic Substances Using an Adaptive Learning Algorithm

AQUATIC BIODIVERSITY 1

- P11 *Nuray Emir AKBULUT, Aydın AKBULUT, Süphan KARAYTUĞ, Kemal ÇELİK, Nurhayat BARLAS, Serdar BAYARI, Alp ALPER, Dursun ÖZATLI, İlkey YILMAZ*
Limnological assessment on the shallow Uluabat lake (Bursa/ Turkey): plankton composition, benthic macroinvertebrates, chemical and physical variables
- P12 *Ivars DRUVIETIS*
Climate driven changes on phytoplankton communities structure and algae species seasonal development in Latvia's freshwaters
- P13 *Andrea ZIGNIN, Nico SALMASO*
Phytoplankton as a tool to investigate the ecological quality of river Adige (North East Italy): the project Planadige
- P14 *Janusz ZBIKOWSKI, Jaroslaw KOBAK*
Light level at the bottom as a factor influencing taxonomic composition and abundance of macrozoobenthos in extralittoral zone of shallow eutrophic lakes
- P15 *Ahmet ALTINDAG, Sibel YIGIT, Murat KAYA*
Species diversity and community structure of the zooplankton in eutrophic Lagoon Lake Köyceğiz- Muğla-Turkey
- P16 *Luciana PINTO SARTORI, Marcos GOMES NOGUEIRA*
Longitudinal zooplankton distribution and general limnology of a tropical Brazilian reservoir (Rosana-Parapanema River)
- P17 *Sibel YIGIT, Ahmet ALTINDAG, Burak YASIN*
Changes in rotifer species composition and its abundance in an hypertrophic lake Eber (Afyon) Turkey
- P18 *Hasan ASLANPARVIZ, Abbasali Aghaie MOGHADDAM*
Application of natural resources of Cladocera in South Caspian Sea Aquaculture (North of Iran)
- P19 *Bożena KIZIEWICZ*
Occurrence of saprotrophic fungi and fungus like organisms in Supraśl River and its several tributaries in Podlasie Province of Poland

- P20 *K. STEFANIDIS, E. S. PAPASTERGIADOU*
Nutrient dynamics and eutrophication patterns in two shallow lakes of Greece: Effects of macrophytes species richness on aquatic environment
- P21 *Genevieve MADGWICK, Carl SAYER, Thomas DAVIDSON, Dan HOARE*
[Change in macrophyte communities in the Norfolk Broads](#)
- P22 *Mateja GERM, Zdenka MAZEJ*
Species presence and abundance in relation to nutrient supply and geomorphological characteristics of the artificial lake Velenjsko jezero (Slovenia)

MICROBIAL ECOLOGY

- P23 *Luigi MICHAUD, Consolazione CARUSO, Santina MANGANO, Viviana BRUNI, Angelina LO GIUDICE*
Phylogenetic characterization of the culturable bacterial community inhabiting three Antarctic lakes
- P24 *Paola VALENTI, Florinda DI PIAZZA, Maria Antonella DI BENEDETTO, Francesco VITALE*
[Occurrence of *Giardia* and *Cryptosporidium* in River Oreto \(Palermo, Sicily\)](#)
- P25 *Mohamad Bashir ARNOUS, Jean-François CARRIAS*
[Spring dynamic of Transparent Exopolymeric Particles \(TEP\) in two lakes of the Massif Central of France](#)
- P26 *Tatjana SIMČIĆ, Anton BRANCELJ*
Seasonal changes in respiratory enzyme activity of microplankton, zooplankton and sediment communities in two lakes of different trophic state
- P27 *Irena DOUSKOVA, Jiri MACHAT, Dasa UMYSOVA, Milada VITOVA, Jiri DOUCHA, Vilem ZACHLEDER*
[Scenedesmus quadricauda - a promising microorganism for selenium-enriched algal biomass production](#)
- P28 *Monika HLAVOVÁ, Vilém ZACHLEDER, James G. UMEN, Katerina BISOVÁ*
Regulation of *Chlamydomonas reinhardtii* cell cycle by mitotic inhibitor, WEE1 kinase
- P29 *Monika HLAVOVÁ, Mária ČIZKOVÁ, Vilém ZACHLEDER, James G. UMEN, Katerina BISOVÁ*
[Regulation of *Chlamydomonas reinhardtii* cell cycle by B-type specific cyclin-dependent kinase](#)
- P30 *Giuseppe MORABITO, Alessandro OGGIONI, Karin SPARBER*
[Seasonal variability of diel phytoplankton cycles in a shallow lake \(L. Candia, N. Italy\)](#)
- P31 *Vanessa BECKER, Vera L. M. HUSZAR*
[Steady-state phytoplankton community during thermal stratification in a subtropical reservoir](#)

MEDITERRANEAN LIMNOLOGY AND TEMPORARY PONDS

- P32 *Giuseppe BAIAMONTE, Rosario SCHICCHI*
[Mediterranean temporary pools and the *Isoetes-Nanojuncetea* communities in Sicily](#)
- P33 *Paola ERNANDES, Leonardo BECCARISI, Vincenzo ZUCCARELLO*
[Conservation of Mediterranean Temporary Pools in Apulia \(Southern Italy\): definitions, principles, problems](#)
- P34 *Marcello BAZZANTI, Valentina DELLA BELLA, Francesco GREZZI, Cristina COCCIA*
Macroinvertebrate ecology and conservation in temporary and permanent ponds in Central Italy
- P35 *Giuseppe CASTELLI, Valentina PIERI, Federico MARRONE*
[Freshwater ostracods \(Crustacea: Ostracoda\) of the circum-Sicilian islands](#)
- P36 *Marco SEMINARA, Daria VAGAGGINI, Fiorenza G. MARGARITORA*
Multi-year observations on zooplankton diversity and dynamics in a pond with variable hydrological cycle
- P37 *Aline WATERKEYN, Patrick GRILLAS, Luc BRENDONCK*
[Invertebrate communities in temporary wetlands across a salinity and hydroperiod gradient in the Camargue \(France\)](#)
- P38 *Francesco Paolo FARAONE, Francesco LILLO, Gabriele GIACALONE, Mario LO VALVO*
A non-native population of *Xenopus laevis* in Sicily feeding during the reproductive period
- P39 *M. ILHÉU, P. GUILHERME, J.M. BERNARDO*
Patterns of fish distribution in dry-season stream pools in temporary streams
- P40 *P. MATONO, J.M. BERNARDO, M. ILHÉU*
Fish based ecological assessment in Mediterranean temporary streams: effects of temporal variability
- P41 *Paloma LUCENA, Isabel PARDO, Maruxa ÁLVAREZ*
Development of a typology for coastal lagoons in the Balearic islands, Spain
- P42 *Amina TALEB, Nouria BELAIDI, James GAGNEUR*
Downstream effect of a polluted reservoir on water quality river in semi-arid Algeria

BIOLOGICAL INTERACTIONS

- P43** Zohreh RAMEZANPOUR, Blahoslav MARSÁLEK
Cyanophyta bloom and its effect on species diversity of water bodies
- P44** Yelda AKTAN, Hacer OKGERMAN, Cenk GÜREVİN, Zeynep DORAK, Reyhan AKÇAALAN
Phytoplankton development and its relationships with zooplankton and environmental parameters in the Büyükçekmece reservoir, Turkey
- P45** Stefano FENOGLIO, Tiziano Bo, Elżbieta ROŚCISZEWSKA, Artur CZEKAJ
Diet, microdistribution and fine structure of *Euthyplocia hecuba* (Ephemeroptera: Euthyplociidae) nymphs
- P46** Tiziano Bo, Stefano FENOGLIO, Marco CUCCO, Giorgio MALACARNE
[Prey preference of *Perla grandis* \(Rambur 1841\) \(Plecoptera, Perlidae\) in the rio Berga \(NW Italy\)](#)
- P47** István TÁTRAI, Kálmán MÁTYÁS, János KORPONAI, Ágnes GYÖRGY, Máté HAVASI, Tamás KUCSERKA, Piroska POMOGYI
Food web structure following fish manipulation in a shallow wetland lake with abundant submerged vegetation
- P48** Petr VLASÁK, Ladislav HAVEL, Zdeněk ADÁMEK
Water reclamation of the residual coal mining pit in Czech Republic
- P49** Andrea BERTOLO and Pierre MAGNAN
Logging-induced variations in doc affect yellow perch recruitment in Canadian shield lakes
- P50** Anne-Laure BROCHET, Andy GREEN, Matthieu GUILLEMAIN, Michel GAUTHIER-CLERC, Hervé FRITZ
[Local movements of Teal \(*Anas crecca*\) and their consequences for seed and invertebrate dispersion within wintering grounds](#)
- P51** Romina FUSILLO, Manlio MARCELLI
Geographic distribution and environmental correlates of fish species predated by otters in Southern Italy
- P52** Elżbieta ZBIKOWSKA, Janusz ZBIKOWSKI
The initial study on Digenea larvae invasion to *Potamopyrgus antipodarum* populations in Poland
- P53** Antti ELORANTA, Roger I. JONES
[Food sources of Arctic char \(*Salvelinus alpinus* L.\) in two Arctic lakes with contrasting fish communities](#)

RIVER 1

- P54** Valérie DEVALLOIS, Patrick BOYER, Jean-Luc BOUDENNE, Bruno COULOMB
[Transfert and mobility of trace metals in the rivers: modelling of solid-liquid exchange and early diagenesis](#)
- P55** Blanka DESORTOVÁ
Phytoplankton distributions along the River Vltava (the Czech Republic): a case of a watercourse with a cascade of dam reservoirs
- P56** Adéla MORAVCOVÁ, Ota RAUCH, Linda NEDBALOVÁ, Jaromír LUKAVSKÝ
[Epilithic diatoms and water quality of mountain streams in the Giant Mountains and Bohemian Forest \(Czech Republic\) under the influence of recreational activity](#)
- P57** Gunta SPRINĢE, Leonard SANDIN, Evija ZEILISA
Distribution of benthic diatoms at high-quality sites of medium-size lowland streams
- P58** Dénes GÖR, Csaba DEÁK, István GYULAI, Gyula LAKATOS
Phytobenthonic zoo-community of stream Kerka, Hungary (2003-2006)
- P59** Marco DE CICCIO, Filippo FABBRI, Simone PETRACZEK, Lorenzo PROIA, Gianmaria CARCHINI
Effects of a small dam on macroinvertebrate communities and environmental variables in a headwater stream
- P60** Jana PAIDERE, Arturs SKUTE
Impact of the flood regime on the zooplankton density and community composition in the Daugava River, Latvia
- P61** Pavla REZNICKOVA, Petr PARIL, Jitka KRAJCOVA, Svetlana ZAHRADKOVA, Jan HELESIC
[Drift activity of macroinvertebrates in an intermittent stream - a case study from the Czech Republic](#)
- P62** Agnija SKUJA
[Caddisfly Trichoptera drift characterisation in the dominating habitats of small streams in Latvia \(preliminary results\)](#)

AQUATIC BIODIVERSITY 2

- P63** *Giuseppe ALFONSO, Salvatore MOSCATELLO, Genuario BELMONTE*
New records of the australasian copepod *Boeckella triarticulata* (Copepoda, Calanoida, Centropagidae) in Italy
- P64** *Luciana MASTRANTUONO, Valentina Di VITO*
Spatial distribution and diversity of plant-associated invertebrates in a lotic-lentic ecosystem (Lake Posta Fibreno, Central Italy) and water quality monitoring
- P65** *Rosa ANDREU, Carles IBAÑEZ, Narcís PRAT*
Macrophyte colonization and their associated macroinvertebrates in the lower Ebro river
- P66** *Sylvain DOLEDEC, Bernard CELLOT, Marie-Claude ROGER*
Responses of stream invertebrate communities to different types of human impacts: patterns of taxonomic vs functional diversity
- P67** *Geta RISNOVEANU, Gheorghe IGNAT*
Benthic communities as service providing units in Danube Delta shallow lakes
- P68** *Nouria BELAIDI, Amina TALEB, James GAGNEUR*
A preliminary assessment of the effect of a dam release water on invertebrates community structure
- P69** *Ewa JURKIEWICZ KARNKOWSKA*
Mollusc communities of floodplain water bodies of a large lowland river (lower Bug River, Eastern Poland)
- P70** *Marketa OMEJKOVA, Jindriska BOJKOVA, Rudolf ROZKOSNY, Michal HORSÁK, Jan HELESIC*
The Diptera taxocenoses in the Western Carpathian spring fens: preliminary results
- P71** *Arkadijs POPPELS*
The Study of Mayflies (Ephemeroptera) ecology in Latvia's running waters (1986-2006)
- P72** *Svetlana ZHRADKOVA, Tomas SOLDAN, Petr PARIL, Pavla REZNICKOVA, Libuse OPATRILOVA*
Long-term changes of mayfly (Ephemeroptera) taxocene of a central european potamal river
- P73** *Rachid BOUHADAD, Djamel Eddine ZOUAKH, Mokrane MOULLA, Yasmine BELLABES*
Anthropogenic impact on the aquatic ecosystems and genetic diversity of the ichthyofauna in desert of Algeria
- P74** *Alessandra SICILIA, Federico MARRONE, Roberto SINDACO, Souad TURKI, Marco ARCULEO*
Contribute to the knowledge of Tunisian amphibians: Notes on distribution, habitat features and phenology
- P75** *Vasily PONOMAREV, Olga LOSKUTOVA*
Aquatic fauna of the Ural mountain lakes
- P76** *Angela BOGGERO, Federica SICCARDI, Bruno ROSSARO*
Benthic macroinvertebrates of eutrophic Lake Viverone (Piedmont, Northern Italy)

RIVER 2

- P77** *M.A. STUDENOVA, I.I. STUDENOV, A.P. NOVOSELOV*
The role of Chironomids in benthofauna formation of the Yarenga river (the Severnaya Dvina river system)
- P78** *A. FABRIZI, E. GORETTI, C. MARCUCCI, A. DI VEROLI, L. SCOPETTA, M.V. DI GIOVANNI, R. SELVAGGI, R. CEREGHINO*
Influence of intensive fish farming on macroinvertebrate community structure in Apennine streams (Italy)
- P79** *Gorazd URBANIČ, Branka TAVZES*
Assessing the impact of hydromorphological degradation on the benthic invertebrates in the rivers of the hydroecoregion Alps; single multimetric index for different types?
- P80** *Branka TAVZES, Gorazd URBANIČ*
Methodology for assessment of hydromorphological degradation of rivers and its evaluation with benthic invertebrate communities; Alpine case study
- P81** *Jesús ORTIZ, Francesc SABATER, Eugènia MARTÍ, M. Ángeles PUIG*
Influence of a point source on nutrient storage in the benthic community in a Mediterranean stream
- P82** *Javier PEREZ, Jesús POZO*
Inter-site variability of leaf litter breakdown in reference headwater streams
- P83** *Peter BITUŠÍK, Marek SVITOK*
Long-term changes in chironomid assemblages of the River Hron, Slovakia
- P84** *Michal BILY, Ondrej SIMON*
Possibilities of Pearl Mussel (*Margaritifera margaritifera*) Locality Saving in the Catchment of Luzni Stream (Czech - German Frontier)

- P85 *Laura GRINBERGA, Andris URTANS, Gunta SPRINĢE, Lelde ENGELE*
Aquatic macrophytes in high quality lowland streams of Latvia
- P86 *Ladislav HAVEL, Petr VLASÁK, Katerina ARONOVÁ*
Temporal and spatial changes of the Bílina River ecosystem (Northwest Bohemia, Czech Republic)

LARGE LAKES

- P87 *Reinaldo BOZELLI, Marina MANCA, Piero GUILIZZONI*
Daphnia in Lake Maggiore starts to invest in an egg bank: a preparation for upcoming decades or centuries?
- P88 *Carla BONACINA, Roberta PISCIA, Jaromir SEDA, Marina MANCA*
On the presence of *Daphnia galeata* in Lake Orta (N. Italy)
- P89 *Barbara LEONI, Rossana CARONI, Alba VARALLO, Letizia GARIBALDI*
Studies on the pelagic zooplankton of the deep subalpine Lake Iseo
- P90 *Küllli KANGUR, Tõnu MÖLS*
Changes in spatial distribution of phosphorus and nitrogen in large north-temperate lowland lake
- P91 *Helen LUUP, Tõnu FELDMAN, Tiina NÖGES*
[The primary production of aquatic macrophytes and their epiphytes in two large shallow lakes \(Lake Peipsi and Lake Võrtsjärv\) in Estonia](#)
- P92 *Kaire TOMING, Helgi ARST, Tiina NÖGES, Birgot PAAVEL*
[Spatial and temporal variation of coloured dissolved organic matter in two Estonian large lakes](#)

CONSERVATION

- P93 *Angela DARWELL*
Macrophyte Mapping in the 21st Century. Are aerial survey and hydroacoustics effective for macrophyte mapping?
- P94 *Ian DODKINS*
Combining Metrics and Confidence in Status Boundaries within the Water Framework Directive
- P95 *Lindsey DEFEW*
[The importance of storm events in estimating nutrient loads to lakes](#)
- P96 *Eleonora FERRANTE, Stefania D'ANGELO, Arturo ZENONE, Gianluca SARÀ*
[Distribution and trophic role of invasive crayfish, *Procambarus clarkii* in "Preola and Gorgi tondi" Natural Reserve: a study case](#)
- P97 *Rosa TERMINE, Alessandro SACCÀ, Ornella SIDOTI, Guglielmo LETTERIO*
Environmental Monitoring of Pergusa Lake (Enna, South Italy) from 2001 to 2006, using zooplankton
- P98 *Matina KATSIAPI, Elisabeth VARDAKA, Evaggelia MICHALOUDI, Spyros GKELIS, Konstantinos Ar. KORMAS, Maria MOUSTAKA-GOUNI*
[Plankton changes in a eutrophic lake with a history of toxic cyanobacterial blooms after sewage diversion](#)
- P99 *Andu KANGUR, Külli KANGUR, Peeter KANGUR, Tõnu MÖLS*
Decline of cold-water fish and changes in predator-prey relationship in the fish community of Lake Peipsi: interaction of natural factors and human impacts
- P100 *Barbara LEONI, Letizia GARIBALDI, Alba VARALLO, Giuseppe MORABITO, Piero GUILIZZONI, Andrea LAMI, Aldo MARCHETTO, Claudio SILI, Rosario MOSELLO*
Limnological studies on Monticchio Lakes (Potenza, Italy)
- P101 *Jordie J.C. NETTEN*
[Effect of reduced light and dissolved oxygen concentration on submerged macrophytes](#)
- P102 *Ryszard WISNIEWSKI*
Analysis of sediments in urban lakes as a basis of an assessment of their degradation state and possibility of restoration

LIFE HISTORIES AND MOLECULAR ECOLOGY

- P103 *Milada VITOVA, Katerina BISOVA, Monika HLAVOVA, Dasa UMYSOVA, Vilem ZACHLEDER*
A circadian clock is not involved in the timing of cell division in the alga *Chlamydomonas reinhardtii*
- P104 *Pavel PRIBYL, Vladislav CEPÁK*
Unusual reproduction patterns and life cycles of some freshwater green microalgae

- P105** *Renata MATONIĆKIN KEPČIJA, Mirela SERTIĆ, Marko MILIŠA, Ivan HABDIJA, Biserka PRIMC-HABDIJA, Ines RADANOVIĆ*
Size-structure of aquatic insect larvae during colonization
- P106** *Martina ŠTROJSOVÁ and Jaroslav VRBA*
Population growth and reproduction of the rotifer *Brachionus calyciflorus* fed with P-replete or P-depleted algal food
- P107** *Rasul GHORBANI, Masoud MOLLAEI, Abdolmajid HAJIMORADLOO*
Study of some biological characters of *Gambusia holbrooki* on the adjusted channel of Gomishan Lagoon
- P108** *Aitor LARRAÑAGA, Ana BASAGUREN, Jesús POZO*
Storage of lipid and protein by the shredder *Echinogammarus berilloni* (Catta) (Amphipoda) as affected by resource quality changes in streams
- P109** *Judit NÉDLI, László FORRÓ, János KORPONAI*
Daphnia species and the genetic diversity of their populations in Lake Balaton, Hungary
- P110** *Jelena OREHA, Natalja SHKUTE*
RAPD analysis and isoenzyme profiles some vendace (*Coregonus albula*) populations in Latvia

POPULATION AND COMMUNITY ECOLOGY

- P111** *Petr ZNACHOR, Jiří NEDOMA*
Application of PDMPO technique in the study of silica deposition in natural diatom populations in a eutrophic reservoir
- P112** *Linda NEDBALOVÁ, Jan FOTT, Jaroslav HRBÁČEK, Lucie KRUTÍLKOVÁ, Evzen STUHLÍK*
Seasonal periodicity of phytoplankton in the Slapy Reservoir (Czech Republic)
- P113** *János KORPONAI, István GYULAI, Mihály BRAUN, László FORRÓ, Judith NÉDLI, István PAPP, Gyula LAKATOS*
Cladocera remains in sediment of Zalavari Pond and Keszthely bay of the Lake Balaton
- P114** *Marek SVITOK, Vladimír KUBOVČÍK*
Palaeoecological study of lake Vysné Wahlenbergovo pleso (the Tatra Mountains, Slovakia): chironomids, climatic changes and acidification
- P115** *Giampaolo ROSSETTI, Ireneo FERRARI, Pierluigi VIAROLI*
Changes in the relative importance of the planktonic and benthic compartments of a mountain lake driven by anomalous meteorological conditions and the establishment of a charophyte
- P116** *Bernadette PINEL-ALLOUL, Simon DE SOUSA, Antonia CATTANEO*
How lake recreational development affects invertebrates living on different natural substrata
- P117** *M. ŠPOLJAR, I. HABDIJA, B. PRIMC-HABDIJA, M. KUČINIĆ*
Influence of the moss-covered travertine barriers on zooseston retention of the Plitvice Lakes (Croatia)
- P118** *Agrieta BRIEDE, Gunta SPRINĢE, Agnija SKUJA*
High quality stream habitats in Latvia and role of environmental factors for benthic macroinvertebrates
- P119** *Marc PEPINO, Pierre MAGNAN and Andrea BERTOLO*
Within-population differences in behavioural thermoregulation tactics in lacustrine brook charr (*Salvelinus fontinalis*, Mitchell)
- P120** *Francesca BARALDI, Andrea GANDOLFI*
Salmo trutta marmoratus in the Adige river basin: a genetic, phenotypic and ecological study aimed at its conservation

HYDROLOGY AND PHYSICAL CONSTRAINTS

- P121** *Antonio CARUSO, Antonio CIMINO, Claudia COSENTINO, Antonino OIENI, Luigi TRANCHINA*
A Georeference database and a geographic information system for Palermo plain and gulf (Western Sicily): aquifers and marine environments
- P122** *Antonio CIMINO, Claudio ARTINO, Antonino OIENI*
Sea-fresh water exchanges in coastal aquifers of Sicily: a recent contamination cartography
- P123** *Luigi TRANCHINA, Maria BRAI, Antonio CARUSO, Claudia COSENTINO*
Influence of waste water in marine ecosystem: preliminary data on benthic foraminifera assemblages and metal concentration in marine sediments
- P125** *Alessandro OGGIONI, Gabriele CANDIANI, Claudia GIARDINO, Giuseppe MORABITO*
Variability of absorption coefficients in Italian lakes: implications about regionalisation of algorithms

Plenary Lectures

Evolution and our understanding of the ecology of aquatic ecosystems

Luc DE MEESTER

Laboratory of Aquatic Ecology, University of Leuven, Belgium

There is increasing evidence for rapid evolutionary responses in natural populations, and evidence is accruing that genetic diversity and composition may directly impact ecological interactions. Given the intrinsic dynamics of biotic interactions and the associated arms races as well as the increasingly pervasive anthropogenic impact, one may expect that strong selection pressures are ubiquitous in nature. In this lecture, I will use examples to illustrate the need to take evolutionary responses into account to gain understanding in ecological interactions, and will present possible fruitful approaches to this endeavour. I will present a metacommunity approach as a potentially very constructive view on the interplay between evolution and ecology, and will discuss the extent to which species sorting and natural selection may either reinforce or counteract each other. With this lecture I hope to convince ecologists to take evolutionary dynamics into account, and to inspire research on the interplay between ecology and evolutionary biology both in terms of concepts as well as in methodology. Aquatic systems may prove to be ideal model systems for this type of research.

The role of biota in P cycle in aquatic environments

Vera ISTVÁNOVICS

Budapest University of Technology and Economics; istvera@goliat.eik.bme.hu

Phosphorus is a micronutrient that is universally needed by biota for energy storage, metabolic regulation and storage of genetic information. Although phosphorus occurs in a series of rocks, solubility of phosphate minerals is characteristically low, and phosphate ions are strongly sorbed on a range of substances. As a consequence, phosphate has low mobility in natural terrestrial ecosystems and low availability in the hydrosphere compared to the rich natural supply of other nutrients. Human activity, however, has caused manifold increase in the amount of phosphorus cycling in the biosphere and has broken up the nearly closed natural cycle of this nutrient. This has led to eutrophication, which is up to now the most widespread environmental problem that threatens water quality and integrity of freshwater ecosystems. Due to serious limitations eutrophication puts on various kinds of resource utilization, as well as to ecological loss in eutrophicated waters, phosphorus cycling in aquatic ecosystems has got more attention during the past five decades than any other nutrients.

The lecture intends to summarise the most important discoveries, as well as the main unresolved questions in the field of phosphorus cycling in lakes and wetlands. Equal emphasis will be put on both scientific and management aspects. From the scientific perspective we explore how the deepening insight into the aquatic phosphorus cycle has modified our views about ecosystem functioning. From the perspective of water resources management we seek how scientific understanding of P cycling has been incorporated into models developed for eutrophication management, and what is the role of P management in regulating eutrophication. Abiotic and biotic processes are intrinsically coupled within the P cycle in aquatic ecosystems. The main focus will be on the role of biota.

Cyanobacteria and toxin production in freshwater: research priorities from a limnological perspective

Rainer KURMAYER

Austrian Academy of Sciences, Institute for Limnology, Mondseestrasse 9, 5310 Mondsee

The worldwide occurrence of cyanobacterial blooms in freshwater and brackish water is a matter of growing concern due to the potential production of cyanotoxins. Fatalities of wildlife and livestock as well as severe human illness due to consumption of water containing toxic cyanobacteria have been reported. During the last decades limnology has contributed substantially to our knowledge on toxin production in freshwater which today has become a research field of major significance in its own including numerous disciplines such as genetics, microbiology, microbial ecology, evolutionary biology, physiology, chemistry, toxicology and others. Considerable progress has been made in many of those fields and excellent research teams with the pertinent expertise in those fields have been established in Europe and other countries. During this lecture major developments will be summarized and important new research directions will be identified. In the future limnology as an ecological sub-discipline will be of crucial relevance for the integration of those multiple research avenues into population orientated and system orientated approaches.

Structure and diversity of bacterial communities, does it matter for lake ecosystems?

Eva S. LINDSTRÖM

Department of Ecology and Evolution - Uppsala, Sweden

Since the beginning of the 1990's molecular tools have been applied in the study of microbial diversity in nature. The application of these tools has led to the discovery of an enormous number of previously unknown bacterial and archaeal taxa. Before this era we already knew that bacteria and other microorganisms play crucial roles in lake ecosystems, and, thus, it was assumed that deeper knowledge about diversity and community structure would contribute to our understanding of lake ecosystems. Questions hotly debated today will be discussed with special emphasis on lake communities: How much can the molecular tools tell us about community structures and diversity, and which are the technological limitations? Is bacterial diversity in nature high or low? Are bacteria globally dispersed or do geographical limitations exist? Which forces are shaping lake bacterial communities? Is bacterial diversity of importance for lake ecosystem functioning?

Ecology of large lakes - how much does the size really matter?

Tiina NÖGES

Estonian University of Life Sciences, Institute of Environmental and Agricultural Sciences, Centre for Limnology, Tartu County, Estonia, 61101

Lake size is an important characteristic of lake typology as large lakes react differently to pressure factors compared to small lakes. According to the European Water Framework directive (WFD), lakes with a surface area of 10-100 km² could be considered as 'large', and lakes larger than 100km² as 'very large'. The surface area, volume and depth are all determining the lake size, which influences hydrodynamics, light climate, biogeochemical cycles, food-web structure, and the length of the food chain. Long water retention time in large and deep lakes leads to a slow reaction to pressures from the catchment and also to a long recovery time once the lake has been impacted. According to the database of European Environmental Agency, large lakes are generally deeper than small lakes but the relative depth decreases with increasing surface area. Large lakes experience a longer wind fetch, which causes deep mixing or intensive sediment disturbance if the lake is shallow. Our study showed a positive relationship between the P content in sediments and the relative depth of the lake. Large lakes may have different parts belonging to different types and having different ecological quality. Among examples of climate forcing on the physics of large lakes in Europe are the deep water warming of large Perialpine lakes, and large-scale water level fluctuations following the dynamic of the North Atlantic Oscillation in a number of large lakes in Finland, North-Western Russia and Estonia. Large lakes offer socio-economic benefits and possibilities for multiple uses and are often the regional centres of economic, agricultural and political activities. The importance of large lakes in terms of economy, e.g. fisheries, is incomparable with that of small lakes. These multiple uses of large lakes form potential risks to the lakes' structure and functioning. One of the challenges of the implementation of WFD in large lakes is, that the number of lakes of a comparable size is small and usually there are no reference sites available. Large lakes have usually been exploited historically for longer time than small lakes and one has to consider carefully how far in history to go to find reference conditions.

Habitat complexity affects resource versus consumer control in benthic food webs

Anja RUBACH

University of Cologne, Institute for Botany, Aquatic Ecology – Cologne, Germany

The importance of habitat-modifying organisms for aquatic systems is increasingly recognized. The presence of these species dramatically increases habitat structure and their activities can affect the distribution and / or abundance of other species by modifying the physical environment, altering the availability of resources, and providing habitat for associated organisms. In theory, structurally complex habitats are expected to sustain more diverse communities than structurally simple ones, since the former should provide a large array of competitive and predatory refuges. Accordingly species richness and habitat complexity are positively correlated in many natural communities, and more structurally complex habitats support higher grazer abundances. A key question regarding the forces that structure communities is the relative influence of consumers (top-down) vs. resources (bottom-up) in controlling community composition, structure and function. Understanding the relative effects of these forces is becoming increasingly important as humans alter ecosystems by removing consumers and increasing nutrients over large spatial scales. While recent syntheses suggest that the direct and indirect effects from trophic levels both below and above operate simultaneously and interactively in structuring communities, it is less well understood, how biotic contribution to habitat structure interacts with bottom-up and top-down processes. More diverse and abundant consumer assemblages should be more efficient at reducing prey biomass. In addition, one of the most striking features of canopy-forming species is to produce shaded habitat. While most studies have used nutrients as a measure of resource availability, light has received much less attention. Light and nutrients may however have strong interacting effects on biomass and diversity of primary producers, and nutrient limitation may be only evident when light is not limiting. Light and nutrient both effect diversity, rates of production and the quality of resources in terms of elemental composition (e.g. C:N ratios). In this keynote lecture I will review empirical data on the integrative effects of resources and consumers on algal biomass. Examples of factorial experiments reporting the biomass of algae in response to manipulations of habitat structure in the presence or absence of consumers will be discussed to highlight the importance of habitat structure for the regulation of autotrophic biomass in aquatic systems.

Local and global disturbances in rivers. Effects on structure and functioning, and implications for management

Sergi SABATER

University of Girona – Girona, Spain

River structure and functioning is largely a reflection of climate characteristics, but also of natural and human-related disturbances. Biological communities in the river ecosystem are able to respond to disturbances faster than those in most other aquatic systems. However, some extremely strong or lasting disturbances constrain the response of river organisms and jeopardise their extraordinary resilience. Among those, the human-induced alterations of river drainage structure and the intense use of water resources may irreversibly influence these systems. The increased channelization and damming cause the interruption of sediment transport, the alteration of biogeochemical cycles and the decrease of biodiversity, both at the local and global scales. Further, detraction of water resources can specially affect the functioning of arid and semiarid rivers. In particular, interception and assimilation of inorganic nutrients can be detrimental under hydrological abnormalities. This might cause, among other effects, a shift from heterotrophy to autotrophy because of both direct effects on primary producers and also indirect effects through the food webs, even in light-limited rivers.

The individual and combined responses of stream ecosystems to multiple stressors

Colin TOWNSEND

Department of Zoology, University of Otago - Dunedin, New Zealand

Resource managers need to understand the effects of stressors on ecosystems in order to identify thresholds of harm but, to be meaningful, thresholds will usually need to be defined for situations where multiple stressors are operating. In this talk I consider the individual and combined effects of the principal stressors (nutrient concentration and streambed sediment cover) operating in native tussock grassland streams converted to pasture in New Zealand, using two different approaches – a survey of 32 small streams and an experiment involving 9 streams in which the stressors were manipulated in a factorial design. We investigated the consequences for populations of individual taxa and for the structure of whole communities, including taxon richness and the representation of species traits. An ecosystem response variable (leaf decomposition rate) was also studied in the experiment. Up to half the taxa and most of the community and ecosystem metrics responded to at least one of the stressors. Effects were more obvious at the community and ecosystem level than for populations of individual taxa, running counter to previous predictions. Our results also suggest that in these streams an increase in sediment from anthropogenic causes has a generally more deleterious effect than augmented nutrient concentrations. Consequently, the development of indexes of stream health that distinguish the effects of sediment from those of nutrients should help prioritise catchment management actions. Of most significance is our finding, both from the survey and, in particular, the experimental approach, of a variety of complex interactions among the stressors. It is not unusual, in other words, for the consequences of stressors to be unpredictable on the basis of knowledge of single effects. If managers only consider the effects of individual stressors their assessment of risk may be higher or lower than reality.

Oral Presentations

Spatial and temporal surface water chemistry variation in a semiarid river network during the monsoonal floods pulse

Vicenç ACUÑA, Cliff DAHM

Department of Biology, University of New Mexico - Albuquerque, USA

Spatial and temporal surface water chemistry variation was analyzed in a semiarid basin in the southwestern US during the monsoonal floods of summer 2006. Landscape characteristics were quantified for the entire basin and the upland-river ecotone (100 m stream buffer strip). Basin and ecotone data were then compared with stream water data chemistry from nine sites across spatial scales in the Gila river network using multivariate and regression techniques. Geology at the basin level and drainage size rather than elevation, slope, vegetation type, soil type or precipitation explained the chemical differences between sites. In contrast, ecotone was a best predictor for sediment related factors in stream channels, such TSS, as well as phosphate. The flood pulses associated with the monsoon period involved a major shift in the water chemistry across spatial scales, which decreased the differences among sites. However, the overall variability in each site was proportional to the drainage size, so that higher chemical stability was found in smaller basins and viceversa. The role of the monsoon pulse in decreasing differences across the river network may be related to the predominance of recent rainfall as major water source and the decreased residence time of water in the basin, while diverse water sources and longer residence times during baseflow conditions enhance differences across sites. The unexpected inverse relationship between chemical stability and spatial scale may be unique of basins in semiarid climates.

How the concentration and availability of organic matter and nutrients affects the bacterial community composition in lakes? - Long-term in situ and mesocosm investigations (Mazurian Lake District, Northeastern Poland)

Tomasz ADAMCZEWSKI, Ryszard Jan CHRÓST

Microbial Ecology Department, Institute of Microbiology, Faculty of Biology, Warsaw University, Miecznikowa 1, 02-096 Warsaw - Poland

The major goal of long-term investigations was to evaluate the relationship between water environment resources (organic matter and nutrients) availability and variability of microbial community composition and intensity of growth and biomass production. The working hypothesis was that the bacterial abundance, cellular activity, biomass production rates as well as changes in cell-size distribution and morphological structure are positively proportional to the degree of water eutrophication of the studied lakes. In order to verify this hypothesis in situ studies on microbial communities in the upper trophogenic water layer in the pelagial zone along the trophic gradient (from oligo/mesotrophy to hypereutrophy) in 18 lakes of the Mazurian Lake District (Northeastern Poland) were conducted. Results of these studies indicated that the most of all examined microbial parameters were tightly coupled to the trophic condition of the studied lakes. Bacterial numbers and biomass production rates markedly increased along the eutrophication gradient of the lakes. Additionally, the contribution of active bacterial cells to the total bacterial number in the studied lakes was positively correlated with DOC concentration. Distinct shifts were found in size distribution of small and large bacterial cells in lakes with higher degrees of water eutrophication. For better recognizing factors regulating bacterial activity, growth and morphological diversity the mesocosm studies with different nutrients (N and P) and organic matter compounds (DNA and BSA) additions were performed. In all enriched mesocosms the changes in microbial community composition were recorded. Their intensity was dependent on supplementation type. The most distinct shifts in bacterial abundance, biomass and cells activity were noted in experimental mesocosms with inorganic phosphorus and dDNA addition. In comparison to the control, 4 - 5 times higher rates of biomass production was observed. Statistical analyses of mesocosm data indicated the crucial role of dDNA as an important source of phosphorus and other compounds for the bacterial growth, activity and biomass production. Results of both types of studies proved the working hypothesis and confirmed the importance of bottom-up mechanisms regulating microbial community composition and activity. However, the potential role of protistan, especially heterotrophic nanoflagellates, impact on microbial parameters and processes (top-down effect) will be discussed.

The role of zooplankton grazing in shallow eutrophic lake ecosystems in Estonia

Helen AGASILD, Priit ZINGEL, Ilmar TÖNNO, Tiina NÖGES

Institute of Agricultural and Environmental Sciences, Kreutzwaldi 64, 51014 Tartu - Estonia

The presentation gathers data collected from several zooplankton feeding studies (1998-2001) in shallow eutrophic lakes in Estonia. The main objectives of the investigation was to estimate the zooplankton grazing influence on bacteria and phytoplankton in a seasonal cycle and to determine the dominant grazers. The study was mainly focused on large naturally highly eutrophic Lake Võrtsjärv where a major part of the zooplankton biomass is composed of ciliates. Ciliates play dominant role in pico- and nanoplankton grazing in this lake: their average daily grazing accounted for 9.3% and 20% of the bacterial and nanoplankton standing stocks, respectively. Metazooplankton that is formed mainly of rotifers, cyclopoids and small cladocerans, consumed only a minor part of the bacteria and nanoalgae. In size fractionation study the abundant small-sized organisms (48-100 μm) like ciliates and rotifers contributed to the most of zooplankton filtration and grazing throughout the major part of the productive period. Larger zooplankton that is composed mainly of crustaceans contributed on average one third of the zooplankton feeding. Due to largely inedible phytoplankton taxa prevailing in the lake, the zooplankton was able to consume on average less than 5% of the total phytoplankton biomass and approximately one third of primary production during one day. The results suggest that in Võrtsjärv the majority of the bacterial and phytoplankton primary production is most likely consumed via the microbial loop. In contrast to Võrtsjärv a considerably larger extent of bacterial and phytoplankton organic matter was consumed by metazooplankton in lakes Kaiavere and Prossa where the zooplankton feeding conditions are more favorable and the grazers assemblage contains more effective filtrators. The results of the studied lakes show that the size structure and taxonomical composition of zooplankton played an important role in energy and matter transport in the food web. In lakes with abundant population of small-sized grazers ciliates may be even more important trophic link than metazoan zooplankton.

Comparison of "constant rate" and "slug" addition methods in the study of nutrient retention in rivers

Marta ÀLVAREZ PÉREZ¹, Francesc SABATER I COMAS¹, Andrea BUTTURINI², Lorenzo PROIA³, Antonio RUGGIERO³, Gianmaria CARCHINI³

¹ -Universitat de Barcelona, 08028 Barcelona - Spain

² -Centre d'Estudis Avançats de Blanes, 17300 Blanes, Girona - Spain

³ -Università degli Studi di Roma "Tor Vergata", 00133 Roma - Italy

Within the spiralling length framework, the nutrient retention efficiency in rivers has become object of numerous works of investigation in fluvial biogeochemistry. Although the most popular method used to estimate the nutrient retention efficiency is the "constant rate" addition method, several studies are based on the "slug" addition method which is simpler and less expensive in time, instruments and reagents. However, the extent to which the results using both methods are comparable it is unknown. In order to reduce this gap we performed 10 double slug and constant rate addition experiments in two low-order Mediterranean streams: Fuirosos (Barcelona, Catalunya), draining granitic watershed, and Simbrivio (Rome, Italy), draining calcareous watershed. During each addition we estimate the phosphorus uptake rate (K , s^{-1}) by means of a mass balance equation. K is a first-order uptake rate coefficient and can be used as an estimate of the stream nutrient retention efficiency. The experiments were carried out with stream discharges ranging from 3.5 to 25 $L s^{-1}$ in Fuirosos and from 46 to 203 $L s^{-1}$ in Simbrivio. In 70 % of the cases, the uptake coefficient determined by constant rate addition (K_c) resulted greater than the uptake coefficient determined by slug addition (K_s). The relative differences among the two estimates ranged between -54% and 86% in Fuirosos and -18% and 64% in Simbrivio. In more detail, in Simbrivio these differences increased significantly at high discharges ($r=0.76$, $p<0.05$). These preliminary results suggest that the uptake rates estimated with the slug method are not easily comparable to that estimated with the constant method.

Differences between abiotic and biotic typologies of Swiss ponds

Sandrine ANGELIBERT¹, Beat OERTLI¹, Dominique AUDERSET JOYE², Emmanuel CASTELLA, Raphaëlle JUGE, Jean-Bernard LACHAVANNE

¹ -University of Applied Sciences of Western Switzerland, EIL, 1254 Jussy/Geneva - Switzerland

² -Laboratoire d'Ecologie et de Biologie Aquatique, University of Geneva, 1206 Geneva - Switzerland

The development of a typological classification for aquatic ecosystems is essential for their comprehensive management and conservation; it is furthermore required by the European Water Framework Directive. As ponds are now recognized as freshwater habitats clearly distinct from lakes and running waters, there is a need for a specific pond-typology. Eighty permanent ponds scattered throughout Switzerland were described using 100 environmental variables; the species diversity of four animal taxa (Gastropoda, Odonata, Coleoptera and Amphibia) was recorded. The Self-Organizing Map algorithm (SOM, an unsupervised neural network) was used to interpret the variability of 1) environmental conditions in order to establish an abiotic variables based typology and of 2) species assemblages, to build a biotic classification. At first, a preliminary abiotic based typology of Swiss ponds is proposed which defines three distinct pond types: high altitude ponds, forested lowland ponds and agricultural lowland ponds. The various species richness patterns were confronted to the resulting clusters of sites. In a second step, we produced four typologies based on biotic variables to test how consistently different taxonomic groups classify pond sites. Depending on the taxa used, ponds were discriminated into three to four clusters of sites. Altitude was always the major environmental factor explaining the differences in species assemblages. Then, Amphibia community structure was mainly correlated to pond age, submerged vegetation and water transparency whereas Coleoptera were only related to pond age and Odonata to both pond surface area and water transparency. Gastropoda species assemblages could not be correlated to any of the environmental variables studied. The results are discussed with emphasis on the implications for pond conservation and environmental management.

Artificial wetlands of Crete. A study on their rate of biological succession based on the structure of their macroinvertebrate communities

Panagoula ANTONOPOULOU, Catherina VOREADOU, Mihalis DRETAKIS

The Natural History Museum of Crete, University of Crete, Knossou Av., 71409 Iraklion, Crete - Greece

A lot of artificial wetlands have been already constructed in Crete, due to high demands for water. The "oldest" is 78 years old and the "youngest" only 1.5. In most of the studies which present the ecological status in Mediterranean artificial wetlands of different "ages", a satisfactory invasion of new colonizers is shown. The aim of this study is to record the rate of biological succession of several artificial wetlands of different ages based on the structure of their macroinvertebrate communities. The results revealed that mature artificial wetlands have developed high biodiversity rates, comparable to the natural ones. Advantages and disadvantages of the construction and management of present artificial wetlands are also commented.

Changes in transient storage and nutrient retention related to channel manipulations

Alba ARGERICH¹, Eugènia MARTÍ², Roy HAGGERTY³, Francesc SABATER¹, Miquel RIBOT²

¹ -Universitat de Barcelona, 08028 Barcelona - Spain

² -Centre d'Estudis Avançats de Blanes -CSIC, 17300 Blanes - Spain

³ -Oregon State University, OR 97331-5506 Corvallis - USA

Water transient storage is assumed to influence nutrient retention in stream ecosystems. However, recent studies suggest that this influence is not only related to the size of the hydrological transient storage, but also to the nature of the compartments involved in it. In the present study we examined the effect of structures having distinct hydraulic conductivity on water transient storage and nutrient uptake using an experimental channel manipulation approach. The study was conducted in an irrigation canal where we selected 4 20-m reaches in which we placed bags of nylon mesh filled with either sand, mud or cobbles distributed at even intervals. We compared hydraulic and nutrient responses to a control reach, where no substrata were introduced. A total of sixteen short-term additions (chloride + ammonium + phosphate) were performed during November 2006. The OTIS model was used to estimate transient storage area (A_s) and exchange coefficient (α). Uptake velocity (V_f) was used as the metric to assess phosphate and ammonium retention. The introduction of the bags into the canal contributed to decrease average water velocity, but only the treatment with cobbles increased the relative size of the water transient storage zone. Lack of effect of the other two substrata treatments on the water transient storage could be due to the low hydraulic conductivity of the bags with both sand and mud. The effect of substrata treatments on nutrient retention was also more evident in the reaches with cobbles: V_f for both ammonium and phosphate were higher in the control and cobble treatments than in the treatments with sand and mud.

Creation of a predictive model for small mountainous Mediterranean streams (R-M4 type) and comparison of its performance with biotic and multimetric indices

Vassilia ARTEMIADOU, Maria LAZARIDOU

Aristotle University, University Campus, 54124 Thessaloniki - Greece

The comparison of the observed benthic macroinvertebrate fauna to that of respective reference conditions is a well documented approach for the estimation of the running water quality and from 2001 and on a requirement of the European legislation (Water Framework Directive 2000/60/EC, WFD). The only method that has been in force before the publication of the WFD and is based on the idea of the deviation from site specific reference condition is the RIVPACS type models, already in use in Great Britain, Australia and Czech Republic. Moreover, in view of the WFD deadlines, the European member states have been involved in the exercise of the Intercalibration of the water quality assessment methods, a key point of which is the determination of reference conditions and the harmonization of the national methods based on the concept of their deviation from undisturbed conditions. Under the requirements of the recent developments an effort was made for the first time in Greece to create a RIVPACS type predictive model, as a preliminary phase, for a mountainous basin (161.3 km²) consisted of ten streams (intercalibration type R-M4) that ended up in the Tavropos Reservoir (Western-Central Greece). Benthic macroinvertebrate 3 min kick sweep sampling (plus 1 min when bank vegetation existed) and determination of 39 physical/physicochemical and habitat evaluation parameters took place at ten sites (covering the entire basin) seasonally for two consecutive years. The initial study of the area revealed the high/good condition of all sites but one. Thirty-two samples were chosen as reference based on the surrounding land use and their habitat condition. The clustering of their benthic fauna was based primarily on site specific and secondarily on time varying characteristics. Discriminant Analysis verified the fauna clustering using mainly physical variables which were farther used for the prediction of the expected fauna. The remaining 46 samples were then used for validation of the model and for the comparison of the model assessment to the performance of the Hellenic Evaluation System and the Multimetric indices used in the Intercalibration Exercise.

Benthic structure and metabolism in a Mediterranean stream: from the biological communities to the whole stream ecosystem function

J. ARTIGAS¹, A.M. ROMANI¹, S. SABATER¹, A. GAUDES², I. MUÑOZ²

¹ -Institute of Aquatic Ecology, University of Girona, Campus Montilivi, 17071 Girona - Spain

² -Department of Ecology, University of Barcelona, 08028 Barcelona - Spain

In headwater forested streams, the energy sources transformed by heterotrophs exceed the energy produced within the stream by photosynthesis, except during short periods in winter and spring. An analysis on the structure and metabolism of biofilms and meiofauna colonising leaves, sand and rock substrata of a stream reach was performed in a Mediterranean stream. This analysis was carried out at habitat scale, and later converted to the reach scale by considering the cover of each substrata in the reach, the analysis of microbial (bacteria, fungi, algae) and consumers (meiofauna) biomass, the microbial decomposition of organic matter (extracellular enzymes) and the stoichiometry of biofilms (C/N/P ratios). During spring, algal and bacterial biomass increased on inorganic substrata conjointly with the peptidase activity in biofilms. In contrast, the fungal and bacterial biomass increased on leaves and sand substrata in autumn, coinciding with the high cellulolytic activities in the benthic community. Meiofauna proliferated in this two moments of large availability of OM sources from different origin (autochthonous vs. allochthonous). Overall, biofilm structure and metabolism were organised responding to availability of light and organic matter.

Characterization of the development of Cyanobacteria functional group (Plankothrichetum) in the highly eutrophic Lake Nero (Russia)

O.V. BABANAZAROVA, S.I. SIDILEV, S.V. SHISHELEVA

Yaroslavl State University by named P. G/ Demidov, 150057 Yaroslavl - Russia

Qualitative and quantitative studies of phytoplankton, concentration of inorganic nitrogen, phosphate and chlorophyll *a* in the water column and their seasonal and spatial variations have been studied in the open water of the large, shallow and highly eutrophic Lake Nero in periods spanning over a decade (1987-1989 and 1999-2005). We show that phytoplankton of Lake Nero now consists of commonly occurring combination of the **J** greens, **C** and **D** diatoms and **S₁** filamentous Cyanobacteria (Reynolds et al., 2002). It is a shallow-water, nutrient-rich regime, which supports the algal assemblage of the Plankothrichetum **S₁** type. The composition of this community is dominated by persistent species that perform well under conditions of poor light. The dependence of transparency on total biomass has increased in the past period ($r=-0.83$). The seasonal dynamics also conforms to the Plankothrichetum expectations. The set of dominant species varies within this assemblage. *Pseudanabaena limnetica* (Lemm.) dominated in the end of 90s, whereas *Limnothrix redekei* (Van Goor) Meffert and *Planktothrix agardhii* Gom. have reached dominant, high-frequency occurrences only in the past six years. We discuss how common the situation observed is, as well as the correlations of the community compositions on the most important abiotic and biotic factors.

Reynolds C.S., Huszar V., Kruk C., Naselli-Flores L. & Melo S. (2002) Towards a functional classification of the freshwater phytoplankton. *Journal of Plankton Research* 24, 417–428.

***Daphnia* distribution in Andean Patagonian Lakes: Effect of low food quality and fish predation**

Esteban BALSEIRO, Beatriz MODENUTTI

CONICET-UNC. Laboratorio de Limnología., 8400 Bariloche - Argentina

Food quality in terms of carbon (C):phosphorus (P) ratio can constrain the success of highly demanding P herbivores as *Daphnia*. North Andean Patagonian lakes are ultraoligotrophic with low nutrient concentrations and well developed euphotic zones. We investigated the distribution of the large *Daphnia commutata* in relation with food quality (sestonic C:P ratio) and predation risk in these lakes. The predation risk was estimated based on the fish species present and their relative eye diameter and transparency of the lake. The C:P ratios in the lakes were high, varying from 350 to >1200. The lakes with *D. commutata* had significantly lower C:P ratio than those without these daphnids. On the other hand, those lakes where *Daphnia* is present have the lower predation risk than those where *Daphnia* is absent. In addition, we carried out growth experiments with neonates and natural seston of three lakes with different C:P ratio. The growth rates were inversely related with C:P of the food. Food quality and predation risk together determined the success or failure of large *Daphnia* populations in these Andean clear ultraoligotrophic lakes.

Host manipulation by an acanthocephalan parasite (*Polymorphus minutus*): escape performance of an intermediate host (*Gammarus roeselii*) against non-host predators

Jean-Nicolas BEISEL, Vincent MEDOC

Univ. Paul Verlaine - Metz / IEBE Laboratory, 57070 Metz - France

The acanthocephalan parasite *Polymorphus minutus* influences intermediate host behaviour in order to favour trophic transmission to its ultimate host, generally a bird. The host manipulation was investigated in *Gammarus roeselii*, a gammarid species introduced in France 150 years ago which now coexists with several exotic species from different origins. We clearly placed host-parasite interactions on the community scale within the current context of biological invasions.

According to recent studies, the vertical distribution of *G. roeselii* is modified by *P. minutus* infection. However, under laboratory conditions both infected and non-infected individuals remained benthic. The addition of a benthic predator (*Dikerogammarus villosus*) to the experimental device was perceived as a physical stimulus which involved a vertical displacement of infected *G. roeselii* towards the water's surface. This altered behaviour limits the consumption of infected gammarids by non-host species and promotes parasite transmission to avian predators. To go further we first tested the survival abilities of the *G. roeselii* / *P. minutus* system when exposed to a pelagic non-host predator. A second aim was to investigate the escape performances (swimming speed) of infected *G. roeselii* depending on the water depths and the availability of refuges. Finally, we determined whether the feeding activity of amphipods was modified by the *P. minutus* infection considering that the foraging activity makes individuals more conspicuous to predators and decreases their vigilance.

Parasite-induced effects depend on the altered traits of hosts, favouring their safety behaviours and inhibiting the risky ones according to potential non-viable predators. In a biological invasion context, our results show that parasites can mediate the outcome of the new inter-specific interactions, such as predation, especially when the species are closely related.

Effect of global climate change on the role of hydrology and nutrients in the ecology of shallow lakes in Mediterranean Turkey

Meryem BEKLIOGLU

Biology Department, Middle East Technical University, 06531 Ankara - Turkey

Functioning of shallow lakes is very sensitive to hydrology, especially water level fluctuations (WLF). Water level naturally fluctuates spatially and temporally on scales determined by catchment characteristics, regional climate, and anthropogenic factors including human water use and global climate change. Large water level fluctuations are common in semi-dry to dry Mediterranean climates due to high evaporative loss that is not balanced by an adequate water income. Turkish shallow lakes, which are located in a semi-arid Mediterranean climate, are very sensitive to water level fluctuations that appear to be governed by the North Atlantic Oscillation (NAO) teleconnection pattern comprising various drought and wet periods. Investigation of the relationships between WLF and submerged plant development in several Turkish shallow lakes revealed that in all lakes WLF emerged as a major factor determining submerged plant development. In relatively nutrient poor shallow lakes, high submerged plant coverage was observed when the water level was low. However, during the warmer and drier periods observed during the strong negative phases of NAO index, hydraulic residence time and salinity increased profoundly and led to the disappearance of Cladocera species, especially *Daphnia*. Furthermore, in eutrophic lakes, drier conditions associated with warmer water temperature, increased phytoplankton production - largely cyanobacteria - and low dissolved oxygen availability led to an increased internal phosphorus loading. However, the same conditions resulted in suppression of denitrification and in turn accumulation of ammonium. Such turbid conditions led to the disappearance of submerged plants despite the low water level. Major fish kills also became a part of drier periods. Through global warming, these processes are likely to be enhanced, leading to enrichment of nitrogen and phosphorus and in turn, turbid water conditions. Since it is predicted to lead to a further increase in temperature and drier conditions in the region, many freshwater lakes will become more vulnerable to increased salinity, eutrophication and even desiccation, ultimately leading to alterations in the littoral community and associated diversity. This may pose new challenges for the management of shallow lakes located in the Mediterranean region.

New state of benthos in large lakes of European Russia as a result of human-mediated stresses

Nadezhda BEREZINA

Zoological Institute of the Russian Academy of science, 199034 St. Petersburg - Russia

This study focuses on cumulative impact of two anthropogenic stresses as nutrient pollution (eutrophication) and intentional introductions of invasive species on macroinvertebrate communities in the lakes and estuary on north-western Russia (Baltic Sea basin). High nutrient inputs into these aquatic ecosystems induce expansion of reeds and/or blooms of fast-growing filamentous algae in the littoral zone. These processes have resulted in increasing eutrophication, pollution by decaying macroalgae, temporary deoxygenation of water and near bottom layer and influenced negatively on dynamics of benthic communities. These destabilizing fluctuations in benthic biomass contribute invasive species success through increase of ecosystem vulnerability. The rate of species introductions into the Baltic Sea basin, associated with human activity, has increased since the 1950s. Baikalian amphipod *Gmelinoidea fasciatus* (Stebbing) is one of the most successful invaders in inland waters of Russia. Currently *G. fasciatus* have successfully established in Baltic Sea basin including the Neva Estuary and large lakes as Lake Ladoga, Lake Onega and Lake Peipsi. Benthic communities in coastal zone of these aquatic ecosystems were monitored from 1980s to 2005. Changes in native benthos biomass and structure after invasion of *G. fasciatus*, role of newcomer in benthic communities and diet of fish in different freshwater ecosystems are analyzed. High reproductive rate and environmental tolerance of *G. fasciatus* have facilitated their rapid population growth and key role in the communities (up to 70 % in total biomass). Its predation pressure on benthic invertebrates resulted in abrupt alterations in macroinvertebrate communities, decrease in biomass or losses of some species, and structural homogenization. The *G. fasciatus*, which was introduced with the aim of food enhancement for fish, has occurred as the main food item in diet of ruffe, perch and young burbot. The consequences of *G. fasciatus* invasion need thorough study to assess the changes in the lake ecosystem.

Susceptibility of bacterioplankton to nutrient and substrate addition in ultraoligotrophic Patagonian lakes

Roberto BERTONI¹, Cristiana CALLIERI¹, Esteban BALSEIRO², Beatriz MODENUTTI²

¹ -CNR - *Institute of Ecosystem Study, 28922 Verbania - Italy*

² -CONICET - *UNC Laboratory of Limnology, Universidad Nacional del Comahue, San Carlos de Bariloche -Argentina*

We measured bacterioplankton activity in four North Patagonian lakes during austral summer 2006. These lakes are ultraoligotrophic with TDP concentration ranging 1.46-2.27 $\mu\text{g L}^{-1}$. They are deep (90 - 460 m max depth range), clear (kd PAR 0.09 - 0.16 m^{-1}) with a pronounced DCM. The trophic chain is mainly made up by large mixotrophic ciliates, nanoflagellates and picoplankton. For this reason the bacterioplankton predation constitute a large portion of the energy transfer within the trophic chain. The range of leucine uptake was 10-50 pmoles $\text{Leu L}^{-1} \text{h}^{-1}$ showing a reduced metabolic activity also in productive season. We made laboratory experiments with natural samples from Lake Gutierrez, limited by phosphorus and organic carbon. We amended natural samples with orthophosphate (P), organic carbon as glucose (C) and both (P and C), keeping the natural C:P ratio. We followed in the short time the growth and bacterial activity variation to understand the importance of P and C addition as heterotrophic activity enhancer. The experiments were performed in spring (November) and summer (February) at different temperatures (12 °C and 17 °C respectively) and different bacterial metabolic status (23-64 pmoles $\text{Leu L}^{-1} \text{h}^{-1}$ respectively). In the spring experiment we did not observe an increase in growth rate after 24 hours for all the treatments but the leucine uptake increased significantly in the PC treatment (from 23 to 136 pmoles $\text{Leu L}^{-1} \text{h}^{-1}$). In the summer experiment an increase in growth was observed already after 4 hours. After 24 hours a noticeable increase in leucine uptake became evident in all the treatments [from 64 to 1084 (P), 1071 (C), 1364 (P and C) pmoles $\text{Leu L}^{-1} \text{h}^{-1}$]. These results indicate the presence, in summer, of a bacterial population with low metabolic rate but potentially able to respond quickly to nutrient/substrate addition. On the other hand, the spring population were more abundant and more resilient to medium alteration. The low activity of bacterioplankton of andine ultraoligotrophic lakes is not an inherent property of such population but it can be altered in the short-term when nutrient/substrate pulse is applied in summer condition, i.e when they are metabolically ready to react.

Structure and species richness of benthic macroinvertebrate assemblages in the Western Carpathian spring fens

Jindriska BOJKOVA, Marketa OMELKOVA, Jan HELESIC, Michal HORSÁK

Department of Botany and Zoology, Masaryk University, 61137 Brno - Czech Republic

Spring fens represent a unique and rare aquatic biotope whose benthic fauna have been mostly overlooked. The main aim of the study is to describe the macroinvertebrate assemblages and assess the main environmental factors influencing them. We chose sites differing both in water chemistry and the substrate characteristics to cover the complete variability of treeless spring fens. The study was carried out in 2005 on 11 sites in the Western Carpathians (the borderland between the Czech Republic and Slovakia). Macroinvertebrates were sampled quantitatively three times a year in two habitats (flowing and moist) at each site (66 samples). Altogether, 75 taxa were recorded (Diptera was not included in presented results). Insecta represented most of the number of taxa, but non-insect taxa highly dominated in total abundance in all sites. A cluster analysis of macroinvertebrate assemblages separated the studied fens into five clusters which were in accordance with the results of detrended correspondence analysis (DCA); for these cluster indicator species were computed (Indicator species analysis). Each cluster was characteristic by different set of taxa dominated in macroinvertebrate assemblage: the amphipod-oligochaete-dominated assemblage was associated with tufa-forming fens, the mollusc-dominated assemblage with grassland fens, the oligochaete-mollusc-dominated assemblage with peat-forming fens, the mollusc-stonefly and the oligochaete-stonefly assemblages with *Sphagnum* fens. The influence of the gradient of mineral richness (the poor-rich gradient) and the fertility gradient, which were assessed as a major environmental gradients in the vegetation and molluscan communities in central European spring fens, on the composition of macroinvertebrate assemblages will be discussed.

Past events explaining caddisfly biodiversity and distribution in the Western Mediterranean: from communities to populations

Núria BONADA¹, Carmen ZAMORA-MUÑOZ¹, Cesc MÚRRIA², Narcís PRAT², Majida EL ALAMI³

¹ -University of Granada, 18071 Granada - Spain

² -University of Barcelona, 08028 Barcelona - Spain

³ -University of Tetouan, 93002 Tetouan - Morocco

Along the east of the Iberian Peninsula and north of Morocco, three main geological events might be important for aquatic biota: the alpine orogeny that began in the Eocene, the orogeny and movement of the Betic-Rif plate between the Oligocene-Pliocene, and the glaciations during the Pleistocene. To understand how these historical factors explain present caddisfly biodiversity and distribution, 100 reference sites were sampled covering an area of about 1200 km from the Pyrenees to the Rif region in north of Africa. In the same area, individuals of the Betic-Riffian headwater species *Allogamus mortoni* and the Palearctic downstream species *Chimarra marginata* were collected and the gene COI from the mtDNA was sequenced to estimate gene flow, phylogeography, and population structure. Community structure analyses revealed that central and northern areas were characterized by a high proportion of Palearctic species with some endemisms. The Betic and Rif areas have higher endemism and share few caddisfly species in comparison with previous coleopteran and botanical studies. Regional effect was present at community level in headwater sites illustrating historical effect of each region, but it was lost in downstream sites. Population genetic analyses confirmed structural patterns in headwaters species and also indicated regional effect in downstream species. Haplotype analyses revealed that two lineages arose from *C. marginata* northern specimens: one that colonized the Rif and the Betic regions and another that colonized central Iberian Peninsula. For *A. mortoni*, Betic populations also seemed to be originated from a Rif lineage. Our results suggest that the Rif area, not affected by glaciations and not mixed with central European species, has a great biogeographical value and urgent conservation measures are needed given that drought periods are extending and most of caddisflies lack of traits to cope with the increase of temporality.

Impacts of hydropower production on the macrobenthic communities in mountain streams

Elisa BOTTAZZI¹, Gaetano GENTILI², Giampaolo ROSSETTI¹

¹ -Department of Environmental Sciences, University of Parma, 43100 Parma - Italy

² -Graia S.r.l., 21020 Varano Borghi (Varese) - Italy

We studied the impacts of water captations for hydropower generation on mountain streams of the Adamello Regional Park (Retic Alps, Italy). Three streams with different hydrological conditions were chosen: natural flow, water release matching the minimum flow requirements established by the Italian legislation, and below those low flow limits. In each stream, three sampling sites were fixed and samples were collected at seasonal intervals for one year. Benthic macroinvertebrates were gathered using a Surber net, and biological indexes (Rapid Biomonitoring Protocol III, Simpson and Shannon-Weaver indexes) were calculated; in addition, flow rates and water physical and chemical parameters were determined. The stream with natural flows showed the best quality conditions. In particular, the average deviations of all indexes from reference conditions were lower than in altered flow regimes, and the benthic community was characterized by greater species richness and stability throughout the year. In the streams influenced by hydropower regulation, stress conditions were mainly due to hydropeaking, reduction of thermal homeostasis, and loss of riverbed microhabitats as a consequence of sediment flushing from upstream reservoirs. This study emphasizes the necessity of addressing mitigation efforts to minimize the negative impacts of hydropower generation on the river biota, ecosystem functionality, and integrity of alpine habitats.

Cladoceran succession in hydrologically different temporary pools

Liesbet BOVEN, Luc BRENDONCK

Catholic University Leuven, Laboratory of Aquatic Ecology, 3000 Leuven - Belgium

Seasonal succession in the invertebrate communities of temporary pools usually follows a distinct pattern. First, large branchiopods and cladocerans appear. Their fast growth and reproduction allows them to colonize the new habitat rapidly. Next, insects such as odonates, bugs and beetles, amongst which main predators, arrive. As these species need more time to develop, they only become dominant in a later stage. While this general pattern is already well understood, studies on seasonal changes within the succeeding groups (e.g. cladocerans) are missing. Our aim is to study more in detail the turnover of cladoceran species over time. Besides, we want to investigate the effect of length of inundation (i.e. hydroperiod) on succession in the pools. Temporary freshwater habitats in and around the Kiskunság National Park (Hungary) are exceptionally species rich. Therefore, they are ideal study systems for our research. 20 pools with a length of inundation varying from less than ten weeks (short-lived) up to more than four months (long-lived) were selected. In the spring of 2005, pools were sampled every two weeks from the moment they filled with snowmelt (March) until they dried. Sampling included the collection of cladocerans as well as the monitoring of habitat characteristics following standard procedures. Cladoceran assemblages were investigated using multivariate statistics. Significant seasonal changes were observed in the cladoceran communities, especially early in the season. Changes are discussed and interpreted in regard to changing habitat characteristics. Although some species were associated with different hydroperiod classes, overall community composition did not differ significantly between pools with different length of inundation. Interactions between time and hydroperiod class were also not significant. As such, we did not observe an increasing dissimilarity between hydroperiod classes over time. Finally, in short-lived pools we observed an interruption of succession as the pools dried up, rather than an 'acceleration' towards a late inundation community. In subsequent studies, the macroinvertebrate community will be analysed using an analogue approach. Results of both groups will be linked and compared.

Century scale pollution history of River Tisza (Hungary) reconstructed by sediment chemistry of oxbow lakes

Mihály BRAUN¹, István PAPP², Imre SZALÓKI³, Martine LEERMAKERS⁴, János KORPONAÍ⁵

¹ -Department of Inorganic and Analytical Chemistry, University of Debrecen, H-4032 Debrecen - Hungary

² -Department of Mineralogy and Geology, University of Debrecen, H-4032 Debrecen - Hungary

³ -Department of Experimental Physics, University of Debrecen, H-4032 Debrecen - Hungary

⁴ -Department of Analytical and Environmental Chemistry (ANCH), Vrije Universiteit Brussel (VUB), B-1050 Brussels - Belgium

⁵ -West-Transdanubian District Environmental and Water Authority, Dept. Kis-Balaton H-8360 Keszthely - Hungary

The regulation of the river Tisza was probably the greatest influence on the natural environment in Europe in the 19th century. The regulation increased the kinetic energy of the river and reduced the duration of floods. River meanders were cut off and oxbow lakes were formed with known details. The two major environmental problems in the studied area are the floods and the heavy metal pollution events. The origin of heavy metal pollution are mining and industrial activities on the catchment area since historical times. The most serious pollution event of the last decades occurred in May, 2000, when flotation slurry with high Cu, Zn and Pb concentrations contaminated the river originating from Baia Borsa, Romania. The aim of this paper is to investigate the pollution history of river Tisza using palaeolimnological traces of heavy metal pollutions in oxbow lake sediments. Sediment cores were taken from oxbow lakes in the Upper Tisza region in 1997, in 2000 shortly after the Baia Borsa mine disaster, and in 2003. Surface sediment samples were taken to determine the mobility of the heavy metals. The concentrations of Pb, Zn and Cu were extremely high in the upper sediment layer. Speciation analysis showed that the amount of heavy metals were high in the immobile fractions such as sulfides and compounds bound to Fe-Mn oxyhydroxides. The highly contaminated layer associated with the Baia Borsa mine accident was reflected by the sharp peaks of Pb, Cu and Zn in the sediment core taken in 2003. Owing to the high sedimentation rate, the peak was at a depth of 10 cm from the sediment surface. Due to the high sedimentation rate and the anoxic conditions in the bottom water, the heavy metals form highly insoluble sulfides. X-ray densitometric measurements of the sediment cores showed that the sediment layers have fine structure which indicates negligible mixing of sediment. The Cs-137 originating from nuclear explosions appears in the sediments deposited after 1945. Its profile has two maxima: the lower is associated with the nuclear tests between 1963 and 1967, the upper is associated with the Chernobyl accident in 1986. The sedimentation rate was found to be 2-3 cm y⁻¹. The concentration of 17 elements were analyzed by multivariate statistical methods (principal component and cluster analysis). The sediment layers deposited during floods were found to have higher Cu, Pb and Zn concentrations. Investigation of sediments were found to be a useful method to detect past pollution events. Such unreported pollutions occurred in the middle of the 20th century due to industrialization.

The potential impacts of climate warming on spatial patterns of stream fish assemblages

Laetitia BUISSON¹, Gael GRENOUILLET¹, Puy LIM²

¹ -Laboratoire Evolution et Diversité Biologique, Université Paul Sabatier, 31062 Toulouse cedex 4 - France

² -ENSAT, Auzeville Tolosane, 31326 Castanet-Tolosan - France

During the last century, climate change has been increasing continuously and there is now ample evidence that this change will irreversibly affect animal and vegetal species across the globe. One of the main expected impact is the modification of the species spatial distribution. In freshwater ecosystems, fish species are very sensitive to temperature fluctuations as they are ectothermic animals. Therefore, this study aimed at assessing the impacts of climate warming on fish species distribution in a large French watershed. To this purpose, fish data were annually collected between 1994 and 2005 in 141 sites distributed evenly across the Adour-Garonne drainage basin, southwestern France. Spatial distribution models (GAM) for each of the 28 most common species were used. These models, including both local physical factors such as the position on the upstream-downstream gradient or water velocity, and one climatic factor (annual mean temperature), described the current species distribution and assemblages composition. Then, several scenarios of climate warming were applied to the observed specific distribution models in order to predict potential changes in species distribution and fish assemblage structure. Overall, cold-water species such as brown trout or bullhead would tend to less occurred in the Adour-Garonne basin and to be confined in the most upstream sites. On the other-hand, the responses of warm-water species would be much more variable. These potential changes in species distribution would result in a rearrangement of fish assemblage structure.

Picophytoplankton of Andine deep ultraoligotrophic lakes: a comparison with the oligo-mesotrophic subalpine Lake Maggiore

Cristiana CALLIERI¹, Beatriz MODENUTTI², Emanuele CARAVATI¹, Gianluca CORNO¹, Esteban BALSEIRO², Roberto BERTONI¹

¹ -CNR - Institute of Ecosystem Study, Verbania Pallanza - Italy

² -CONICET – UNC Laboratory of Limnology, Universidad Nacional del Comahue, Bariloche - Argentina

Picophytoplankton (PicoPhy: 0.2-2 μm) has been recognized as an important component within the pelagic communities in both, freshwater and marine environments. Compared with larger-sized phytoplankton, PicoPhy do best in resource-poor habitats. Importance of PicoPhy was observed to relatively rise with decreasing phosphorus concentrations. In the Andean-Patagonian region (around 41°S), many lakes are ultraoligotrophic and could be considered, therefore, as suitable environment for PicoPhy success. In these lakes total dissolved phosphorus (TDP) concentration ranges between 1.46-2.27 $\mu\text{g L}^{-1}$. They are deep (90 - 460 m max depth range), very clear (k_d PAR 0.09 – 0.16 m^{-1}) with a pronounced deep chlorophyll maximum (DCM) which forms below the thermocline and is caused by communities of mixotrophic ciliates, nanoflagellates, dinoflagellates and PicoPhy. Lake Maggiore is an oligo- mesotrophic subalpine lake (Northern Italy, around 45°N); it is deep (372 m) and clear (k_d PAR 0.22 m^{-1}). Lake Maggiore has been selected as a comparative site in the study for the PicoPhy of Andine lakes. PicoPhy in Andine lakes is mainly composed by very small picocyanobacteria (rods 0.96x0.58 μm , cocci 0.78x0.64 μm) but in some of these lakes also elongated forms are present (11x 0.99 μm). In Lake Nahuel Huapi small red fluorescing cells (probably eukaryotic) were observed but not yet classified. Picocyanobacteria from Lake Maggiore (rods 1.57x0.91 μm , cocci 1.24x1.08 μm) are mainly phycoerytrin-rich cells and a minority of undetermined eukaryots. During summer stratification the range of daily PicoPhy production was 45-95 $\text{mgC m}^{-2} \text{d}^{-1}$ in Andine lakes versus 34-266 $\text{mgC m}^{-2} \text{d}^{-1}$ in Lake Maggiore. In this presentation we will discuss a comparative study of PicoPhy ecological characteristics: distribution along the water column, photosynthetic efficiency, P/E curves, phosphorus limitation. Furthermore we applied molecular techniques in order to assess the biodiversity of picocyanobacterial communities from Andine lakes and Lake Maggiore environmental samples of different depths. DNA fragments by denaturing gradient gel electrophoresis (DGGE bands, identifying for operational taxonomic units, OTU) after polymerase chain reaction (PCR) amplification of the 16S rRNA gene were used. Richness and relative composition of PicoPhy communities was compared with a cluster analysis of recognized OTUs.

Epiphytic macroinvertebrate communities on *Phragmites australis* in the coastal lagoons of the Llobregat's river deltaic plain (Barcelona, Spain)

Miguel CAÑEDO-ARGÜELLES IGLESIAS, María RIERADEVALL SANT

Departamento de Ecología de la Universidad de Barcelona, 08028 Barcelona - Spain

Epiphytic macroinvertebrates assemblages associated to *Phragmites australis* were studied seasonally in 11 shallow lakes of Llobregat's river Delta (Barcelona, Spain). Water physical and chemical analyses included field measurements, nutrient analyses and epiphytic algae biomass and particulated organic matter analysis. Macroinvertebrates were collected quantitatively in three locations at each site and were analyzed both in terms of density and biomass.

Total macroinvertebrates density ranged from 64 to 32960 individuals m⁻²; and chironomids were the most abundant taxon, averaging 79 % of total density and representing the 44% of total taxa richness (S = 34). Macroinvertebrates density decreased significantly with conductivity. Crustaceans and polychaetes were representative of lakes subjected to direct marine influence, while insects' larvae and oligochaetes were more abundant in oligohaline sites. Species composition also varied according to a eutrophic gradient, although nutrients played a secondary role, being more important to chironomids than to the rest of macroinvertebrates. *Chironomus thummi* and *Cricotopus sylvestris* resulted representative of the most eutrophic sites, while *Cricotopus intersectus*, *Corynoneura scutellata* and *Psectrocladius sordidellus* were associated to less eutrophic conditions.

No significant relation was found between macroinvertebrates and epiphytic algae biomass, although the lagoons with the highest macroinvertebrates' biomass presented the lowest epiphytic algae biomass, evidencing some grazing pressure over the stems.

The time of the season and the *Phragmites* stand orientation (sunlight exposure) were tested as external factors that could be influencing communities' composition. It resulted that orientation had no significant influence on the communities, while the time of the season determined some significant changes. Densities were higher in summer, with a clear domain of chironomids over the rest of the groups, and in winter, with oligochaetes presenting the highest densities.

Diatom assemblages responses to environmental gradient on Catalan reservoirs of different trophic; Catalunya (NE, Spain). A practical application of Diatom Indexes of water quality

Luciano CAPUTO¹, Manuel LEIRA², Joan ARMENGOL¹

¹ -University of Barcelona, Barcelona - Spain

² -University of A Coruña, 15076 A Coruña - Spain

Changes on pelagic diatom assemblages, due to environmental gradients along the main longitudinal axis of reservoirs, which occur as a consequence of the well known self-depuration process on the stored water quality (WQ) in reservoir, were studied. Diatom assemblage changes were mainly related with longitudinal increase of WQ. In total we sampled four reservoirs with different trophic condition, from mesoeutrophy to advanced hypereutrophy. Between 4 and 7 sampling sites were located along the main horizontal axis of each reservoir, obtaining a total set of 19 stations. As descriptors of trophic condition, the Trophic State Indexes (TSI) criteria as well as other representative chemical variables were used. These results allowed us to make a comparison with the Diatom Indexes of Water Quality (DIWQ) through Pearson correlation analysis. The DIWQ were calculated on the basis of diatom assemblage changes in each reservoir's sampled point using the OMNIDIA program. Correlation analysis results showed that only 8 of the 16 calculated Diatom indexes were significantly correlated with the TSI characterization of the reservoirs' sampled points. Among these, Sládeček's Index, Descy's Index, Leclercq & Maquet Index, Eutrophication/Pollution Index, Rott's Index and Generic Diatom Index, were negatively correlated with the TSI while the Trophic Diatom Index and the Percentage Pollution showed a positive relationship with the TSI, the total nitrogen and nitrate concentration. Our results from the co-evaluation of biological and physico-chemical parameters of trophic condition in reservoirs of different trophic suggest that the application of the Sladeck, Descy and EPI diatom indexes could be considered the most useful Diatom Indexes to evaluate the effects of the water chemistry on the pelagic diatom assemblages, and consequently for the assessment of the ecological quality of the reservoirs' stored water.

Increased phosphorus concentrations at the sediment-water interface trigger cyanobacterial blooms in an oligotrophic lake

Cayelan C. CAREY¹, Kathryn L. COTTINGHAM², Kathleen C. WEATHERS³

¹-Uppsala University, 751 23 Uppsala - Sweden

²-Dartmouth College, 03755 Hanover, New Hampshire - United States

³-Institute of Ecosystem Studies, 12545 Millbrook, New York - United States

Gloetrichia echinulata is a cyanobacterium whose blooms are well-documented in eutrophic systems, particularly in northern Europe. In the past few years, however, *G. echinulata* has started blooming in oligotrophic lakes across New England, USA. *G. echinulata* is unique among cyanobacteria because it can transport a considerable amount of phosphorus from the sediment into the water column. Past research from eutrophic lakes has demonstrated that increases in light and temperature can stimulate *G. echinulata* recruitment from the sediment, yet the importance of phosphorus in triggering *G. echinulata* germination and recruitment remains unknown. We examined the influence of phosphorus on the early stages of *G. echinulata*'s life cycle in the laboratory and in Lake Sunapee, an oligotrophic lake in central New Hampshire, USA. We experimentally investigated the effects of increased phosphorus availability on germination in the laboratory and on recruitment using in situ enrichment of lake sediment. We also monitored *G. echinulata* recruitment and total dissolved phosphorus (TDP) at the sediment-water interface in Lake Sunapee during summers 2005 and 2006. Our experiments demonstrate that a phosphorus pulse increases germination rates by 2.5 X and recruitment rates by 2-16 X. Moreover, our field observations suggest that a pulse of phosphorus at the sediment-water interface can significantly increase *G. echinulata* recruitment after a three-week lag, the interval of time *G. echinulata* akinetes need to develop into planktonic colonies. Our results indicate that *G. echinulata* outbreaks in oligotrophic New England lakes may be in response to higher nutrient concentrations and therefore are an incipient sign of increasing eutrophication.

Benthic cyanobacteria in the St. Lawrence River (Quebec, Canada)

Antonella CATTANEO¹, Christiane HUDON²

¹ -Université de Montréal, H3C 3J7 Montréal - Canada

² -Environment Canada, H2Y 2E7 Montreal - Canada

In contrast with lakes, where planktonic cyanobacteria predominate, widespread occurrence of colonial, benthic, nitrogen-fixing cyanobacteria has been increasingly reported in nutrient-rich sectors of the St. Lawrence River. *Gleotrichia pisum* forms spherical colonies epiphytic on submerged vascular plants whereas *Lyngbia wollei* develops as dense mats of benthic filaments. To assess and explain cyanobacterial distribution and abundance, a 72-stations survey was carried out in August 2006 in Lake Saint-Pierre (400 km²), a large fluvial lake of the St. Lawrence River. Physical (depth, clarity, current speed, conductivity, colour), chemical (TN, NO₂-NO₃, NH₄, TP, TDP, DOC) and biological (biomass of vascular plants and chlorophytes) characteristics were measured simultaneously at each station. *Gleotrichia* occurred in all areas surveyed, in shallow and clear-water stations characterized by markedly low nutrient concentrations, particularly nitrate (19 µg L⁻¹) and ammonium (4 µg L⁻¹). In contrast, *Lyngbia* grew only along the south shore; highest biomass (10-15 g dry mass m⁻²) also corresponded with stations poorest in nitrate (4 µg L⁻¹) and ammonium (4 µg L⁻¹). We hypothesize that cyanobacterial distribution and abundance reflect the frequency and duration of nitrogen deficit episodes, which occur commonly in summer in areas of slow water transit time and intense biological activity (assimilation by macrophytes, bacterial denitrification). A predictive model of benthic cyanobacterial biomass will further allow to quantify their contribution to lake-wide primary production and nitrogen budget in this heavily-enriched sector of the St. Lawrence River. Future work will focus on the ecosystemic impacts of benthic cyanobacterial proliferation in terms of macrophyte survival, food-chain structure, potential toxicity and production of volatile organic compounds.

Influence of intermittent disturbance on the diversity, secondary production and trophic relationships of macroinvertebrates in a mountain stream

Regis CEREGHINO¹, Antonio RUGGIERO²

¹ -Univ. Paul Sabatier, 31062 Toulouse - France

² -Università degli Studi di Roma "Tor Vergata", 00133 Roma - Italy

The macroinvertebrates of a mountain stream were studied up- and downstream of a power plant with hypolimnetic releases from a nearby high-altitude reservoir. The study sites were located at 700 m upstream (site A) and 700 and 3500 m downstream (B and C, respectively) of the plant. The natural flow of the river was preserved when the plant was inoperative. During power generation, the natural flow in the river below the outlet was enhanced several times a day from 1 to 11 m³ s⁻¹ in summer and winter, and from 5 to 15 m³ s⁻¹ during spring spates. Assuming that increased frequency and intensity of disturbance is detrimental to benthic diversity, we hypothesized that hydropeaking could adversely affect production and trophic relationships in macroinvertebrate communities. Site A mainly showed behavioural invertebrate drift that was nocturnal. Below the plant, peaking flows added to this a catastrophic drift, which was highest when the difference between natural and peak flows was greatest. Catastrophic drifts affected community structure to the detriment of density and biomass, and, subsequently, annual production. The annual production was 24, 16, and 32 g dry weight m⁻² year⁻¹ at sites A, B, and C respectively. The production yields were 13, 10, and 12 % at sites A, B, and C respectively. The lowest values for density and biomass were observed at site B, and were consistent with a prominent role for hydropeaking (flushing action) on the benthic fauna. By reducing the availability of most potential preys, disturbance simplified prey-predator relationships below the outlet. Downstream changes in ingestion, respiration and egestion showed the same patterns as those described using annual production changes, whatever the functional or taxonomic group. Because secondary production is a composite of various parameters such as density, biomass, individual growth rate, survivorship, and development time, it offered a very accurate means of examining the effects of disturbance. This approach is too time-consuming to be used in routine, contrary to density and biomass records. However, once estimates are available, they allow to target the periods where density and biomass are the most representative of the benthic community, for subsequent routine surveys.

Life history and production of the burrowing mayfly *Ephoron virgo* (Ephemeroptera Polymitarcidae) in the lower Ebro river (NE Spain): a comparison after 18 years

Núria CID¹, Carles IBAÑEZ¹, Narcís PRAT²

¹ -Aquatic Ecosystems Unity (IRTA), 43540 Sant Carles de la Ràpita - Spain

² -Dep.of Ecology.Faculty of Biology. University of Barcelona, 08028 Barcelona - Spain

Life cycle of the burrowing mayfly *Ephoron virgo* was studied during spring and summer 2005 in the lower Ebro River (NE Spain) and was compared to a previous study performed in 1987. This univoltine specie remains in a diapause egg stage during autumn and winter and begins a nymphal stage after eclosion when a threshold temperature is reached in mid April. When the nymphal development is completed, last instar nymphs (subimago) emerge during summer. Nymphal densities were obtained using a surber sampler (250µm pore, 50x50 cm) and adult were collected by light attraction trapping. Water temperature was analysed during development and degree days were obtained using the Southwood method. Adult sex ratio was calculated. Body length, head width and wingpad length were measured for each nymph to determine growth patterns along different stages. Secondary production was estimated by the instantaneous growth, increment summation and removal summation methods. We also took into account that preservation procedures resulted in a nymph weight loss of up to 50 %. We observed that 2005 nymph development reached the maximum growth peak one month earlier than in 1987 and adult emergence peak in 2005 began 3 weeks earlier. Comparing adult sex ratios (F: M), we found that in 2005 there was a major presence of females (1:4), just the opposite case observed in 1987 (2:1). Production rates were higher in 2005, obtaining 580.46 mg fresh dry weight m⁻² year⁻¹ compared to 267.09 mg m⁻² year⁻¹ in 1987, using the same method. In 2005, degree days (dd) (>14.5 °C) required from eclosion to first adult emergence were 841 and during all nymphal stage we obtained higher dd values than in 1987. Thus, we conclude that life cycle was advanced up to 3 weeks due to slightly higher water temperatures in 2005 during eclosion time and nymphal stage. Secondary production rates had also changed. A global tendency of higher air temperatures and lower discharges in the Ebro river during the last years could be the main cause of rising water temperature that is related to changes in life cycle patterns of this species.

Ecology of ammonia-oxidising bacteria in freshwater shallow lakes

M.COCI, P.L.E. BODELIER, H.J. LAANBROEK

Netherlands Institute of Ecology, Dept. of Microbial Wetland Ecology, 3631 AC Nieuwersluis - the Netherlands

Ammonia-oxidising bacteria (AOB) are responsible for the first step in the nitrification process. They are considered a model in microbial ecology because of their clear eco-distribution pattern. Freshwater shallow lakes offer at least three potential habitats for AOB, i.e. the benthic, pelagic and epiphytic compartments. Diversity, activity and abundance of AOB have been studied in relation to these three compartments in a continuum of seven artificial lakes, known as the Randmeren, in the Netherlands.

16S rRNA PCR-DGGE analyses demonstrated that the benthic compartment was inhabited mainly by members of the cluster 3 of the genus *Nitrosospira* in association with members of the cluster 0 of the genus *Nitrosospira* spp. and of the *Nitrosomonas oligotropha* lineages. The latter was dominating the pelagic compartment. The epiphytic compartment was occupied by members of *Nitrosomonas oligotropha* lineages and the cluster 3 of the *Nitrosospira* spp. Fluorescent in situ hybridization analyses demonstrated that AOB cells were actually present on the leaves of aquatic macrophytes. Numbers of AOB, measured with quantitative Real Time PCR, were higher in the benthic and the epiphytic and lower in the pelagic compartment. Potential activity values were in accordance with AOB numbers. Multivariate analyses identified environmental parameters associated with the different lakes as driving factor for the AOB niche differentiation. This study gives demonstrates that the epiphytic compartment is a potential niche for AOB in freshwater shallow lakes. Since the establishment of dense stands of macrophytes is a target for the water management to repress the growth of noxious algae and cyanobacteria, the role of the epiphytic compartment in the nitrogen turnover of shallow freshwater lakes must be carefully considered in the biomanipulation processes. Moreover the significant link between AOB distribution, activity and abundance and the trophic status of the lake suggests the potential of AOB of being used in monitoring programs.

Relationships between Biodiversity, Stability and Invasibility in river ecosystems

Isabelle COMBROUX¹, Photis NOBELIS², Michele TREMOLIERES¹

¹ -CEVH, 67083 Strasbourg - France

² -IRMA, 67083 Strasbourg - France

Relationship between biodiversity and ecosystem stability have been studied through several microcosm- or long term field experiments in the last decades. These experiments usually showed the positive relationship between biodiversity and ecosystem stability. As a correlate, more diverse ecosystems are supposed to be more resistant to invasive species.

However a few studies in natural terrestrial ecosystems suggest that ecosystem stability may be negatively correlated with species richness or biodiversity. We tested the hypothesis that there is a relationship (either negative or positive) between aquatic plant species richness and aquatic ecosystem stability in running waters within the alsacian Rhine floodplain. Vegetation surveys for more than 100 sites were used to test this hypothesis. Aquatic plant communities were surveyed several times for more than a decade and temporal stability of the ecosystems was assessed through (1) the stability in plant cover, and (2) the temporal variability in plant species assemblages. We also estimated the capacity of the ecosystem to resist to the settlement of invasive species (mainly *Elodea* sp.).

Results are discussed regarding the interaction between biodiversity and trophy and finally, relationship between established-, latent- and gained- biodiversity and ecosystem stability and invasibility is considered.

An intriguing link between macroinvertebrate elemental composition and pollution tolerance

Christian K. DANG, Michael M. STURT, Marcel A.K. JANSEN, Paul S. GILLER, Simon HARRISON

University College Cork, Distillery Field, North Mall, Cork - Ireland

During the past century, freshwater ecosystems have been subjected to dramatic increases in nitrogen and phosphorus loading. This, along with other environmental pressures on these ecosystems, has triggered profound changes in the structure and diversity of freshwater invertebrate communities. It is commonly thought that these changes are due to differential sensitivity to oxygen depletion. We discuss here the potential role of invertebrate elemental composition as a deterministic factor to shaping communities along a nutrient gradient. We investigated the link between macroinvertebrate P:C and N:C ratios and pollution tolerance, as indicated by the BMWP index, a commonly used biotic index to assess stream quality in Europe. Our analysis showed that the average P:C and N:C ratios of families increased with increasing pollution tolerance; a loss of quality by three points on the BMWP scale (ca. 1-13) was associated with an average increase of 1.08 atom of phosphorus and 10.7 atoms of nitrogen per 1000 atoms of carbon. These relationships were particularly strong ($r^2=0.68$ and $r^2=0.61$, for P:C and N:C, respectively) among scrapers, suggesting that these consumers that "rasp" biofilm indiscriminately, are affected more by changes in food quality than other consumers such as other algae-eating or detritivorous. The P:C ratio of predators was also strongly correlated with BMWP-values ($r^2=0.86$), indicating that their elemental composition follows the P:C ratio of their prey along the pollution gradient. Our analysis indicates a link between macroinvertebrate elemental composition and tolerance to nutrient enrichment, and consequently, a novel and hitherto unsuspected mechanistic link between water chemistry and invertebrate community composition.

Evidence of food quality limitation in benthic river insects

François DARCHAMBEAU, H el ene GLEMET, Tommy BELANGER, Andr eanne PARIS, St ephane CAMPEAU, Gilbert CABANA

UQTR, CP500, G9A 5H7 Trois-Rivi eres (QC) - Canada

Food nutrient content was shown to limit growth in some crustacean plankton, *Drosophila* and terrestrial herbivore insects. To date, there is little knowledge of food quality in lotic systems and potential food quality limitation of herbivore growth. We analyzed stoichiometry (C:N:P ratios) of benthic microalgae in two Qu ebec (Canada) streams and followed in situ potential growth (%RNA) of three benthic grazers. Both streams were sampled weekly during summer 2005. Sites were well-illuminated and differed only by their trophic status. Algae from epilithon samples were successfully separated from detritus using density fractionation in colloidal silica. No significant differences in algal nutrient content were observed between streams whereas temporal variability of algal nutrient content was high within sites (C:P = 227-1356 and N:P = 24-96 in Nicolet stream, C:P = 326-1343 and N:P = 36-122 in St-Anne stream). Algal C:P ratios commonly varied by a factor > 2 between two consecutive weeks. A significant fraction of within-site variance of algal C:N:P ratios was explained by irradiance and water chemistry (total nitrogen and total phosphorus), which were directly linked to discharge events. This suggests that nutrient quality of food for herbivorous benthic organisms was primarily controlled in rivers by abiotic stochastic factors. P and RNA content of the water penny (Coleoptera Psephenidae *Psephenus herricki*) and two mayfly larvae (Ephemeroptera Heptageniidae *Stenonema* sp. and *Heptagenia* sp.) were also determined weekly in both rivers. Body %RNA was positively correlated with body %P ($P < 0.01$). In Heptageniidae species, body %RNA and %P were linked with ontogeny and environmental variables, including benthic algal C:P ratios ($P < 0.05$). High light conditions and low algal P richness led to a decline in body %P and %RNA. Together, our observations unveil, for the first time, the impact of low food quality on potential growth rate limitation in benthic aquatic organisms.

Long term eutrophication induced erosion of benthic pathways of production in a shallow lake.

Thomas DAVIDSON¹, Peter LANGDON², Zoe RUIZ¹, Katerina KARI¹, Amy BURGESS¹, Carl SAYER¹

¹-UCL – London, United Kingdom

²-University of Southampton – Southampton, United Kingdom

Contemporary studies of shallow lakes have suggested a broad scale response to nutrient enrichment characterised by a shift in the dominant location of primary production. As nutrient levels rise there is a loss of benthic pathways of production and an increase in the proportion of primary productivity that takes place in the pelagic zone. Here we employ plant macrofossil, cladoceran and chironomid sub-fossil assemblages to test this hypothesis at a small shallow lake (Felbrigg Lake, UK). Over a period of approximately 250 years there were marked changes in all indicator groups in our sediment cores. Species responses established using surface sediment assemblages from a training set of 39 sites were used to interpret shifts in chironomid assemblages. Furthermore, a new cladoceran based technique employing a multiple regression tree (MRT) to semi-quantitatively infer species responses to past fish and macrophyte densities was applied. The cladoceran assemblage indicated a shift away from dominance by benthic productivity concomitant with a shift in macrophyte structure in the early 19th century. The macrofossil assemblage indicated a series of changes in the dominant component of the submerged macrophyte flora. The records indicate a further shift to pelagic productivity in the 1970s which may have been a cause or a consequence of large increases in the population of zooplanktivorous fish. The results are discussed in the context of current ecological theory on shallow lakes functioning with specific reference to changes in the balance of benthic versus pelagic productivity and the stability of the macrophyte-dominated state.

Responses of hyporheic invertebrate community to large-scale variation in flow permanence and surface-subsurface exchange

Thibault DATRY¹, Scott LARNED², Mike SCARSBROOK³, Graham FENWICK²

¹ - Cemagref, 69 336 Lyon - France

² - Niwa, Christchurch - New Zealand

³ - Niwa, Hamilton - New Zealand

In its most extreme form, hydrologic variability consists of alternating wet and dry periods in river channels. Over time, the flow permanence of a river reach is defined by the spatial and temporal distribution of these periods. The effects of variable flow permanence on benthic invertebrate communities have been well-studied, but corresponding effects on hyporheic invertebrate communities have received little attention. Similarly, the effect of large-scale surface-subsurface exchange on the distribution of hyporheic invertebrates is still unexplored at alluvial-plain scales (i.e., 104-106 m).

The Selwyn River (Canterbury Plains, New Zealand) represents a 58 km-long flow-permanence gradient. This gradient, and interactions between losing and gaining reaches, comprise a natural experiment in hyporheic invertebrate ecology. As a general model, we predicted that 1) hyporheic density, diversity and community stability in the hyporheic zone would decrease with decreasing flow permanence, and 2) hyporheic community would shift between losing and gaining reaches, the latter one being characterized by with higher proportions of hypogean taxa .

Hyporheic invertebrate density and diversity decreased with decreasing flow permanence. Diversity was 30-40% higher at groundwater-dominated sites compared with run off-dominated sites with similar flow permanence. Community composition also varied with both flow permanence and water source. Near-perennial reaches were dominated by harpacticoid copepods and amphipods, and highly ephemeral reaches by chironomid flies and cyclopoid copepods. Losing reaches were characterised by ostracods, oligochaetes, and hydroptilid caddisflies, and gaining reaches by stygobitic amphipods and isopods, and the gastropod *Potamopygus* sp. Several invertebrate taxa were restricted to the most ephemeral sites, suggesting that ephemeral sites contribute substantially to overall biodiversity. The proportion of benthic species in the hyporheic zone was highest at intermediate flow permanence levels, suggesting that a threshold level of desiccation stress exists, above which benthic species cannot persist.

Hyporheic invertebrate communities in the Selwyn River are clearly influenced by flow permanence and surface-subsurface exchange. We suggest that this influence is manifested through differences among taxa in desiccation tolerance and in colonization pathways.

The flood pulse concept in the ecology of floodplain lakes of the middle Daugava river

Davis GRUBERTS

Daugavpils University, 5401 Daugavpils -Latvia

This presentation summarises the main results and conclusions of the doctoral thesis of the author, performed at Daugavpils University in 2003-2006 and supported by the ESF project VPD1/ESF/PIAA/04/NP/ 3.2.3.1/0003/0065. This is the first application of the Flood Pulse Concept in Baltic region, the first study of the high-latitude European floodplain lakes under natural hydrological conditions, the first evaluation of the flood pulse - ice cover interaction in phytoplankton ecology of floodplain lakes as well as the modification of the conceptual model of nutrient and energy cycling on river floodplains. The goal of this study was to adjust the Flood Pulse Concept (JUNK, 1999) for the Baltic region. The object of the study was phytoplankton communities of floodplain lakes of the Middle Daugava River, which are located in South-East Latvia and are characterised by cold temperate climate and natural hydrological regime. Materials and methods included preliminary analysis of the available maps and hydrological data series, field studies and measurements of major limnological parameters, sampling of water and phytoplankton, zooplankton and zoobenthos communities, laboratory analyses of the samples as well as summarization, statistical analysis (rank correlation, PCA, similarity, clustering) and interpretation of the obtained data. Samples were collected in 24 floodplain lakes during the low water period, July 2004, as well as in the four largest floodplain lakes of the Daugava during March-October, 2005. The study resulted in translation of the main terms of the Flood Pulse Concept into Latvian, hydrological classification of the lakes, identification of the main influencing factors acting during the summer low water period, discovery of the flooding-diversity relationship, evaluation of the flood-ice interaction, determination of ecological role of the floods in phytoplankton ecology of floodplain lakes, as well as modification of the matter and energy cycle for river floodplains proposed before by other authors.

JUNK WJ, 1999. The flood pulse concept of large rivers: learning from the tropics. *Archiv für Hydrobiologie* (3): 261-280
Suppl. 115

Wetlands need water: the influence of interannual variability in rainfall on wetland macroinvertebrate communities

Jenny DAVIS

Murdoch University, South Street, 6150 Murdoch - Australia

The wetlands of the Swan Coastal Plain are an important component of the natural environment of Perth, a city of over 1.4 million people, in the southwest of Western Australia. The wetlands are highly valued socially, economically and for nature conservation but are also vulnerable to the impacts of urbanisation. These include changes to natural hydrological regimes brought about by groundwater extraction or drainage, loss of fringing vegetation, nutrient enrichment, pesticide and heavy metal pollution and the introduction of exotic plants and animals. The region experiences a Mediterranean climate, with hot, dry summers and cool, wet winters. The wetlands, which are predominantly expressions of an unconfined aquifer, experience a strongly seasonal hydrological cycle: first filling with winter rains and then drying during summer and autumn when evaporation rates far exceed precipitation. The annual winter rainfall is a major determinant of maximum wetland water levels. The macroinvertebrate communities and water quality of ten wetlands have been sampled every spring, and some summers, over a 11 year period from 1996 to 2006, as part of an ongoing biological monitoring program for wetlands potentially affected by a groundwater extraction scheme. A less regular sampling program, from 1989 to 1994, has resulted in the collection of 16 years of data for four of these wetlands. Sampling was conducted using a rapid bioassessment protocol where the dominant habitats at each wetland were identified and sampled for macroinvertebrates using a long-handled sweep net (250 μ m mesh) for a standard collecting time (two minutes). Comparison of the rainfall records, depth records and number of macroinvertebrate families recorded each year indicated that richness was low in years when rainfall was well below average and higher in years when rainfall was higher. Classification and ordination of the macroinvertebrate and water quality datasets revealed that the effects of changes in climate (i.e. rainfall) appeared to be greater than other impacts including eutrophication, exotic plant invasion and groundwater extraction.

Is structure or function a better measure of the effects of water abstraction on ecosystem integrity?

Russell DEATH¹, Zoe DEWSON², Alex JAMES²

¹ -*Institute of Natural Resources - Ecology, Massey University, Palmerston North - New Zealand*

² -*Massey University, Palmerston North - New Zealand*

Assessments of flow abstractions in streams often focus on changes to biological communities and in-stream physical characteristics, with little consideration for changes in ecosystem functioning. It is unclear whether functional indicators of ecosystem health may be useful for assessing the impacts of reduced discharge on small streams. We used weirs and diversions to reduce stream discharge by over 85% in three small New Zealand streams (11 to 84 L s⁻¹), ranging in water quality from pristine to moderately impaired. We used both structural (benthic and drifting invertebrates) and functional (leaf breakdown, coarse particulate organic matter (CPOM) retention, and primary productivity) measures of ecosystem integrity to compare responses to water abstraction in before-after, control-impact (BACI) designed experiments during summer 2005. At the pristine site, the density of invertebrates and percentage of EPT individuals decreased in response to reduced flows. Only taxonomic richness decreased at the mildly impaired stream, and reduced discharge had no effect on the invertebrate community at the stream with the lowest water quality. We found that reduced discharge had little influence on the breakdown rate of willow leaves in mesh bags over one month. Primary productivity was also relatively insensitive to water abstraction. However, CPOM retention increased exponentially with decreased flows. Structural measures of ecosystem integrity suggested that the impacts of water abstraction differed between streams of varying water quality, probably because of differences in the sensitivity of invertebrate assemblages in the three streams. In contrast, the three functional measures tested were generally less sensitive to water abstraction impacts than the structural measures, although understanding how stream ecosystems respond to water abstraction clearly requires that both are considered.

Population dynamics of mayflies (Ephemeroptera) in Carpathian mountain stream

Tomás DERKA¹, Marek SVITOK²

¹ -Department of Ecology, Faculty of Sciences, Comenius University, 842 15 Bratislava - Slovakia

² -Department of Biology and General Ecology, Faculty of Ecology and Environmental Sciences, Technical university in Zvolen, 960 53 Zvolen - Slovakia

The aim of this research was to describe life histories, estimate secondary production of mayflies in a high mountain Carpathian stream and to determine potentially important environmental factors influencing their growth. The benthic community and food resources (CPOM, FPOM and periphyton) were sampled at monthly intervals. Physical and chemical factors were measured in parallel. Multiple regression analysis was used to assess the relationship between growth of mayflies and environmental variables. Secondary production was estimated using different methods for abundant and rare species. Five mayfly species (*Ameletus inopinatus*, *Baetis alpinus*, *Electrogena lateralis*, *Rhithrogena loyolaea*, *R. iridina*) were recorded. The mean annual density, biomass and annual production were 703 ind. m⁻², 135.9 mg DW m⁻² and 386.3 mg DW m⁻².y⁻¹, respectively. The most abundant species was *B. alpinus*, the highest biomass and production values were due to *R. loyolaea*. Specific daily growth rates in weight and length for studied species ranged from 0.38 ± 0.06 to 6.55 ± 13.02% DW day⁻¹ and from 0.12 ± 0.04 to 0.94 ± 5.09% length day⁻¹, respectively. Growth of *B. alpinus* appeared to be influenced mainly by water temperature. On the other hand, growth of *R. iridina* appeared to be influenced more by length of photoperiod than by other factors. However, significant relationship was found for growth in weight only. No statistically significant linear relationships were found between the growth of other species and measured environmental variables.

The study was founded by the Scientific Grant Agency VEGA (grants No. 1/4334/07 and 1/4355/07).

Morphology and physical habitat use in a lotic macroinvertebrate community

Hélène DESBROSSES¹, Pierre SAGNES¹, Sylvie MERIGOUX², Thibault DATRY²

¹ -UMR CNRS 5023, *Ecologie des Hydrosystèmes Fluviaux, Université Claude Bernard Lyon 1, 69622 Villeurbanne - France*

² -CEMAGREF, *Laboratoire d'Hydroécologie Quantitative, 69336 Lyon - France*

Aquatic organisms adapt their life-history strategies to their physical and biological environment through diverse combinations of biological traits. For example, numerous studies have shown that general body shape and other morphological features of fish, invertebrates or macrophytes are clearly related to their physical habitat use at different scales. However, in the literature, morphological features of benthic macroinvertebrates usually considered are often qualitative, and not directly measured on the organisms (e.g. streamlined vs cylindrical vs flattened bodies; flexible vs rigid bodies; etc.). To our knowledge, there are no studies relating quantitative morphological traits of benthic invertebrates to local physical constraints at the community level. In this context, we measured (using image analysis) numerous morphological features (including various lengths, widths, a flexibility index and attachment systems such as claws or suckers, which can be important to withstand high constraints) on 65 invertebrate taxa. These taxa were sampled in the same Rhône river section at 3 occasions, and lived in a wide range of hydraulic habitat conditions (bottom shear stress and substrate structure). We showed that some accurate morphological features of benthic invertebrates could be correlated to the physical habitat they use. We highlighted functional morphological groups, including combinations of morphological features that were the more adapted to a given environment. Such ecomorphological study could be useful to better understand fundamental and/or applied ecological topics using a quite simple method as morphological features of taxa are easy to determine on photographs. For instance, this work could be used to predict impacts of human alterations of the physical aquatic habitat (e.g. hydraulic peakings or siltation due to dams) on the spatial distribution of the different functional morphological groups, according to their morphological abilities to colonize modified habitats.

Plankton ecology of Lake Kivu and the consequences of a planktivore introduction

Jean-Pierre DESCY¹, Hugo SARMENTO¹, François DARCHAMBEAU¹, Mwapu ISUMBISHO²

¹ –FUNDP, B-5000 Namur - Belgium

² -ISP, Bukavu - DR Congo

The introduction of the planktivorous *Limnothrissa miodon* into the previously fishless pelagic zone of Lake Kivu (Eastern Africa) raised major concern about the fate of mesozooplankton in this lake. Studies conducted in the 1980s demonstrated dramatic decrease of mesozooplankton abundance and the disappearance of a major grazer, *Daphnia curvirostris*. Phytoplankton and zooplankton studies were conducted from 2002 to 2005 with the aim of assessing the present state of L. Kivu pelagic ecosystem. Phytoplankton development was strongly seasonal, with lower biomass in the rainy seasons and a major peak during the dry season. Phytoplankton production was mostly wind-driven, with large differences in depth of the mixed layer, on which nutrient availability depended, and substantial changes in community composition occurred. Mesozooplankton abundance was tightly coupled with phytoplankton biomass, which suggests that mesozooplankton dynamics in Lake Kivu were mainly bottom-up controlled, contrary to expectations from supposed strong fish predation. The zooplankton community of Lake Kivu is presently dominated by cyclopoid copepods, which seem to efficiently reduce predation losses by diel vertical migration. Regarding zooplankton body size, there was no conspicuous differences with the same species in other large, deep tropical lakes (e.g. Lake Malawi), except for the cladoceran *Diaphanosoma excisum*, which was twice as small in L. Kivu as in L. Malawi. Despite relatively high phytoplankton biomass and production, zooplankton production in L. Kivu was low, and total biomass of mesozooplankton in Lake Kivu was much lower than in lakes Tanganyika and Malawi. While the lack of a planktivore control by piscivore predation is an obvious trait of L. Kivu food web, part of the problem may also arise from the disappearance of the large and efficient grazer which existed prior to the sardine introduction. The part of primary production not exploited by grazers may fuel the microbial food web and/or be lost by sedimentation to the deep anoxic waters, where it contributes to methane production in this meromictic lake.

Oligotrophy in Patagonian Lakes: the case for nitrogen regulation

M. DIAZ¹, F. PEDROZO¹, C.S. REYNOLDS², P. TEMPORETTI¹

¹ -Universidad Nacional del Comahue, 8400 Bariloche - Argentina

² -European Federation for Freshwater Sciences – United Kingdom

Chemical composition and nutrient concentrations of 39 relatively poorly known Patagonian lakes (38°S to 50°S and from 70°W to 68°W) are presented. We seek to demonstrate that the extreme oligotrophy characterising many lakes and reservoirs of Argentine Patagonia owes more to nitrogen deficiency than to a shortage of available phosphorus. The chlorophyll-carrying capacities of the available phosphorus, albeit modest, are consistently and significantly ($p < 0.05$) in excess of observed levels but maximum chlorophyll a values correlate well with the strikingly low levels of bioavailable nitrogen (generally, $< 100 \mu\text{g N L}^{-1}$, often considerably so). It is all the more remarkable that the phosphorus capacity is not filled, as might be anticipated, by dinitrogen-fixing phytoplankton. The reasons for this are explored. The most likely explanation, borne out by observations on the slightly more P-rich lakes in the series (where dinitrogen-fixing *Anabaena* spp. do thrive) is that there is insufficient phosphorus to support it. So, the paradoxical question arises – is the limitation in these lakes by P or N?

The impact of climate change on lakes in Central Europe

Martin DOKULIL

Institute for Limnology, Austrian Academy of Sciences, 5310 Mondsee - Austria

The contribution summarises major results and outcomes of investigations on the impact of climatic change on lakes in Central Europe. The region, the climate and the lakes considered are defined. Future climatic scenarios are described and the climatic indicators used such as the North Atlantic Oscillation (NAO) are discussed. Impacts on physical constraints such as temperature, stability, mixing and ice duration are described and their effects on the biology evaluated. Chemical and biological effects and their timing are examined in detail. Impacts from extreme events directly to the lakes or via the catchment will be mentioned. Finally, regional coherence among lakes in particular sub-regions will be discussed.

Making space for the newcomer: trophic niche separation in an invaded food web.

F.K. EDWARDS^{1,2}, R.B. LAURIDSEN^{1,2}, J.I. JONES¹, A. IBBOTSON¹, W. BEAUMONT¹, C.E. DAVIES¹, G. WOODWARD², A.G. HILDREW²

¹ -*Centre for Ecology and Hydrology, Dorset, UK*

² -*Queen Mary University of London, UK*

Human impacts on aquatic ecosystems, in particular when species are added or deleted from a natural community, often entail changes in feeding links and competitive interactions, and ultimately a modification of trophic structure. The introduction of predators, such as the stocking of streams with a new fish species, can have a disproportionate impact on the distribution of feeding links within the food web and the availability of resources to producers and other consumers. The interaction between the new species and established species with similar trophic position/function is key to predicting the impact of such a species invasion. To what extent do their dietary niche and their trophic habit overlap? How does interaction strength change with ontogeny, and with seasonal fluctuations in their resources or prey? We monitored and quantified a stream food web dominated by brown trout and bullheads, before and after the introduction of Atlantic salmon fry. Because our salmonids are electronically tagged, we are able to present diet data at the population, cohort and individual levels. We report on the growth, abundance and diet of the main fish species. Results suggest that dietary niche overlap/separation is a function of ontogeny and seasonality, rather than a fixed attribute. We contrast intraspecific interactions between trout cohorts with interspecific interactions between trout and salmon. We present evidence of a shift in small trout diet, post salmon introduction. Results indicate that salmon consumed benthic prey resources that were previously available to trout, and that in the presence of salmon the trout relied more heavily on alternative benthic prey types and on the allochthonous subsidy of terrestrial invertebrates. We suggest mechanisms for the resource partitioning between trout and salmon.

Modelling the effects of changing retention time on phytoplankton

J. Alex ELLIOTT, Ian D. JONES

CEH, LA1 4AP Bailrigg - UK

Changes in rainfall can impact on lakes by affecting the retention time of the system. As climate change predictions suggest large changes to future rainfall patterns we may expect lake retention times also to change. In order to investigate the algal response to changing annual mean retention time in two lakes, we used a phytoplankton community model, PROTECH. Two sets of model experiments were employed: one method varied the inflow to the lake whilst keeping the annual nutrient load constant. The other approach allowed the nutrient load to vary as the inflow varied. The simulations showed that in both sets of experiments retention time shorter than the original time resulted in reduced chlorophyll concentrations, but at longer retention times chlorophyll concentrations rapidly reached a maximum level. The timing of the spring and autumn blooms were also affected, both lasting longer as retention times lengthened. Furthermore, some types of algae seemed to be more sensitive than others.

Impact of water diversion for hydropower on nutrient retention in streams

Arturo ELOSEGI¹, Oihana IZAGIRRE¹, Alba ARGERICH², Eugenia MARTÍ³

¹ -*Faculty of Science and Technology, University of the Basque Country, 48080 Bilbao - Spain*

² -*Departamento d'Ecologia, Universitat de Barcelona, 08028 Barcelona - Spain*

³ -*Centre d'Estudis Avançats de Blanes (CSIC), 17300 Blanes - Spain*

Small hydropower plants have important effects on the hydrology of stream and rivers. These plants divert part of the stream flow into man-made canals, and finally revert it to the streams, often several Km downstream. Water residence time and transient storage, and thus, interactions with the substrate, are reduced because of the simple canal morphology, and this could affect nutrient dynamics. The aim of this study was to examine the effect of hydrological and morphological modifications caused by hydropower plants on the stream nutrient retention capacity. We hypothesized nutrient retention to be lower in the canals than in the streams. We selected 5 small dams along Leitzarán, a clearwater stream in the Basque Country affected by multiple hydropower plants. Based on the slug addition technique, we measured phosphate and ammonium retention at both the stream channel and the diversion canal below each dam, and also at the unregulated reach upstream from one of the dams. In 4 out of the 5 sites, canals carried more water than the streams, and at one particular site > 95% of the discharge was diverted. Uptake lengths (i.e., an indicator of retention efficiency) ranged one order of magnitude among reaches (from hundred metres to kilometres). Although results differed between ammonium and phosphate, in general uptake lengths were longer (i.e., lower efficiency) in the canals than in the streams. However, when these results were weighed by differences in discharge among reaches, the canals tended to exhibit a higher nutrient demand (i.e., higher mass transfer velocity from water column to channel substrata) than the streams. Results show that hydropower operation can have profound effects on the stream nutrient retention capacity at the catchment scale, and thus, ultimately influence nutrient export. Nevertheless, at local scale the effect is highly variable and mostly modulated by operational decisions upon the proportion of water diverted into the canals.

Effect of riparian land use on leaf litter breakdown and invertebrate community composition in tropical montane forest streams

Andrea ENCALADA^{1,3}, Juan CALLES², Veronica FERREIRA¹, Manuel GRAÇA¹

¹ -IMAR, Dept Zoologia, 3004-517 Coimbra - Portugal

² -Universiteit van Amsterdam, Faculty of Science, Amsterdam - The Netherlands

³ -USFQ, Departamento de Ciencias Biológicas y Ambientales, 17-1200-841 Quito - Ecuador

Low-order streams flowing through forests are subsidized by allochthonous leaf litter inputs from the surrounding vegetation. Hence, changes in riparian vegetation caused by altered land use may affect leaf decomposition rates and energy incorporation into stream food webs by decomposers and consumers. We examined the effect of riparian land use on leaf litter breakdown and the relative importance of invertebrate communities and microorganisms in litter processing in tropical montane streams. We determined leaf decomposition of two tree species, *Alnus acuminata* (Betulaceae) and *Inga spectabilis* (Fabaceae) in streams running through forest and grasslands, using coarse and fine mesh bags during a period of 63 days. Coarse mesh bags allowed access of invertebrates to the leaves, while fine mesh bags excluded invertebrate access. Percentage of mass loss was significantly higher in forest than in grassland, higher for *A. acuminata* than for *I. spectabilis* and higher loss occurred in coarse mesh bags (invertebrates and microorganism) than in fine mesh bags (microorganism). The difference between fine and coarse mesh bags suggested that invertebrate shredding influenced leaf processing. Density of shredders in forest (13.5%) was significantly higher than in grassland (1.8%). The main shredder found was *Phylloicus* sp. (Calamoceratidae). Sporulation (conidial production) was higher for *Alnus* and no differences were detected between forest and grassland. The most abundant aquatic hyphomycetes was *Filospora versimorpha*. Fungal biomass (Ergosterol content) in leaves increased constantly until the end of the experiment. Our results suggest that the conversion of forests to grasslands can alter litter decomposition rates by changing invertebrate community composition, especially by reducing the shredders functional feeding group. It is concluded that deterioration of the natural riparian vegetation affects the energy flow through these detritus based stream food webs, ultimately affecting the entire river ecosystem.

Using community structure to assess ecological quality of riparian vegetation

Teresa FERREIRA, Francisca AGUIAR, Patricia RODRIGUEZ-GONZALEZ, António ALBUQUERQUE

Forest Research Centre, Agronomy Institute, Technical University of Lisbon, 1349-017 Lisboa - Portugal

In response to prevailing abiotic gradients, river plants display a wide range of growth forms, from submerged or floating to riparian woody perennials occupying full bank limits. In this study, we propose that plant assemblages can react to disturbance and act as indicators of river condition based on the variation of functional patterns and compositional attributes (i.e. metrics) that reflect ecosystem processes and functions, and henceforth its degradation under the influence of human pressures. River plants were surveyed during 2004 and 2005 in about 400 sites nation-wide (Portugal). All plants occurring in the river corridor were considered, including banks. The species composition was transformed into structural attributes (or candidate metrics), e.g. percentage richness of exotic species, number of ruderal species or cover of riparian woody species. Thirty-four metrics of plant assemblage structure were established and their response to disturbance evaluated using 10 abiotic indicators of human pressure, scored in 1 to 5 classes, and summed up to give global stress. Ecological and statistical adequacy of the metrics' response to single stressors and global stress were obtained using Spearman rank correlations. Median values from reference and non-reference sites were used to attribute a 1-3-5 score to each responsive metric and scores were summed up to create a multimetric riparian vegetation index, which included 10 metrics. The percentil distribution of the index values obtained for reference and non-reference sites was used to create five ecological quality classes. Performance of the multimetric index and single metrics against both single stressor and global stress was evaluated, including the analysis of residuals and the level of uncertainty of the obtained quality classification. Riparian vegetation can indeed meaningfully reflect the ecological quality of the sites.

Dynamics of algae and nutrients along a lowland river continuum from its middle section to the estuary

Helmut FISCHER, Annette BECKER, Volker KIRCHESCH, Andreas SCHOEL

Federal Institute of Hydrology, 56068 Koblenz - Germany

The concentrations of nutrients and plankton along a river continuum show characteristic longitudinal and temporal patterns reflecting processes of transport, transformation and retention. Here, we describe the processing of carbon, nitrogen and phosphorus along a 645 km section of the Elbe River (Germany), including a 586 km long freely flowing stretch and the adjacent estuarine freshwater section. In parallel, we examined phytoplankton composition and concentrations of algal pigments including degradation products. We use data from several Lagrangian sampling campaigns and fixed monitoring stations, combined with measurements of sedimentary microbial activity. Strong phytoplankton growth lead to an increase of the particulate organic carbon load along the river continuum while dissolved organic carbon remained relatively constant. All major dissolved nutrient concentrations, including silica, decreased significantly along the Elbe River during the growth period, caused by intense algal uptake. Nutrients were additionally retained by algal sedimentation. The pattern of algal biomass and pigments reflects growth and loss processes along the continuum. The phytoplankton population dynamics were temporarily strongly controlled by zooplankton grazing. Fresh organic matter, probably mainly derived from algae, drives microbial decomposition in the sediments and supports denitrification. This autochthonous organic matter fuels intense degradation processes in the lower course of the river leading to strong oxygen depletion in the deep estuarine freshwater section. Thus, high rates of carbon and nitrogen processing in the river bed highlight the importance of sedimentary microbial activity for the heterotrophic turnover of biomass that has been produced and transported in the water column. Simulation runs with the water quality model QSim showed that ecosystem processes are affected by human impact on river morphology such as construction of groynes (wingdams) in the middle part of the river and extremely increasing water depth in the freshwater part of the estuary.

Variability in stream nutrient retention and metabolism along an altitudinal calcareous gradient

Paula FONOLLÀ¹, Eugènia MARTÍ¹, Francesc SABATER²

¹ -CEAB-CSIC, 17300 Blanes - Spain

² -Universitat de Barcelona, 08028 Barcelona - Spain

Present predictions on climate change indicate a temperature increase and a change in the precipitation regime. Mountain regions may be particularly vulnerable to these changes, which can in turn influence biogeochemical responses in stream ecosystems. Here we assessed the influence of climate-related factors on stream nutrient retention and metabolism using a space-for-time substitution approach by examining the variation of these parameters among streams located along an altitudinal gradient. We selected 14 streams in the Central Pyrenees, which drained calcareous catchments and covered an altitudinal range from 2100 to 700 m a.s.l. At each stream we measured the uptake length (i.e., an indicator of nutrient retention efficiency, S_w in m) for multiple nutrients (phosphate, ammonium, nitrate, acetate) using short-term nutrient additions; and the whole-stream metabolism using the upstream-downstream diurnal dissolved oxygen change technique. Samplings were conducted at all streams in summers of 2005 and 2006. Variability in water temperature among streams reflected their position along the altitudinal gradient. Variability across streams in S_w differed among nutrients. S_w values for phosphate, ammonium, nitrate and acetate ranged from 29 to 141 m, 56 to 625 m, 59 to 909 m and 42 to 1666 m, respectively. Streams were comparable and highly efficient (i.e., shorter S_w) at retaining phosphate, whereas they were less efficient and more variable at retaining the rest of studied nutrients. Correlation analyses using S_w for the different nutrients only showed a positive relationship between S_w -acetate and S_w -phosphate. Across-stream variability in metabolism parameters was larger than that observed for nutrient retention parameters. Gross Primary Production (GPP) and Ecosystem Respiration (ER) ranged from 0.001 to 5.14 g O₂ m⁻² day⁻¹ and from 1.04 to 70.74 g O₂ m⁻² day⁻¹, respectively, among streams. GPP and ER were positively correlated, and P:R ratios consistently <1 indicate a dominance of heterotrophic metabolism in all the streams. Despite the large variability in biogeochemical responses across the streams, we did not observe any clear pattern with altitude for any of the studied parameters. This suggests that other factors operating at local scale may exert a greater influence on the variability in biogeochemical responses across these streams.

Relationships between structure and function in streams contrasting in temperature: possible impacts of climate change on running water ecosystems

Nikolai FRIBERG¹, John B. CHRISTENSEN², Jon S. OLAFSSON³, Gisli Mar GISLSON³

¹ -Macaulay, AB158QH Aberdeen - UK

² -NERI, 8600 Silkeborg - Denmark

³ -Uni Iceland, 101 Reykjavik - Iceland

Ten first order Icelandic streams differing in geothermal influence were studied. The streams drained separate catchments and summer temperature (July-August) ranged between 6 and 23 °C. Overall species richness was low and in total 36 macroinvertebrate species were recorded. Chironomidae was the dominating taxonomic group totalling 15 species. Structurally, the streams differed with temperature: more species and higher densities of chironomids were found in the colder streams. In contrast, warm streams (> 19 °C) were dominated by the snail *Lymnea pereger* and the blackfly *Simulium vittatum*. Breakdown rates of fine meshed leaf packs (containing *Betula pubescens* leaves) was significantly related to temperature ($p < 0.05$, $r^2 = 0.71$). In coarse mesh leaf packs breakdown rates were almost doubled, ranging between 0.5 to 1.3 g DW 28 days⁻¹, but the relationship with temperature was less strong ($p < 0.05$, $r^2 = 0.50$). This might reflect that numbers of shredders differed with temperature thereby weakening the direct effect of temperature primarily mediated through an increased microbial activity. Twenty nutrient diffusion substrates were placed in each stream with addition of nitrogen (N as 85 g L⁻¹ NaNO₃), phosphorous (P as 8.1 g L⁻¹ KH₂PO₄) and N+P. In the warmest streams (> 19 °C) the N+P treatment doubled the average algal biomass compared with the N treatment whereas there was no difference between these treatments in the colder streams. Stable isotope analyses revealed that the main pathway of energy was from periphyton to grazers. Our study showed that structural and functional indicators were linked. However, structural indicators tended to be more variable among streams than the functional indicators for other reasons than temperature. In a climate change context, our results demonstrate that streams in future could be more susceptible to the impacts of eutrophication.

The IRESA Project: Catchment properties, habitat conditions and functional organization of key species in tropical rivers

Leopold FÜREDER¹, Wasantha S. WELIANGE^{1,2}, Maria LEICHTFRIED³, Upali AMARASINGHE²

¹ -River Ecology and Invertebrate Biology, Institute of Ecology, University of Innsbruck, A-6020 Innsbruck - Austria

² -Department of Zoology, University of Kelaniya, Kelaniya 11600 - Sri Lanka

³ -Institute for Limnology of the Austrian Academy of Sciences, A-5310 Mondsee - Austria

The cooperative project "IRESA - Initiative of River Ecology in Sri Lanka: from Science to Application" between Austria and Sri Lanka investigates two streams each draining different climate zones: a) Yan Oya, a seasonal dry zone stream, flows to the Hurulu Reservoir and is experiencing annual floods during the NE-monsoon (XI - II), and b) Eswathu Oya, a perennial wet zone stream, which is a tributary to the Kelani Ganga and flows throughout the year with sudden fluctuations in discharge due to torrential rain. Catchment characteristics, land-use activities and anthropogenic impacts were assessed during three field trips in 2005, 2006 and 2007. The main physico-chemical parameters were measured and analysed. Seston and Aufwuchs organic matter and Chl *a* were sampled. Dual stable isotope analysis ($\delta^{15}\text{N}$, $\delta^{13}\text{C}$) were used to estimate the functional organisation of key organisms. With this investigation on typical tropical river ecosystems with the special focus on explaining trophic interactions also in relation to catchment properties, environmental dynamics and human impacts (land use, water demand, catchment and riparian vegetation, etc.) key elements in current water issues are approached.

The role of zooplankton as a nutrient source in a meso-eutrophic lake: merging observations and modeling results

Gideon GAL¹, Tamar BSOR²

¹ -Kinneret Limnological Laboratory, 14950 Migdal - Israel

² -Bar Ilan University, 52900 Ramat Gan - Israel

The role of zooplankton in lakes has long been viewed within the framework of trophic cascades and their role as grazers, predators or food for planktivores. More recently, published reports show zooplankton playing an additional role in aquatic food webs; an autochthonic source of nutrients. Zooplankton maintain homeostasis, in relation to their internal C:N:P ratios, excreting excess amounts thus contributing to the overall pools of N or P in their surroundings and converting them to a biologically available form for uptake by phytoplankton or bacteria. Their role as a source of nutrients results in their ability to apply both top-down and bottom-up pressure on phytoplankton. Over the past 35 years significant changes have occurred to the Lake Kinneret ecosystem. These have included changes to the phytoplankton and zooplankton populations. It is not clear, however, what led to these changes. A significant change in the zooplankton population could lead to changes in the biologically available nitrogen and phosphorus thus altering ambient N:P ratios. This in itself could alter the balance between various algal groups. We examine the role of zooplankton in Lake Kinneret as nutrient recyclers based on a zooplankton long term database, published excretion rates and results of simulations conducted using a lake ecosystem model, DYRESM-CAEDYM. We conclude that while zooplankton play a key role in recycling nutrients in the lake, without further information it is not possible to determine if indeed the observed change in the lake phytoplankton is a result of changes to lake zooplankton.

Response of biological indices to pressures in the running waters of the Alsace floodplain (Eastern France). Towards a proposal of a new tool to assess ecological status of waterbodies

Corinne GRAC¹, Florence LE BER¹, Michèle TREMOLIERES²

¹ -CEVH /ULP-ENGEES, 67089 Strasbourg - France

² -CEVH /ULP-ENGEES, 67083 Strasbourg - France

The EC-water framework directive "requires the establishment of classification schemes to reflect the ecological status or potential of surface water bodies". According to this request we aim at comparing four french normalized biological indices used to assess ecological status of running waters. We selected 40 sites 1) according to the classification of waterbodies under WFD and 2) related to different pressures. Physical and chemical measurements were made for specific pressures: hydromorphological, chemical (eutrophicants, organic pollution, micropollutants). In each site we calculated the four indices, based on macrophytes (IBMR), invertebrates (IBGN), Oligochaetes (IOBS) and diatoms (IBD). Multivariate analyses were used to establish relationships between pressures and biological indices and to compare response of the different indices to pressures. Preliminary results showed that IBGN would be more useful for the evaluation of organic pollution and eutrophication, IBD is more efficient for determining organic and mineral micropollutants, as well as organic pollution and eutrophication. These results seem to confirm the literature results. We also tried to establish relationships between taxa and pressures. Some taxa of the different organisms groups were statistically related to specific pressures. No relationship was established between types of waterbodies and indices. The next step will be to propose a multiple indice which could combine several indices, and to identify biological traits assemblages as indicators of ecological status.

Mine run-off affects sporulation of aquatic hyphomycetes and feeding rates of shredders

Manuel A.S. GRAÇA, Adriana O. MEDEIROS, Paula ROCHA

Department of Zoology; University of Coimbra, 3004-517 Coimbra - Portugal

Leaf litter is a main energy source for headwater streams and litter breakdown is a key functional ecosystem process in these systems. Here we assess how drainage water from an abandoned gold mine affects litter breakdown, using three sites (P = polluted, R = reference, and RP = intermediate) with had similar pH (6-7) but differing in heavy metal content (As, 0.4 mg L⁻¹; Fe, 4.9 mg L⁻¹; Mn and Zn, 1.2 mg L⁻¹ in the polluted site) and PO₄³⁻ (0.04 mg L⁻¹ in the polluted site). Decomposition mediated by aquatic fungi (fine mesh bags approach) was similar across sites (ANCOVA; $k = 0.0016$ to 0.0080), but fungal sporulation rates were significantly higher at the reference site (up to 2488 spores mg AFDM day⁻¹). Breakdown mediated by shredding invertebrates (coarse mesh bags) was significantly lower at the impacted sites ($k < 0.0160$ vs $k > 0.0191$), in spite of similar shredder biomass in all sites. The caddisfly *Allogamus ligonifer* was dominant across sites and discriminated between leaves exposed in the reference and in the polluted site (consumption rates of 0.60 vs 0.35 mg mg⁻¹ AFDM day⁻¹). *In situ* experiments revealed that shredders from the polluted site consumed leaves at lower rate than in the reference site (0.46 vs 0.35 mg mg⁻¹ AFDM day⁻¹). Our results suggest that although pollution was not enough to suppress microbial growth and invertebrate survival, sub-lethal effects affected the ecosystem function.

The effect of sewage effluent on the ecology of a salmonid river

C.T. GRAHAM¹, S.S.C. HARRISON¹, P. PHELAN², P.S. GILLER², R.I. JONES²

¹ -Dept. of Zoology, Ecology & Plant Science, University College Cork, Distillery Fields, Cork - Ireland

² -Dept. of Biological & Environmental Sciences, University of Jvaskylä - Finland

Organic pollution can have many deleterious effects on running waters, the most obvious of which is the great increase in the growth and abundance of algae and macrophytes. The respiration and subsequent death and decay of these primary producers can then lead to widespread and ecologically damaging stream anoxia. Salmonids, particularly the younger life stages, have a relatively weak tolerance to low oxygen concentrations and are thus particularly vulnerable to organic pollution. Salmonids are therefore considered to be indicator species for riverine pollution. Irelands temperate maritime climate is cool with a high, relatively aseasonal annual rainfall with considerable precipitation falling during summer months. Consequently, river discharge is rarely extremely low and oxygen concentrations are usually maintained at relatively high levels. We examined the effects of sewage effluent on algae, invertebrate and fish production in a salmonid river. As expected, the fertilisation of the river with plant nutrients (nitrogen and phosphorus) had a positive effect on the growth of epilithic algae. This increase in primary production was accompanied by an increase in the abundance of macroinvertebrates and a change in their community structure. For the fish populations, salmonids were somewhat more abundant above the outfall, and both stickleback (*Gasterosteus aculeatus aculeatus*) and stone loach (*Barbatula barbatula*) markedly more abundant below the outfall. The mean size and condition of both salmon (*Salmo salar*) and trout (*Salmo trutta*), increased downstream of the point source of pollution. Stomach content analysis of salmon, trout, stone loach and sticklebacks, and stable isotope analysis of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ of the major constituents of the food web have been analysed in order to elucidate the trophic changes associated with this point source of sewage.

Spatial and temporal patterns in the dispersal of anostracans by waterbirds

Andy J. GREEN, Marta I. SANCHEZ, J. FIGUEROLA

Doñana Biological Station-CSIC, 41013 Sevilla - Spain

Migratory waterbirds are known to be dispersal vectors for various invertebrate groups, but there is an absence of quantitative studies comparing differences between sites, seasons and vector species. We present a study of the dispersal of brine shrimps *Artemia* by more than 10 bird species at different locations in the Iberian Peninsula. We quantified the number and viability of resting eggs (cysts) excreted in the faeces and pellets of shorebirds, ducks, gulls and flamingos. We look for consistent differences between bird species in their role as vectors. We compare dispersal rates during spring and autumn migration and from two consecutive years. We evaluate the role of birds as vectors of the native bisexual *A. salina* and native parthenogenetic *Artemia* populations, as well as for the invasive *A. franciscana*. We ask whether genetic differences between populations are consistent with a major role for birds in effective long-distance dispersal. This system represents an excellent model for the study of passive dispersal of aquatic invertebrates by waterbirds, and of their role in the expansion of exotic species.

Spatial autocorrelation and concordance among stream assemblages along a fragmented gradient

Gael GRENOUILLET, Sebastien BROSSE, Loïc TUDESQUE, Sovan LEK, Geraldine LOOT

Lab. EDB - University Paul Sabatier, 31062 Toulouse - France

Patterns of spatial autocorrelation of biota and distributional similarity (concordance) between assemblages have important implications in both theoretical ecology and biodiversity conservation. Here we report environmental gradients and spatial distribution patterns of taxonomic composition among stream fish, benthic macroinvertebrate and diatom assemblages along a fragmented stream in southwestern France. We quantified spatial patterns of lotic assemblage structures along this stream, and we tested for concordance in distribution patterns among the three taxonomic groups. Our results showed that both environmental characteristics and stream assemblages were spatially autocorrelated. For stream fish and diatom assemblages, these patterns reflected assemblage changes along the longitudinal stream gradient, whereas local habitat conditions and benthic macroinvertebrates exhibited a more patchy spatial pattern. Cross-taxa concordance was significant between stream fish and diatoms, and between stream fish and benthic macroinvertebrates. The assemblage concordance between stream fish and diatoms could be attributed to similar responses along the longitudinal gradient, whereas those between stream fish and benthic macroinvertebrates may result from biotic interactions. Our results validate the two hypotheses that lowly dispersing taxa exhibit greater concordance than highly dispersing ones and that dispersal capacities affect how taxonomic groups respond to their local environment. The effect of stream fragmentation was significant for highly dispersing stream fish, but not for invertebrates with strongly flying adults. These results suggest that addressing the effects of life-history characteristics on stream assemblage patterns is crucial to identify mechanisms behind patterns and to better understand the determinants of stream biodiversity.

Impacts of agricultural land-use on ecosystem structure and function of tropical Cerrado streams

Björn GÜCKER, Iola G. BOECHAT

Universidade Federal de Minas Gerais, 31270-010 Belo Horizonte, Minas Gerais - Brazil

The tropical Cerrado savannah, the second-largest South American biome, is undergoing the most rapid land-use changes on the American continent, including a wholesale shift from native vegetation to pasture and cropland. However, the consequences of this development for terrestrial and aquatic ecosystem functioning remain unclear. In this study, we investigated how agricultural land-use affects chemical, physical, and biological characteristics of headwater streams in the Brazilian Cerrado, and how these changes relate to an important ecosystem function, i.e., whole-stream metabolism. The direct estimation of stream metabolism has recently been proposed as a tool for the integrative assessment of stream and watershed health. Nevertheless, the indicative value of stream metabolism for different disturbance scenarios in different biomes, including the Cerrado savannah, remains to be tested. Three paired samplings of one pristine and one agricultural stream were conducted considering abundant morphotypes of Cerrado streams (swamp, meandering, and run type; all open-land streams). Nutrient concentrations, stream morphometry and hydrodynamics, as well as biofilm biomass, elemental stoichiometry, and chlorophyll-*a* content were investigated. In parallel, whole-stream gross primary production (GPP) and respiration (R) were estimated using the diurnal open-channel dissolved oxygen change technique. Across stream types, agricultural streams had consistently higher nutrient concentrations, less variability in channel depth and width, smaller transient storage zones, and 10-fold higher current velocities than pristine streams. At baseflow, agricultural streams exhibited a midstream band of shifting sediments with extremely low contents of organic carbon, while pristine streams had stable sediments. Both agricultural and pristine streams were dominated by thick microbial biofilms. Due to differences in stream hydrodynamics and sediment stability, these biofilms covered the entire streambed in pristine streams, but were restricted to the stream margins in agricultural streams. As a result, pristine streams had higher areal biomasses of benthic biofilms than agricultural streams. Interestingly, agricultural streams had higher areal rates of GPP, but lower areal rates of R. Scaling by biofilm biomass separated effects of increased nutrient availability from those of altered hydrodynamics, and biomass-specific chlorophyll-*a*, total nitrogen, and total phosphorus concentration, as well as GPP and R were higher in agricultural than in pristine streams. In conclusion, agricultural land-use impacted Cerrado streams through two antagonistic mechanisms: altered stream hydrodynamics resulted in decreased areal biofilm biomass and whole-stream R by the abrasion of biofilms from the central streambed, but higher nutrient availability lead to increased GPP and R in marginal zones. Thus, hot-spots of ecosystem function were relocated from the central streambed to the stream margins. Finally, measures of whole-stream metabolism were useful indicators of stream ecosystem health and allowed for the differential assessment of the effects of altered stream hydrodynamics and eutrophication.

Comparative examination of Cladocera remains, which were found in the sediment of Keszthely- and Siófok-bay (Lake Balaton, Hungary)

István GYULAI¹, Mihály BRAUN², Dénes GÓR¹, Gyula LAKATOS¹, János KORPONAI³

¹ -Department of Applied Ecological, University of Debrecen, H-4010, Debrecen, Hungary

² -Department of Inorganic Chemistry, University of Debrecen, H-4010, Debrecen, Hungary

³ -West Transdanubian Water Authority, Dept. Kis-Balaton, H-8360 Keszthely, Hungary

The aim of our study is a paleolimnological reconstruction of the shallow lake, the Lake Balaton by cladocera remains. The latest cognition of Cladocera remains has a key role in paleolimnological research. The sediment of lake provides a good quality and a large quantity of Cladocera species. The information about it required explorations which are essential to reconstruct the ancient history lake. The various evolution of the Keszthely bay gave us a good chance to study the composition of sediments. The Keszthely bay is a basin of Lake Balaton. Lake Balaton is one of the shallow and eutrophic lakes of Hungary. The field of lake paleoecology has gone under significant changes. Inclusion of zooplankton and benthic Chydorid Cladocerans has provided previously unavailable information about on the historical development of planktivorous fish populations, lake production and has been used to document exotic species introductions and human disturbance of lakes. On January, 2006, in Keszthely-bay and on May, 2006, in Siófok-bay we collected a meter long column of sediment which was 0,05 meter in diameter. Cladocera remains, organic material content, the CaCO₃ content, the mineral material content and the chronology of the sediment were studied.

In the sediment of Keszthely-bay we identified 22 species of cladocera and 1610 individuals were counted. In the sediment of Siófok-bay we identified 14 species and 1447 individuals were counted. The *Bosmina longirostris* (O. F. Müller) is the characteristic species in the Lake Balaton. The *Bosmina coregoni* (Baird) was found only in the youngest sediment layer (depth 0-4 cm) which proves that this species is a new element in Lake Balaton. It is a dominant species of the recent fauna. The high CaCO₃ content decreased the quantity and the body size of recent *Daphnia* population. We found only some individuals of *Daphnia*. In the sediment of Keszthely-bay three dominant species *Chydorus sphaericus* (O. F. Müller), *Leydigia leydigii* (Schoedler) and *Alona affinis* (Leydig) were found, in the sediment of Siófok-bay two dominant species *Alona quadrangularis* (O. F. Müller) and *Monospilus dispar* (Sars) were found during our study.

Research was financially supported by the Hungarian Scientific Research Fund T 49098.

Experimental evidence shows that substrate size affects density and taxon richness in meiofaunal assemblages

Barbara HANCOCK, Anne ROBERTSON, Peter SHAW

University of Roehampton, Holybourne Avenue, SW15 4JD London - UK

We describe experimental work on substrate colonisation by benthic meiofauna (63 μm - 1mm) in the newly created Jubilee River, a 12 km flood alleviation channel running parallel to the Thames in South-East England. In 2005, the physical and biological variables affecting the meiofauna were studied at one site on the Jubilee and the Thames River, addressing the following questions;

- I. Does species richness vary between the Jubilee and the Thames River?
- II. What is the influence of substrate particle size on the colonisation and abundance of meiofauna?
- III. What is the influence of coarse (CPOM) and fine (FPOM) particulate organic matter on the colonisation and abundance of meiofauna?

At each site, defaunated cages (5cm·8cm·8cm) were introduced to the shallow benthos containing either original riverbed substrate (control) or artificial substrates in the following size categories; sand, gravel, pebbles. Meiofauna were allowed to colonise for 2 weeks, then collected and preserved in 70% I.M.S., identified and enumerated.

The Jubilee River benthic samples were found to have significantly greater meiofaunal density in comparison to the Thames River for 21 out of 23 taxa tested ($p < 0.05$). The lack of utilisable sub-surface habitats in the homogeneous Thames clay riverbed could explain the differences seen. In the Thames, substrate composition affected meiofaunal abundance in only three taxa (Oligochaetes, Nematodes and the cladoceran *Pleuroxus uncinatus*, $p < 0.05$). In comparison, 11 of the 23 taxa investigated in the Jubilee showed a significant difference in abundance between the substrate size categories. Although it has been widely shown that benthic organisms increase in abundance as particle size increases, here a contradictory response was found, with the smallest artificial substrate (sand) generally containing the highest meiofaunal density. Although some species show a significant relationship with the CPOM and FPOM levels, ANCOVA showed that this was not enough to explain substrate associations. Other factors, such as substrate heterogeneity and stability, local population density and other ecological factors may also play an important role in the habitat preference of meiofauna.

Can artificial wetlands favour biodiversity?

Jan HERRMANN

Department of Natural Sciences, University of Kalmar, 391 82 Kalmar - Sweden

In recent years, construction of wetlands is increasingly popular in northern Europe, and very much so also in Sweden, mostly for reduction of nutrients, especially nitrogen. Besides, even if less raising the needed money, is frequently argued the benefit for biodiversity in agricultural landscapes, today often deprived of most natural water bodies. Of many hundreds of artificial wetlands/ponds being established in Sweden, only a smaller fraction have been monitored in a way that allows to us ascertain if the biodiversity has been favoured. This presentation evaluates those studies regarding benthic plants and invertebrates, telling what taxa are colonizing the new water bodies and when. From this will be discussed what importance these biotic components might have for the nutrient retention function.

Are our rivers healthy? Community structure and ecosystem function in UK chalk streams

Alan HILDREW, Ian SANDERS, James PRETTY, Mark TRIMMER

Queen Mary, University of London, E1 4NS London - UK

Assessment of the 'ecological health' of freshwater systems is usually achieved via some sort of characterisation of the species present, often combined with inferences based on their tolerances or traits. These bio-assessments are therefore based on community structure and are usually assumed to relate to ecosystem processes, for instance decomposition, primary production or nutrient cycling, such that ecosystem health can be judged by structure alone. Here we show that UK chalk streams, which are of excellent ecological status based on their macroinvertebrate communities, are sources of significant emissions of greenhouse gases, including nitrous oxide and methane, which would not normally be associated with streams in good condition. Sediments eroded from agricultural fields accumulate beneath extensive macrophyte beds and create conditions in which organic matter, apparently mainly of terrestrial origin, is processed anaerobically. Here we have an intriguing mixture of a biodiverse ecosystem exhibiting processes that are apparently deleterious. How can we deal with this both conceptually and in the practice of ecological assessment?

Modeling submerged macrophyte distribution and abundance as a function of water level fluctuations in shallow Lake Balaton

Mark HONTI, Vera ISTVÁNOVICS

Budapest University of Technology and Economics – Budapest, Hungary

Balaton is a large (area: 597 km²), shallow (mean depth: 3.2 m) lake in western Hungary. Its lateral positioning relative to the prevailing N-NW winds create different conditions on the protected northern and the wave-exposed southern shoreline. The lake regularly experiences significant water level fluctuations, which became more intense with the recent climatic variability. In low water periods the lake withdraws from the constructed banks. As the turbidity of the lake prevents submerged macrophytes from growing in deeper water (below 2-2.5 m), water level fluctuations can essentially reorganize the habitats of these plants from one year to another.

Underwater light conditions vary with many orders of magnitude despite the shallowness of the lake, because of high turbidity (K_d avg.: 4 m⁻¹) caused by continuous resuspension of sediments. Thus, light conditions to submerged plants can be quite different according to the physical structure of the plant, that is the depth-distribution of biomass.

Macrophyte stands at a few sites around the lake were assessed with echosounding, plant photography and wave exposure experiments. Based on the field measurements, a new, individual based submerged macrophyte model was developed to simulate the distribution and abundance of the dominant weed of Lake Balaton, *Potamogeton perfoliatus*. The model describes the physical development of *P. perfoliatus* individuals within the growing season. Water depth, light availability, temperature and wave damage were considered as characteristic environmental impacts to the development of weeds. Model parameters were set according to the field observations and literature. The model was adjusted to run on raster maps covering the whole lake, so that macrophyte abundance outside the measurement sites could be estimated.

Response of four riverine biological assemblages to human pressures: Identifying sentinels of change for restoration in a Mediterranean system of Southern Portugal

Samantha Jane HUGHES^{1,2}, Maria Teresa FERREIRA¹, José Maria SANTOS¹, Ana MENDES¹

¹ -Forest Research Centre, Technical University of Lisbon, 1349-017 Lisbon - Portugal

² -Centre for Macaronesian Studies, University of Madeira, Campus da Penteadá, 9000-390 Funchal - Portugal

The Odelouca River, situated in the Algarve region of southern Portugal is one of the few remaining national Mediterranean fluvial systems with intact galleries of riparian vegetation. However increasing pressure concerning water supply in the region has resulted in the approval of the construction of a dam on the Odelouca with the condition that extensive restoration and impact mitigation measures are carried out. This requires the identification of (i) benchmark sites or reference conditions and (ii) reliable biotic indicators (sentinels) of habitat quality, capable of reflecting factors that induce change over several spatial scales. Habitat quality was assessed using the River Habitat Survey (RHS) assessment method at 30 sites situated on the main course and three tributaries. Four biotic elements - benthic macroinvertebrates, fish, birds and plant communities - were sampled at each site. Further, a map of River Corridor Conservation Status was drawn that included the definition of existing fluvial reaches using geographic and hydrogeomorphological variables which were then assessed according to the presence of anthropogenic pressures. A hierarchical cluster analysis of the physical character and habitat quality of the sample sites revealed three strongly distinct groups, namely the benchmark sites, degraded sites and the tributary sites. The benchmark sites were characterized by having relatively complex riparian galleries with the presence of important associated features mainly associated with the presence of large woody debris, bankside roots and shading of the channel. Multivariate data analyses (Hierarchical Cluster Analysis, non-metric Multi Dimensional Scaling analysis, Principal Component Analysis, Canonical Correspondence Analysis and partial Canonical Correspondence Analysis) showed that changes in the benthic macroinvertebrate, fish and plant communities in particular could be reliably associated with gradients of habitat quality at the spatial scales of habitat, reach and basin and showed good levels of correspondence (PROcrustean Randomization, ProTest). The bird community was found not to be as responsive as the other biotic elements. The results of this study emphasise the importance of an integrated approach based on several biotic groups and abiotic features for assessing habitat quality and define restoration measures.

Allelopathic interactions between plankton species: Where lie the costs of toxin production?

Florence D. HULOT¹, Guillaume SAPIEL²

¹ -Bioemco, 75005 Paris - France

² -UMR 8186, 75005 Paris - France

The role of toxin produced by some cyanobacteria species that affect other species is still subject of discussion in the literature. Toxin-producing species and toxin-sensitive species are engaged in allelopathic interactions defined here as an indirect interaction between two individuals mediated by an organic compound. One open question is to know whether these toxins are a waste product that may eventually affect other species (waste product hypothesis) or whether toxins may compensate competitive disadvantages or are a defences against predators (allelopathy hypothesis). According to the waste product hypothesis toxin production should be constant and not directly influenced by environmental factors. Conversely, the latter hypothesis implies firstly that toxin production is likely correlated with environmental factors, such as the presence of a predator or a shortage of a limiting resource, and secondly that not all strains of a species would produce toxins. Variability in toxin production within a species would be a result of evolutionary constraints if toxins are costly and some strains may take advantage of the toxins produced by other strains. Empirical data show that toxin production is variable between strains of cyanobacteria species favouring the hypothesis of allelopathy. In the following we analyse the potential costs of toxin production at several levels. Costs may be expressed at molecular level, i.e. the cost of toxin biosynthesis, at physiological level, i.e. the cost of toxin storage and transport in cells, at environmental level where the cost depends on the persistence of toxin in the medium, and finally at the evolutionary level because some strains may benefit from the ecological effects of toxin produced by other strains without supporting the costs of its production. We illustrate our analysis with microcystins that are produced by several species of cyanobacteria.

Stability or lack of it of the microbial food web in a humic lake - Results from mesocosms experiment

Iwona JASSER¹, Iwona KOSTRZEWSKA-SZLAKOWSKA², Jolanta EJSMONT-KARABIN², Krystyna KALINOWSKA², Teresa WĘGLEŃSKA¹

¹ -Warsaw University, 00-927 Warsaw - Poland

² -Centre for Ecological Research, 05-092 Lomianki - Poland

The aim of the study was to check if and to what extent changes in biomass of crustacean consumers may influence the diversity and biomass of microbial food web components. The experiment with six mesocosms of 4.5 m depth and 0.75 m diameter was set in an oligohumic, acidic, mid-forest lake in the Masurian Lake District, northeastern Poland. Metazooplankton was removed from five mesocosms with a plankton net of 100 µm mesh size, obtaining 1/2, 1/5, 1/25 and 0 of the abundance of crustacean zooplankton in the lake. The sixth mesocosm in which no zooplankton was removed served as a control. The results of the experiment revealed that the manipulation of the level of crustacean consumers influenced the biomass and the structure of the whole food web. The highest biomass of phytoplankton was observed in the treatments with the lowest metazooplankton abundance and the lowest in the mesocosms with the highest abundance of zooplankton and in the control. The biomass and ratio of rotifer and protozoan zooplankton also changed, showing a mirror image in treatments with lowest crustaceans biomass. Within protozooplankton, the mirror image of biomass of both ciliates and nanoflagellates was also noted in all the treatments compared to the situation in the lake. The results showed also that bacteria and autotrophic picoplankton (APP), serving as a base for the microbial food web, were the steadiest element of the food web. It seems that bacteria and APP, prey for various trophic and taxonomic groups, were controlled in all the treatments, regardless of which consumers dominated each of them. Despite the modifications noted within the phytoplankton, rotifer and protozooplankton biomass as well as their low biodiversity, the structure of the food web in the studied lake was relatively stable, with no incidents of extinction nor radical changes of communities.

The structure and functioning of a manipulated stream ecosystem.

J.I. JONES¹, F.K. EDWARDS^{1,2}, R.B. LAURIDSEN^{1,2}, A. IBBOTSON¹, C.E. DAVIES¹, G. WOODWARD²,
M. EMMERSON³, A.G. HILDREW²

¹ -*Centre for Ecology and Hydrology, Dorset - UK*

² -*Queen Mary University of London - UK*

³ -*University College Cork - Ireland*

In recent years there has been increasing concern about the impact humans have on ecosystem processes. However, we do not have a full understanding of the link between community structure and the functioning of ecosystems. Human impacts on aquatic ecosystems often result in species being added or deleted from the natural community, resulting in changes to feeding links and competitive interactions, and ultimately a modification of ecosystem functioning.

Here we report the results of a study where we quantified the biomass of all the structural components of a stream ecosystem, quantified the strength of the food web links that connect them (using gut contents, stoichiometric and stable isotope methods) and simultaneously measured ecosystem functioning (herbivory, detritivory, primary production, secondary production). After one year we then manipulated the structure of the community by a controlled introduction of an "invasive" species near the top of the web (as part of an Atlantic salmon reintroduction programme in the River Frome, Dorset). The consequences of the manipulation, both in terms of community structure and ecosystem functioning, were then followed. The relationship between structure and functioning, and the potential for different techniques to detect change, will be discussed.

Converting to biogas - the chironomids' tale

Roger JONES¹, Jonathan GREY²

¹ -University of Jyväskylä, Department of Biological and Environmental Sciences, PL35, 40014 Jyväskylä - Finland

² -School of Biological and Chemical Sciences, Queen Mary, University of London, E1 4NS London - UK

Substantial amounts of methane are produced in the anoxic sediments of lakes. Since a high proportion of this is utilized by methane-oxidizing bacteria, these bacteria could potentially be an important source of carbon for lake food webs. Reports of unexpectedly ¹³C-depleted lake chironomid larvae have led to an hypothesis that significant transfer of detrital organic matter to chironomid larvae may occur via methane-cycle bacteria. However, to date it has not been clear how cosmopolitan such transfer might be, across species and across lakes. We gathered data from 87 lakes to determine how widespread this phenomenon might be and to define boundaries for its likely magnitude. Carbon stable isotope values of chironomid larvae varied greatly, with clear differences between taxa. Very marked ¹³C-depletion was evident only in *Chironomus plumosus*, *C. anthracinus*, and *C. tenuistylus*, all taxa characteristic of eutrophic or dystrophic lakes and known to be tolerant of low oxygen conditions. Furthermore, marked ¹³C-depletion was only found in larvae from lakes in which late-summer hypolimnetic oxygen depletion near the sediment surface was below an apparent threshold concentration of 2-4 mg O₂ L⁻¹. Accordingly, when the late summer oxygen concentration dropped below this threshold concentration, our estimates of the contribution to larval carbon biomass from methanotrophic bacteria were highest. These estimates were derived using a two-source mixing model in which the sources were surface sediment detritus and methanotrophic bacteria (and assuming upper and lower $\delta^{13}\text{C}$ values for methanotrophic bacteria). Larvae also exhibited frequent ¹⁵N-depletion, and larval $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values were significantly correlated across all our data. Our study demonstrates that methane-derived carbon can indeed make an important, and until recently neglected, contribution to the flux of carbon through the food webs of many lakes, which may even transfer onwards to riparian communities that depend heavily on emerging chironomid imagos.

Study of feeding regime of the Persian sturgeon (*Acipenser persicus* Borodin- 1897) of the Caspian Sea in different age classes

H. JOUSHIDE¹, J.N. IMANPOUR², H. KHARA³

¹ -International Sturgeon Research institute, Rasht - Iran,

² -Department of Fishery, Faculty of Natural Resource, University of Guilan, Sowmesara - Iran

³ -Department of Fishery, Azad University, Lahijan Branch, Lahijan - Iran

Considering the amount of caviar harvested, the Persian sturgeon, *Acipenser persicus* is regarded one of the most important sturgeon species in Iran and in the world. Study on natural feeding habits of *A. persicus* was carried out in the year 2004 in the southern shores of the Caspian Sea. A total of 130 *A. persicus* specimens with a fork length varying from 13 to 94cm (mean= 38.54 ± 23.2 cm), with average weight of 837.39 ± 1276.2 ranging from 10 to 5350 g and in age classes ranging from 0+ to 6 years (mean= 2.79± 1.3) were collected using bottom trawl from the depths of 2 to 100 m of which 56% were females and 35 % males. The alimentary tracts were analyzed and abundance and percentage of feed items were calculated using standard methods. The study showed that the Persian sturgeon feeds on relatively wide spectra of food items especially in lower age classes. Total of 12 feed items were found in the guts of the examined specimens. Order Polychaeta with 52.88%, fish species (26.22%), Crustaceans (18.86%), insects (1.92%) and bivalves (0.12%) were main feed items observed in the gut of the all examined specimens quantitatively. Mean relative length of gut was 0.40± 0.1; mean feeding intensity index was 227.03± 217, condition factor was 0.35± 0.1 and percentage of vacuity index (CV) was 20.77. Feeding intensity and condition factor showed relatively inverse relationship and the highest feeding intensity and lowest condition factor were observed in lower age classes. The main food items of YOY *A. persicus* were crustaceans including Mysidae, Pseudocumidae, Ampharetidae, whereas fishes in the 6 years age class feed mainly on fish species of the family Gobiidae.

The quasi-stochastic phytoplankton of Lake Kinneret under environmental change conditions

Yury KAMENIR

Bar-Ilan University, Bar-Ilan, 52900 Ramat-Gan - Israel

The stability analysis of natural communities and ecosystems requires quantitative means to evaluate the structural deformation of the aquatic community or assemblage taken as a whole. Size spectrum provides such assessment and most often considers the size distribution of organisms in a community. Another old, but rarely used in aquatic sciences, tool describes the size-frequency distribution of taxonomic units encompassed by an assemblage, and is called here 'traditional taxonomic size spectrum' (TTSS). The phytoplankton assemblage of Lake Kinneret was used to compare several years characterized with the most pronounced (during some 40 years of monitoring) abnormalities in many biotic and abiotic parameters. The phytoplankton taxonomic size spectra have revealed consistent patterns. Simple statistical methods (cluster analysis, correlation) produced quantitative similarity estimates for such patterns. Unpredictability in the annual frequency scores was much higher for particular taxonomic units than for the assemblage size classes. We interpret this distinction as the self-regulation success of the natural aquatic community.

Faunal zonation in agricultural drainage ditches

Jane KAVANAGH, Simon S.C. HARRISON

Department of Zoology, Ecology and Plant Science, (Cooperage), University College Cork, Distillery Fields, Cork - Ireland

It is widely recognised that agricultural practices within catchments can have major implications for stream ecosystems, particularly via the diffuse input of nutrients and fine sediment. The drainage ditch network in the upper headwaters of a river catchment represents the greatest interface between land and running water. Drainage ditches, therefore, are likely to experience proportionally the greatest degree of agriculturally-derived disturbance. Despite this, little research has been carried out on the ecology of these small headwater systems. This study is an investigation of the effects of agricultural inputs into the small headwater tributaries draining an intensively managed lowland agricultural catchment in southern Ireland. Headwater habitats and communities were characterised across a longitudinal gradient from the upper dendritic drainage channels to downstream reaches. Invertebrate communities and water chemistry were investigated bimonthly. Small changes in the physico-chemical environment were accompanied by large variations in community assemblages over very short distances, resulting in distinct longitudinal faunal zonation. These zonation patterns are discussed in relation to habitat complexity and nutrient dynamics within the system and are interpreted with reference to ecosystem functioning and best management practices for agricultural drainage ditch maintenance. The contribution of drainage ditches to the overall gamma diversity of a stream system is also considered.

Hydraulic preferences of freshwater taxa observed in multiple sites: some critical issues

Nicolas LAMOUROUX¹, Sylvie MERIGOUX², Hervé CAPRA¹, Sylvain DOLÉDEC²

¹ - Cemagref, Lyon - France

² - UMR 5023 University Lyon 1, Villeurbanne - France

A number of studies using data collected in multiple sites has recently advanced our knowledge of hydraulic preferences of many fish and macroinvertebrate taxa in small and large rivers. They indicated contrasting and often strong responses of taxa to microhabitat hydraulics. Using examples from such studies, we discuss some critical issues in this field and propose future work for improving preference models.

In our view, when modelling hydraulic preferences using data from multiple sites, the first important issue is the modelling approach. Whatever the type of model that is used, we think that it should attempt to separate hydraulic effects from others. An efficient means for separating the effects of hydraulics is to model variations in taxa abundance within stream reaches at a given date. This is because differences in abundance between-dates and between-reaches may result from many other factors than hydraulics.

A second question that is often debated is the relevance of generalised models 'averaged' across reaches vs. reach-specific models. Our opinion is that both are complementary and useful for different objectives. In particular, some studies showed that generalised models can explain a large proportion of abundance variations within sites. This may be particularly true for specialised species, whose preferences vary less across streams and dates.

A third important question concerns the hydraulic variables involved. We still lack comparative studies of the ability of various descriptors to reflect variations in species abundance. The gathering of data set enabling such comparisons and the development of field techniques quantifying complex hydraulics (e.g. three-dimensional velocities, turbulence) and their spatial patterns should increase our ability to identify flow conditions that are most important for organisms.

There are many other issues that can be addressed to improve our knowledge of taxa hydraulic preference. In particular, the effects of shoaling and species interactions on observed habitat preferences remain little quantified in rivers.

Stoichiometric constraints on secondary production in a headwater stream food web

R.B. LAURIDSEN^{1,2}, F.K. EDWARDS^{1,2}, J.I. JONES¹, M. BOWES¹, G. WOODWARD², A.G. HILDREW²

¹ -*Centre for Ecology and Hydrology, Dorset, UK*

² -*Queen Mary University of London, UK*

Most consumers must maintain body tissue Carbon:Nitrogen:Phosphorus within relatively narrow constraints, even though these ratios often vary markedly among basal resources. These elemental constraints might be a major factor governing resource selection by, and production of, consumers. As a consequence, elemental imbalances could constrain the flux of matter through food webs, and hence their structure. In this study we aim to characterise and quantify the distribution of C, N and P within the nodes of the food web of a headwater stream ecosystem (i.e. species populations and basal resources). The experimental reach was surveyed twice a year in 2005 and 2006. Standing stock and elemental composition of epilithic algae, particulate organic matter (POM), macroinvertebrates and fish were quantified. The feeding links were quantified using gut content analysis for macroinvertebrates and fish. The results show that the basal resources (POM and primary producers) contain low concentrations of nitrogen and phosphorus compared to invertebrate and fish consumers. Imbalances in the nutrient composition of consumers and the basal resources exist therefore. There was limited variation in phosphorus and nitrogen content among the macroinvertebrate consumers. The fixed elemental ratios of nutrients in invertebrate consumers in combination with the low phosphorus and nitrogen content of the basal resources potentially constrain the secondary production of the stream ecosystem.

Allelopathic interactions between two green algae, the benthic *Uronema confervicolum* and the planktonic *Scenedesmus quadricapsa*

Joséphine LEFLAIVE, Yvan NICAISE, Loïc TEN-HAGE

Laboratoire d'Ecologie Fonctionnelle, 31 062 Toulouse - France

In aquatic environments, allelopathy is a strategy used by algae, cyanobacteria and macrophytes to eliminate competitors and to have access to resources. Here we report an allelopathic reciprocal interaction between a benthic filamentous green algae, *Uronema confervicolum*, and a planktonic green algae, *Scenedesmus quadricapsa*, both isolated from the Tarn river, France. A well-studied property of the genus *Scenedesmus* is its high phenotypic plasticity. They are notably able to be either unicellular or colonial depending on the environmental conditions. In our stock culture conditions, *S. quadricapsa* was essentially unicellular (1.05 cells/coenobite). In presence of a dense culture filtrate of *U. confervicolum*, *S. quadricapsa* shifted to a colonial form after 48 hrs of exposure, with mainly 4-celled coenobia. Neither filtrates from another green algae cultures (*Monoraphidium* aff. *dybowskii*) nor filtered fresh medium induced colony formation in *S. quadricapsa*. To our knowledge, this is the first report of colony induction by algal products. Extracts from *U. confervicolum* also induced colony formation, at low concentration ($8 \mu\text{g mL}^{-1}$) while they inhibited *S. quadricapsa* growth at higher concentrations (from 20 to $100 \mu\text{g mL}^{-1}$). To understand the mechanisms involved in those two reactions, the Reactive Oxygen Species (ROS) production in *S. quadricapsa* has been assayed. The formation of ROS is often an early response of algae to allelopathic compounds. Filtrate and low concentrations of *U. confervicolum* extracts did not induce oxidative stress after 48 hrs of exposure while $100 \mu\text{g mL}^{-1}$ of extract caused a 10-fold increase in the number of stressed cells. The formation of ROS seems to be implied in *S. quadricapsa* growth inhibition but not in colony induction. Extracts from *S. quadricapsa* reduced *U. confervicolum* growth and sporulation at $100 \mu\text{g mL}^{-1}$. This is an example of reciprocal interaction between two algae belonging to two different aquatic compartments, benthos and plankton. The formation of colonies increases settling of *S. quadricapsa* which may help *U. confervicolum* to decrease shading. Growth of settled cells may also be inhibited by allelochemicals from the benthic alga. In return, *S. quadricapsa* is able to reduce *U. confervicolum* development. The equilibrium between those two algae may be strongly influenced by the environmental conditions.

The IRESA Project: Bed sediments - what role they play in tropical low order stream ecosystems in dry and wet zones?

Maria LEICHTFRIED¹, Leopold FÜREDER², Wasantha S. WELIANGE^{2,3}, Upali AMARASINGHE³

¹ -*Institute of Limnology, Austrian Academy of Sciences, A-5310 Mondsee - Austria*

² -*Institute of Ecology, University of Innsbruck, A-6020 Innsbruck - Austria*

³ -*Department of Zoology, University of Kelaniya - Sri Lanka*

The cooperative project between Austria and Sri Lanka "IRESA - Initiative of River Ecology in Sri Lanka: from Science to Application" investigates two streams each draining different climate zones: a) Yan Oya, a seasonal dry zone stream, flows to the Hurulu Reservoir and is experiencing annual floods during the NE-monsoon (XI - II), and b) Eswathu Oya, a perennial wet zone stream, which is a tributary to the Kelani Ganga and flows throughout the year with sudden fluctuations in discharge due to torrential rain. Both streams are temporarily influenced by regular annual floods, which cause changes (e.g. channel morphology, nutrient fluxes and biotic characteristics) in the stream ecosystems. Five 50-m-long sites were chosen in both streams longitudinally for the investigation of potential patterns. Five samples were taken in each site of each stream. In comparison with results from the temperate zone, the fine bed sediments and biofilms are inhabited by a rich macro-, meio-, and microbenthic fauna, which indicates that an important part of energy flows through this compartment of the stream ecosystem. The analysis of the organic food base included aquatic hyphomycetes, the potential microbial activity (ETS) of biofilms and nutrients in sediments. Also here, the comparison with selected temperate-zone streams demonstrates the specific situation of tropical streams. They show a higher diversity of aquatic hyphomycetes and higher microbial activities.

Effect of copper sulphate treatment on planktonic communities

Anne-Hélène LE JEUNE¹, Marie CHARPIN¹, Véronique DELUCHAT², Denis SARGOS¹, Jean-Claude ROMAGOUX¹, Michel BAUDU², Christian AMBLARD¹

¹ -Laboratoire de Biologie des Protistes, 63177 Aubière - France

² -LSEE, 87060 Limoges - France

Copper sulphate treatments is still largely employed with the rising frequency of Cyanobacteria bloom, and is applied at the early stage of their development in ponds used for recreational activities in order to avert potential human exposure to cyanotoxins. The effects of copper sulphate on single autotrophic species (toxicity tests) and phytoplanktonic communities (field studies) have been well researched. By contrast, little work has been reported on its effects on non-targeted organisms. In freshwater, the food web interaction among autotrophic and heterotrophic bacteria and their protozoan grazers (flagellates and ciliates) recycle particulate and soluble nutrients released by the classical pelagic food chain (phytoplankton, zooplankton, fish). This complementary trophic food chain, termed the microbial loop, can act as a significant mediator of energy transfer to upper trophic levels by recovering part of the pelagic production that would otherwise be lost from the systems. The aim of this study was to investigate the effect of copper on the size class structure and diversity of phytoplankton communities and on non targeted organisms in the microbial loop and among the zooplanktonic communities. The two added copper concentrations were set with respect of the water ligand capacity of the dissolved fraction and in the range of concentrations applied in ponds. The data showed interesting responses of direct and indirect effects of copper on planktonic communities. Copper treatments caused a significant effect on size class structure and diversity of phytoplanktonic communities. In the microbial loop, heterotrophic bacteria and heterotrophic flagellates did not seem to be affected by either of the treatments, whereas, copper caused a significant decreased of pigmented flagellate biomass. Potential mixotrophic and nanoplanktorivorous ciliates appeared to be more sensitive than bacterivorous ciliates, suggesting a stronger direct and (or) indirect effect of copper on the former. In the zooplanktonic community, Cladoceran and Rotifera showed the higher sensitivity than Copepoda. Cyanobacteria were kept under control, however, the planktonic communities (phytoplanktonic, microbial loop, zooplanktonic communities) restructuring impact of both copper treatments through direct and indirect effects may imply a global modification of the ecosystem function.

Changes in community similarity among the 25 major European river basins following freshwater fish introductions: a null model approach

Fabien LEPRIEUR¹, Olivier BEAUCHARD¹, Bernard HUGUENY², Gaël GRENOUILLET¹, Sébastien BROSSE¹

¹ -Laboratoire Evolution & Diversité Biologique, U.M.R 5174, C.N.R.S -Université Paul Sabatier, 31062 Toulouse - France

² -University of Antwerp, Faculty of Sciences, Dept. of Biology, Ecosystem Management Research Group, 2610 Antwerpen (Wilrijk) - Belgium

In recent years, there has been growing concern of how species invasions and extinctions could change the distinctiveness of formerly disparate fauna and flora, a process called biotic homogenization. In the present study, a null model of biotic homogenization was developed and applied to the freshwater fish fauna of the 25 major European river basins. We first demonstrated that biotic homogenization was a non-random ecological pattern in regards to the geographical distribution of non-native species, giving evidences to previous assumptions. Then, we found that fish fauna homogenization was greatest in southwestern basins whereas fish fauna differentiation was greatest in northeastern basins. Last, the place of origin of non-native species was considered in our analyses by distinguishing between exotic (originating from outside Europe) and translocated species (originating from Europe). We showed that exotic and translocated species generated distinct geographical patterns of biotic homogenization across Europe because of their opposite effect on the change in community similarity among river basins. Both fundamental and applied implications from this study were discussed.

CO₂ dynamics in a Mediterranean eutrophic reservoir

Pilar LOPEZ, Rafael MARCÉ, Enrique MORENO-OSTOS, Joan ARMENGOL

Department of Ecology, University of Barcelona, 08028 Barcelona - Spain

The role of lacustrine ecosystems in the global carbon cycle has been widely studied in recent years. Most of the works have focussed in processes occurring at the epilimnion, assuming that hypolimnion is isolated from the atmosphere and tributaries. However, in man-made mainstream reservoirs, river water can plunge directly into the hypolimnion, and also water leaving the system can come directly from the hypolimnion. In such a scenario, the interaction between hypolimnetic water and the atmosphere may be not driven through epilimnetic processes.

We have studied the seasonal variation of the different forms of inorganic carbon in the column water, tributaries, and run-off in Sau, an eutrophic reservoir located in North-eastern Spain. Inorganic carbon forms have been calculated from temperature, pH, and alkalinity data measured monthly from December 1999 to November 2004.

Seasonal variation of CO₂-saturation was characterized by supersaturation of the whole water column during winter months (October/November to February/March) and subsaturation of the superficial water the rest of the year. Exceptionally, in 2003 superficial water appeared subsaturated only from June to August. Below 5 m depth water usually remained supersaturated through the year, but a short period with deep-water subsaturated in CO₂ was observed in spring-2000. Maximum supersaturation values were usually observed at the bottom, but also at 15-20 m depth.

As a whole, the concentration of total dissolved inorganic carbon was quite similar in tributaries and run-off. However, CO₂ saturation in run-off water was usually much higher than in tributaries.

CO₂ -supersaturation in hypolimnetic waters may have two different causes: respiration of organic matter from both autochthonous and allochthonous origin, but also changes in dissolved inorganic carbon as a consequence of pH changes. A mass-balance is used in order to evaluate the relative importance of both processes in our data.

Our results suggested that, as well as in other eutrophic systems, epilimnetic waters in Sau reservoir may incorporate atmospheric CO₂ during most of the year. However, this sink of CO₂ is counter-balanced by the outflow of hypolimnetic water supersaturated in CO₂.

Grazing selectivity of *Eukiefferiella claripennis* (Chironomidae: Orthoclaadiinae) on two different epilithic algal assemblages

Alain MAASRI, Stephanie FAYOLLE, Evelyne FRANQUET

IMEP - CNRS, UMR 6116, Faculté des Sciences de St Jérôme, 13397 Marseille cedex 20 - France

The top down effect of grazing was approached via consumption effects on stream periphyton, with the assumption that invertebrate grazing reshapes the periphytic algal community. This was proven under limited water enrichment degrees; but under high enrichment degrees, high nitrogen and phosphorus concentrations enhance algal growth and alter the algal biomass and community composition. These modifications induce changes in the grazer's community where opportunistic taxa occur in high abundances. We examined in situ the grazing selectivity of a rheophilic chironomid (*Eukiefferiella claripennis*) on two contrasted algal assemblages, one dominated by Bacillariophyceae while the other dominated by the filamentous algae *Audouinella* sp. (Rhodophyceae). Larval gut contents were analyzed and compared on these two contrasted algal assemblages; Ivlev's index of electivity was used to compare the food intake of *Eukiefferiella claripennis* and was generated at the algal genera and species levels.

Gut contents of four instars larvae grazing on these two algal assemblages were similar. *Eukiefferiella claripennis* showed selective food intake based on the items size and quality. Bacillariophyceae were preferred as food on the two algal assemblages, while *Audouinella* sp. was avoided even when it was dominant. Our results suggest that filamentous algae are not a major food source for *Eukiefferiella claripennis* but seem to play an indirect role providing shelter or substrate for epiphytic Bacillariophyceae.

Life cycles and trophic role of some Perlodidae and Chloroperlidae species in the hyporheic macroinvertebrate community of an Alpine stream (Noce Bianco, Trentino, Italy)

Bruno MAIOLINI¹, Luana SILVERI¹, J. Manuel TIERNO DE FIGUEROA²

¹ - Museo tridentino di Scienze Naturali, 38100 Trento - Italy

² - Departamento de Biología Animal, Universidad de Granada, 18071 Granada - Spain

In Alpine streams, particularly in glacier-fed ones, environmental conditions are frequently very harsh and as a consequence Plecoptera tend to use the hyporheic zone as refuge, nursery and feeding area.

In this work we investigate the life cycles and feeding habits of predatory stoneflies sampled in the hyporheic zone of an Italian Alpine stream.

The hyporheic habitat was intensively studied from 2003 to 2005 in Val de la Mare (Stelvio National Park-Trentino-NE Italy) where low order streams of different typologies are present. Samples were collected with a Bou-Rouch pump and different artificial substrates. To investigate the feeding habits of the most abundant predatory species, we analyzed the gut contents by clearing the entire animal with KOH, or by extracting the gut with its content. Life cycles were estimated from the presence or absence of nymphs, the nymphal size variation along the year measuring body and head length, and the adult flight period date.

We collected 3 species of Perlodidae (over the 21 species known for Italy) and 1 species of Chloroperlidae (over the 6 known for Italy) in the hyporheic habitat. The most abundant species were the Perlodidae *Perlodes microcephalus* (Pictet 1833) and the Chloroperlidae *Siphonoperla* (cf) *torrentium* (Pictet 1841); other species such as the Perlidae *Dictyogenus fontium* (Ris 1896), *Perlodes intricatus* (Pictet 1841) and *Isoperla rivulorum* (cfr) (Pictet 1842) were rare.

P. microcephalus is known to have an annual life cycle and flying period from spring to late summer; in our study this species emerged in late spring or in autumn, and it used the hyporheic habitat as feeding area especially during the early nymphal stages or for interstage moulting. *P. microcephalus* showed a feeding preference for Diptera Chironomidae but also for Trichoptera and partially for herbivorous stoneflies.

S. torrentium had an annual life cycle with flying period in spring and summer. This species was found to be a hyporheic predator during its entire life cycle, especially active during the late nymphal stages.

First results show that *P. microcephalus* and *S. (cf) torrentium* used the hyporheic habitat as a refuge and feeding area during and between moulting or in particular phases of their life cycle.

Aquatic insects play important roles in terrestrial processes

Björn MALMQVIST, Darius STRASEVICIUS

Umeå University, Department of Ecology and Environmental Science, 90187 Umeå - Sweden

Studies have shown that rivers exchange organisms and matter with surrounding terrestrial landscapes. While the importance of inputs to rivers are widely recognised the reverse is far less studied and understood. Here we show that blackflies develop in massive numbers in free-flowing boreal rivers. Adult blackflies are potential food for terrestrial consumers and known bloodsucking vectors of parasites and pests for mammals and birds. Regulation of rivers destroys larval habitats with smaller numbers emerging with significant consequences for organisms in the terrestrial surroundings. By comparing processes involving blackflies along regulated (i.e. with reduced blackfly numbers) and unregulated rivers (intact numbers), we show examples of these insects' importance in linking aquatic and terrestrial ecosystems. Our study demonstrates that while female blackflies disperse from their natal rivers males stay in numbers that may be 1-2 orders of magnitude greater compared to densities at regulated rivers. Females are also more abundant along free-flowing rivers but their densities are only higher by 25-50%, probably because they reach valleys of regulated rivers during extensive movements away from natal rivers to find blood hosts. We found that an insect-eating species of bird (pied flycatcher) showed higher fledging success along unregulated than regulated rivers presumably due to better food supply. In another study, we found that along a free-flowing river the most common songbird species were infected to a higher degree by a form of bird malaria (*Leucocytozoon*) uniquely spread by blackflies than along a regulated adjacent river, again suggesting an indirect effect of river regulation, in this case by suppressing the vectors. Blackflies deriving from large rivers dominated strongly in catches over species typical of small streams. We conclude that aquatic insects can be of great importance in terrestrial environments and that humans by altering the natural flow of rivers may inadvertently interfere with terrestrial processes.

Occurrence of microcystin-producing cyanobacterial in Polish water bodies and associations with environmental factors

Joanna MANKIEWICZ-BOCZEK¹, Katarzyna IZYDORCZYK¹, Tomasz JURCZAK²

¹ -International Centre for Ecology PAS, 90-364 Lodz - Poland

² -Department of Applied Ecology University of Lodz, 90-237 Lodz - Poland

Composition of cyanobacterial blooms and relationship between microcystins (MC) concentration and environmental variables were studied in six selected water bodies (lakes and reservoirs) located in different region of Poland, during summer from July till October 2004 and 2005. The presence and identification of toxic strains in water bodies was analyzed by PCR amplification of *mcy A,B,D* and *mcyE* genes in the microcystis synthesis pathway. Genetic analysis indicated that the potential to produced toxins was determined early in July and persisted throughout summer period. Potential MC-producing cyanobacterial were represented by *Microcystis aeruginosa*, *Planktothrix agardhii* and *Anabaena* sp. MC values, measured by PPIA and HPLC, ranged from undetectable to 31,22 µg L⁻¹. MC concentration were strongly associated with biomass of hepatotoxic cyanobacteria ($r=0.86$), dissolved nitrogen ($r=-0.82$) and also with chlorophyll a ($r=0.66$). The average of microcystin (> 10 µg L⁻¹) found in studied water bodies indicated that toxicity had reached the first-alert level according to WHO recommendations. The above results suggested that studied water bodies should be monitored, despite low toxicity, because potential effect of toxin (microcystin) accumulation might create a hazard for persons exposed regularly over a number of days or weeks (e.g., during summer vacation). The further investigation and analysis of relationship between environmental factors and MC concentration should provide the background for water management and mitigation of cyanobacterial risk.

These studies were supported by the State Committee for Scientific Research 2PO4F 044 27

First contribute to the systematics and phylogeography of the *roubau*-group of the genus *Hemidiaptomus* (Copepoda, Calanoida, Diaptomidae)

Federico MARRONE, Sabrina LO BRUTTO, Marco ARCULEO

Dipartimento di Biologia Animale, Università di Palermo - Palermo, Italy

The genus *Hemidiaptomus* comprises seventeen large-bodied copepod species distributed in temporary water bodies of the Palaearctic region. Based on morphology, the species belonging to the genus have been divided in three subgenera: *Hemidiaptomus* s.s., *Gigantodiaptomus* and *Occidodiaptomus*. The latter, for which a recent morphological revision proposes the status of independent genus, occurs in west Mediterranean countries and is composed by three species and some taxa of subspecific rank whose real meaning is to date unclear. To date, there is no accordance on the systematics of the entire group and no molecular data are available to support the morphological observations. The currently recognized species of the subgenus *Occidodiaptomus*, i.e. *Hemidiaptomus* (*Occidodiaptomus*) *roubau*, *H. (O.) maroccanus* and *H. (O.) ingens*, are hereby cited as the *roubau*-group of the genus *Hemidiaptomus*.

We investigated the group with a combined morphological and molecular approach with the aim of understanding the real meaning and rank of the taxa with a controversial status and to enlighten the phylogenetic relationships among the taxa of the *roubau*-group in the frame of the presumptive subgenus *Occidodiaptomus*. The taxon *Occidodiaptomus* itself has been compared with the other presumptive subgenera of the genus *Hemidiaptomus*.

On these bases we compared the present patterns of morphological and genetic diversity and the geographical distribution of the different taxa with the palaeogeography and the climatic history of the Mediterranean region with the aim of reconstructing the phylogeography of the species belonging to the *roubau*-group.

Effects of stoichiometry and source of nutrient inputs on retention of multiple nutrients in streams

E. MARTÍ¹, F. SABATER², T. J. BATTIN³, J. L. RIERA², S. GAFNY⁴, B. GÜCKER^{5,6}, P. GUILHERME⁷, M. T. PUSCH⁵, A. SOLIMINI⁸, P. VERVIER⁹, C. VOREADOU¹⁰

¹ -Limnology Group (CEAB-UB), Centre d'Estudis Avançats de Blanes (CSIC) - Blanes - Spain

² -Dept. d'Ecologia, Universitat de Barcelona, Barcelona - Spain

³ -Department of Freshwater Ecology, University of Vienna – Vienna, Austria

⁴ -School of Maritime and Marine Environment Sciences, Ruppin Academic Center, Michmoret - Israel.

⁵ -Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin - Germany

⁶ -Universidade Federal de Minas Gerais, Belo Horizonte - Brasil

⁷ -Centro de Ecologia e Ambiente, Universidade de Evora, Evora - Portugal.

⁸ - European Commission Joint Research Centre, Ispra - Italy

⁹ -Laboratoire d'Ecologie des Hydrosystèmes–CNRS, Université Paul Sabatier, Toulouse - France.

¹⁰ -Natural History Museum of Crete, University of Crete, Iraklion - Greece.

In this study we compared in-stream retention among multiple nutrients (i.e., NH₄-N, NO₃-N, and PO₄-P) and across 11 European streams covering a wide range of environmental conditions and draining catchments with different land uses. We further examined relative changes in nutrient retention in response to wastewater treatment plant discharge into the investigated streams. We focussed on mass transfer coefficients of different nutrients (i.e., stream nutrient demand, V_f in m s⁻¹) as the stream retention metric allowing for comparison among and within streams. Results come from slug nutrient additions conducted on several dates over a year at two reaches (upstream and downstream of the effluent input) in each studied stream. Taking all data together ($n = 90$), streams showed higher demand for NH₄-N and PO₄-P than for NO₃-N. This pattern was consistent when we examined data from streams draining catchments with relatively high agricultural activity and data from streams with low agricultural activity separately. However, V_f for all nutrients were lower in streams draining agricultural catchments, and thus, having higher nutrient concentrations, especially for NO₃-N. Point source inputs had a greater effect on the stoichiometry of nutrient demand (i.e., V_f ratios) than on stream demand for each nutrient. V_f NO₃: V_f NH₄ and V_f NO₃: V_f PO₄ ratios increased below the point source inputs, coinciding with an increase in NH₄-N concentration relative to NO₃-N concentration and higher PO₄-P concentration. The variation in the V_f NH₄: V_f PO₄ ratio at downstream reaches depended on catchments' land use upstream of the point source. In streams draining agricultural catchments this ratio decreased, whereas it increased in the streams with low agricultural influence. In conclusion, our results indicate that variability in nutrient retention across streams is sensitive not only to stream nutrient concentrations, but also to the relative availability of different nutrients. Results also suggest that changes in nutrient concentrations derived from human activities may affect the relative retention of different nutrients. This effect was closely related to the type of human activity in the catchment. Therefore, although seldom considered by stream managers, nutrient retention metrics could be used as part of their programs to assess the integrity of stream ecosystems.

Differences in egg tolerance, hatching success and postembryonic development between sexual and asexual lineages of the geographic parthenogen *Eucypris virens* under contrasting laboratory conditions

Maria Joao MARTINS¹, Jochen VANDEKERKHOVE², Tadeusz NAMIOTKO³, Giampaolo ROSSETTI¹

¹ -University of Parma, 43100 Parma - Italy

² -University of Valencia, 46100 Burjassot (Valencia) - Spain

³ -University of Gdansk, 80-822 Gdansk - Poland

Parthenogenetic lineages have intrinsically a high colonization ability and a high potential for fast population growth compared to sexuals which pay the cost of males. Egg diapause, a form of resistance to adverse conditions, has been proven to play an important role in the dispersal of parthenogenetically reproducing ostracods. Yet in this group, high dispersal ability and faster population growth were not found sufficient for a consistent clonal dominance in ephemeral habitats. The objective of this study is to understand the role of diapausing eggs in the local and regional distribution patterns of the ostracod *Eucypris virens*, a known geographic parthenogen. Dried eggs from five all female populations and five bisexual populations were stored under room temperature (20 °C), high temperature (45 °C) and low temperature (-15 °C). The extreme temperatures are recorded during the dry phase in sites within the geographic range of sexual (south of Europe) and parthenogenetic populations (e.g. northern Europe), respectively. Subsequently, the eggs were inundated under northern (8 °C, photoperiod 10L:14D) and southern European conditions (17 °C, photoperiod 12L:12D) observed at the start of the growing season of *E. virens*. This allowed us to also quantify the potential for hatching and growth under both environments conditions. Both sexual and parthenogenetic eggs survived the low and high temperature storage treatment. No interaction between hatching environment and reproductive mode on the hatching success was observed. Yet, the eggs from the all female populations presented an overall higher success in hatching and survival to adulthood regardless of storage or hatching conditions. These results suggest that the absence of bisexual lineages in northern Europe is not due to a failure to survive, hatch or develop under the prevailing environmental conditions.

Efficacy of saltwater solutions to kill invasive freshwater species in New Zealand

F.E. MATHESON, A.M. DUGDALE, R.D.S. WELLS, A. TAUMOEPEAU, J.P. SMITH

National Institute of Water & Atmospheric Research, 3215 Hamilton - New Zealand

New Zealand freshwater environments have suffered irreparable damage as a result of the introduction and successful establishment of a number of exotic, invasive species. Many of these species continue to spread to new environments, mostly as a result of human activities, including the use of nets by commercial and recreational fishers. This study tested the efficacy of a range of saltwater solutions to achieve a 100% kill of targeted species in order to assess their likely effectiveness as a sterilisation treatment for freshwater fishing nets. Tests were conducted with four solutions (35, 50 and 70 g NaCl L⁻¹ and 35 g NaCl L⁻¹ plus 10 mL L⁻¹ detergent) under controlled laboratory conditions with a 1-h immersion time. Eight plant species (*Alternanthera philoxeroides*, *Ceratophyllum demersum*, *Egeria densa*, *Elodea canadensis*, *Hydrilla verticillata*, *Lagarosiphon major*, *Myriophyllum aquaticum*, *Potamogeton crispus*), seven fish species (*Amerius nebulosis*, *Carrasius auratus*, *Cyprinus carpio*, *Gambusia affinis*, *Perca fluviatilis*, *Scardinius erythrophthalmus*, *Tinca tinca*) and two snail species (*Lymnaea stagnalis*, *Physa acuta*) were tested. A number of species were tolerant of the lower strength saltwater solutions. The most effective solution was 70 g NaCl L⁻¹ which achieved a 100% kill of all species tested except for the two emergent plants, *Alternanthera philoxeroides* and *Myriophyllum aquaticum*, which were tolerant of all solutions, and *Lymnaea stagnalis* snails. However, the snails were killed by the 35 g NaCl L⁻¹ plus detergent solution. Therefore, although not specifically tested in this study, it seems likely that the addition of 10 mL L⁻¹ detergent to the higher strength 70 g NaCl L⁻¹ solution would be effective against all target submerged species. The results of this study have shown that a 70 g NaCl L⁻¹ with/without detergent solution is likely to be an effective sterilisation treatment for freshwater fishing nets and other related equipment to help prevent the spread of submerged invasive freshwater species in New Zealand.

Effects of sediment addition, nutrient enrichment and water abstraction on agricultural streams: a multiple-stressor experiment

Christoph MATTHAEI, Jeremy PIGGOTT, Colin TOWNSEND

Department of Zoology, 9016 Dunedin - New Zealand

Agriculture increasingly impacts streams worldwide through nutrient enrichment and increased input of fine sediment, and water abstraction for irrigation is also becoming more widespread, with further negative effects on stream ecosystems. The effects of these three potential stressors are usually investigated separately, and to our knowledge this is the first study in which all three were manipulated simultaneously. We used a full factorial design with sediment, nutrients and channel flow as the main factors. We added nutrients for 18 days (phosphorus plus nitrogen) and/or natural river sand (grain size 0.2 mm) to 18 streamside channels supplied with water by a stream draining a pasture catchment in the province of Otago, New Zealand. We applied three sediment and three nutrient treatments (high, intermediate, natural), with levels of the enriched treatments based on values typical for streams in deer and dairy farms in Otago. In addition, flow was reduced by 75-82% (compared to controls) in half the channels. Our aim was to determine the individual and combined effects of the three stressors on benthic invertebrates and algal biomass. Invertebrates and algae were investigated using ceramic tiles as standardised substrates. All three potential stressors had strong effects on the benthic organisms. For instance, both total invertebrate density and epilithic algal biomass increased with nutrient enrichment but decreased when flow was reduced, and algal biomass was lowest in the high sediment treatment. Five of the seven most common invertebrate taxa were significantly affected by one or more of the stressors. The stressors also interacted with each other. For example, total invertebrate density increased when sediment was added, but only at normal flow, and the negative effect of added sediment on algal biomass was stronger when flow was reduced. All seven common invertebrate taxa showed significant interactions between at least two of the stressors. Land-use changes differentially influence nutrient and sediment inputs, and effects of water abstraction further add to the complexity of ecological responses. Our understanding of ecological impacts of human land use forms, and how to manage them, will be incomplete without detailed knowledge of interactive effects among multiple stressors.

Assessing the effects of forest management on stream ecosystem integrity: differential responses of structural and functional measures

Brendan G. MCKIE, Björn MALMQVIST

Department of Ecology and Environmental Sciences, Umeå University, 90187 Umeå - Sweden

We investigated the effects of forest clearcutting, a major landscape level disturbance that is expanding in extent globally, on both structural and functional attributes of 10 stream ecosystems in Sweden's boreal region. Half of the studied streams were impacted by clearcutting to the banks, with the remainder comprising reference sites that flowed through intact forest. Rates of leaf decomposition were studied as an index of functional integrity, with replicate mesh bags enclosing leaves from one of two contrasting tree species deployed in each stream for two months. Community structural attributes were characterized based on the composition, diversity, and functional guild organization of macroinvertebrate assemblages sampled from the benthos. No differences in macroinvertebrate abundance, diversity or assemblage structure were detected between forested and clearcut streams, and most functional guilds were similarly unaffected, though species density of algal-grazing scrapers was higher in forested than clearcut channels. In contrast, mass loss of both leaf species was strongly elevated in all clearcut streams, with evidence for additive stimulation of both the microbial and detritivore mediated fractions of decomposition. Increased leaf mass loss in the clearcut streams was associated with greater phosphate concentrations and shredder biomass, and with an increased relative abundance of broadleaves in standing stocks of benthic litter, all indicative of greater carbon and nutrient flows through detrital pathways. These results demonstrate the utility of litter decomposition assays for monitoring effects of forest management on stream functional integrity, and have implications for nutrient cycles in landscapes extensively impacted by forest harvesting. The markedly different responses of our functional and structural measures to clearcutting highlight the risks associated with conducting ecosystem assessments based solely on community structural parameters.

Predicted impacts of discharge management on benthic invertebrates in large rivers

Sylvie MERIGOUX¹, Nicolas LAMOUROUX², Jean-Michel OLIVIER¹, Sylvain DOLEDEC¹

¹ -Université Lyon, Laboratoire d'Ecologie des Hydrosystèmes fluviaux, Bât Forel, 69622 Villeurbanne - France

² -CEMAGREF Lyon, Laboratoire d'Hydroécologie Quantitative, 69336 Lyon Cedex 09 - France

Monitoring the effects of restoration in large rivers is not easy because of the complexity of fluvial ecosystems and the difficulty to compare actual situations with pristine references. A ten-year restoration program of the large Rhône River (France) has started in 1998. It involved an increase of minimum flow rates in several by-passed sections of the river and the reconnection of former secondary channels. We used statistical habitat models adapted to benthic organisms to predict the effect of minimum flow increases on invertebrate communities. To assess hydraulic taxa preferences, we sampled organisms (0.05 m² samples using a Hess sampler) and hydraulic conditions (estimates of shear stresses from FST hemisphere method) in four by-passed sections of the Upper Rhône River on three occasions. From these data, we used non-linear mixed effect models to derive preference models relating species density within surveys and FST measurements. Nearly 60% of the 146 taxa collected were abundant enough to be modelled. Preference models for taxa explained between 0 and 49% of the variation in ln-densities of taxa within surveys and models of 45 % of the taxa explained more than 15% of this variation. Taxa showed contrasting responses to hydraulics. For example, *Athripsodes albifrons* or *Gammarus fossarum* showed no preferences, *Baetis lutheri* or *Hydropsyche siltalai* preferred high shear stresses and *Polycentropus flavomaculatus* or *Caenis luctuosa* avoided such conditions. Coupled with these preference models, the statistical habitat model predicted an increase of rheophilic taxa densities associated with an increase in high hydraulic constraint proportions in the four selected by-passed sections. Out of the 39 taxa with marked hydraulic preferences, 27 should have increased habitat suitability following discharge restoration. These predictions will be further validated by post restoration observations that will be soon available.

Interactions and linkages between streams and other ecosystems during landscape evolution

Alexander MILNER¹, Chris FASTIE², Terry CHAPPIN³

¹ -*University of Birmingham, B15 2TT Birmingham - UK*

² -*Middlebury College, VT 05753 Vermont - USA*

³ -*University of Alaska, AK 99775 Fairbanks - USA*

We synthesize our findings of studies in Glacier Bay National Park and Preserve, southeastern Alaska to elucidate interactions and linkages between stream ecosystems and the terrestrial, lake, and marine intertidal ecosystems as the landscape evolves following ice recession. It is evident that development in the stream ecosystem is initially dominated by physical processes but with time biotic control becomes increasingly important although the extent of biotic control varies between streams. Stream development and increasing biotic control is always subject to resetting mechanisms of major disturbances. Many studies of succession and ecological development have considered ecosystems in isolation, but it is evident from our integration here at Glacier Bay that change in the three ecosystems (terrestrial, marine, and lake) has a major influence on the nature and direction of change in the stream ecosystem. It is imperative that we understand this science of change, at different spatial and temporal scales, so that we can adequately predict the future states of stream ecological systems. The dynamics of change that we document at Glacier Bay during primary succession has important implications for managing the system with respect of anthropogenic change.

Light and resource supplies as factors modulating niche partitioning in two pelagic mixotrophic ciliates

Beatriz MODENUTTI¹, Esteban BALSEIRO¹, Cristiana CALLIERI², Roberto BERTONI²

¹ -CONICET-UNC. Laboratorio de Limnología., 8400 Bariloche - Argentina

² -CNR - Institute of Ecosystem Study, 28922 Verbania Pallanza - Italy

Stratification depth can alter the light supply to phototrophic plankton since the deepening of thermocline, which increases thickness of the mixing layer, can drag down planktonic organisms to low light level. Among phototrophic organisms, mixotrophic ciliate species can be affected by changes in light availability by a direct effect on their endosymbiotic algae. In addition mixotrophic ciliates can eat either bacteria or other protists and, consequently, be also affected by prey availability. Planktonic photosynthetic biomass of Andean Patagonian lakes (around 41°S) is dominated by mixotrophic ciliates (mainly *Stentor araucanus* and *Ophrydium naumannii*). We examined these two ciliate populations in the oligotrophic Lake Moreno during two summer seasons (strong vs mild windy years), postulating the difference in thermocline depth and light availability as factors that would determine the relative abundance of these species. Additionally, we studied bacteria inside food vacuoles with the CARD-FISH technique in order to assess differences in bacterial prey ingested. *S. araucanus*, a UVR-resistant species, was present in the epilimnion attaining higher abundances when the thermocline depth was lower and the mean epilimnetic irradiance higher. *O. naumannii* showed an opposite pattern preferring the metalimnetic layers and being more abundant with deeper thermoclines. We observed that food niche overlap was negligible. *O. naumannii* grazed on all the bacterial assemblages including archaea and picocyanobacteria. On the contrary, we did not observe bacteria in food vacuoles of *S. araucanus* suggesting that this species prey on other cells than bacteria. The analysis of photosynthetic efficiency showed that *O. naumannii* is efficient at low light intensities. The large and dark-pigmented *S. araucanus* needs a high light supply to maintain endosymbiotic algal photosynthesis, showing a sharp decrease in efficiency below 100 $\mu\text{mol photons m}^{-2} \text{ s}^{-1}$. Our results suggest that the temporal or spatial variation in thermoclines depth would imply advantages for one or other ciliate species.

Dynamics of leaf litter degradation in a small stream impacted by pesticides

Bernard MONTUELLE, Romain GRANIER, Bernardette VOLAT, Laura SANCHEZ, Bernard MOTTE, Marie-Claude ROGER

Cemagref, Lyon 69 336 - France

Small streams of rural watersheds are strongly dependant on leaves falling (from riparian area) as a main particulate organic matter (POM) source. This input allows the development of a trophic network that degrades and assimilates OM, assuming then the functioning and the ecological quality of the stream. In vineyard area, intensive pesticides uses could impact aquatic organisms at several trophic level (heterotrophic microorganisms, algae, invertebrates, .) by modifying or reducing diversity and density of biota. The functional consequences are little known, especially those dealing with OM degradation. The present study aims to precise the degradation dynamics of leaves litter along an increasing gradient of pesticides, in a 1st order stream draining a wine-growing watershed during winter. Small bags containing *Alnus* sp leaves collected at leaves falling, after drying and weighting were installed on three pre selected study sites in the stream. Each 15 days, during 2 months, 5 bags per site are sampled for analysis. Parameters were the decrease of leaves dry weight, diversity and density of invertebrates colonizing the bags, bacterial density (DAPI counts), fungi biomass (ergosterol dosage), heterotrophic respiration activity (CO₂ dosed on gas chromatograph). The clean upstream site (reference) had a high POM degradation rate (>50% within 1 month), associated to a high diversity of macroinvertebrates, dominated by shredders like *Gammarus*. The two contaminated sites showed a progressive and marked change in the invertebrates community (disappearance of *Gammarus*, dominance of *Oligochaetes*). Leaves degradation was strongly reduced at the downstream sites, characterized by high pesticides concentration: the weight loss of leaf litter was 57%, 22% and 25% respectively from the reference site (clean) to the impacted ones. Fungi and bacterial biomass remained steady while the global heterotrophic respiration decreased very slowly. Finally, the capacity of this small lotic ecosystem to process organic matter into the trophic network and so to maintain a "healthy" ecological state is strongly reduced by chemical gradient from upstream to downstream.

Changing patterns of phytoplankton succession in Lago Maggiore across 25 years: spring diatoms vs. summer cyanobacteria and the role of the local climate

Giuseppe MORABITO

CNR - Istituto per lo Studio degli Ecosistemi, 28922 Pallanza - Italy

The phytoplankton succession in a large and deep lake follows a quite repeatable pattern across the years. Even in presence of an allochthonous disturbance, due to the high resilience of such a lake type, the environmental conditions can be relatively stable across a long time period or change very slowly. Therefore, it is possible to identify phytoplankton assemblages occurring with a recurrent periodicity: the analysis of the long term data from Lago Maggiore, one of the deep Italian subalpine lakes, shows that the seasonal development of the main phytoplankton groups follow a precise time sequence, characterised by a spring diatom peak and by a mixed summer assemblage (diatoms, cyanobacteria, dinoflagellates). However, the seasonal biovolume reached by the two most important groups, namely diatoms and cyanobacteria, showed large yearly fluctuations, often related to the variability of the local climatic conditions. In fact, past observations showed a strong control of the spring thermal dynamics of the water column (dependent on wind and air temperature) on the development of diatoms. Considering that the extent of the spring diatom growth affect the pool of nutrients available at the time of spring mixing and that, in the oligotrophic Lago Maggiore, such a pool can be important in sustaining also the development of the summer populations, the existence of a time-delayed mechanism of resource competition could be hypothesised. A parallel analysis of the seasonal development of diatoms and cyanobacteria across the long term series seem to support this hypothesis, showing that the summer peaks of cyanobacteria are higher when the spring diatom growth is depressed by adverse climatic conditions.

Biomonitoring acid streams: factoring out confounding variables improves discrimination

J.F. MURPHY¹, J. DAVY-BOWKER¹, S.J. ORMEROD²

¹ -Centre for Ecology and Hydrology, Winfrith Technology Centre, DT2 8ZD Dorchester - UK

² -Cardiff School of Biosciences, Cardiff University, CF10 3TL Cardiff - UK

Despite dramatic reductions in the emissions of acidifying gases, widespread recovery of stream faunas from acidification has not yet taken place and it remains a serious environmental concern. A new macroinvertebrate biotic index for assessing the impact of acidity on streams and rivers is presented, the species-level Acid Waters Indicator Community index (AWICsp). We factored out the confounding influence of physical variables other than mean pH on variation in macroinvertebrate assemblages across 204 English and Welsh streams. We then assigned index scores to taxa according to their relative position along the resultant mean pH gradient. The index was tested on independent datasets from Britain and Sweden and its performance compared favourably with that of other established acid indices throughout Europe. Baseflow, mean and storm flow pH were all highly significantly correlated with AWICsp. AWICsp also performed well outside of its ecoregions of development. It was significantly related to variation in mean pH, ANC and Al³⁺ across the Swedish sites. The empirical approach used to create AWICsp can potentially be applied to the development of other diagnostic indices where sufficient biological and matching environmental data is available.

Molecular diversity patterns of *Hydropsyche* (Trichoptera) in the western Mediterranean Basin: geological and ecological influences

C. MÚRRIA¹, N. BONADA², C. ZAMORA-MUÑOZ², A.P. VOGLER³, N. PRAT¹

¹ -Departament d'Ecologia, Universitat de Barcelona, 08028 Barcelona - Spain

² -Departamento de Biología Animal, Universidad de Granada, 18071 Granada - Spain

³ -Department of Biological Sciences, Imperial College London, SL5 7PY London - UK

Geological processes in the Western Mediterranean Basin during the Eocene and Miocene resulted in four differentiated regions: Rif (north of Africa), Betic (south Iberian Peninsula), Transitional (north of the Betic region) and Hesperic Massif (from south of Pyrenees to the Transitional region). These geological processes together with glaciations and ecological Mediterranean climate characteristics have been related to the high biodiversity of the area. For the genus *Hydropsyche* (Trichoptera), up to 22 morphological species have already been recorded in the Mediterranean climate rivers of this area, which can be assigned to several morphologic lineages. Our aim was to analyze speciation patterns and genetic structure in *Hydropsyche* between and within river basins in the western Mediterranean and to relate them to geological and ecological processes. Current species diversity could (1) be due to ecological restrictions which reduced gene flow between isolated populations and thus induced speciation; given that ecological restrictions act downstream in all regions (i.e. headwaters, midstreams and downstream species groups), we should expect three different lineages of *Hydropsyche* species corresponding to these groups; and/or (2) be the result of vicariance in each geological region from ancient widespread species, recognisable from the existence of endemic species limited to each region in each of the major clades. *Hydropsyche* species and environmental variables were collected from sites across the four regions. Larvae belonging to 19 species were sequenced using the mitochondrial COI gene to reconstruct genealogical evolution. The phylogenetic analysis revealed three lineages mainly corresponding to groups established using male genitalia morphology and also differing in ecological characteristics: *guttata* (downstream species group), *pellucidula* (midstream species group), and *instabilis* groups (headwaters species group). Within the *instabilis*-group, an endemic species was present in each region, including a more recent speciation in the Transitional region (*H. fontinalis*). However, low regional differences were observed within the *pellucidula*- and *guttata*-groups, which could be related to a more favourable dispersion among midstream and downstream sites of different regions. Our results suggest that *Hydropsyche* species patterns in the Western Mediterranean could be explained by combination of longitudinal segregation, geological processes and isolation of headwaters among regions.

Ecology, reproductive biology and conservation of *Acipenser persicus* (Borodin, 1897) in the South of Caspian Sea, Iran

Jiri MUSIL, S.M. Hadi ALAVI

University of South Bohemia in České Budějovice, Research Institute of Fish Culture and Hydrobiology Vodňany, 38925 Vodňany - Czech Republic

The Persian sturgeon, *Acipenser persicus* (Borodin, 1897) is an anadromous species, belonging to the family Acipenseridae, inhabiting both sea (brackish) and freshwater, Ponto-Caspian region and connected rivers. Similarly to other sturgeon species, its stock has declined dramatically due to overfishing, loss of natural habitat for reproduction and interference by other human activities, meaning its conservation status is endangered.

In the present study, we discussed the present conservation measures such as sturgeons recovery plans which include a use of sturgeon hatchery centers for artificial breeding and fingerlings production for releasing them back to sea and the over-years trends in commercial catches. In addition, ecological and reproductive biological performances of this highly valuable fish species are summarized to better understand and improve the reproduction and subsequently higher restoration success of *A. persicus* stocks. Once *A. persicus* reaches the sexual maturity (about 8-17 years for males, 12-19 for females respectively), migrates (not every year) to spawn into rivers such as Sefidroud, Tajan and etc., usually between March and May. Since 1972, artificial propagation and rearing of sturgeons has been started because of environmental degradation and thus lack of suitable spawning sites. The broodfish are captured either in sea or rivers and transfer to hatchery centers. Artificial reproduction includes spawning induction, fertilization, larvae and juveniles rearing (use of semi-intensive pond and intensive tank culture). Any significant differences were not reported in terms of reproductive characteristics (relative fecundity, egg diameter, egg production) between the broodfish origins, sea and river respectively. Total fingerlings production is varying among years and ranged from about 18 000 to 19 000 thousand individuals (1999-2001) with about 90% of *A. persicus*. Despite the fact that the slowly increasing tendency in commercial catching of *A. persicus* is reported, the rapid decline of sturgeons still continues. Therefore, other actions such as environmental restoration and strict control of legal and mostly illegal fishing is highly needed.

This study was supported by the Ministry of Agriculture, National Agency for Agricultural research project No. QF 4118 and the Research Center of Biodiversity in the Czech Republic.

Observed climate change impact on phytoplankton in lakes in Europe

Peeter NÖGES

DG Joint Research Centre, Institute for Environment and Sustainability, 21020 Ispra (VA) - Italy

The presentation will give an overview of the results of the phytoplankton studies made within the EU project CLIME. The observed effects of weather and climate on phytoplankton abundance and community structure reflect the summary effects that climate change has on single species physiology, phenology, distribution and position in the food web. In lakes with a winter ice-cover the most pronounced changes in phytoplankton were those related with the earlier ice break-up. Representing a major change in light conditions and water turbulence, the ice break-up determines the timing, intensity, and composition of the spring bloom. The duration of the bloom and the post-bloom period depends more on nutrient availability and zooplankton grazing and is less linked to ice break-up. In lakes without winter ice-cover the transition period from winter to spring is smoother and the timing of the spring bloom is not so strictly determined by one major climatic variable as in ice-covered lakes. The observed mechanisms affecting phytoplankton development in those lakes in spring were diverse ranging from the completeness of winter mixing and depth of the spring mixing in deep perialpine lakes to the effect of heavy rains flushing the biomass out of small lakes with a short retention time. Time-series analysis has revealed a regime shift in a number of lakes between 1988 and 1992 triggered by shorter ice cover periods and earlier onset of thermal stratification during a period of consecutive mild winters. In several lakes a causal chain was discovered between winter and early spring meteorological conditions and the following planktonic events in early summer, e.g. the clear water phase. Warmer water and a longer stratified period favor the development of cyanobacterial water blooms, metalimnetic dim light species such as the cyanobacterium *Planktothrix rubescens* but also flagellated species, which are able to take up nutrients from the hypolimnion and bring them to the euphotic layer. In many lakes the occurrence of warmer winters, associated with the positive phase of the winter NAOI, has resulted in a tendency towards diminished lake phytoplankton richness which has been masked by a stronger positive effect of oligotrophication on biodiversity.

Structure and longitudinal distribution of caddisfly (Trichoptera) communities of the West Carpathian River

Milan NOVIKMEC, Marek SVITOK, Marek ČILIAK

Department of Biology and General Ecology, Faculty of Ecology and Environmental Sciences, Technical University in Zvolen, 960 53 Zvolen - Slovakia

We studied structure of caddisfly (Trichoptera) communities and their distribution in the longitudinal profile of the Hron River (Slovakia, West Carpathian) and its main headwater tributaries with different bedrock basin type. Structural and functional attributes of caddisfly communities were ordinated and related to environmental factors. On the basis of cluster analysis and indicator species analysis, we attempted to define longitudinal river zones within studied river system. The prominent factor influencing distribution of caddisflies in headwater parts of Hron River was a complex longitudinal gradient as proposed by the river continuum concept, with no significant importance of different bedrock character of headwater tributaries. Canonical correspondence analysis (CCA) showed altitude and conductivity to be the variables best correlated to the caddisfly data of the main river channel. According to results of CCA, altitude explains 14.3% ($p < 0.01$) and conductivity 10.8% ($p < 0.05$) of total variance in species data. Relatively high percentage of explanation in case of conductivity showed possible importance of river pollution on structuring of caddisfly communities. Three main river stretches (defined as hypocranal, rhithral and epipotamal) were distinguished, indicated by *Drusus annulatus*, *Allogamus uncatus*; *Rhyacophila* s. str., *Glossosoma* sp., *Hydropsyche contubernalis* and *Psychoiyia pusilla*. Rhithral was further subdivided into epirhithral (indicated by *Ecclisopteryx madida*, *Rhyacophila tristis*), metarhithral (with no significant indicators for this zone, characteristic species *Micrasema minimum*, *Odontocerum albicorne*) and hyporhithral (indicator species *Chaetopteryx* sp.). However, longitudinal distribution of caddisfly communities within Hron River system appears to be rather gradual than zonal.

The study was co-funded by the Slovak Scientific Grant Agency VEGA (grants 1/4355/07 and 1/4353/07) and Faculty of Ecology and Environmental Sciences (AE-VII 3107).

Effects of lake trophic status on invertebrate body size spectra and decomposition rates of leaf litter in lake littorals

Richard J. O'CALLAGHAN, Simon S. C. HARRISON

Department of Zoology, Ecology & Plant Science (Cooperage), University College Cork, Distillery Fields, Cork - Ireland

Allochthonous leaf litter is a potentially important source of energy in lake littorals. Lake trophic status may have an impact on the abundance and quality of organic detritus as well as the community structure and body size spectrum of detritivores. Decomposition rates of leaf litter were investigated in six medium sized lakes (10 - 60 ha) in southern Ireland. Field experiments were conducted to quantify litter breakdown rates using two leaf species: Alder (*Alnus glutinosa*) and Oak (*Quercus robur*). Leaf litter was placed into coarse- and fine-mesh bags and left for 7, 14, 21 and 28 days during the winters of 2004/5 and 2005/6. Invertebrate assemblages colonizing coarse mesh bags differed markedly between lakes. The crustaceans *Asellus* and *Gammarus*, and large limnephilids dominated in the nutrient rich lakes, whereas, chironomids and caenid mayflies were more abundant in nutrient poor lakes.

The effects of invertebrate body size on decomposition rates of alder and oak leaves were investigated in a single representative oligotrophic and eutrophic lake. Results will be discussed in view of assessing litter breakdown as an assay of lake trophic status.

Effects of small-scale spatial changes in riparian vegetation on algal and invertebrate communities in upland streams

John F. O'DRISCOLL, Simon S.C. HARRISON, Paul S. GILLER

Dept. Zoology, Ecology & Plant Science, University College Cork, Cooperage buildings, Distillery Fields, Cork - Ireland

Riparian trees can have major impacts in the structure and functioning of communities in headwater streams, by mediating the energy supply to the stream. Riparian vegetation is vulnerable to alteration by man, with many streams in upland areas in Ireland being denuded of riparian trees due to overgrazing by domestic farm animals. We report on the longitudinal changes in stream invertebrate and algal communities across an abrupt boundary of riparian vegetation - from densely shaded to fully open - in streams in Western Ireland. We examined temporal and longitudinal variation in the macroinvertebrate communities, and their energy supply in the form of algal and POM abundance, to the effects of riparian vegetation over short spatial gradients. Samples were collected across 3 replicate streams from December 2004 - September 2005. Artificial substrata were placed at eight sites along each stream, three sites were located within a shaded section, with the remaining five sites located in the open at 8-10m intervals downstream of the shaded stretch (depending on stream substrate suitability). Artificial substrata consisted of a mesh basket containing pebbles, with 2 unglazed ceramic tiles fixed to the top. Substrata were allowed to colonise within the streams for 6-8 weeks before each sampling session. From the pebble matrix we obtained invertebrate data and POM abundance; from tile surfaces we obtained invertebrate grazer, algal species and Chlorophyll *a* data. Results will be discussed with respect to how management of riparian habitats can affect primary and secondary productivity and ecosystem function of upland streams in the upland areas.

Invertebrate metrics for assessing lateral connectivity and food resources in a large alluvial floodplain

Amael PAILLEX¹, Sylvain DOLÉDÉC², Emmanuel CASTELLA¹, Sylvie MÉRIGOUX

¹ -University of Geneva, 1206 Genève - Switzerland

² -University of Lyon 1, UMR C.N.R.S. 5023, 69622 Villeurbanne Cedex - France

In large alluvial floodplains, cut-off channels can be permanently or only temporarily connected to the main channel during floods. As a result, hydrological connectivity plays a major role in shaping both the habitat conditions and the biota of floodplain ecosystems. In this study, we will compare the sensitivity of several invertebrate-based metrics to levels of lateral connectivity in a mid-European river. The selected metrics belong to two groups' measurements i) taxonomic diversity of the assemblages, ii) invertebrate traits. Invertebrate assemblages were investigated in the main channel and thirteen cut-off channels of two braided sectors of the Rhône River (France). A total of 240 quantitative samples were collected using a stratified design repeated in summer and spring. Six environmental variables, depicting physical and chemical characteristics, were used to construct a synthetic variable describing the hydraulic connectivity of each channel. EPT richness was highest in the main channel and significantly increased with lateral connectivity ($R^2 = 0.67$, $p < 0.001$) thus reflecting the effect of hydraulic disturbance on insect assemblages. Increasing proportions of individuals having a short life cycle along the connectivity gradient ($R^2 = 0.43$, $p < 0.001$), provided evidence of the dominance of rapid-colonizing species in frequently disturbed habitats. The proportion of predators decreased along the gradient of connectivity ($R^2 = 0.27$, $p = 0.004$), suggesting a decrease of community interactions with increasing flood disturbance. The first axis of a co-inertia analysis underlined that life cycle duration, food web structure and drifting tendency were related to the lateral gradient of connectivity. Functional feeding groups were mostly independent from the main connectivity axis and rather related to the second co-inertia axis, which was interpreted as a surrogate for food resources. The coherence of the relationships established for some of the richness and trait-based metrics demonstrates their potential for the development of invertebrate-based tools to predict and monitor river-floodplain changes, especially those associated with restoration.

Occurrence of Microcystins in Lake Pamvotis (Greece) and tissue distribution in the fish species , *Carassius gibelio* (Bloch)

Theodoti PAPADIMITRIOU, Ifigenia KAGALOU, Ioannis LEONARDOS

Laboratory of Zoology, Dept. of Biological Applications and Technologies, University of Ioannina, 45110 Ioannina - Greece

Microcystins (MCYSTs) are hepatotoxic heptapeptides released into water during or on senescence of cyanobacterial blooms. Microcystin production by cyanobacteria is likely a common occurrence in eutrophic and hypereutrophic lakes over all the world, forming a serious threat for the aquatic life. Much of the research on the toxicity of microcystins has traditionally focused on laboratory mammals (rats, mice) whilst relatively few studies have been conducted on the relationships between the MCYSTs and aquatic organisms. Fish can be exposed to these toxins either during feeding or passively when the toxins pass through gills during breathing.

This paper presents preliminary results of a study that examines the occurrence of Microcystins (MCYSTs) in the water of a shallow eutrophic lake Pamvotis (Greece) and also their distribution in the tissues (liver, kidneys, intestine, gonads, brain and muscle) of ten *Carassius gibelio* specimens. Microcystins were analysed by enzyme-linked immunosorbent assay (ELISA). MCYSTs concentration in water and in the scum of lake Pamvotis were highest during the warm period (April- October). MCYSTs values were always below the WHO Guide level for recreational waters but much higher than the WHO Guide level for drinking water. It was found that MCYSTs can accumulate in the fish tissues of *C.gibelio*. Even though the target organ for MCYSTs is found to be the liver, in our study MCYSTs were found also in the rest of *C.gibelio* tissues in the following order: intestine> kidney> > brain>gonads> muscle. Muscle tissue contained concentrations of microcystins that correspond to $0.096 \mu\text{g kg}^{-1} \text{ day}^{-1}$ well above the recommended limit for human consumption ($0.04 \mu\text{g kg}^{-1} \text{ day}^{-1}$).

Temperature and food quality induces changes on life-history parameters in a dominant detritivore: *Brillia bifida* (Diptera: Chironomidae)

Isabel PARDO, Liliana GARCÍA, Maruxa ÁLVAREZ

Área de Ecología, Universidad de Vigo, 36310 Vigo - Spain

Larvae of *Brillia bifida* feeds primarily on alder leaves being numerically the dominant chironomid shredder colonising leaf packs in small streams of NWSpain. However, in the last decades exotic eucalypt trees are being introduced extensively in riparian corridors of these streams, from which leaves are known to be of lower quality than alder. Moreover, the life cycle of this obligate detritivore is coupled with the alder litterfall period with its life cycle concentrated between spring and autumn. Two rearing experiment were carry out in incubation chambers to decouple the effect of temperature and food quality on the survival, growth and time of emergence of *Brillia bifida*. A two-factor design experiment was followed in each case. Specifically, 2 water temperatures (12 °C, corresponding to average conditions found in early spring versus 17 °C, typically recorded in late summer), and two type of food (autochthonous *Alnus glutinosa* versus exotic *Eucalyptus globulus* leaves) were tested. In the first experiment, larvae were fed with whole leaves, whereas in the second experiment food was supplied as leaf disks cut from leaves. In general, larvae growth was faster at 17°C than at 12°C, independently of leaf treatment. When access to leaf parenchyma was restricted (i.e., whole leaves) mean larval dry mass was higher, growth was faster and *Brillia* emerged sooner in alder than in eucalypt. However, when larvae were supplied with leaf disks, growth rates and average size of larvae were higher in eucalypt. We speculate that diet quality at the larval stage influences life cycle, larval growth and emergence of *Brillia*, helping us to test theories of growth-development tradeoffs and the allocation of resources in species with complex life cycles.

Do the diversity of phytoplankton structure and habitat properties reflect the differential development of charophyte vegetation in the lakes? Case studies from mid-Western Poland

Mariusz PELECHATY¹, Andrzej PUKACZ², Aleksandra PELECHATA²

¹ -Department of Hydrobiology, Adam Mickiewicz University, 61-614 Poznan - Poland

² -Collegium Polonicum, Adam Mickiewicz University - Europa-Universität Viadrina, 69-100 Stubice - Poland

30 lakes of varied morphometric features were investigated in mid-Western Poland (Lubuskie Lakeland) in order to compare phytoplankton structure and habitat properties in the lakes with differential development of charophyte vegetation. Three groups of lakes were distinguished based on the number of charophyte communities: group I - 3-6 communities, group II - 1-2 communities and group III - without charophyte vegetation. In each of those groups qualitative and quantitative structure of phytoplankton as well as selected habitat properties were analyzed.

As a result, the lowest phytoplankton abundance and biomass was found in lakes with the most varied charophyte vegetation (group I). This finding coincided with visibly better physical and chemical conditions (high SD-visibility, low nutrients concentration, low conductivity) in most of lakes of this group, which were deep stratified ecosystems. By contrast, in lakes without charophyte vegetation (group III, mostly small and shallow) the highest phytoplankton abundance and biomass appeared along with the lowest species diversity index. In this group of lakes 'bad' physical and chemical conditions were also found. In the lakes of group II (with 1 or 2 charophyte associations) transitional conditions between the other groups of lakes were observed. Interestingly, in this group of lakes the maximal values of the phytoplankton species diversity index were accounted. It is worth emphasizing that in some lakes (mostly shallow) with well developed charophyte as well as vascular submersed vegetation phytoplankton biomass was rather low and the transparency was high despite eutrophic conditions. Additionally, in those lakes charophyte vegetation was not only abundant but also diverse with rare, valuable or even unexpected communities of high bioindicative value. The results are discussed regarding interrelationships between macrophyte vegetation and phytoplankton assemblages and their usage as indicators in the assessment of the ecological status of lakes.

The study was partly financed by the Polish State Committee for Scientific research (grant No 2P04G 113 27).

Responses in crustacean zooplankton populations to food quality and quantity changes after a whole lake nutrient enrichment of an oligotrophic sub-alpine reservoir

Jonas PERSSON¹, Tobias VREDE², Staffan HOLMGREN³

¹ -Uppsala University\Ecology & Evolution\Limnology, 75123 Uppsala - Sweden

² -Umeå University\Department of Ecology and Environmental Science, 90187 Umeå – Sweden

³ -Mid Sweden University, 831 25 Östersund - Sweden

To sustain production on higher trophic levels in oligotrophic systems, it is important that energy and nutrient fluxes in the food web are efficient. The trophic transfer from phytoplankton to zooplankton is of special interest as potentially nutritional constraints can decouple this energy flow. Increased nutrient loading to oligotrophic systems with low phytoplankton biomass but relatively good food quality could induce unwanted changes in seston composition that greatly reduces the nutritional value for zooplankton.

We carried out a whole lake enrichment experiment in two ultraoligotrophic subalpine hydroelectric power reservoirs located in the north-western part of Sweden. The aim was to restore Arctic char production to pre-impoundment conditions by means of gentle fertilisation. P (0.7 kg P/ha/y) and N (6 kg N/ha/y) were added to Lake Stora Mjölkvattnet 2002-2005, and upstream Lake Burvattnet was used as an untreated reference lake. The objective of this study was to follow the effects of the nutrient additions on food quantity and food quality parameters and to identify seston variables that might affect zooplankton growth

During the years of nutrient additions, food quantity was higher in the experimental lake than in the reference lake, the levels in both lakes were still low. The phosphorus content of the seston was non-limiting for the dominant zooplankton in the experimental lake, while in the reference lake high carbon:phosphorus ratios probably affected cladoceran zooplankton growth negatively. The phytoplankton communities in both lakes were dominated by cryptophytes and chrysophytes before and after nutrient additions, and the seston fatty acid contents indicated a good food quality in both lakes. The zooplankton community was dominated by the zooplankton *Holopedium gibberum*, *Bosmina coregoni*, the calanoid copepod *Arctodiaptomus laticeps*, and the cyclopoid copepod *Cyclops scutifer*. Some shifts in species biomass occurred but no introductions or exclusions. Total zooplankton biomass was higher in the experimental lake.

In summary, this whole lake fertilization experiment increased the food quantity available for zooplankton grazers without affecting the food quality negatively, and the biomass of herbivorous zooplankton increased.

Diversity and function in naturally acidic streams: is there evidence of adaptation?

Zlatko PETRIN, Björn MALMQVIST

Umeå University, Department of Ecology and Environmental Science, 90187 Umeå - Sweden

Naturally acidic freshwater systems are widespread in Fennoscandia and New Zealand. In northern Sweden recent paleolimnological and hydrochemical research implies that lakes and streams have been acidic over evolutionary time scales. At acidic sites in such regions freshwater communities need not automatically be impoverished compared to communities in circumneutral systems as the biota may have evolved tolerances to low pH. We tested this by comparing macroinvertebrate species diversity and leaf litter decomposition in naturally acidic streams in northern Sweden and in streams in southern Sweden where recent anthropogenic acidification has been significant. We also used naturally acidic headwater streams having contrasting water chemistry to investigate how dissolved organic carbon levels interact with pH. Moreover, we analyzed species abundance and hydrochemical data from an inventory comprising 700 streams. Our studies indicate that taxonomic richness, despite being overall higher in circumneutral than acidic streams in both regions, was better maintained where acidity is natural. Different insect orders showed diverging distributions: those of mayflies generally indicated sensitivity to low pH, stonefly richness was unimpaired by low pH even under recent human-caused acidic conditions, whereas caddisfly richness suggested sensitivity to low pH but only where acidity is recent. In addition, when analyzing species abundance distributions of species and genera separately, we found tolerance or adaptation to low pH in 58% of the taxa including the allegedly more sensitive mayflies and bivalves. Microbial decomposition was reduced at low pH when compared to circumneutral sites only where acidity is anthropogenic, whereas shredding was not affected differently by pH in the two regions. High levels of dissolved organic carbon appeared to facilitate decomposition under naturally acidic conditions. The results suggest stream macroinvertebrates or whole communities are acid-tolerant or adapted where acidic conditions are natural.

Nutrient and organic matter balances in fluvial segments characterized by different ecological integrity: external supply, macrophytes uptake and bacterial processes

Monica PINARDI, Marco BARTOLI, Pierluigi VIAROLI

Università di Parma- Dipartimento di Scienze Ambientali, 43100 Parma - Italy

The study presents daily mass balance of oxygen, carbon dioxide, dissolved and particulate nutrients in two fluvial segments of the Mincio river basin. The stretches analysed, Pozzolo-Goito and Formigosa-Governolo, are situated in the Lombardia Region, north and south of the town of Mantova, respectively. Both stretches have a similar length (~8 km), but are characterized by different ecological integrity. The hypothesis of this study is that the northern stretch, one of the few that still flows in natural banks in Italy, characterized by abundant vegetation islands and without transversal and longitudinal interruptions, has higher metabolic capacity than the southern stretch, which runs within artificial banks. Three experimental campaigns were carried out in August, November 2006 and January 2007. Water samples were taken following a "black box" approach, i.e. at the upstream and downstream of each stretch. Samples were taken every 4 hours within a 24 hours period. At the same time, irradiance and water flow were measured in order to estimate loads. These two stretches were also characterized for macrobenthos, primary production and the main physico-chemical parameters of water (conductivity, temperature, pH, oxygen, carbon dioxide, inorganic and organic dissolved phosphorus, inorganic and organic dissolved nitrogen and particulate forms). Incubation of core sediments were carried out in the Pozzolo-Goito stretch only, both in the presence and absence of the macrophyte *Vallisneria spiralis* to assess nutrient uptake rates and denitrification rate. Dissolved and particulated nutrient dynamics resulted to be related to natural/artificial features, typology of riversides and substrate, relative importance of submerged macrophytes or phytoplankton, and to metabolic processes occurring in the hyporheic zone.

***Daphnia's* egg bank in the small Himalayan Lake Piramide Inferiore (LPI)**

Roberta PISCIA, Patrizia COMOLI, Marina MANCA

CNR-ISE, 28922 Verbania - Italy

High mountain lakes host endemic populations of aquatic invertebrates that are adapted to extreme conditions and are able to survive through mechanisms optimising their life cycle and growth during a very short ice-free period and under the ice cover. In these environments, the production of resting stages with retarded development (diapause) can be regarded as a mechanism through which the different taxa maintain their genetic reservoirs, buffering the high risk of extinction resulting from harsh conditions.

Previous research on remote lakes in the Khumbu Valley, Himalayas, suggested that *Daphnia himalaya*, an endemic species of the region, is no longer present in lakes where its occurrence, in some cases as the only *Daphnia* species, has been documented over a period of approximately 2500 years by sediment core analyses. To provide information on the vulnerability of these environments to biodiversity loss, we combined a classic palaeolimnological approach with an analysis of the extent the egg bank in Lake Piramide Inferiore, one of the lakes investigated in the framework of the Ev-K2-CNR- and during the CNR project on "Biodiversity, evolution, and resting egg banks of aquatic organisms from remote lakes".

Our results revealed the existence of two major phases during approximately 2500 years of the lake's history, dominated respectively by *D. himalaya* and *D. longispina*. Ehippia analyses in the topmost sections of the sediment core also revealed a trend toward smaller body size in the most recent period, preceding the replacement of *D. himalaya* by *D. longispina*, which has a considerably smaller body size. The ehippia recovered from the sediments, however, were all found to be empty. This indicates synchronous hatching to ensure the recruitment of individuals each year, at the end of the ice cover period, but insufficient to provide a permanent reserve for the species.

We therefore explained the occurrence of the different *Daphnia* phases as a result of LPI being part of a cascade system, in which the upper Lake Piramide Superiore (where *D. himalaya* is still found) provides a reservoir for recruitment of the species.

Influence of Groundwater on surface Water Chemistry: a Geochemical Attesting Tool

Ian POMIAN-SRZEDNICKI¹, Pascale M. NIREL²

¹-Orga Consult, 1207 Genève - Switzerland

²-OSECOE, 1205 Genève - Switzerland

In the context of local restoration of a small river located in the canton of Geneva, we observed that neither the sewage treatment plant shutting down nor the ecomorphological rehabilitation were sufficient to reach the water quality objectives for streams in the studied watershed.

Suspecting impacts coming from exchanges between river and groundwater, we studied possible chemical changes in surface water due to the groundwater contributions. In that purpose, we applied multivariate statistical analyses on dissolved (filterable at 0.45µm) trace element measurements made on both ground- and surface water samples. We first used principal component analysis (PCA) to identify particular geochemical fingerprints related to local geology. We then used discriminant analysis to examine the ability of the discriminant model in predicting the origin of the water (ground vs surface) according to its chemical pattern. Dissolved trace elements in surface water, such as Ba and U, appeared to be efficient geochemical indicators. Any change in the natural chemical background was therefore examined with attention, as it indicates possible contributions of water from various origins.

Results of these analyses, not only confirmed our hypothesis, but also clarified the extent of exchanges between ground- and surface water in terms of quantity and occurrence. This approach was very efficient to assess the impacts of groundwater on the surface water quality. These results will help proper managerial decisions to be made for improving or maintaining the quality of surface water in the watershed.

Chironomidae assemblages in Mediterranean streams reference conditions

Tura PUNTÍ, Maria RIERADEVALL, Narcís PRAT

Department of Ecology, University of Barcelona, 08028 Barcelona - Spain

Establishment of reference condition is necessary in order to obtain very good ecological status for river types defined according to the guidelines of Water Framework Directive (WFD). Guadalmed project wants to assess the ecological status of Mediterranean streams in Spain, and one of the objectives is to study Chironomidae assemblages in reference conditions. Then, Chironomidae spatial and temporal distributions were investigated over two seasons at 31 reference sites in 8 Mediterranean river basins in NE Spain, and a total of 131 taxa included in 67 genus of chironomid larvae have been identified. Firstly, Chironomidae assemblage composition was related to 35 environmental variables measured through a canonical correspondence analysis. Variation in assemblage structure of chironomid was primarily explained by temperature, altitude and geology, together with hydrological factors as discharge and dry period that play an important role structuring communities in Mediterranean streams. Furthermore, a final classification based solely on Chironomidae reference assemblages produced four biological groups, and corresponding indicator taxa based on INDVAL analysis may be identified. One group is nearly exclusively formed by summer samples showing that seasonal differences are one of the more important drivers of differences in Chironomidae composition. Finally, we tested the agreement between Chironomidae assemblages and 5 "a priori" river types defined (WFD approach) in the Mediterranean region of Spain. Non metric multidimensional scaling showed that there was a great assemblages overlapping, each of them characterized by a low number of indicator taxa. Communities belonging to the ecotype "Siliceous headwaters and high altitude streams" appeared as the most different from the rest of ecotypes studied. Our results suggest that a priori classification of streams (using ecotypes) doesn't necessary implies exclusively different assemblages of chironomids. Similar results were found when macroinvertebrate composition at family level was analysed. These findings have important implications for bioassessment of Mediterranean streams and the application of the WFD.

Effects of wastewater discharge on ecosystem metabolism of European streams: an intersite comparison

Martin T. PUSCH¹, Björn GÜCKER², Angelo SOLIMINI³, Eugenia MARTÍ⁴, Manuela MORAIS⁵, Francesc SABATER⁶, Magali GERINO⁷, Catherina VOREADOU⁸

¹ -Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin - Germany

² -Universidade Federal de Minas Gerais, Belo Horizonte - Brasil

³ -European Commission Joint Research Centre, Ispra - Italy

⁴ -Limnology Group (CEAB-UB), Centre d'Estudis Avançats de Blanes (CSIC), Blanes - Spain

⁵ -Universidade de Evora, Evora - Portugal.

⁶ -Dept. d'Ecologia, Universitat de Barcelona, Barcelona - Spain

⁷ -CNRS-CESAC, Toulouse - France

⁸ -Natural History Museum of Crete, University of Crete, Iraklion - Greece.

While the effects of wastewater outfalls into streams on water quality are well documented, their effects on ecosystem functions has rarely been studied. These functions may potentially be used to develop an assessment scheme for ecosystem integrity which is more independent from geographic and geomorphic differences than existing ones. Hence, we investigated nine European streams differing in catchment features from mesic (Central and West European) and xeric (Mediterranean) climate conditions which received inputs from wastewater plants (WWTPs). Whole-stream metabolism was measured seasonally in stream reaches upstream and downstream of the WWTP, using the diurnal dissolved oxygen (DO) change technique. Background levels of community metabolism in the studied upstream reaches did not vary significantly with climate, but showed marked variation with channel slope and catchment land use. Gross primary production (GPP) was higher in streams in agricultural catchments than in streams with forested catchments, while ecosystem respiration (R) did not differ much.

GPP and estimated net primary production (NPP) increased downstream of the WWTPs by about 70 % in forested streams versus about 30% in agricultural streams, which may be explained by higher background GPP in agricultural streams. Concerning R, similar levels in agricultural and forest streams were replaced by higher levels in forested streams downstream of the WWTPs. From these results, it can be derived that the measured parameter R probably well reflects the rate of processing of organic matter (OM) that takes place in a specific stream ecosystem. Consequently, R showed to represent a sensitive indicator for pollution in all types of streams, but especially in forested and steep streams. The best indicative variable studied was net ecosystem production (NEP). NEP, which is calculated as the difference between R and GPP, showed the highest relative increases due to wastewater input. Hence, clear effects of point wastewater input on stream ecosystem metabolism could be demonstrated across a broad range of geographic, geomorphic and climatological settings. These effects were significantly modulated by human background impacts, and by stream slope. Some variables describing ecosystem metabolism may be useful as functional indicators of stream integrity, with NEP the most sensitive one.

The use of multiple communities to assess river's ecological status

Maëlle RAMBAUD¹, Isabelle COMBROUX², Jacques MORET¹

¹ -Muséum National d'Histoire Naturelle, 75005 Paris - France

² -Université Louis Pasteur, 67083 Strasbourg - France

In this study, our aim was to assess the impact of anthropogenic activities on riverine habitat type *Ranunculion fluitantis*. Thus, we work on four French rivers with homogenous chemical conditions. These rivers had been more or less channelised at different places of their waterway: i.e. concretion of river banks to cope with different human activities (housing, roads, and meals). Seventeen sites were selected (3-5 per river). At least one station per river was severely impacted. Impacts on the habitat type were assessed through the measurement throughout the year of physical and chemical parameters, indices, vegetation, macroinvertebrates and birds. We found differences among seasons and interactions between season and site's status (impacted or not). The impact depends also on the studied taxonomic group. Thus, a good perception of habitat degradation requires the joint study of several communities.

France and other European Members States has to assess (1) the conservation status of community interest habitats under the EU Habitat Directive and (2) the ecological status of all bodies of surface water under the EU Water Framework Directive. This study will provide new tools to perform efficient assessments.

An attempt to quantify the potential influence of a mussel population on the metal cycles in its habitat

Oscar RAVERA

CNR-Institute of Ecosystem Study, 28922 Verbania Pallanza - Italy

The capacity that some taxa, such as freshwater mussels, have to accumulate various metals in their bodies has been exploited to develop an index called concentration factor (C.F.). This index should express a direct positive relationship between the concentration of a metal in the organism and that of the same metal in the water. Though the C.F. is very useful in some cases, it cannot give any information on the potential influence of the mussel population on its environment and, particularly, on the metal biogeochemical cycles. Consequently, an index (Influence index = I.i.) has been developed in the attempt to quantify the potential influence of the mussel population on the metal cycling in its habitat. The value of this index is calculated as the ratio between the metal content in the mussel biomass (soft tissues and shell) per sediment surface unit and the metal concentration in the water where the population lives. The value is expressed as volume of water with the same metal concentration as in the water of the mussel's habitat. The value of this index increases with the increase of the metal content in the mussel biomass and with the decrease of the metal concentration in water. As an example, in Lake Maggiore the amount of Ca immobilized in the shell biomass (149 g dw·m⁻²) of *Unio pictorum* and released after the mussel's death corresponds to the content of 5.6 m³ of water having the same Ca concentration as Lake Maggiore water (26 mg·L⁻¹). In Lake Candia, due to the lower Ca content (34 g dw·m⁻²) in the mussel shell and to the lower Ca concentration in the water (15 mg·L⁻¹), the value of the index is of 2.2 m³ of water. It is evident that the potential influence of the mussel population in Lake Maggiore is larger than that in Lake Candia.

Long term variation of the zooplankton assemblage in a shallow eutrophic lake

Nicoletta RICCARDI, Gianluigi GIUSSANI

CNR-Institute of Ecosystem Study, 28922 Verbania Pallanza - Italy

The zooplankton assemblage of Lake Candia (Northern Italy) has been continuously studied since 1985 in the frame of a project for lake recovery and management. A biomanipulation intervention applied in 1986 and 1987 to aid the recovery of the lake after sewage diversion consisted in removing most of the rudd (*Scardinius erythrophthalmus*) biomass, thus reducing fish predation on zooplankton. In addition, floating macrophytes have been harvested annually since 1986 to reduce the internal nutrient supply and enhance the accessibility of the littoral area for ichthyophagous fish spawning. Zooplankton variations consisted in an early increase of cladocerans density, followed by a more delayed increase of copepods density, probably in response to the reduced predation pressure. This feature characterized the first five years after fish removal, while the following fifteen years were characterized by a reduction of crustacean zooplankton density which established at a lower, but a quite constantly maintained, level. A comparison with the variations of phytoplankton biomass confirmed an enhanced top-down control of phytoplankton density during the first five years after fish removal, while a bottom up limitation of zooplankton development seemed to prevail in the second and still lasting phase. Several changes in species composition and in species dominance were observed which could not be simply explained by the reduction of fish predation or by the concurrent variation in food quantity and quality. Moreover, no marked shifts in the physical and chemical conditions of the lake during the period of this study were identified to account for the changes in species dominance or temporal changes in the species structure of the assemblage. Lake invasion by alien species occurred repeatedly providing examples of both successful invader establishment and invasion failure, in both cases causing either a permanent or a temporary modification of community. Wide year to year fluctuations characterized some species, while others showed more narrow and predictable variations. Either the case was more important than necessity as a driving or causative factor, or we were unable to identify any causal relationship between the system components, the fact is that some dynamics of long-term zooplankton evolution remain substantially unexplained.

Organic matter dynamics in small streams: linking function to structural changes caused by catchment land-uses

John S. RICHARDSON, Trent M. HOOVER, Antoine LECERF

University of British Columbia, Dept of Forest Sciences, V6T 1Z4 Vancouver - Canada

Aquatic ecosystems respond functionally and structurally to the forms and fluxes of detrital organic matter that supplies the key basal resource in many food webs. In small streams, riparian vegetation strongly influences aquatic communities and food web properties through effects on hydrology, geomorphology, water chemistry, light available to primary producers, and inputs of allochthonous organic matter as the primary energy source. Although it is evident that any alterations of riparian vegetation can affect stream ecosystems, we have yet to accurately determine the processes, and the interactions between the processes, that drive stream ecosystems' responses to altered riparian vegetation. Forestry, as a major land-use affecting streams in many parts of the world, provides a useful model perturbation for exploring the dynamic linkages between the physical and biotic components of small stream ecosystems. We use small- and large-scale experimental work to elaborate and parameterise a model that links function to the structural changes in small stream systems that result from forest harvesting and other, more natural, sources of variation. Changes in inputs rates, timing, and composition of particulate organic matter have clear impacts on available resources, while decomposition rates of this material are primarily affected by its chemical composition, stream temperature, consumers, light (through algae), and nutrients in the water. The patterns and amounts of particulate organic matter retained in streams are altered by short- and long-term changes associated with hydrological (peak flow) regimes, reductions in channel complexity due to bank erosion and loss of large woody supplies, the infilling of pools, and a reduction in sediment stability. Retention rate is also directly related to particle sizes of the organic matter, which also links the structure of riparian vegetation with in-stream processes. These complex interactions between structure and functional aspects of stream ecosystems are best demonstrated using our mechanistic model which can make predictions of the net effects of structural changes resulting from land-use management to organic matter dynamics in streams. Furthermore, the approach presented in this paper can be generalised to many types of alterations of the landscape, which will provide a useful tool to assist sustainable forest management.

The nitrogen status of remote lakes in different regions of the globe: the Italian Alps compared to Andes, Himalaya and the Svalbard Islands

Michela ROGORA¹, Aldo MARCHETTO¹, Rosario MOSELLO¹, Gabriele TARTARI¹, Julieta MASSAFERRO²

¹-CNR ISE, 28922 Verbania - Italy

²-CRUB/UNC, Universidad del Comahue, Jardin Botanico, 8400 S.C. de Bariloche - Argentina

High mountain lakes have been recognized as sensitive indicators of environmental change. Despite their remoteness, they are impacted by atmospheric pollutants and climate change. Chronic N deposition in particular may lead to a status of N saturation of terrestrial ecosystems and leaching of NO₃ to surface waters. Beside atmospheric input, N dynamics in soil and water are also affected by climatic factors such as temperature and precipitation. As a consequence, any prediction of future response of remote lakes to atmospheric deposition is dependent on the magnitude and geographic extent of possible climate-induced NO₃ leaching. In this study we focused on N levels, both as inorganic and organic N, measured in high-altitude lakes in the Alps in the course of various surveys since the late 80s. These results were compared with those available for a high number of lakes in other remote areas of the globe (Andes, Himalaya, and the Svalbard Islands). Particular attention was paid to N content of lake water in relation to atmospheric input and lake and catchment characteristics. Lakes in the Alps are characterised by remarkably high concentrations of N (about 20 ad 30 µeq l⁻¹ as total N and N-NO₃, respectively). The N status of the lakes proved to be mainly related to the atmospheric input (100-150 meq m⁻² y⁻¹ as inorganic N). A North-South gradient in the N levels of the lakes was also detected, due to the location of the major pollutant sources south of the area. In contrast to lakes in the Alps, remote lakes in the Andes and Himalaya receive much lower inputs of N. As a consequence, concentrations of N-NO₃ in lake water are always below 5 µeq l⁻¹ and the N content is mainly in the form of organic N (79-80% of total N). These results confirmed the pristine condition of lakes located in area not affected by the deposition of long-range transported pollutant. On the other hand, the situation of the Alps appears to be critical with respect to air-borne pollutant deposition and N enrichment of surface water.

Phytoplankton Structure and Succession in the Reservoir Marne (Seine Catchment Area, France): A Multitable Approach

Anne ROLLAND¹, Frédéric BERTRAND², Stéphan JACQUET¹

¹ -INRA, 74200 Thonon-Les-Bains - France

² -IRMA, 67100 Strasbourg - France

Micro-organisms, especially phytoplankton species, may be considered as potential indicators of local and more global changes in aquatic ecosystems and may thus constitute an excellent biomarker of water quality. Assessing biological, chemical and physical influence on phytoplankton regulation is a key process to understand population structure and dynamics, population diversity and succession, and to propose, if necessary and when possible, a human-hand control before any excessive algal proliferation could occur. Such issues are of main concern to help scientists and water managers to make possible for large-body reservoirs, lakes and ponds to reach the "good ecological state" recommended by the Water Framework Directive (WFD) by 2015. On first hand, our project aims to identify both the spatial and temporal phytoplankton structure and dynamics in the Reservoir Marne (located in the Seine catchment area), referred to as one of the largest reservoirs in occidental Europe. On a second hand, we try to understand the role of the various factors and processes (physical, chemical and biological) implied in both the distribution and the regulation of the phytoplankton. In 2006, i.e. the first year of the project, the reservoir has been sampled once a month in March and April and then, once every two weeks between May and September. To assess spatial heterogeneity, six stations and various depths for each station have been investigated. Water samples were obtained using a Van Dorn bottle for major nutrients, chlorophyll a, phytoplankton abundance and diversity, bacterial and viral abundance analyses. Zooplankton was sampled with a modified 30 L containing Schindler-Patalas box. Transparency was measured using a Secchi disk and light intensity with a LICOR probe. Oxygen concentration, pH and conductivity were determined using a multiparameter probe. Finally, a submersible fluorescence probe (FluoroprobeTM, bbe-Moldaenke) was used to discriminate and quantify the major algal classes in situ. We show that (i) the reservoir is not uniform as revealed by the phytoplankton abundance and structure which vary significantly from one sampling station to another, (ii) a clear seasonal dynamics can be observed for the different microbial communities with main differences on a vertical scale, (iii) in this context, a multitable analysis, still little used in aquatic ecology, is a powerful statistical tool to get a clear representation of the spatial and temporal organization of the assemblages of the different species.

Leafs or bugs? Are leaf litter breakdown a better indicator of eutrophication than community composition of the biota

Leonard SANDIN, Jenny BERGFUR

Department of Environmental Assessment, Swedish University of Agricultural Sciences, 750 07 Uppsala - Sweden

The biotic structure of nine boreal stream along an eutrophication gradient in south-central Sweden was investigated by the sampling of fish, macrophytes, benthic invertebrates, and diatom community composition. At these sites functional aspects of the stream ecosystem were also measured through leaf-litter breakdown studies. Structural aspects of stream ecosystems, usually expressed as different types of indices or metrics related to specific stressors have predominantly been used to assess the ecological status of running waters. However, relatively recently it has been suggested that functional aspects of stream ecosystem responses, such as leaf litter processing might be an alternative or complementary indicator of stream ecosystem health. In this paper we compare the structural measurements of the biota (through community composition and metrics/indices) with the functional aspect, as measured by leaf litter breakdown. The structural and functional properties of the streams were also related to a large number of physical and chemical parameters on different spatial scales (i.e. from catchment variables such as land use to near-stream land-use and in-stream substratum, vegetation cover, and water chemistry). The hydromorphological properties of each site were also inventoried using the UK River Habitat Survey protocol and the structural and functional properties were related to the habitat quality of the streams. Finally the relationships between the biological communities as well as their relationship to the leaf litter breakdown were analysed. With this kind of information we can enhance our understanding of the responses of structural versus functional properties of streams in relation to different types of stressors such as changes in water chemistry, catchment land-use, and hydromorphological features and thus also enhance monitoring programmes and management of these important ecosystems under increased pressures from humans.

Temporal variability in shallow groundwater communities along a New Zealand gravel-bed river

Mike SCARSBROOK¹, Graham FENWICK², Thibault DATRY³

¹ -NIWA, Hamilton - New Zealand

² -NIWA, Christchurch - New Zealand

³ -CEMAGREF, 69336 Lyon - France

Groundwater ecosystems are considered to be relatively stable when compared with surface water ecosystems, but few studies have actually quantified the levels of spatial and temporal variability in groundwater ecosystems. We investigated seasonal and longitudinal patterns in physico-chemical and biological patterns in three arrays of shallow groundwater wells (depth 5.9-9.6 m) along the Selwyn River in Canterbury (NZ), with the aiming of investigating the relationship between varying groundwater levels, resource supply and invertebrate density and species composition. The period of study (September 2005 - July 2006) coincided with a dramatic and sustained decrease in groundwater levels in the region over the spring, summer and autumn, followed by a rapid recharge associated with winter storms in June 2006. Water chemistry showed marked temporal variation, with evidence of a concentration effect over the period of falling water levels, followed by a dilution associated with recharge. Concentrations of DOC peaked after the winter recharge event. Nitrate concentrations increased 20-fold along the longitudinal gradient. There were also significant changes in faunal composition associated with the longitudinal gradient, particularly in the relative abundance of stygobite taxa (e.g. *Phreatoicus typicus*), which increased in up-welling zones. Seasonal variation in community composition and density also reflected location of the well arrays along the gradient from regional down-welling to up-welling zones. Numbers of copepod nauplii increased significantly following the recharge event at two of the sites, suggesting that recharge events can be periods of increased biological activity in shallow aquifers.

Coupling nitrogen and phosphorus spiraling in streams: organism > stoichiometry and the relative use of nutrients

John SCHADE¹, Steve THOMAS², Jill WELTER³,

¹ -*St. Olaf College, Biology Department, 55057 Northfield, MN - USA*

² -*University of Nebraska, School of Natural Resources, 68583 Lincoln, NE - USA*

³ -*College of St. Catherine, Biology Department, 55105 St. Paul - USA*

A central focus of ecosystem ecology is to understand factors that influence the movement of nutrients across landscapes from mountaintops to oceans, particularly those processes that impede downstream fluxes. Export of nutrients downstream can cause eutrophication and other problems in recipient ecosystems. Most of the nutrients exported to the ocean by large rivers pass through low-order streams in the upper watershed. We must understand what factors control the movement of nutrients through these small streams to deal effectively with these problems. Nutrient spiraling theory describes transport and retention of nutrients in streams, and provides a set of metrics useful as a functional assessment of ecosystem health. In contrast, bioassessment techniques use the composition of the stream community to determine when and where degradation of water quality has had an impact on the structure of ecological systems. These two approaches have not been linked, and feedbacks between community changes and nutrient cycling are poorly understood. We argue that food web stoichiometry theory provides a potential framework for such links. Most nutrient uptake is biological, mediated through the activities of plants or microbes. Once nutrients are removed from the water column, their fate is controlled by the strength and nature of interactions between species that compose the food web. These organisms process multiple nutrients simultaneously, and the movement of nutrients into and out of the food web depends on the needs of consumers and the relative availability of nutrients in their resources. These stoichiometric relationships require that multiple nutrients be considered simultaneously and impose constraints that may substantially alter stream nutrient fluxes. Stoichiometric variation among stream organisms is related in part to their life histories, and stoichiometric imbalances between consumers and resources are likely to both influence and result from life history evolution. In this presentation, we will present data on consumer stoichiometry and its impacts on nutrient spiraling metrics. We will also discuss theoretical considerations that suggest a stoichiometric perspective applied to bioindicators, food web dynamics and nutrient spiraling has the potential to forge a link between structural and functional aspects of ecosystem health in small streams and whole watersheds.

Functional assessment of stream ecosystems using leaf litter breakdown rates: how well can we account for natural variability among streams?

Trey SIMMONS, Charles P. HAWKINS

Utah State University, 5210 Old Main Hill, 84322-5210 Logan, Utah - USA

Leaf litter breakdown rates have been proposed as a useful measure of the functional integrity of stream ecosystems. Leaf litter breakdown rates have indeed been demonstrated to respond to anthropogenic impacts; however, these responses are generally limited to changes in mean values (i.e., all reference streams vs. all impacted streams). For a truly useful bioassessment tool, we need to be able to detect changes at individual streams, and to diffuse and potentially unknown stressors. Natural breakdown rates may vary widely among different stream types; we need to be able to account for this variability to make predictions regarding the breakdown rates we expect to see at a given stream in the absence of anthropogenic impacts.

We measured breakdown rates of aspen (*Populus tremuloides*) leaves in 99 streams located in 5 states in the western United States. We also collected macroinvertebrates and physico-chemical data at each site. 74 of these streams were reference-quality streams, and the other 25 (test sites) were subject to varying levels of anthropogenic stress from agriculture, mining and/or urbanization. The streams varied widely in size, elevation, geomorphology, water chemistry and macroinvertebrate community composition. As a whole, there was almost complete overlap of the distributions of aspen leaf breakdown rates between reference and test sites, emphasizing the need for a robust stream classification method.

We tested whether we could identify physical gradients that were correlated with leaf breakdown rates in reference streams. Among all 74 reference streams, temperature was most highly correlated with leaf breakdown rates, accounting for up to 80% of intersite variability. However, when the 8 warmest streams were removed from the dataset, the temperature correlation was substantially reduced, and the best multivariate models accounted for less than 50% of the variation among the remaining 66 reference streams.

We also tested whether we could identify biological factors that were associated with differences in leaf breakdown rates among reference streams. We found that although there was a significant relationship between leaf breakdown rates and the species composition of macroinvertebrates recovered in leaf bags, breakdown rates were poorly predicted by the total macroinvertebrate community composition at each site.

Although we were unable to demonstrate a direct relationship between biological structure and ecosystem function in reference streams, we might expect that changes in structure resulting from the effects of anthropogenic stressors would be associated with changes in function. We are using RIVPACS modeling to assess the biological (structural) integrity of each of the 25 test sites that we sampled. To assess whether functional integrity at these sites is associated with structural integrity, we are determining if deviations in leaf breakdown rates from model predictions are correlated with O/E values.

Large scale environmental classification systems for rivers

Ton SNELDER, Hervé PELLA, Jean-Gabriel WASSON, André CHANDESIRIS

CEMAGREF Laboratoire d'Hydroécologie Quantitative, Lyon - France

Environmental classifications are developed to support environmental and conservation management by defining patches on the earth's surface that have similar ecological characteristics (e.g., biota, water, energy and chemical fluxes). The use of abiotic variables (e.g., climate, topography, geology) to define these classifications assumes that ecosystem characteristics will be similar where locations share similar environmental characteristics. However, there are numerous procedures that can be used to integrate classification variables in order to define an ordered system of classes. To assist with management and restoration of rivers in Europe, the Water Directive Framework proposes the differentiation of rivers by ecoregions. This is a particular approach to classification that is carried out by experts who consider simultaneously maps of various factors to define a spatial framework comprising regions that are relatively homogenous with respect to environmental characteristics. Alternative classifications can be developed based on a spatial framework provided by a GIS-based river network. The classification entities are river segments that can be characterized by the environmental characteristics of their unique upstream watersheds. Multivariate numeric classification can be used to group individual segments based on the similarity of their environmental characteristics. In this article we discuss tests of the performance and applicability of different classifications of all the rivers of France that have been defined using these two contrasting procedures. Our study had two objectives. First, we aimed to test the performance (i.e. their ability to a priori discriminate variation in the characteristics of interest) of these classifications with respect to a specific ecological characteristics (invertebrate assemblages and water chemistry). Second, we wanted to clarify the strengths and weaknesses of each approach with respect to ease of definition and efficacy of use.

Effect of temperature, light and nutrients on growth of and competition between *Cylindrospermopsis raciborskii* and *Microcystis aeruginosa*

Maria Carolina SOARES^{1,2}, Miquel LÜRLING¹, Vera HUSZAR³

¹ -Wageningen University, 700 DD Wageningen - The Netherlands

² -Universidade Federal do Rio de Janeiro, 20940040 Rio de Janeiro - Brasil

Cyanobacterial blooms are a growing problem around the world, and also in Brazil, where *Cylindrospermopsis* and *Microcystis* are common bloom forming genera. Their ability to produce potent toxins increases the need for understanding mechanisms related to their occurrence and dominance. In Funil Reservoir (Brazil), interspecific patterns of succession of cyanobacterial blooms are not well understood. Therefore, a strain of *Microcystis aeruginosa* and *Cylindrospermopsis raciborskii* were isolated from the reservoir and subjected to controlled experiments testing the effects of temperature, light and nutrients on growth of both strains and on the competitive interaction. Experiments were performed in batch and continuous flow systems with the individual species and as co-cultures. Although both species presented low growth rates at low temperatures, it was the only condition where *M. aeruginosa* out competed *C. raciborskii*. The faster initial growth of *C. raciborskii* gave it an advantage in different conditions of light, temperature and nutrients. However, *M. aeruginosa* was able to achieve higher biomass. This feature seemed to be an advantage to *M. aeruginosa* in continuous culture conditions. In mixing cultures, *M. aeruginosa* grew better in absence of *C. raciborskii*. However, *C. raciborskii* expressed growth stimulation by the presence of *M. aeruginosa*. Our results suggest that while *C. raciborskii* has a great invasive potential, with fast initial growth, the dominance of *M. aeruginosa* can be related to its ability to achieve high biomass, forming scums.

Structure-function relationship in running water ecosystems: from theory to application

Angelo G. SOLIMINI¹, Leonard SANDIN²

¹ -EC - Joint Research Centre, 21020 Ispra - Italy

² -Swedish University of Agricultural Sciences, 750 07 Uppsala - Sweden

Linking structural properties of community to ecosystem processes has been identified as a major challenge in contemporary ecology. Often structure (e.g. species richness or community composition) is used as a surrogate for functional properties (processes such as nutrient cycling and retention, productivity, decomposition, and metabolism) even though structure and function might not be linked, i.e. changes in structure can occur without detectable changes in function. At the same time there is a growing concern that anthropogenic stress not only affects species diversity but also ecosystem services that may be lost or impaired as well.

Although the ultimate goal of water policies such as the EC Water Framework Directive is to preserve and restore the well functioning of freshwater ecosystems, to date many biological assessment tools rely on structural properties of communities only. Some indicators of ecological functioning or surrogates for function has been used or suggested, but relatively few studies have linked these to the structure of the community as well as to anthropogenic effects on lotic ecosystems.

The goal of this talk is to explore how to incorporate the concept of function along with the well established structural properties of biological communities for the assessment of ecosystem health. Some of the questions we will discuss: i) are functional aspects superior to structural ones in assessment of ecosystem health, ii) are there good indicators of ecological functioning, iii) can we predict changes in function based on structure or other features or running waters (e.g. physical properties), iv) how do we incorporate functional aspects in the assessment of success in river restoration projects.

Distribution of benthic invertebrates in a small stream

Michal STRAKA, Jan HELESIC

Dept. of Botany and Zoology, Laboratory of Running Waters Biology, Masaryk University, 611 37 Brno - Czech Republic

The distribution of benthic macroinvertebrates can be studied at different scales. At a mesohabitat scale the variation in a benthic community structure is influenced by four major processes: 1) physical factors, 2) patchy food supplies, 3) reproductive and age related effects, 4) biological interactions. Even in a small part of a stream we find habitats with different environmental conditions and therefore the distribution of organisms is not uniform but reflects the characteristics of the habitats.

We studied spatial distribution of benthic macroinvertebrates within a 100 m long reach of a Strahler's first order stream Hadůvka (Czech-Moravian Highlands, Czech Republic). Several mesohabitats were distinguished there: fine sediment, pure sandy bottom, sand covered with leaves, gravel bottom, gravel covered with leaves and cumulated woody debris - debris dams. From each mesohabitat all substratum was taken using Hess sampler (area 0.03 m², 100µm mesh size) into the depth 5 cm. In a laboratory organic and inorganic matter was separated using decantation and elutriation. Mineral substrate roughness and the amount of organic matter were evaluated.

The importance of substrate characteristics to the macroinvertebrate community structure was evaluated using multivariate analysis and species preferences for particular substrate were assessed.

Research is a part of project MSM 0021622416.

Inner horizontal distribution and diversity of phytophilous aquatic macroinvertebrates in wide reed (*Phragmites australis*) beds of pond littoral

Jan SYCHRA^{1,2}, Zdeněk ADÁMEK^{2,3}, Karla PETŘIVALSKÁ¹

¹ -Department of Botany and Zoology, Faculty of Science, Masaryk University, 611 37 Brno - Czech Republic

² -Department of Fish Ecology, Institute of Vertebrate Biology AS CR, 603 65 Brno - Czech Republic

³ -Research Institute of Fish Culture and Hydrobiology Vodňany, University of South Bohemia in České Budějovice, 389 25 Vodňany - Czech Republic

Reed beds (*Phragmites australis*) form a frequent vegetation type in littoral zones of stagnant waters in central Europe and create an important living space for many aquatic macroinvertebrates. Nevertheless, their diversity and horizontal distribution in extensive reed beds are insufficiently known. We investigated the spatial distribution of macroinvertebrates within a large reed bed at the Nesyt fishpond (South Moravia, Czech Republic). Using a hand net, we sampled a reed bed in 6 horizontal lines from its marginal area (contact with the open water) towards the shore. Dense reed beds disable fish admittance and provide very specific environmental conditions (e.g. reducing sun illumination and dissolved oxygen level, increasing organic matter accumulation, etc.) which change along this gradient and affect the taxonomic and functional structure of macroinvertebrate communities.

The study proved the dominance of gastropods, oligochaetes, corixids and larvae of chironomids. The environment of dense reed bed interior was found to be analogous to pool habitats in both the environmental conditions and community structure. This suggests that wide reed beds may serve as refuges for pool animals such as aquatic beetles and larvae of dipterans within the fishpond ecosystems.

This study was supported by the grant GA ČR 524/05/H536 and by the Ministry of Education of the Czech Republic (projects no. MSM 0021622416 and MSM 6007665809).

Stable isotopes indicate changes in feeding niche widths of perch (*Perca fluviatilis*) and roach (*Rutilus rutilus*) after competitive release

Jari SYVÄRANTA, Roger I. JONES

University of Jyväskylä, 40014 Jyväskylä - Finland

We have used stable isotope analysis of carbon and nitrogen ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) to characterise possible impacts of a biomanipulation on a freshwater lake recovering from severe eutrophication. Here we present results on an empirical test of a recent proposal that feeding niche widths might be detected by variation in stable isotope values. Biomanipulation, by means of mass fish removals, was started in spring 2004 and continued until 2006. A considerable amount of fish has now been removed from the lake, creating more niche space and available resources for remaining fish. We analysed stable isotope ratios of carbon and nitrogen from two key fish species, perch (*Perca fluviatilis*) and roach (*Rutilus rutilus*) in 2003-2006. Variances in both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values first increased significantly in both fish populations, indicating a wider food spectrum and expanded feeding niche width following competitive release. Greater changes were observed in the perch population than for roach. In 2006 the perch population abruptly changed its diet so that most individuals were primarily consuming the abundant young-of-the-year (YOY) fish, which was reflected as significantly reduced variances in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values. We conclude that isotopic variance can indeed reflect changes in feeding niche width and offers a promising way to study such general ecological concepts.

Zooplankton assembly in lentic waters is primarily driven by local processes

Silvia TAVERNINI¹, Raul PRIMICERIO², Giampaolo ROSSETTI¹

¹ - *University of Parma, 43100 Parma - Italy*

² - *University of Tromsø, 9037 Tromsø - Norway*

The influence of local (i.e. physical and chemical constraints and ecological interactions) and regional (i.e. dispersal) processes in determining the structure of zooplankton communities in lentic waters was analysed in a mountain district of 4500 km² (northern Apennines, Italy). In the 47 lakes and ponds considered in this study, a total of 139 taxa were found. Species richness was significantly correlated with the surface area of water bodies, but not with their elevation or maximum depth. Local environmental conditions (i.e. maximum depth, altitude, pH and conductivity) accounted for 35.6% of the variation in rotifer assemblages, whereas the remaining variation appeared to be partly influenced by dispersal limitation. A negative relationship between the similarity in species composition among sites and their mutual geographic distance was shown. The importance of environmental constraints in structuring zooplankton communities was best documented by the microcrustacean distribution in the study area, which was mainly correlated (58.7% of the variation in the species data) with dissolved reactive silica concentration, pH and hydroperiod of the habitats. Although previous studies on processes shaping zooplankton assemblages that operate at different scales have yielded contrasting results, our data provide clear evidence for a major role of local constraints.

Long-term change in the timing of phytoplankton blooms in Windermere

Stephen THACKERAY, Ian JONES, Stephen MABERLY

CEH Lancaster, LA1 4AP Lancaster - UK

Climate variation can affect the population dynamics and phenology of phytoplankton, through its effects on lake physical processes. However, these dynamics can also be affected by changes in trophic state and variations in the magnitude of grazer populations and overwintering phytoplankton populations. As yet, few studies have attempted to disentangle the effects of these multiple drivers on phytoplankton phenology. In this study unique long-term records of water temperature, nutrient concentrations and planktonic populations (1955 - 2000) from Windermere (UK) will be presented and analysed. Using non-linear statistical models, temporal changes in the seasonal timing of two spring-blooming diatoms will be described and related to long-term changes in the ecology of Windermere. Throughout the study period, *Asterionella* blooms have become progressively earlier as a linear function of time. In contrast, the timing of the *Cyclotella* bloom showed no systematic change prior to the late 1980s but then advanced rapidly until the end of the study period. In the case of *Asterionella*, the shift in timing appears to be related to the long-term increase in soluble reactive phosphorus concentrations in the lake and an increase in the magnitude of the overwintering population. For *Cyclotella*, the primary influence on timing appears to be an advancement in the date of thermal stratification in the lake following the late 1980s. By using flexible statistical models to consider the effects of multiple drivers on phytoplankton phenology we show that the processes behind changing phenology are species specific and that these shifts cannot always be attributed to long-term climate variation.

Phenotypic variation of *Elodea nuttallii* (Planch.) H. St John in the North-East of France

Gabrielle THIÉBAUT, Fiorant DI NINO, Serge MULLER

University Paul Verlaine, 57070 Metz - France

The morphological variation of *Elodea nuttallii* (Planch.) H. St John, a clonal aquatic macrophyte introduced in Europe, was investigated at sites of different trophic states in Northern Vosges streams (NE France). Studies of morphological plasticity in clonal plants have analysed responses to habitat quality in terms of spacer length and branching intensity. The capacity for these parameters to respond to environmental quality has been interpreted as an expression of foraging behaviour, as it confers the potential to intensify the placement of ramets in the more favourable patches of a heterogeneous environment. In our study, the first step consisted in testing the Foraging Concept applied to plant morphology as an adaptation to the acquisition of resources (DE KROON & HUTCHINGS 1995). Eight morphological traits of individuals of *E. nuttallii* were studied monthly at six sites to document morphological plasticity. Measurements were taken from thirty randomly-selected plants at each site from march to october. A significant difference in morphological traits appeared among the dates and among the sites. A seasonal pattern of the growth of *E. nuttallii* was established. In agreement with the prediction of the foraging hypothesis, there was a difference in internode and in photosynthetic surface among sites. Plants growing in oligotrophic water were long and thin, while plants growing in no limited nutrient resources were shorter and more robust, with a greater leaf surface. However, the morphological responses of *Elodea nuttallii* were explained by the physical features of the habitat in nutrient rich waters.

The second step consisted in investigating the degree of genetic diversity among *Elodea nuttallii* plants in Northern Vosges streams by analysing twenty-seven samples using Amplified Fragment Length Polymorphic (AFLP) markers. Altogether 258 AFLP markers were scored using 5 primer pairs. The average proportion of shared AFLP fragments was higher than 99.80 %. These results establish that *E. nuttallii* propagates clonally in Northern Vosges streams. They exclude morphological variations due to the presence of ecotypes, and show an only phenotypic adaptation.

DE KROON & HUTCHINGS 1995. Morphological plasticity in clonal plants – The foraging concept reconsidered. *Journal of Ecology* 83 (1): 143-152.

Towards the use of ecosystem-scale variables in stream bioassessment

Steven A. THOMAS, John SCHADE, Camille MCNEELY, Jill WELTER

School of Natural Resources, University of Nebraska-Lincoln, NE 68583-0995 Lincoln - USA

Functional variables are poorly represented in bioassessment. In part, this is due to the relative difficulty of measuring process rates, but it also results from an inadequate framework for incorporating process-based data. Functional variables exist for individual, population, community and ecosystem scales of ecological resolution. We adopt an ecosystem-scale perspective and assess the value of nutrient spiraling and other ecosystem variables in stream assessment.

Nutrient spiraling is a conceptual and numerical framework for describing the cycling of elements in flowing waters. Its distinguishing characteristic is its focus on spatial rather than temporal dynamics. Three metrics have emerged to describe the transport and removal of inorganic nutrients: uptake length (SW, L), uptake velocity ($v_f, L T^{-1}$), and the areal uptake rate ($U, M L^{-2} T^{-1}$). Each metric provides unique information and, in combination, reflect the temporal and spatial properties of solute retention and transport. Surprisingly, coincident study of multiple elements (e.g. nitrogen and phosphorus) has been relatively rare and a spiraling has not been used to assess nutrient limitation in streams. Drawing on concepts from ecological stoichiometry, we develop a framework for assessing the direction and strength of nutrient limitation using spiraling parameters. Specifically, serial enrichment experiments were used to quantify spiraling metrics as nutrient availability increased. The slope of the relationship between uptake length and enrichment level is used to compare and contrast the limitation status of several research sites.

Nutrient spiraling represents one set of ecosystem variables that may prove useful in ecological assessment. Oxygen mass balance approaches to characterizing ecosystem scale metabolic activity (energy flow) have advanced in parallel with spiraling techniques. In addition to traditional photosynthesis: respiration ratios, carbon turnover indices are also emerging and will be briefly discussed here using examples from the literature. Structural variables are well suited to describe a time integrated index of ecological conditions. However, these metrics provide little information on how drainage subsystems influence and modulate material movement between terrestrial, freshwater, and marine systems. This presentation explores how we might use functional variables in this capacity.

Environmental heterogeneity as a controller of biodiversity and ecosystem processes in riverine landscapes

Klement TOCKNER

EAWAG - Duebendorf, Switzerland

One of the greatest influences humans have had on the environment is simplification of habitats, landscapes and catchments. This current loss of heterogeneity is a serious threat to the persistence and sustainability of ecosystems including their services. The active conversion of simplified ecosystems back to a more heterogeneous state has become an important aspect of restoration and management. Therefore knowledge of how habitat heterogeneity controls biodiversity and ecosystem processes is a necessary element for managers and restoration projects. Recent research on near-natural European rivers emphasises strong links between spatiotemporal heterogeneity and ecosystem processes. For example, flow and flood pulses create a shifting mosaic of aquatic and terrestrial habitat patches. Composition and spatial arrangement of these habitat patches controls the flux of organisms and matter among adjacent patches. The capacity of a habitat to process matter is also dependent on the productivity of adjacent patches and on the exchange among these patches. This exchange of matter and organisms among habitats of different age and productivity is often of a pulsed nature. For example, small pulses of a physical driver (e.g. short-term increase in flow) can cause mass X emergence of aquatic insects and therefore impact recipient terrestrial community structure. What are the consequences of pulsed events on the persistence and intensity of aquatic-terrestrial linkages? And what characteristics of the exchange process, donor or recipient, tend to make the exchange more pulsed? Hierarchical partitioning of species richness allows quantifying the proportional contribution of individual samples, habitat patches, river segments, and corridors to total catchment diversity. Our results highlight the importance of lateral habitats, including tributary confluences, for structuring diversity along river corridors. Lateral habitats need to be fully integrated in future conservation and restoration projects; particularly since they are among the first landscape elements that disappear as a consequence of river regulation and flow control.

The invasiveness of two macrophytes species in waterbodies, *Elodea nuttallii* (Planch.) St John and *E. canadensis* Michaux. Adaptive species strategy and key factors controlling habitat invasibility ?

Michèle TREMOLIERES¹, Marie-Hélène BARRAT SEGRETAIN², Gabrielle THIEBAUT³, Isabelle COMBROUX¹, Gisèle HAAN-ARCHIPOFF¹

¹ -CEVH/ULP, 67083 Strasbourg - France

² -Ecologie des systèmes fluviaux univ Lyon, 69622 Villeurbanne - France

³ -Interactions, Ecotoxicologie, Biodiversité et écosystèmes Univ Metz, 57045 Metz - France

The North American genus *Elodea* was introduced in Europe in the 19th and 20th centuries. *Elodea canadensis* Michaux was the first species introduced, followed by *E. nuttallii* (Planch.) St John which tends to replace the first one and to colonize large surface of aquatic habitats in France. The questions are : What is the present dynamics of colonisation of the two species in France ? Why does *Elodea nuttallii* replace *Elodea canadensis*? Does *E. nuttallii* present more efficient adaptive strategies than *E. canadensis*? Do some ecological factors favour the expansion of *E. nuttallii*? To answer these questions, we report the results of field observations and laboratory experiments.

For the past 30 years *E. nuttallii* has been colonising numerous ponds and streams in metropolitan France, except in the south-east. We focused on a more detailed study in three French regions, the Rhône plain, the Rhine plain in Alsace and the Northern Vosges mountains (Eastern France).

The colonisation dynamics of *Elodea* species was favoured by opening the habitat (connection to the main river for example) and by a fine substrate. It seems to be stabilized in the three regions since a few years. *E. nuttallii* shows a higher morphological variability than *E. canadensis*, which demonstrates a higher adaptive strategy. Dynamics of biological traits with the growth rate over the season confirms the adaptability of this species. In laboratory conditions a high trophic level favours the growth of *E. nuttallii*, and light intensity influences largely the replacement of *E. canadensis* by *E. nuttallii* in nutrient-rich conditions. The development stage and the distribution pattern of the two species also influence the competition between both species. Finally we also report the results of laboratory experiments on resistance of the two species to herbivory and to drawdown, two treatments that were hypothesized to be useful in the limitation of the invasion process.

Assessment of the organic pollution of rivers based on benthic invertebrates according to European Union Water Framework Directive; adaptation of the saprobic system in Slovenia

Gorazd URBANIČ, Špela AMBROŽIČ

University of Ljubljana, Biotechnical Faculty, Department of Biology, 1000 Ljubljana - Slovenia

One of the main goals of the Water Framework Directive 2000/60/EC (WFD) is to achieve or maintain a good ecological status of all surface waters by the end of 2015. The new policy also demands a novel approach regarding water quality assessment. The official method for water quality assessment in Slovenia has for many years been the Saprobic index. Therefore only an adjustment of the Saprobic index was needed. First the new Slovenian version of the Saprobic index was prepared. Four versions of the saprobic system were initially calculated differing in the used taxonomic levels and indicative weights (G). The version of the Saprobic index where only taxa with indicative weight (G) ≥ 3 were used best reflected the whole range of actual organic pollution conditions and was therefore found to be the most appropriate. Using this version of the Saprobic index a reference saprobic value was determined for each national river type. The influences of season and habitat characteristics on the type-specific reference saprobic value were tested using Mann-Whitney U-test. For both ecological factors statistically significant differences were observed, but not for all the tested types. For some national types similar reference saprobic values were calculated. Therefore new saprobic types were defined including all national types with similar saprobic reference values and new reference values were calculated. Based on the deviation from the reference conditions the boundaries for 5 quality classes were calculated for each saprobic type.

Invertebrate traits for the biomonitoring of European rivers: assessing the effects of various stressors

Philippe USSEGLIO-POLATERA¹, Virginie ARCHAIMBAULT², Paulo PINTO³, Manuela MORAIS³, Barbara BIS⁴, Konstantinos GRITZALIS⁵, Ioannis KARAOUZAS⁵

¹ -Paul Verlaine University, LIEBE, Campus Bridoux, F-57070 Metz, France

² -CEMAGREF, Unité de Recherche "Biologie des Ecosystèmes Aquatiques", Lyon France

³ -University of Évora, Centre of Applied Ecology, Water Lab., Évora – Portugal

⁴ -University of Lodz, Lodz, Poland

⁵ -National Centre for Marine Research, Institute of Inland Waters, Athens, Greece

Our primary objective was to examine the possibility of using traits of invertebrate assemblages as effective, ecologically-based indicators of different stressors and different intensities of stress in wadeable rivers at pan-European scale. Benthic invertebrates were sampled in 316 sites from 25 stream types covering 13 ecoregions and three main disturbance types (organic contamination, degradation in stream morphology and general degradation). Sites had been pre-assigned to one of five "surface water status" categories using pre-existing data. Approximately 15% of faunal samples were randomly selected to form a test data set, while the remainder was used as the development data set. Biological traits reflect the life cycle of organisms, their resistance and resilience potential, some behavioural aspects of their reproduction or nutrition and physiological features. Ecological traits are large-, intermediate- or micro-scale descriptors of spatial features of the habitat used by the taxa. Traits were resolved into multiple categories. The affinity of taxa for the different categories of a trait was described using a fuzzy coding procedure. We analysed the observed abundance-weighted trait composition of benthic communities at the site scale. We searched for stressor-type specific combinations of biological and ecological trait categories that would signal a given disturbance type and that could be used at the site scale to assess river condition. Such trait combinations support a statistical design that allocates a given site to a given surface water status quality class taking into account both biological and ecological attributes of its invertebrate community. 84.5 % of sites in the test dataset were correctly classified into the surface water status categories using combinations of trait modalities; the percentage of correctly classified sites ranging from 70.6% for "good" to 95.5% for "reference" sites. Such results were not statistically different from those obtained with the development data set. These results highlight the assessment tool's ability to evaluate surface water status of European rivers. Further testing and refinement is envisaged to test and improve the statistical procedure including (i) improving the tool's relevance with additional tested sites, (ii) enlarging the scope of the stream types, and (iii) extending it at a larger spatial scale.

Influence of environmental factors on growth rate of zebra mussel (*Dreissena polymorpha*) in small manmade water bodies in the Central Moravia (Czech Republic)

Ivona UVÍROVÁ, Vladimír UVÍRA, Evzen TOSENOVSKÝ, Alena VLÁČILOVÁ

Palacký University, Department of Zoology, Faculty of Science, 77146 Olomouc - Czech Republic

A number of manmade water bodies in the Central Moravia have been invaded by zebra mussel during last decade. It concerns especially sand-gravel pits in the catchment of the Morava River and flooded quarries. These water bodies are often used for recreational activities (fishing, diving, water sports, etc.) which are also the main vectors of zebra mussel spreading. Among natural factors, floods play the crucial role in spreading of this invasive species. We have studied the growth of individuals against selected abiotic parameters (temperature, pH, conductivity, nutrients, Ca^{2+} and others) and the food offer (chlorophyll *a*, TOC) on three different localities: 1) the old shallow sand-gravel pit with a large littoral; 2) deep stratified sand-gravel pit with the current sand-gravel mining and drinking water pumping; 3) flooded quarry without a littoral. We have measured growth rate of young individuals zebra mussel put into experimental hampers. Hampers were installed in the depth of 2 - 9 m using diving equipment and exposed for three years there. Hampers were taken out three-times a year and the length of shells was measured. Simultaneously, water from all observed depth levels was sampled for the analysis of abiotic parameters and food offer quantification. The growth rate differs in the individual localities depending on the food offer and water temperature. While the growth rate is directly dependent on the TOC amount in shallow water, it is inhibited by low water temperature at the bottom of the stratified lakes. In the shallow sand-gravel pit in the depth of 2 m ($\text{TOC} = 4.1 \text{ mg L}^{-1}$), the increment of individuals reached 10 mm in average after the first year. In the same depth in the quarry ($\text{TOC} = 1.5 \text{ mg L}^{-1}$), the average increment was only 1.5 mm. In the deep stratified sand-gravel pit, the growth rate of individuals varied considerably depending on the water depth, in spite of the fact that similar TOC values were detected across the whole water column: in the depth of 9 m the increments reached the half (3.2 mm) of those measured in the depth of 2 m (6.5 mm).

Structural and functional indicators in Water Framework Directive assessment methods

Wouter VAN DE BUND, Angelo SOLIMINI

EC Joint Reserach Centre Institute of Environemnt and Sustainability, 21030 Ispra (VA) - Italy

The Water Framework Directive (WFD) defines ecological status as 'an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters'. Almost all EU Member States have now established monitoring and assessment methods for the ecological status of rivers for at least some of the 'quality elements' prescribed by the WFD. Especially methods based on benthic macroinvertebrates are relatively advanced. However, they are to a large extent based on methods that were developed long before the WFD became operational, with a focus on structural rather than functional parameters. An overview of macroinvertebrate methods used in the different Member States was made based on the descriptions in the reports of he WFD intercalibration exercise and other available sources. In most cases these methods are solely based on community structure, with a variety of metrics being calculated from the relative abundance of the different taxa. If ecosystem functioning is addressed, this is done only indirectly through indicator taxa or functional groups. The need and possibilities for including in the monitoring programmes indicators that more directly assess ecosystem functioning are evaluated, taking into account the requirements of the WFD.

Longevity of sexual and asexual females of *Eucypris virens* (Crustacea: Ostracoda) in the presence and absence of males

Jochen VANDEKERKHOVE^{1*}, Tadeusz NAMIOTKO¹, Francesc MEZQUITA², Giampaolo ROSSETTI³

¹ -Department of Genetics and Cytology, University of Gdansk, 80822 Gdansk - Poland

² -Department of Microbiology and Ecology, University of València, 46100 Valencia - Spain

³ -Department of Environmental Sciences, University of Parma, 43100 Parma - Italy

Males of several species transfer along with spermatozoa seminal fluids or pellets that increase the short-term fecundity of females, at the expense of their lifespan. In other species, where males benefit from the lifelong reproductive success of females due to their capacity to store sperms, this trade-off is absent. Males of the geographic parthenogen *Eucypris virens* (Jurine, 1920) are known to produce exceptionally large sperms, which can be stored in the female receptacle for at least several weeks. In this study sexual and parthenogenetic females, each from three populations, were kept without food in the presence and absence of a male until they died. On average, sexual females survived longer than parthenogenetic females (179 hours vs. 161 hours), and they had a five times higher probability of being observed mating. The survival curves and the scatterplot of the survival time as a function of the probability of mating provide no support for any effect of males on the longevity of *E. virens* females. This suggests that parthenogenetic females do not benefit directly from erroneous matings in ponds with a mixture of parthenogenetic and sexual lineages. Still, it is possible that in these ponds parthenogenetic females have a competitive advantage because non-selective mating may result in sperm limitation for the sexual population.

Seasonal dynamics of *Planktothrix rubescens* and toxin production in lake Albano (Rome, Italy)

Emanuela VIAGGIU¹, Neil T.W. ELLWOOD², Rosario MOSELLO³, Renato FUNICELLO³, Patrizia ALBERTANO¹

¹ -Università degli Studi di Roma "Tor Vergata" - Dipartimento di Biologia, 00133 Roma - Italia

² -Università Roma Tre, Dipartimento di Scienze Geologiche, 00146 Roma - Italia

³ -CNR Istituto per lo Studio degli Ecosistemi, 28922 Verbania-Pallanza - Italia

The meromictic Lake Albano is situated in the Colli Albani Volcano 25 km southeast of the city of Rome. Physico-chemical measurements and analyses of water were made at discrete depth intervals across an almost full depth profile of the lake (0-160m) from May 2005 to August 2006. Analyses of phytoplankton peptides were made on net samples using MALDI-TOF mass spectrometry. For toxin identification, sampling was made on eight occasions between July 2005 and August 2006 to incorporate a complete seasonal cycle. Measurement of photosynthetic activity (using Pulse-Amplitude Modulated fluorometry) and pigment contents were made to evaluate the acclimation mechanisms of the phytoplankton community. Morphometric analyses of cells and filaments of *Planktothrix rubescens* (DC ex Gom.) Anagn. et Kom. (= *Oscillatoria rubescens*) were done to observe seasonal variation. The lake is classified meso-eutrophic, based on average epilimnion values of total phosphorus ($48 \mu\text{g L}^{-1}$), total nitrogen ($523 \mu\text{g L}^{-1}$) and chlorophyll *a* ($3\text{-}22 \mu\text{g L}^{-1}$). Observations and counts were made on samples collected between 0 and 30m. *P. rubescens* was normally the dominant species with maximum cell counts ranging from 107 to 0.6×10^6 cell L^{-1} . The distribution of cells was normally across a small depth range under thermal stratification. However, a highly unusual full overturn of the lake between January and March 2006 led to large changes in water quality and *P. rubescens* population dynamics. During this phenomenon there were large increases in epilimnetic nutrient concentrations concurring with decreases in oxygen, alkalinity and pH. There was also a large dispersal of the normally metalimnetic *P. rubescens* population and a subsequent decrease in the size of the population. This coincided with a succession of replacement dominant phytoplankton. There was an increase in photosynthetic activity and efficiency; this was probably due to an abundance of cyanobacteria (*P. rubescens* in spring, *Aphanizomenon* sp. and *Anabaena* sp. in summer 2006). Throughout the study period three variants of microcystin were identified, MCYST-RR was present in all five samples, whilst the variants, (Asp)-MCYST-LR and MCYST-YR, were absent in autumn.

Impact of pesticides (Diuron and Azoxystrobin) on microbial aquatic biodiversity and functions. An experimental study

Aurelie VILLENEUVE¹, Agnès BOUCHEZ¹, Bernard MONTUELLE²

¹-INRA, 74200 Thonon les Bains - France

²-CEMAGREF, 69336 Lyon - France

Pesticide field applications could result in high concentrations of environmental pollutants and this is a common situation in streams flowing through vineyard watersheds. Periphytic microorganisms that develop in such streams could be affected, in term of functions and diversity.

Periphyton exposures to pesticides could (alter both population stability (resilience and resistance) and their contribution to the self depuration capacities of the stream.

Assessments of pesticide effects (Diuron and Azoxystrobin) were performed using natural periphytic communities growing on artificial substrate in outdoor artificial streams. Pesticide effects were studied at environmental concentrations and at different hydrological regimes. Effects on bacterial and phytobenthic diversity were evaluated by microscopy and Denaturing Gradient Gel Electrophoresis (DGGE) on rRNA 16S and 18S coding genes. Primary and bacterial production, nitrification, denitrification and respiration were measured in order to address pollutant impacts on periphyton functions.

Periphyton diversity was driven by hydrological regimes rather than by pollutant exposure. Neither Shannon diversity index, nor periphyton specific composition drastically changed following short- and medium term exposures to pesticides. However, pesticide exposures altered the functions of periphytic communities but these effects depended on current velocity, with higher impacts at lower current velocities.

Herbivory among algal mosaics in a chalk stream

H.M. VINCENT¹, J.F. MURPHY², A.M. MILNER¹, M.E. LEDGER

¹ -University of Birmingham, Edgbaston, B15 2TT Birmingham - UK

² -CEH Dorset, Winfrith Technology Centre, DT2 8ZD Dorchester - UK

In chalk streams, herbivorous invertebrates forage among patches of benthic algae with contrasting physiognomies. We observed two algal patch types in a lowland chalk stream in the UK: calcareous crusts dominated by the green alga *Gongrosira incrustans*, and filamentous strands predominantly of *Melosira varians*. This algal heterogeneity is a product of the interplay between biotic (e.g. succession) and abiotic (e.g. drought or flood) processes, with algal crusts dominating undisturbed habitat and algal strands exploiting frequently disturbed patches of stream bed. Grazer impacts among resource patches of contrasting structure are likely to vary strongly but have not been widely studied in the past. We investigated how invertebrate grazers affected the biomass (chlorophyll *a* and AFDM) and taxonomic composition of algae in each patch type. We predicted that grazers were likely to exert weaker effects on the robust crystalline structure of *Gongrosira* compared to more palatable strands. We used in-stream mesocosms in a randomised blocks design to quantify the interaction strength between six common grazers and benthic algae in each patch. Grazing by three gastropod molluscs (*Radix balthica*, *Theodoxus fluviatilis* and *Bithynia tentaculata*) and three mayfly taxa (*Baetis buceratus* gp, *Baetis scambus* gp and *Serratella ignita*) was compared on the two algal types. Grazing on strands was stronger than on crusts for some species. For example, the snail *Radix balthica* strongly depressed diatom strands but did not affect *Gongrosira*. However, *Bithynia tentaculata* reduced AFDM and increased densities of *Gongrosira incrustans*, suggesting *Bithynia* reduces the non-photosynthesising component of the layer, thereby stimulating algal growth. Mayfly grazing was weak on both patches. Our results reveal that for some herbivores, grazing intensity varies spatially depending on the architecture of algae assemblages in habitat patches. Since algal heterogeneity in our system is produced by patchy disturbance our data may indicate that altered disturbance regimes, arising through climate change or river regulation, may change the strength of species interactions in running waters.

Implications of temperature increase for the zooplankton of Lake Maggiore

Anna VISCONTI, Marina MANCA, Riccardo DE BERNARDI

CNR-Istituto Per lo Studio degli Ecosistemi, 28922 Pallanza (VB) - Italia

Global mean surface temperatures are increasing; all ecosystems will be affected to some extent by this global warming and there is much interest in predicting these effects. In freshwater ecosystems, the effects are thought to be fully comparable to those of eutrophication. We expect to observe an increase in population density and total biomass of zooplankton as a result of faster population growth.

Lake Maggiore provides a good opportunity to test the hypothesized eutrophication-like effect of climate warming: originally oligotrophic, the lake became mesotrophic. It then underwent re-oligotrophication during the mid-eighties and arrived at its present oligotrophic state. Recent exceptionally warm years (i.e. 2003, the warmest in the last hundred years) allow an analysis of zooplankton biomass and density accompanying temperature increase and a comparison between years with normal temperatures from the oligotrophic phase and years representative of the mesotrophic period.

A sharp increase in density and biomass was observed in 2003. This resulted from an increase in Cladocera, particularly *Daphnia*, which reached values fully comparable to those recorded during the mesotrophic phase. These values were exceptional compared to those typical of the most recent period, after re-oligotrophication.

The increase in *Daphnia* was accompanied by a decrease in the colonial rotifer *Conochilus unicornis hippocrepis*, which had replaced *Daphnia* during lake re-oligotrophication. The seasonal increase in *Daphnia* also had a noticeable impact on water transparency, suggesting a control of phytoplankton growth. *Daphnia* density increase in 2003 appeared consequent to an earlier start of the population growth, which is consistent with the direct effects of earlier water warming. *Daphnia* increase was also accompanied by a rise in standardized egg number, probably mediated by increased food availability.

Zooplankton yearly density and biomass in 2003 seem comparable to the values recorded during mesotrophy, confirming the hypothesis that increased temperature will have similar effects to eutrophication. However, seasonal trends, characterized by an earlier start of population growth, are consistent with the effects of water temperature increase, as observed in laboratory experiments on *Daphnia* reproductive and growth strategies.

A biological relevant habitat index derived of the River Habitat Survey for portuguese running waters

Rui Manuel Vitor CORTES, Simone VARANDAS OLIVEIRA, Marco MAGALHÃES, Samantha Jane HUGHES

Universidade de Trás-os-Montes e Alto Douro, 5001-801 Vila Real - Portugal

In comparison with biomonitoring, the evaluation of physical habitat is a relatively young discipline which needs to be better developed to be profitable for river management. However, even if substantial new procedures have been developed during last decade, for the habitat assessment to be meaningful the physical features assessed must be also biologically important. The objective of the present work relied first on testing the ability of the River Habitat Survey (RHS) to discriminate sites along gradients of perturbation and to determine its relation to typological and environmental stressors. Besides, it was conducted a biological validation of RHS parameters independently trough fishes and invertebrates with two objectives to detect the most relevant physical features responsible for the composition and structure of the aquatic communities. Using a set of near 400 sites distributed all over Portugal and including a wide range of stream orders, from pristine areas to highly disturbed ones, which data was treated by multivariate analyses, it was possible to conclude for the handicaps of the RHS indices in separating reference from disturbed sites. It was evident that the habitat descriptors were more related to the fish community than to benthic fauna, which is a consequence of the different sampling strategy for each community. Further, multiple regressions, performed on the base of the aggregation of the original RHS variables, allowed to select the most relevant habitat descriptors to assess disturbance, after extracting redundance and dependence on the typological factors. This allowed to define a new general index, where features associated to land use are the most represented ones, after attributing scores to those physical metrics. Besides constituting a simplification of the previous RHS methodology, requiring significant less field labour, this index is more sensitive to disturbance and may be extended to all the river types found in Portugal. Moreover, it were also created several sub-indices more specific to each river type.

The green beats the blue: allelopathy between *Monoraphidium minutum* and *Planktothrix agardhii*

Johan VANDE VOORDE¹, Maria Betânia G. SOUZA^{1,2}, Miquel LÜRLING², Petra VISSER¹, Hans MATTHIJS¹, Jef HUISMAN¹

¹ -Aquatic Microbiology, Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, 1018 WS Amsterdam - The Netherlands

² -Aquatic Ecology and Water Quality Management Group, Wageningen University, 6700 DD Wageningen - The Netherlands

Generally, blue-green algae are known as potentially toxic, not only to other phytoplankton species but also for humans. While investigating the competition between filamentous cyanobacteria and green algae, the allelopathic activity between *Planktothrix agardhii*, a causative agent of harmful algal blooms, and *Monoraphidium minutum*, a small chlorophyte, was examined. Unexpectedly, using two different types of bio-assays (agar diffusion and liquid culture) it was confirmed that *M. minutum* can affect the vitality of both a toxic and a non-toxic strain of *P. agardhii*, mainly influencing its photosynthesis. Thus, we suggest that this type of interaction should be included in competition models. In none of the experiments the growth or photosynthetic activity of the green algae was hampered due to cyanobacterial presence. As the experiments indicated that when brought in contact with the cyanobacteria, *M. minutum* produces substances toxic to *P. agardhii*, the results obtained in this research might lead to interesting future applications in the control of harmful algal blooms (HAB).

The role of testate amoebae in benthic microbial communities in lakes (Jura, France) : ecological and paleo-ecological studies

Adeline WALL¹, Michel MAGNY¹, Daniel GILBERT²

¹ -Université de Franche-Comté, Laboratoire de Chrono-écologie UMR CNRS 6565, 25030 Besançon - France

² -Université de Franche-Comté, Laboratoire de Biologie Environnementale, USC INRA EA 3184, 25211 Montbéliard - France

The aim of our studies, carried out in French lakes (Jura mountains), was (1) to assess the community structure of the different microbial groups, and particularly testate amoeba, in the benthos of two lakes (mesotrophic vs eutrophic) (2) to study the sub-fossil testate amoeba communities of sediments samples from a paleo-lake dating from the Lateglacial and the early Holocene periods (15 700 - 11 000 yr cal. BP). Our results show that present heterotrophic microbial communities are dominated by testate amoeba, possibly because these organisms are able to move easily on solid substrate and because their feeding preferences is well adapted to the trophic diversity existing in these milieus. In these conditions, testate amoeba seems to have a key role in the functioning of the microbial loop (organic matter vs Bacteria vs heterotrophic protists) in benthos.

In addition, our results show that many species of testate amoeba are present in the whole part of the benthos. The abundance of these species seems to be mainly explained by the amount of organic matter depositions and the dissolved oxygen concentration. Otherwise, the quality (or origin) of this organic matter (allochthonous vs autochthonous) could influence the testate amoeba diversity.

The paleo-ecological study suggests that the accumulation rates of testate amoebae were significantly higher in periods of moderate climate than in cold periods. Furthermore, the repartition of species in the different communities varies from a balanced structure in cooling periods to a more uneven community during warmer phases. These changes are attributed to an increase and a diversification of nutritive resources (i.e. allochthonous and autochthonous organic matters inputs) caused by both an increase in lake productivity and a development of the vegetation in the catchment during the most favourable climatic phases.

These whole results show that testate amoeba could be an efficient tool to study the functioning of both present and past lakes, and particularly the organic matter dynamic.

The IRESA Project: Can colonization success of *Chitala ornata*, an accidentally introduced exotic fish species, be predicted from the body-shape indices of stream fish assemblages in Sri Lanka?

Wasantha S. WELIANGE^{1,2}, P.P. Ajith PRASANTHA^{1,2}, Upali S. AMARASINGHE², Maria LEITCHFRIED³, Leopold FÜREDER¹

¹ -River Ecology and Invertebrate Biology, Institute of Ecology, University of Innsbruck, A-6020 Innsbruck, Austria

² -Department of Zoology, University of Kelaniya, Kelaniya 11600 - Sri Lanka

³ -Institute for Limnology of the Austrian Academy of Sciences, A-5310 Mondsee, Austria

The cooperative project between Austria and Sri Lanka “IRESA - Initiative of River Ecology in Sri Lanka: from Science to Application”, investigates fish populations in two streams each draining different climate zones. Yan Oya, a seasonal dry zone stream accommodates 18 indigenous fish species, 4 endemic and 2 exotic species. In Eswathu Oya, a perennial wet zone stream, which is a tributary to the Kelani Ganga and flows throughout the year with sudden fluctuations in discharge due to torrential rain, 12 indigenous, 8 endemic, and no exotic species occur. Little information is available on the ecological impact of introduced fish species on the local fish fauna in Sri Lanka. Gross Body shapes defined as P1 (= Height of the body/ Width of the body) and P2 (= Total length/ Height of the body) are known to be useful to predict food habits and the ecology of freshwater fish assemblages. The present analysis is based on the P1 and P2 values obtained from Sri Lankan freshwater fishes in two streams and *Chitala ornata*, an accidentally introduced exotic fish. Among the fishes that co-exist in Sri Lankan water bodies, carnivores have dorso-ventrally flattened slender, long-bodies (low P1 and higher P2) whereas herbivores have short, deep bodies (high P1 and low P2). The accidentally introduced *C. ornata*, which is a voracious piscivorous species, possesses a high P2 and low P1 indicating that this species represents an outlier in the P1 and P2 relationship of freshwater stream fish communities in Sri Lanka. It can therefore be predicted that being a carnivorous fish species, *C. ornata* can alter composition of freshwater fish communities of Sri Lanka when it is introduced to a freshwater habitat. Strict controlling measures are therefore needed to prevent range expansion of this invasive alien fish species in Sri Lankan freshwaters.

Biodiversity, ecosystem functioning and food webs in freshwaters: assembling the jigsaw puzzle

Guy WOODWARD

School of Biological and Chemical Sciences, Queen Mary University of London, UK

In recent years, ecologists have made dramatic advances in the study of biodiversity-ecosystem functioning (B-EF) relationships and food webs, and these two previously disparate disciplines are now starting to converge. Here, I provide an overview of some of the historical developments and breakthroughs in both fields, and how the study of freshwaters has informed the debate and opened up new avenues of research, as we move towards a more integrated approach to ecology. Freshwaters are, in many ways, fundamentally different from the terrestrial grasslands that have been the focus of most B-EF research to date. For instance, vertical "top-down" or "bottom up" interactions within the food web are often extremely important in freshwaters, whereas B-EF research has largely focussed on lateral competitive interactions. Also, primary production has been the primary B-EF response variable of interest, whereas in many freshwaters (e.g. headwater streams), decomposition of terrestrial detritus is the main energy input at the base of the food web. Freshwaters are now being used as model systems to test more general B-EF theory, and to address the shortcomings of previous approaches (e.g. the absence of trophic interactions). Food web research has also changed recently, with a shift in focus from exploring patterns (connectance) to developing an understanding of processes (fluxes of energy or biomass) and how the topology of these ecological networks influences their dynamics, and vice-versa. Freshwaters have been extremely influential in the evolution of this field of ecology: the best-characterised food webs are from freshwater ecosystems. The convergence of B-EF and food web research that is beginning to emerge in general ecology is particularly rapid in freshwater ecology, where some of the new ecological theories are now being tested empirically and experimentally. Examples of this include the application of metabolic theory and ecological stoichiometry to provide a new conceptual framework within which freshwater food webs are constrained by physical and chemical laws. The implicit links between B-EF relationships and food web properties also has implications for the supply of "goods and services" of socioeconomic value to humans, particularly in systems perturbed by environmental stressors (e.g. eutrophication, acidification, climate change).

Contrasting responses to catchment modification among a range of functional and structural indicators of river ecosystem health

Roger YOUNG¹, Kevin COLLIER²

¹ -*Cawthron Institute, Nelson - New Zealand*

² -*Environment Waikato, Hamilton - New Zealand*

In order to maintain or improve river ecosystem health, tools for assessing the current ecological state of river ecosystems are needed so the causes of poor health, or the success of rehabilitation efforts, can be measured. The tools traditionally used to measure river ecosystem health have concentrated on structural aspects of the ecosystem, such as community composition. The potential value of incorporating measurements of ecosystem processes/functions into regular monitoring programmes is increasingly being recognized, but we need a better understanding of the likely indicator responses to different types and degrees of impacts. We measured a range of potential functional (ecosystem metabolism, leaf decay, cotton strip tensile strength loss and wood decay) and structural (invertebrate community composition) indicators at 15 sites to compare responses across a gradient of agricultural/urban development in two river catchments in New Zealand. Rates of gross primary production increased throughout the gradient of impairment, while ecosystem respiration only increased at the most impaired sites. Cotton strip tensile strength loss also increased throughout the gradient of impairment and appeared to be related to warmer water temperatures. In contrast, leaf and wood decay was slower at the more impaired sites, possibly reflecting a lack of detritivorous invertebrates at these sites. The composition of invertebrate communities varied to some extent among sites but simple biotic indices did not clearly differentiate among sites or indicate a pattern of cumulative ecological stress. More complicated biotic indices incorporating community composition and abundance were more successful at indicating a gradient in river ecosystem health. Our results demonstrate that a range of responses to agricultural development can be expected depending on the types of functional or structural indicators that are used. An analysis of the relationship among the different indicators found relatively low levels of intercorrelation supporting the view that functional indicators are complementary to more traditional monitoring approaches and are providing additional information about the health of river ecosystems.

Too much water - too little water: precipitation extremes and their effects on the structure and function of the Elbe

Heike ZIMMERMANN-TIMM

Potsdam Institute for Climate Impact Research, 14467 Potsdam - Germany

Several widespread episodes of extreme precipitation or extreme lack of precipitation (often exacerbated by high temperature-driven evaporation) as well as some dramatic and high-impact floods and droughts have occurred in Europe in recent decades. Based on climate scenarios one may anticipate more severe problems of having too little or too much water in the future.

The impact of these extremes on the functionality of a large river was examined through the example of the structure and function of the plankton community of the large River Elbe. Plankton data from the last ten years and measured abiotic factors were considered for this study and helped in assessing the impact of too much and little water.

The retention time of the water, the habitat diversity / shoreline structure and connectivity / passability between water bodies is necessary for the reproduction and development of the plankton community. Besides this the importance of some abiotic factors, e.g. temperature, turbulence and turbidity, increases, dependent on the water availability.

It is known that plankton is an important food source for higher trophic levels, e.g. mussels, fish and water birds, and the water quality in the potamal of a river is defined by the functionality of the different riverine compartments.

The identification of the impacts of extremes is a necessary basis for making timely plans on adaptation arrangements.

Poster Presentations

Active and passive bio-indication of a pesticide contamination by *Gammarus fossarum* (K.)

O. ADAM, F. DEGIORGI, G. CRINI, P-M BADOT

University of Franche-Comte, Place Leclerc, 25000 Besançon - France

All over the world, wood from conifer trees is treated at different stages of production against fungal and beetle attacks by fungicides and/or insecticides. For historic reasons, sawmills dealing with coniferous wood are often established at basin heads, at the edge of particularly fragile streams. Previous studies have revealed a significant reduction of the piscicultural and macrobenthical communities downstream of these installations.

The crustacean *Gammarus fossarum* (K.) was retained as target organism because of its relative tolerance to pollution by organic matter and its high sensitivity to a wide range of toxic contaminants. Furthermore, its exclusively aquatic life cycle does not permit it to escape from intermittent toxic flows.

Densities and populations structures were assessed at several upstream and downstream sites of a wood treatment area using pyrethroid insecticides and triazole fungicides. These results were compared with information provide by exposure of gammarids in cages implanted in the river and by the levels of sediment contamination. Experiments were conducted before and after a rainfall event.

Density and population structures were strongly impacted from the wood treatment area to 2 km downstream, and no recovery was observed between downstream areas at both sampling periods. Nevertheless, *in situ* bioassays have revealed that higher mortality occurs a few hundred meters downstream of the wood treatment area.

This study provides further explications on differences occurring between ecotoxicological sensitivity obtained in (semi-)controlled conditions, e.g. *in situ* bio-assay, and field observations. Consequences of the impact dynamics observed on biological monitoring strategy is discussed.

Limnological assessment on the shallow Uluabat lake (Bursa, Turkey): plankton composition, benthic macroinvertebrates, chemical and physical variables

Nuray Emir AKBULUT¹, Aydın AKBULUT¹, Süphan KARAYTUĞ³, Kemal ÇELİK⁴, Nurhayat BARLAS¹, Serdar BAYARI², Alp ALPER⁴, Dursun ÖZATLI⁴, İlkay YILMAZ⁵

¹-Hacettepe University, Faculty of Science, Dept of Biology – Beytepe, Ankara, Turkey

²-Hacettepe University, Faculty of Engineering, Dept of Hydrogeology – Beytepe, Ankara, Turkey

³-Mersin University, Faculty of Science and Letters, Dept. of Biology – Mersin, Turkey

⁴-Balıkesir University, Faculty of Science and Letters, Dept. of Biology – Balıkesir, Turkey

⁵-Republic of Turkey, Ministry of National Education

Lake Uluabat is one of the RAMSAR site wetland which is under the threat of human activities such as drainage of irrigable lands and pollution from industrial, domestic and agricultural sources. The objective of this study was to investigate the distribution patterns and composition of zooplankton, phytoplankton, benthic macroinvertebrates considering the physical and chemical variables and heavy metals. Data were collected and analyzed from the shallow Lake Uluabat in the years 2001-2002. A total of 54 zooplankton species were identified; among these, 31 species belong to Rotifera, 13 to Copepoda, and 10 to Cladocera. A total of 191 phytoplankton species were identified: among these, 115 are Bacillariophyceae and 40 Chlorophyceae. Among benthic organisms, a total of 21 species and 8281 individuals from three stations were identified. Groups present in large numbers included Oligochaete (81%) and Chironomidae (18%), dominated by *Chironomus plumosus*. The highest number of individuals was observed in summer, while the lowest was observed in winter.

During the study, the chlorophyll *a* concentration ranged from 0.3 to 110.8 µg L⁻¹. Our results showed that phytoplankton and rotifers dominated in spring and early summer period while cladocerans and copepods became abundant in summer and fall periods. Multivariate ordination techniques were applied to investigate zooplankton and benthic macroinvertebrates seasonal and spatial distribution according to physical and chemical variables and heavy metals.

Impact of pesticide Cypermethrin and fish kairomone on the life history traits of *Daphnia pulex*

Sara Banu AKKAS, Gizem BEZIRCI, Meryem BEKLIOGLU

Biology Department, Middle East Technical University, İnönü Bulvarı, 06531 Ankara - Turkey

In freshwaters *Daphnia*, which help increasing water clarity due to its high grazing pressure and water filtration capacity, are fundamental for the conservation of aquatic biodiversity. In lake ecosystems, predation pressure and exposure to agricultural pesticides are among the most important factors affecting the *Daphnia* population. Therefore, the investigation of the adaptations of *Daphnia* under the combined influence of fish predation pressure and insecticides provides a new and more realistic ecological approach to the traditional toxicological approach because pesticides shown to disturb natural chemical communication significantly and thus pose an ecological risk. One of the commonly used pesticides in recent years in Turkey is the synthetic pyrethroid insecticide cypermethrin. The survival of the *Daphnia pulex* individuals exposed to cypermethrin levels between 0.01-5.00 $\mu\text{g L}^{-1}$ in the acute toxicity experiment indicated that these species might be more sensitive to cypermethrin in the presence of the fish kairomone, which was mimicked by fish kairomone. The chronic toxicity experiments, which were carried out at very low doses (ng L⁻¹), suggested that there might be a trade-off between survival and reproduction, especially in the presence of fish predation pressure. These effects of cypermethrin in the presence and absence of fish predation pressure on *Daphnia* are discussed from an ecological perspective.

Phytoplankton development and its relationships with zooplankton and environmental parameters in the Büyükçekmece reservoir, Turkey

Yelda AKTAN, Hacer OKGERMAN, Cenk GÜREVIN, Zeynep DORAK, Reyhan AKÇAALAN

Istanbul University, Fisheries Faculty, Ordu, 34470 Istanbul - Turkey

The aim of this study was to determine the qualitative and quantitative characteristics of phytoplankton and zooplankton community structure and the environmental factors that effect its distribution and the changes and to determine the growth of toxic species in Büyükçekmece Reservoir, which is used as a drinking water source.

The water samples were collected between June 2004 and May 2005 from the six sampling sites from surface and different depths. During the study period, some physical and chemical parameters were measured and plankton community structure was determined. Phytoplankton densities were calculated as cells L⁻¹, biomass was estimated by biovolumes and chlorophyll *a* content. Changes in phytoplankton and zooplankton dynamics were also examined using Shannon-Wiener diversity index.

A total of 132 taxa from seven algal classes, Bacillariophyta, Chlorophyta, Cyanophyta, Euglenophyta, Chrysophyta, Cryptophyta and Dinophyta were determined in Büyükçekmece Reservoir. Bacillariophyta were recorded the most important group in terms of species number. However, Cryptophyta, represented only three species, was dominant in terms of density and biomass. In the structure of zooplankton, 56 species of Rotatoria were determined, 8 species of Cladocera, 6 species of Copepoda. In the lake, *Keratella cochlearis* was the most abundant among rotifers, *Bosmina longirostris* among cladocerans and *Cyclops abyssorum* among copepods. Phytoplankton and zooplankton community structure were correlated to the environmental variables in the lake, but switching in dominant taxa of phytoplankton was not observed along time.

Findings showed that reservoir has a mesotrophic character. However, intensive cryptophytes (mainly *Plagioselmis* sp.) development in phytoplankton and species of Brachionidae, *Lepadella patella*, *Euclanis dilatata*, *Trichocerca* sp., *Pompholyx sulcata*, *Keratella quadrata*, *Filinia longiseta*, which were determined in low quantities in zooplankton have showed that the lake could show an eutrophic character hereafter. In addition, *Microcystis viridis*, recognized as one of common toxic bloom forming cyanobacteria all over the world, was recorded at Station 5 on Büyükçekmece Reservoir and at Station 6 (Karasu River). Microcystin was not detected in Büyükçekmece Reservoir and Karasu River. *Microcystis* cells isolated from the Reservoir was cultured and microcystin was detected by HPLC. According to these results, present microcystin concentration in the lake, which is used as a drinking water source, is not a risk for people health. However, it might represent a threat in future provided an increase of density of this species, which is found in the phytoplankton of the reservoir

New records of the australasian copepod *Boeckella triarticulata* (Copepoda, Calanoida, Centropagidae) in Italy

Giuseppe ALFONSO, Salvatore MOSCATELLO, Genuario BELMONTE

University of Salento, Lecce - Italy

Boeckella triarticulata (Copepoda, Calanoida, Centropagidae) was found in 3 artificial lakes of Southern Italy: Rendina, Lampeggiano (both in the Ofanto river basin, tributary to the Adriatic Sea), and Serra del Corvo (Bradano river basin, tributary to the Ionian Sea). The lakes have a surface ranging from about 300 to 1,250 ha and a depth ranging from 5 to 11 m. Two of them are drained during winter. They are all artificial and of recent realization (younger than 15 years). Hence the species was not there before 1992.

This australasian copepod has been already reported (even not abundant) from Northern Italy in artificial ponds and along the Po river in the last 20 years. Contrary to the hypothesis of a localized rooting, formulated by first authors, the present record allows to hypothesize a larger geographic distribution of this species in the Peninsular Italy.

B. triarticulata is the dominant species in autumn Rendina zooplankton, where it is absent during winter. Waiting for molecular analysis to state the genetic relationships of the South Italy population, a detailed study on the morphology has been conducted.

Species diversity and community structure of the zooplankton in eutrophic Lagoon Lake Köyceğiz- Muğla- Turkey

Ahmet ALTINDAG, Sibel YIGIT, Murat KAYA

Ankara University, Faculty of Science, Department of Biology, Tandogan, Ankara, Turkey

In this study, the zooplankton diversity and community structure of Köyceğiz Lake, which is undergoing gradual eutrophication was studied. Köyceğiz Lake was established as a specially protected by the Turkish Ministry Council in 1988. The lake level is approximately that of Mediterranean Sea. The Lake water is brackish particularly after periods of high evaporation when marine water may penetrate the channel and Lake system easily. The length of lake is 12 km. The maximum depth is about 30 m. Zooplankton samples were collected from Köyceğiz Lake between January – November 2006. It was found that the zooplankton diversity was dominated by Rotifera. Rotifers respond more quickly to environmental changes than Cladocera and Copepoda species, and appear to be sensitive indicators of changes in water quality. In this study, fifty zooplankton species were identified, 43 belonging to Rotifera, 3 to Copepoda and 4 to Cladocera. The dominant rotifer species of the Köyceğiz Lake were *Brachionus plicatilis*, *Keratella quadrata*, *Filinia terminalis*, *Synchaeta oblonga*, *Hexarthra fennica*, dominant Cladoceran species of the lake were *Diaphanosoma brachyurum*, *Podon* sp. – dominant Copepod species was *Calanipeda aquaedulcis*. Among to rotifer species *Macrochaetus altimirai* is the new record for Turkey.

According to results of the study, rotifer species diversity was increased last 10 years. In addition, some physical and chemical parameters of the lake water were also measured.

Macrophyte colonization and their associated macroinvertebrates in the lower Ebro river

Rosa ANDREU¹, Carles IBAÑEZ¹, Narcís PRAT²

¹ -Acuatic Ecosystem Unit. IRTA, Ctra. Poble Nou s/n, 43540 Sant Carles de la Ràpita - Spain

² -Ecology Department, Barcelona University, Av. Diagonal 645, 08028 Barcelona - Spain

The lower part of the river has suffered significant changes in the last years. In past decades the lower Ebro was dominated by phytoplankton due to eutrophication. However, nowadays macrophytes are the most important primary producers, due to an increase in water transparency. *Potamogeton pectinatus* is the predominant species, colonizing high flow zones where other macrophytes can not live. The high density of this macrophyte has caused the increase of dwelling macroinvertebrates, among which the black flies (*Simulium erythrocephalum*) have increased dramatically in the last years. This species has caused serious problems to humans living near the river due to its biting. Macrophytes are also changing benthic habitats and this can have consequences for species like the protected freshwater mussel *Margaritifera auricularia* and the mayfly *Ephoron virgo*. The Ebro river is non-wadeable, and water speed can vary from 0 to 2.5 m s⁻¹, being the most frequent around 0.5-1.5m s⁻¹. The major part of the river is lotic and water speed is a sampling restriction. The purpose of this study was to describe and analyze the community of this new habitat using a reliable sampling method. None of the already existing sampling methods (like nets, boxes, etc) were suitable for dwelling macroinvertebrates on macrophytes in this area, mainly due to the high water velocity. Using a modified dredge, macrophyte samples were taken at five reaches of 2 km, divided in three transects with three sampling points in each one. The composition and abundance of the macroinvertebrate community was obtained. A patchy distribution of macroinvertebrates was found, that could be due to the method used or to local differences between sampled points. In order to estimate the individuals or taxa lost because of the method we took some samples with a hand net and with the dredge in different areas. The dredge method is suitable in running waters, but in standing waters Coleoptera and Heteroptera are underestimated. Nevertheless the macroinvertebrate diversity found in the samples show that this is a good method where high flow is an important sampling limitation.

Spring dynamic of Transparent Exopolymeric Particles (TEP) in two lakes of the Massif Central of France

Mohamad Bashir ARNOUS, Jean-François CARRIAS

Laboratoire de Biologie des Protistes, UMR CNRS 6023, Les Cézeaux, 63177 Aubière - France

Transparent exopolymer particles (TEP) are important components in the turnover, decomposition and sinking flux of both organic and inorganic matter and elements in aquatic ecosystems. Moreover, these polysaccharidic particles can provide favorable and specialized sites for the development of bacteria. In addition, these microaggregates and the associated-bacteria can be used as food by protozoa, micro-zooplankton, and even fish larvae. Freshwater TEP was studied in two French lakes of different trophic status during spring 2006. Abundance, distribution, size spectra and bacterial colonization of the particles were examined in the epi-, meta- and hypolimnion of the eutrophic Lake Aydat and the oligomesotrophic Lake Pavin situated in the Massif Central of France. Relationships between TEP and phytoplankton, zooplankton and protozoa were also investigated. The abundance of these particles, according to microscopic and colorimetric estimates, were high (average: 3.6×10^6 particles L^{-1} and 6.7×10^5 particles L^{-1} for the Lakes Aydat and Pavin respectively) and values increase significantly with the trophic level. The density of TEP is strongly related to the development of the phytoplankton and particularly diatoms. 98.2% of the particles were colonized by bacteria. Attached bacteria increase with trophic level but bacterial density per surface area of the particles is higher in the oligotrophic lake (averages: 0.23 bacteria. μm^{-2} in Lake Aydat and 0.32 bacteria. μm^{-2} in Lake Pavin). The distribution of nanoflagellates and picophytoplankton is slightly related to the distribution of the particles and that of bacteria. Finally, our results indicate that TEP play an important ecological role, in a direct or indirect way, within the microbial food web of the two lakes.

Application of natural resources of Cladocera in South Caspian Sea Aquaculture (North of Iran)

Hasan ASLANPARVIZ¹, Abbasali Aghaie MOGHADDAM²

¹ -Gorgan university, Beheshty, 386-49 Gorgan - IRAN

² -Fisheries of Golestan, Shahid Shekari, Gorgan - IRAN

In Iran, aquaculture activities have been started since 1970s, so have no long background. One of the valued live foods in the aquaculture is Cladocerans, especially genus *Moina* and *Daphnia*. At the beginning of breeding season, aquaculture managers need to find natural resources to start artificial propagation and breeding of Cladocera. In Iran, recent investigations revealed that there were many problems in this case. One of these is degradation of habitats of Cladocera including lakes, wetlands and reservoirs due to anthropogenic effects. So, effectiveness and efficiency of aquaculture industries and subsequently enhancement of sturgeons stocks, which their stocks declined sharply in last decade, indirectly based on inland waters quality. In this study, therefore, assessment of the combination of inland-water ecosystems, live food resources and aquaculture effectiveness will be discussed more in-depth.

Mediterranean temporary pools and the *Isoeto-Nanojuncetea* communities in Sicily.

Giuseppe BAIAMONTE, Rosario SCHICCHI

Dipartimento di Scienze Botaniche dell'Università, Via Archirafi, 28 – 90123 Palermo

Due to climatic and edaphic conditions, ephemeral wetlands are widespread in Sicily. In the last years, a large amount of data regarding the plant assemblages present in these areas has been collected, paying special attention to floristic, vegetational and ecological aspects. From the syntaxonomical point of view, those communities are generally ascribed to the *Isoeto-Nanojuncetea* class. Many associations, like *Pulicario-Scirpetum savii*, *Isoeto-Ranunculetum parviflori*, *Crassulo-Elatinetum gussonei*, *Ranunculo-Antinorietum insularis*, *Myosuro-Ranunculetum lateriflori*, *Coronopo-Sisimbrillietum dentatae*, are exclusively present in Sicily, often in one or in a few sites. Those habitats shelter endemic, isolated and very rare taxa like *Cicendia filiformis* (L.) Delabre, *Damasonium polyspermum* Cosson, *Elatine gussonei* Sommier, *Molineriella minuta* (L.) Rouy, *Myosurus minimus* L., *Ranunculus parviflorus* L., *Sisymbriella dentata* (L.) O. E. Schulz, which are extremely important in a geobotanic perspective and often endangered. Their survival depends on the existence of those sites which switch every year from the littoral to the terrestrial phase (inundation-desiccation).

Most of the studied temporary ponds already fall into protected areas (Natural Parks and Reserves). Nonetheless, these assemblages are often poor from a floristic point of view and in regression, since specific management and protection guidelines are missing. Even worse, the adoption of inadequate measures may totally destroy these habitats. In particular, the implementation of the strategies used successfully in North-European countries is not suitable for Mediterranean temporary pools, mainly because their transformation into permanent basins would result in the disappearance of annual and dwarf perennial ephemeral isoetid and ciperoid communities. Moreover, the directive 79/409/CEE, which has the purpose of protecting birds and their habitats, allowed the creation of permanent ponds, but in some cases to the detriment of ephemeral wetlands already present in the same area, therefore causing a loss of biodiversity. Temporary pools have a scattered distribution and cover small surfaces, hence are easy to destroy. Hydrological characteristics and low productivity (summer drought, few nutrients) are the most important factors for the conservation of the species and peculiar communities present in ephemeral wetlands. Often human activities have a strong impact on the conservation of the biodiversity which they host, either because of damage leading to the direct destruction of pools (urbanisation, infilling, etc.), or because of perturbation (partial drainage, pollution, etc.) which alters their ecological functioning.

Ecological problems in the shallow eutrophic Latvian lakes

Maija BALODE¹, Ieva BARDA¹, Ingrida PURINA²

¹ -University of Latvia, Faculty of Biology, Department of Hydrobiology, Riga - Latvia

² -Latvian Institute of Aquatic Ecology, Department of Experimental Hydrobiology, Riga - Latvia

Ecotoxicological studies were performed in 4 eutrophic - hypertrophic Latvian lakes. Investigated lakes (the Lake Lielais Baltezers, Mazais Baltezers, Langstinu, Babelitis) are located near the capital of Latvia and widely used for recreation, fishing activities and also as drinking water source for Riga City (the Lake Mazais Baltezers). Due to the strong anthropogenic impact, intensive blooms of potentially toxic cyanobacteria are observed in the studied lakes every summer. In this study we attempted to quantify the concentrations of hepatotoxins in different stages of cyanobacterial blooms. The presence of hepatotoxins was detected by enzyme linked immunosorbent assay (ELISA). The most frequently occurring cyanobacterial species in all lakes were *Microcystis* spp., *Anabaena* spp. and *Aphanizomenon flos-aquae*. The highest concentrations of microcystins were observed in the lakes Mazais Baltezers and Lielais Baltezers, ranging from 0.3-10.9 $\mu\text{g L}^{-1}$ during the maximum of the cyanobacterial bloom. The toxin concentrations showed high inter-annual variation. Nevertheless the cyanobacterial biomass was mainly composed of potentially toxic species, it didn't significantly correlate with microcystins concentrations, what could be explained with the presence of other cyanobacterial toxins. High concentrations of microcystins (often exceeding 2mg L⁻¹) and possible presence of other algal toxins in the lakes suggest that more public attention should be paid to this problem and regular monitoring of harmful algae and algal toxins must be invented.

***Salmo trutta marmoratus* in the Adige river basin: a genetic, phenotypic and ecological study aimed at its conservation**

Francesca BARALDI, Andrea GANDOLFI

Istituto Agrario San Michele all'Adige, Centro Sperimentale, via E. Mach 1, 38010 Trento - Italy

The *Salmo trutta* species complex, widely distributed in Europe, North Africa and Western Asia, is made up of a heterogeneous mosaic of different phenotypic forms, comprising diverse geographic morphae, and is characterized by considerable morphological diversity and life history variation. The marble trout is considered to be a subspecies of *S. trutta* by some authors, while it is regarded as a true species by others. Even though its exact taxonomic definition is debated, the marble trout can surely be defined as an independent and well characterized evolutionary lineage and for these reasons considered to be worthy of status as a "conservation unit".

The main risk for the survival of the taxon is represented from massive and repeated *S. trutta m. fario* stocking practices, putting at risk the marble trout's genetic integrity, food competition and pathology diffusion. Anthropogenic alterations of water courses, the excessive water exploitation and the high fishing pressure are also factors that negatively affect the survival of the taxon.

The aims of the study are: 1) to find, along the entire Adige basin, the residual components of native marble trout populations; 2) to restore, in quantitative and qualitative terms, such populations; 3) to define and protect suitable environments, in particular for the reproductive stages, to support a self-maintaining population.

A genotypic and phenotypic analysis approach and an ecological study of the environment will enable evaluation of the degree of 'purity' of each individual and to identify the characteristics of either similarity or uniqueness of the different populations. This is necessary for implementing a sustainable management plan, aimed at the taxon conservation.

Macroinvertebrate ecology and conservation in temporary and permanent ponds in Central Italy

Marcello BAZZANTI¹, Valentina DELLA BELLA², Francesco GREZZI¹, Cristina COCCIA¹

¹ - Department of Animal and Human Biology, University "La Sapienza", 00185 Rome - Italy

² - Department of Environment and Primary Prevention, National Institute of Health, 00161 Rome - Italy

The small size of ponds has made them highly vulnerable to increasing human activities (e.g. urbanization and agricultural practices), which in recent years have been responsible for a sharp decline in the number of small lentic water bodies and especially temporary ponds. Macroinvertebrate communities of 58 (35 temporary and 23 permanent) ponds located in four protected areas along the Tyrrhenian coast near Rome (central Italy) were studied from 1995 to 2005 to evaluate the faunistic differences between the temporary and permanent ponds, and their species richness and distribution related to the two pond typologies. The presence of rare and threatened species for conservation purposes of these small wetlands was also highlighted. A total of more than 300 taxa (more than 70% identified to species level) belonging to 21 high zoological groups was collected during the studies. The insects were the most diversified group (more than 80% of the total taxa richness) and were dominated by coleopterans and dipterans. Our results showed clear differences between temporary and permanent ponds, which both contained a high number of taxa, with the permanent biotopes showing higher number than temporary ones. Moreover, both temporary and permanent ponds contained rare or threatened species, which increase their conservation value, suggesting that both pond types and all microhabitats/mesohabitats therein should be considered in order to obtain a correct evaluation of pond conservation value. Because of their high taxonomic richness, the studied ponds play an important role as "reservoirs" of species for neighbouring aquatic biotopes less or more impacted by anthropogenic activities.

Steady-state phytoplankton community during thermal stratification in a subtropical reservoir.

Vanessa BECKER^{1,2}, Vera L. M. HUSZAR²

¹ -Universitat de Barcelona, Barcelona, Spain

² -Museu Nacional/ UFRJ – Rio de Janeiro, Brazil

Equilibrium and non-equilibrium hypothesis have often been used to explain community ecology. For the steady states phytoplankton community conditions are expected to be more likely in deep lakes than in shallow mixed ones. Most of them occur in a long-living stability of the water column due to particular conditions, like permanent stratification or constant mixing. We studied the phytoplankton seasonal succession in Faxinal Reservoir (South of Brazil) through weekly surface sampling. It is a subtropical deep, clear, warm monomictic and slightly eutrophic reservoir (epilimnion annual mean of total phosphorus=0.92 μM and chlorophyll *a* 15 $\mu\text{g.L}^{-1}$). Following the equilibrium phase criteria (two or three coexisting species, contributing to 80% of the total biomass, for at least 2 weeks), three periods of phytoplankton steady state have been identified, all of them during stratification. Physical structure (hydrology, temperature and light), nutrient availability and grazing pressure are the most important factors driving the phytoplankton biomass and composition. The main factor of persistence and maintained the steady-state was stratification. As a consequence, low nutrients and clear system were observed during these phases. Each phase of steady state was dominated by different species. During five weeks in the summer 2004, more than 80% of the total biomass was dominated by *Anabaena crassa*, with low changes in biomass and low diversity. During the fall, another steady state was observed, but with a colonial green algae dominance, *Nephrocytium* sp. during three weeks. Unexpectedly, high species richness and diversity were observed. Another steady state was observed during the spring, when the reservoir was starting to stratify, after a mixing period. *Asterionella formosa*, a colonial diatom, dominated during five weeks, despite a slightly variable biomass. Biomass and diversity were significantly different (ANOVA tests) between steady and non-steady states. In our research we can recognize the steady states in the phytoplankton assemblage, maintained during the stratification period. However, the expected equilibrium with consistent reduction of diversity and species richness was not always been observed. Dominance phase of green algae presented high diversity and high richness, opposed pattern observed in the periods with dominance by blue-greens and diatoms.

A preliminary assessment of the effect of a dam water release on invertebrate community structure

Nouria BELAIDI¹, Amina TALEB¹, James GAGNEUR²

¹-Biology Dpt, University of Tlemcen - Tlemcen, Algeria.

²-UMR LADYBIO, University Paul Sabatier - Toulouse Cedex 4, France.

This preliminary study (September 1998- April 2001) describes the effects of release reservoir water on benthic macro-invertebrate and hyporheic community structure.

The invertebrate assemblages of the Tafna wadi (N-W Algeria) were studied during two hydrological periods (natural high water, and reservoir water releases), below the site of the polluted hammam boughrara reservoir. Investigations on the hyporheos and benthos of this stream have allowed the comparison of densities, taxa richness and diversity by analysis of variance

The stations influenced by the dams showed lower values, but with a gradual trend towards recovery downstream from the dam.

Correspondances analysis showed that the major differences between the study sites were related to longitudinal position in the river. The second ordination axis could be related to seasonal changes in the fauna. Variations in the pattern of axis 2 scores at sites downstream of the dam site suggested continuing changes in the community at these sites. Possibly due to increases in the density of species favoured by sediment deposition

Logging-induced variations in doc affect yellow perch recruitment in Canadian shield lakes

Andrea BERTOLO and Pierre MAGNAN

Département de Chimie-Biologie, Université du Québec à Trois-Rivières - Trois-Rivières (Québec) Canada

There is an increasing interest on the effects of allochthonous carbon on lake food webs. By temporarily increasing levels of dissolved organic carbon (DOC) in lakes, logging can help us understand how carbon from the watershed could affect lake biota. The goals of this study were to determine (i) if logging has a significant effect on the abundance of young-of-the-year (YOY) yellow perch (*Perca flavescens*) in Canadian Shield lakes and (ii) if any changes in yellow perch recruitment could be related to increases in nutrients (N and P) and (or) DOC following logging. To do this, we examined 22 Canadian Shield lakes; the watersheds of 12 were not impacted while 10 underwent logging (1-78% of the watershed area). We found that the relative abundance of YOY yellow perch increased after logging in proportion to the ratio between the area of the logged watershed and the lake volume. We show that this effect is likely explained by an increase in DOC following logging. This might be related to (i) an increase in secondary productivity due to a positive effect of terrestrial carbon on the microbial loop and (or) (ii) an increased hatching success due to a greater protection from UV by DOC.

Effects of salinity and fish predation pressure on *Daphnia pulex* life history traits

Gizem BEZIRCI¹, Banu AKKAS¹, Meryem BEKLIOGLU¹, Feriha YILDIRIM²

¹ -Middle East Technical University, İnönü Bulvarı, 06531 Ankara - Turkey

² -Healthcare Services Vocational College, Gazi University, Golbasi, 06500 Ankara - Turkey

In the 21st century, it is anticipated that climate change will affect hydrology of freshwater ecosystems profoundly. As a result of global warming, evaporation is expected to increase by about 10% in the most likely scenario of a global 2 °C temperature increase associated with decreased precipitation especially in dry regions. Under such hydrological conditions, salinity levels are expected to increase in freshwaters. This increase in the salinity levels are expected to alter the biodiversity of lake ecosystems significantly. Therefore, in this study we took the opportunity of such circumstances to explore the combined effects of salinity and fish predation pressure by employing *Daphnia pulex* as indicator species since *Daphnia* species are very sensitive to salinity levels and to fish predation. This approach allows for a more realistic ecological interpretation since it incorporates both predation pressure and the impact of global warming. During the acute toxicity experiments, *Daphnia* individuals were exposed to fish predation pressure, which was mimicked by fish kairomone, and salinity levels between 0.25-5.00 g L⁻¹ because the salinity levels in Turkish lakes were about 0.50 g L⁻¹ in spring and may double or triple at the end of summer. On the other hand, during the chronic toxicity experiments, it was observed that *Daphnia* individuals were more sensitive to salinity (0.10-1.50 g L⁻¹) in the presence of the fish kairomone, while there was a trade-off between survival and reproduction. Moreover, the results also presented that for a small increase in salinity (0.1 ‰), there was a minor positive effect - i.e. lowered mortality, but with a further increase (≥ 0.4 ‰) mortality rose rapidly. This effect was enhanced at higher temperatures in an experiment that temperature was also manipulated, suggesting that with a 3 °C increase in temperature, there is an average 88% increase in mortality. Thus, increase in combination of salinity and temperature may set a strong challenge to survival of daphnids in freshwater systems at the face of warming with strong ecological consequences i.e turbidity and loss of vegetation.

Possibilities of Pearl Mussel (*Margaritifera margaritifera*) locality saving in the catchment of Luzní Stream (Czech - German Frontier)

Michal BILY, Ondrej SIMON

T.G.M. Water Research Institute, Podbabska 30, 160 62 Prague - Czech Republic

Pearl Mussel (*Margaritifera margaritifera*) is a critically endangered species of European fauna. It indicates very clean oligotrophic rivers and streams. The character of the bottom and the composition of surrounding terrestrial vegetation are important for this species. Central European population occurring at the boundary of Danube, Elbe, and Rhine basins (in the Czech Republic, Austria, and Germany) are the last remnant of the formerly large spread of the species in this region. With minor exceptions, these populations no longer reproduce themselves. Luzní Stream represents a locality where a pearl mussel population decreased rapidly during last decades.

To describe current situation and to find a ways of saving this rare locality are the aims of our study. A hydrochemical monitoring was realized in the network of profiles in the catchment. Both surface and interstitial waters are investigated. A set of basic parameters limiting for pearl mussel (conductivity, pH, dissolved oxygen, nitrates, ammonium, COD) and some other parameters (Ca, specific metals) were measured. Older data from other authors are also used to examine the development of water quality. Historical map information (from the year 1946), including aerial photographing were used to identify causes of changes in the water chemistry resulting from land use of the catchment. The quality of detritus (the food for pearl mussels) was tested on young animals.

Two main stress factors were detected in Luzní Stream: periodic low pH (in the upper stream) and temporary high concentration of dissolved inorganic and organic matter indicated by the conductivity values (in the low part of the stream). While agriculture is the cause of the second one, the first one is determined by forestry changes in the spring area (spruce monoculture introduction, peat bogs draining). The low pH values may be also a cause of cadmium accumulation in the mussel biomass. The detritus analysis shown that a food availability is another key factor limiting pearl mussel in this locality. A complex management of all the catchment (especially changes of agriculture and forestry) is a condition for the saving of Luzní Stream as an oligotrophic locality with occurrence of viable pearl mussel population.

Long-term changes in chironomid assemblages of the River Hron, Slovakia

Peter BITUŠÍK¹, Marek SVITOK²

¹ -Faculty of Sciences, Matthias Belius University, Banská Bystrica - Slovakia

² -Technical University in Zvolen, Zvolen - Slovakia

Changes in chironomid assemblage structure were determined at time scale of two decades (1986-2003) at nine sites along the River Hron. In addition, a number of water quality variables were measured monthly over the same periods. Statistical significant upward trends of pH were detected at most studied sites. Long-term decrease of nutrients concentration and increase of oxygen amount was apparent at three upper situated sites. Environmental conditions at lower reaches appeared to be rather stable without significant trends in water quality variables.

The greatest component of variation between the chironomid assemblages was related to spatial differences rather than temporal differences. Responses of species richness to altitudinal gradient to position on the longitudinal gradient showed in 1980s bimodal pattern with a distinct peak in the middle reaches, while bell shaped pattern with a peak in lower reaches and continual decrease towards higher altitudes was found in 2003. Differences in chironomid distributional patterns along the longitudinal profile appeared to be driven mostly by changes in water quality.

Financial support for this research project No. 1/0200/03 was provided by Grant Agency VEGA.

Prey preference of *Perla grandis* (Rambur 1841) (Plecoptera, Perlidae) in the rio Berga (NW Italy)

Tiziano BO, Stefano FENOGLIO, Marco CUCCO, Giorgio MALACARNE

DISAV University of Piemonte Orientale, Via Bellini 25, 15100 Alessandria - Italy

The use of benthic invertebrates in biological monitoring has produced an evident increase in the knowledge of taxonomy and systematic of these organisms but, unfortunately, the knowledge of great part of their ecology is still incomplete. Plecoptera constitute a numerically and ecologically significant component in freshwaters, mainly in lotic systems, all over the world. For the most part, larvae are either primarily carnivores (feeding largely upon other stream invertebrates), as are many Systellognatha stoneflies and Euholognatha, or primarily leaf shredders and detritivores, as are many Euholognatha. Large sized stoneflies, such as Perlidae and Perlodidae, represent the main group of predators in many small, fishless lotic systems where they act as top-down control elements in the benthic community. In this work, feeding habits of *Perla grandis* nymphs have been investigated in the Rio Berga, an Apenninic stream of Northwestern Italy. In this study, we analysed gut contents of 50 nymphs of this species, with the aim to investigate feeding preferences. Nymphs were collected from a single riffle, whose benthic coenosis was also determined. To analyze the dimensional shift in food preference, we separately considered gut contents of nymphs of different ages: smaller (< 15.0 mm) and larger nymphs (> 15.0 mm). We detected a change in the diet during ontogenesis, with small instars feeding mainly on detritus and large instars strictly carnivorous. The increase in number and type of preys is probably related not only to a dimensional increase of the nymphs (and the related ability in to catch more prey types) but also to an increase in the energetic demand in organisms that don't feed in the adult stage and rely on the preimaginal stages diet to perform gametogenesis. We also detected the existence of an evident trophic selection: diet was almost entirely dominated by Chironomidae, independently from their availability on the substratum. This result led to formulate the hypothesis that midges represent the preferred food item for many Systellognatha: probably they offer a good combination of different elements, such as mobility, dimensions and microhabitat overlap. This finding is discussed on the basis of ecological and ethological considerations.

Benthic macroinvertebrates of eutrophic Lake Viverone (Piedmont, Northern Italy)

Angela BOGGERO¹, Federica SICCARDI¹, Bruno ROSSARO²

¹ -CNR - ISE, 28922 Verbania Pallanza - Italy

² -University of Milan, Department of Biology, Section Ecology, 20133 Milano - Italy

Lake Viverone is located in Piedmont (Northern Italy) at an altitude of 230 m s.l.m., it has an area of 5.7 km² and a maximum depth of 50 m. In its watershed there are no large streams, only natural and artificial channels are present. The lake is surrounded by moraines, partly covered by woods, it is subject to different forms of direct anthropogenic impact (tourism and landuse, farming and hydropeaking). The shores has undergone morphological modification for tourism and recreational purposes, mainly along the north- to the south-eastern side of the lake. The lake is warm monomictic, with complete circulation from December to March and summer stratification from May to September, it supports nutrients accumulation and depletion of oxygen in the deeper layers highlighting pronounced drops to 20% till a maximum of <5% of saturation on the bottom.

To evaluate the ecological quality of the lake, as requested by WFD 2000/60/CE, a research was carried out to study the biological, chemical and physical elements. The methodologies and the results gained after one year of work on the benthic communities are here presented. Benthic macroinvertebrates were collected in 2006 with a Ponar grab (covered area 262 m²) in two replicate samples at different depths along three transects during homeotermly and stratification periods. The samples were sieved in the field through a net of 250 µm mesh size, and immediately preserved in 10% neutralized formaldehyde. Temperature and transparency (Secchi disc) were recorded at any depth, chemical analyses were performed from one litre of water sampled with a polythene bottle, granulometry, carbonates and organic matter content were also evaluated. Macroinvertebrates show significant modifications from the lake shore, with a quite diverse fauna extending to a depth of 20 m, to the bottom, where the organic enrichment of sediments ant the depletion of oxygen determine a substantial faunal impoverishment.

Anthropogenic impact on the aquatic ecosystems and genetic diversity of the ichthyofauna in desert of Algeria

Rachid BOUHADAD, Djamel Eddine ZOUAKH, Mokrane MOULLA, Yasmine BELLABES

FSB/USTHB; USTHB, 16111 Alger - Algeria

A brief view of photosatellites of Algeria country allows us to distinguish easily a saharan hydrographical network, fossilized, witness of the former sahara which was existing 10000 years ago. This network subsists know as points of water which are very distant between others. These points of water are ranged in three important groups: Oasis, Natural lakes (called locally Gueltas) and streams. This situation justifies a climatic evolution which has an important impact on the assignation, the sociology and the feeding of the local populations. In these ecosystems live an important fish fauna dominated by the Cyprinids which has been studied using different methods. The fish populations are not threatened in this moment, a program of conservation is recommended.

On the presence of *Daphnia galeata* in Lake Orta (N. Italy)

Carla BONACINA¹, Roberta PISCIA¹, Jaromir SEDA², Marina MANCA¹

¹ -CNR Institute of Ecosystem Study, Largo Tonolli 50, 28922, Verbania, Italy

² -Biology Centre of the ASCR, Hydrobiological Institute, České Budějovice - Czech Republic

Lake Orta is a very interesting environment because of its history of heavy chronic pollution and biota recolonization. There have been long-term studies of the lake's zooplankton, particularly *Daphnia*; this has allowed us to trace the appearance, success, and decline of various species.

Lake Orta was the first deep lake in Italy in which allozyme techniques were used to investigate clonal diversity. In 1986, a newly established *Daphnia obtusa* population, which was capable of colonizing stressed environments, was found to be composed of a single multilocus genotype, detected through an analysis of 27 different allozymes, 15 of which were active and stable for up to 12 generations. This result was interpreted to be indicative of colonization by a single clone, which was able to establish under strong selective pressures. This species was allochthonous for the lake, and was replaced in 1996 by a *Daphnia longispina* of the same morphotype as that originally described from the pelagic environment of the lake. The latter also appeared to remain the only *Daphnia* species in the lake's littoral until 2001, when regular sampling to monitor the lake began. During a 2004 sampling to detect the occurrence and prevalence of parasites in *Daphnia* parental species and hybrids in several lakes located north and south of the Alps, *Daphnia galeata* was first identified in Lake Orta's pelagic environment through morphological and allozyme analyses. Lake Orta zooplankton was then resampled in June 2006, to identify species and clonal composition of the *Daphnia* population, using the same techniques of morphotype and allozyme analyses. We expected to find low clone diversity and the presence of hybrids, whose success is enhanced in disturbed environments. Although preliminary, our results confirm that clone diversity in Lake Orta's *Daphnia* population is low, suggesting a recent colonization by *D. galeata* and providing evidence for a founder effect. In addition, the detection of the M variant at the AO locus, which we interpret as a rare allele of *D. galeata/D. longispina* hybrids, fits the hypothesis of enhanced hybrid success in disturbed environments, such as the once heavily contaminated Lake Orta.

***Daphnia* in Lake Maggiore starts to invest in an egg bank: a preparation for upcoming decades or centuries?**

Reinaldo BOZELLI¹, Marina MANCA², Piero GUILIZZONI²,

¹ -UFRJ - Lab. Limnologia, Ilha do Fundão, Rio de Janeiro - Brazil

² -ISE-CNR, Verbania-Pallanza - Italy

Zooplankton is able to withstand harsh environments because of specific adaptations, such as the production of resting stages that can survive unfavourable environmental conditions.

The *Daphnia* population of Lake Maggiore has historically been composed of parthenogenetic females. However, a significant number of males and ehippial females were found in the spring of 2005. This occurrence stimulated research to evaluate the role of a transient egg bank in seasonal *Daphnia* population recruitment. We collected and analyzed samples from seven sediment cores, representing different phases of trophic evolution and different lake basins. Ehippial production was found to be a new phenomenon in the lake, and began 8 years ago at the earliest. In addition, a horizontal distribution analysis permitted us to trace spatial heterogeneity and led us to view the littoral as a zone of ehippial egg recruitment to pelagic waters. Laboratory experiments on the viability of ehippial eggs showed that hatching success was more than two times higher for eggs coming from shallow sites compared to eggs from deeper areas of the lake. The observed modifications in the reproductive strategy of *Daphnia* in Lake Maggiore, resulting in the production of ehippia, may signal important environmental changes.

High quality stream habitats in Latvia and role of environmental factors for benthic macroinvertebrates

Agrita BRIEDE, Gunta SPRINĢE, Agnija SKUJA

Institute of Biology, University of Latvia, Salaspils - Latvia

The particular study of stream habitats is done within the 5th Framework Programme the project "STAR" in which the research of medium-sized lowland streams located in three different river basins of Baltic Province (Ecoregion 15) was carried out. Focus has been placed on trying to determine which abiotic factors are of main importance for structuring the communities, in this case benthic macroinvertebrates. The role of environmental factors on 27 high quality river reaches was assessed. About 40 parameters describing morphology, hydrology, chemistry, catchments' characteristics as well as the Habitat Quality Assessment Index (HQA), and Habitat Modification Score (HMS) from the River Habitat Survey were estimated for each site. The predominant river channel substrate was sand, cobbles and gravel. The banktop and bankface vegetation structure in most of the studied stream stretches was simple with 2 or 3 vegetation types, and mixed semi-natural woodland or shrubs were typically found within 50 m from the banktop. The dominant flow type for all spot checks of investigated streams was rippled or smooth flow. The HQA scores varied from 35 to 68. In relation to the HMS index, the studied river sites belong to classes 1 and are classified as pristine and semi-natural streams. The redundancy analysis (RDA) triplot was used to detect character of relationships between benthic macroinvertebrate species and environmental parameters. At the beginning all above mentioned environmental parameters and benthic macroinvertebrates species were used in RDA analysis. After that only six main environmental parameters with $p < 0.05$ and 31 species were selected for the next steps. Then environmental parameters explained 34.8 of the total dispersion, first axis explained 36,3 %, but the second - 20% environmental variables. The first RDA axis positively correlated with mesolithal, catchments' size and HMS. The second axis correlated with oxygen, phosphorus and CPOM. It should be mentioned that founded relationship between macroinvertebrates and chemical parameters mostly linked with river basin genesis is better pronounced in one of three investigated river basin.

Local movements of Teal (*Anas crecca*) and their consequences for seed and invertebrate dispersion within wintering grounds

Anne-Laure BROCHET¹, Andy GREEN², Matthieu GUILLEMAIN³, Michel GAUTHIER-CLERC¹, Hervi FRITZ⁴

¹-La Tour du Valat, Le Sambuc, 13200 Arles - France

²-Doñana Biological Station-CSIC, 41013 Sevilla - Spain

³-Office National de la Chasse et de la Faune Sauvage, Le Sambuc, 13200 Arles - France

⁴-CNRS UMR 5558 Biométrie et Biologie Evolutive, Université Claude Bernard Lyon 1, 69622 Villeurbanne cedex - France

Wintering ducks in the Camargue roost during daylight on marshes with large surface area and disperse at night to peripheral marshes to feed. This switch in habitat use is likely to favour the dispersal of plants and invertebrates at a local scale. Previous studies have shown that ducks can transport seeds or invertebrates in their plumage or in their digestive tract (at egg, larvae or adult stages), even over long distances. Nevertheless, the capacity of ducks as vectors over different scales has yet to be quantified. A major objective of my thesis is to quantify the probabilities of transport by teals (*Anas crecca*) for different organism within the wintering ground of the Camargue. We inspected the contents of the rectum and intestinal caeca of 150 teal shot in the 2006-2007 winter, as propagules found in this lower part of the gut can be considered to have survived digestion. 31 % of samples contain at least one intact seed and/or egg. 15 plant taxa and 17 invertebrate taxa were recorded. Plant species that were germinated in the laboratory after removal from the lower gut included *Polygonum lapathifolium*, *Echinochloa crus-galli* and *Eleocharis palustris*. These data underestimate the number of propagules being dispersed per bird, as they would also contain propagules higher up the alimentary canal likely to survive digestion. We will also quantify propagules transported on teal plumage and feet, and study the local movements of teal using radio-transmitters and nasal marks. Finally the retention time for seeds and eggs will be quantified experimentally in captivity. Collectively, these data will allow us to determine patterns of dispersal of different propagules between different wetlands within the wintering quarters.

A Georeference database and a geographic information system for Palermo plain and gulf (Western Sicily): aquifers and marine environments

Antonio CARUSO, Antonio CIMINO, Claudia COSENTINO, Antonino OIENI, Luigi TRANCHINA

Dipartimento di Fisica e Tecnologie Relative, Università di Palermo – Palermo, Italy

In the frame of multidisciplinary studies carried out on the territorial features of Palermo area, a georeference database and a Geographic Information System have been realized with the aim to collect and organize various environmental pieces of information. These ones are relevant to inland and marine coastal waters. Authors present details concerning the selection of data and their filing and management, together with the first results of the representation procedures of surface, ground and sea waters contaminations in the urban Palermo area and its gulf, near the coast line.

The availability of a sole archive, containing different and integrated records, represents an agile tool for a quick and real-time elaboration of different data, so performing parametric and synthetic cartographies - in GIS setting - concerning the most significant elements of environmental degradation. These easily updatable procedures permit also to find possible correlations among apparently unrelated information, even linked to fresh and sea water interactions.

Contaminations of well-circumscribed areas of Palermo plain and their relationship with metals concentrations in marine sediments, collected along the coastal line, have been analyzed. In particular, both the input of Oreto and Eleuterio rivers in Palermo' Gulf, and factors directly referred to the pollution of aquifers have been considered. Besides, Authors also consider those elements as sources of contamination in marine shallow water sediments. Most of inventories and measurements are already available for both inland and coastal waters, due to previous samplings and analyses. The plain data regard shallow and ground waters as well as aquifer vulnerability; furthermore, analyses on marine shallow sediments are performed to evaluate heavy metals concentrations and the statistical distribution of the abundance of benthic foraminifera.

Lastly, geochemical studies show the importance of the proposed procedures to estimate the evolution of groundwater quality for Palermo Plain. In order to validate statistical correlations among inland and marine contaminations, Authors propose further inventories and measurements, with the dynamic updating of the georeference archive.

Freshwater ostracods (Crustacea: Ostracoda) of the circum-Sicilian islands

Giuseppe CASTELLI¹, Valentina PIERI², Federico MARRONE³

¹-Dipartimento di Scienze Botaniche, Università degli Studi di Palermo – Palermo, Italy

²-Dipartimento di Scienze Ambientali, Università degli Studi di Parma – Parma, Italy

³-Dipartimento di Biologia Animale, Università degli Studi di Palermo – Palermo, Italy

The ostracod fauna of eight small islands around mainland Sicily (Ustica, Lipari, Vulcano, Favignana, Levanzo, Isola Longa, Lampedusa and Pantelleria) was studied from February 2003 to December 2005. Ostracods were collected in 32 sites, belonging to different habitat typologies: temporary ponds, rock pools, ground puddles, tyres tracks, concrete reservoir, wells, troughs and flooded meadows. In all, twelve taxa were recorded: *Heterocypris incongruens*, *Eucypris virens*, *Tonnacypris lutaria*, *Ilyocypris decipiens*, *Plesiocypridopsis newtoni*, *Sarscypridopsis aculeata*, *Lymnocythere inopinata*, *Cypridopsis vidua*, *Potamocypris arcuata*, *Potamocypris* cf. *arcuata*, *Cypridopsis* cf. *vidua*, and *Cypria ophthalmica*. Among these, *H. incongruens* proved to be the most widespread taxon.

The maximum number of species recorded in a single island was seven (on Favignana, Egadi Archipelago), and no more than four co-occurring species *per* site were observed.

The distances and relations of the islands with neighbouring mainlands, the origin of the islands, the geological nature of substrata and some habitat features were considered with the aim of pointing out the possible relationships among these variables and the recorded species richness.

A comparison with the ostracod faunas of Sicilian mainland and of other Mediterranean islands was performed using the available datasets.

Sea-fresh water exchanges in coastal aquifers of Sicily: a recent contamination cartography

Antonio CIMINO, Claudio ARTINO, Antonino OIENI

Dipartimento di Fisica e Tecnologie Relative, Università di Palermo – Palermo, Italy

Most of Mediterranean littoral areas are generally characterised by aquifer contamination. Good examples are constituted by the crowded coastal belts of Northern Sicily, where groundwaters have undergone a heavy degradation. This paper considers two different sectors of the island: the plains of Bonagia-Cornino and Acquedolci, respectively located in Western and Eastern sectors of Sicily. Here the anthropic intervention has caused integrated pollution of water resources, bacteriological too, testified by their chemical analyses. In detail, sea intrusion interests large belts along the sea border, with heavy consequences for groundwaters and soils.

In both areas, in spite of the excessive quantity of contaminants, aquifers are intensely exploited for industrial and agricultural purposes. The consequent uncontrolled overdraft creates a real risk for the groundwater use itself, which should need precise quality features. So, in the Bonagia-Cornino area, the manufacturing industries of building stones use waters of various characteristics, producing possible corrosions and/or incrustations. This difference is determined by the Langelier index.

On the other side, groundwaters of the coastal plain of Acquedolci are mainly utilized for irrigation, but the excessive salinity, besides the apparent damages to plants, decreases - in the short run too- the fertility itself of the grass. On this subject, the alkalinization risk due to sodium, defined by the SAR index (Sodium Absorption Ratio), is considered the mean tool to classify waters for irrigations in the range excellent to inadequate.

In order to minimize the whole risk for the health, zonings of sectors with various risk classes were executed, also with geophysical and geochemical investigations. Results of these measurements are presented in form of maps and diagrams, defining a good quality picture relevant to water resources directed to different destinations.

Macrophyte Mapping in the 21st Century. Are aerial survey and hydroacoustics effective for macrophyte mapping?

Angela DARWELL

APEM Ltd - Enterprise House, M15 6SE Manchester – United Kingdom

APEM is a dedicated aquatic science consultancy which has been at the forefront of developing habitat mapping techniques over the past 20 years. APEM have been trialling both hydroacoustic technology and aerial photography for macrophyte mapping. Hydroacoustic survey has established biomass and extent of macrophyte stands at Barrow Docks and Salford Quays, whilst aerial photography has been successfully used to map *Ranunculus* beds in a north Cumbrian river. Work is currently underway to determine the accuracy to which species can be determined, and the effectiveness of mapping the distribution of invasive macrophytes in lakes. Early outputs suggest that, with ground-truthing, both techniques have the potential to prove highly effective for macrophyte mapping. This short talk summarises our work to date.

Effects of a small dam on macroinvertebrate communities and environmental variables in a headwater stream

Marco DE CICCO, Filippo FABBRI, Simone PETRACZEK, Lorenzo PROIA, Gianmaria CARCHINI

Dip. Biologia, Univ. Tor Vergata, Roma - Italy

Three reference sites and at six impacted sites located upstream and downstream respectively of a small dam located in the Simbrivio Stream (Tiber basin, Central Italy) were investigated over 1 yr period. Data on physical, chemical, hydro-morphological and trophic variables together with species composition, density, diversity and trophic structure of macroinvertebrate communities were collected to assess possible dam effects. Major changes in environmental variables occurred within the first three sites downstream the dam. In particular: change of flow regime, increase of epilithon biomass and, during spring period, decrease of the coarse and fine particulate organic matter associated with benthic samples. Water temperature, conductivity, pH, dissolved oxygen and nutrient concentrations (ammonium and soluble reactive phosphorus) were not affected by dam presence. In spring, the dam has a clear effect on the invertebrate fauna, with an alteration of the species composition and a reduction of taxa richness of downstream sites, particularly in relation to stoneflies, caddisflies and mayflies (EPT taxa). Seven taxa collected upstream were absent in all downstream sites. On the contrary, in autumn, the results showed an increase of total and EPT taxa of downstream communities. The analysis of environmental variables patterns along the study sites suggested that the principal factors affecting the biota were alteration of hydrological conditions, epilithic development and substrate stability.

The importance of storm events in estimating nutrient loads to lakes

Lindsey DEFEW

Centre for Ecology and Hydrology, EH26 0QB Edinburgh - Scotland

Water regulation authorities currently use river monitoring techniques that estimate the nutrient load to lakes on the basis of occasional (weekly or monthly) samples and flow measurements. Such infrequent measurements fail to take into account the influence of storm events on the mobilisation and transport of pollutants. It has been suggested that up to 80% of the total pollutant input to surface waters can occur during such events. This issue has been investigated for the transport of phosphorus (P) by a stream that drains an agricultural catchment and flows into Loch Leven, Scotland. The work involved using an intensive survey method based on two hourly measurements of total-P (TP) concentration and stream flow between October and December 2006. The survey explored changes in P concentrations in response to storm flows generated by rainfall and estimated P loadings to the loch from that stream. Based on the 8-day survey method results showed that the estimated load of total phosphorus entering Loch Leven from the Pow Burn during October 2006 was 46.79 kg. The estimated monthly load for the same stream, based on the 2 hourly survey method was 249.96 kg. This was a direct result of catching short-term changes in TP loads due to high flow events. Staggeringly, one major storm event sampled between 25th and 27th October 2006 contributed 181.78 kg of TP or 72% of the estimated monthly load. The results also showed that the majority of the TP mobilised during high flow events was accounted for by the particulate, rather than the dissolved, fraction of phosphorus. Because poor water quality is often driven by an increase in TP concentrations (which in turn, increases phytoplankton productivity and biomass), the majority of freshwater lake restoration programmes strive towards an improvement in water quality through the reduction of TP. On the basis of the results presented here, it is becoming increasingly clear that one of the largest challenges to water managers in the future is how to reliably estimate nutrient loads entering lakes in order to comply with the WFD and facilitate successful lake restoration.

Phytoplankton distributions along the River Vltava (the Czech Republic): a case of a watercourse with a cascade of dam reservoirs

Blanka DESORTOVÁ

The T.G.Masaryk Water Research Institute, 160 62 Prague 6 - Czech Republic

Longitudinal changes of phytoplankton biomass and structure have been investigated from the middle part of the River Vltava (downstream of km 210) to its confluence with the River Elbe. The Vltava (total length of 430 km) is mostly regulated and its course is interrupted by several man-made reservoirs. On the river stretch under study, there is a cascade of 7 dam reservoirs with quite different hydromorphometric characteristics, operation and purpose. The reservoirs also differ in the depth of outlet, i.e. water is released either from the surface of the dam, from near the bottom or by both manners.

The study of phytoplankton distribution along the mentioned reach of the Vltava was carried out during the seasonal period (March-October) of the years 1996-2006. Data on chlorophyll-a concentrations are used for the expression of phytoplankton biomass.

Below the uppermost reservoir Hněvkovice the seasonal mean values of chlorophyll-a ranged from 10.1 to 30.2 $\mu\text{g L}^{-1}$. Down the river, an important inoculum of phytoplankton biomass from the tributary Luznice influenced the chlorophyll-a concentrations. As a consequence, the high values of chlorophyll a (seasonal means up to 130 $\mu\text{g L}^{-1}$) were observed in the inflow to the Orlik Reservoir.

In the river stretch below the Orlik, which is the deepest (72 m) and longest (68 km) reservoir on the Vltava, the phytoplankton biomass is very low. Seasonal mean values of chlorophyll a did not cross 6.0 $\mu\text{g L}^{-1}$ during the period of study. The phytoplankton biomass values in the outflows from the next two reservoirs Slapy and Stěchovice were very similar to previous one. The last reservoir Vrané is supplied with water outflowing from Stěchovice and by the tributary Sázava which is rich in phytoplankton. In the river stretch below the dam Vrané seasonal mean values of chlorophyll a ranged from 17.5 to 28.1 $\mu\text{g L}^{-1}$. Lower downstream the tributary Berounka with the high biomass of phytoplankton influenced the chlorophyll-a concentration in the Vltava River. But downstream of km 60, a gradual increase of chlorophyll a concentration is evident reaching the seasonal mean values up to 106.7 $\mu\text{g L}^{-1}$ at the Zelčín site, near the confluence with the Elbe River.

Transfer and mobility of trace metals in the rivers: modelling of solid-liquid exchange and early diagenesis

Valérie DEVALLOIS¹, Patrick BOYER¹, Jean-Luc BOUDENNE², Bruno COULOMB²

¹ -IRSN/DEI/SECRE/LME, CE Cadarache BP3, Saint Paul lez Durance - France

² -Laboratoire de Chimie et Environnement, Université Aix-Marseille 1, Marseille - France

The trace metal pollutants transferred in freshwater systems can be found in water and sedimentary columns under dissolved forms and fixed onto solid particles. These latter ones can be accumulated in the sedimentary areas and constitute important stocks of pollutants. Management of freshwater system quality requires to assess mobility of these stocks by erosion, interstitial diffusion and bioturbation.

This study deals with modelling of mobility of trace metals by interstitial diffusion in the sedimentary column and at the interface with the water column. This topic involves assessing two main points: 1) the solid-liquid fractionation of the trace metal pollutants and 2) mobility of the mobile phases.

The first point is governed by sorption/release processes. These chemical reactions on particle surfaces are regulated by physico-chemical parameters (pH, ionic strength, redox, particle-size, reaction rate constants). In the sedimentary column, these parameters are influenced by the early diagenesis that involves redox transformations resulting from reduction of the organic matter by the microbial activity: oxic respiration, denitrification, manganese hydroxides and iron hydroxides reduction, sulphate reduction, methanogenesis. These reactions cause the disappearance of dissolved and solid oxidants and the appearance of reduced species. The evolution of the solid and the dissolved forms of trace metals in the sedimentary column is thus strongly dependent on the early diagenesis. For example, reduction of manganese and iron hydroxides causes the release of trace metals fixed onto these particles.

In this context, this communication presents the analysis results of natural sediment cores sampled in the Durance and Rhône rivers. These results show the distribution of dominant parameters (pH, redox, O₂, dissolved sulphide content) and solid-liquid forms of metals (Fe, Mn, Ni, Zn, Co, Pb, Cu) in water and sedimentary columns. These profiles can be explained by a coupling between sorption and diagenesis processes. In order to simulate and to interpret these profiles, a model coupling these processes is currently elaborated from the approaches of Soetaert et al., 1996 and Wijsman et al., 2002.

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Combining Metrics and Confidence in Status Boundaries within the Water Framework Directive

Ian DODKINS

University of Ulster, Environmental Studies, Coleraine, Northern Ireland – United Kingdom

The Water Framework Directive (WFD) requires confidence in the ecological status measured at monitoring sites to be provided. Current methods of measuring ecological status are difficult to validate since ecologists have differing views on what constitutes ecological status. The importance of assessing both robustness of metrics and the representativeness of anthropogenic impact is discussed. Some ecologists also argue that combining different metrics, and metrics from different biological elements into a quantitative score is inappropriate. Current methods of reference condition prediction are also poor and further reduce our ability to have confidence in our ecological status predictions. Recommendations for producing scientifically more justifiable and legally supportable methods of determining anthropogenic impact and deterioration in ecological status are given. This includes separating state-change assessments (deterioration) from determination of whether a site is achieving 'good' ecological status.

Responses of stream invertebrate communities to different types of human impacts: patterns of taxonomic vs functional diversity

Sylvain DOLEDEC¹, Bernard CELLOT¹, Marie-Claude ROGER²

¹-Université de Lyon, UMR CNRS 5023 LEHF, Villeurbanne - France

²-CEMAGREF, UR Biologie des Ecosystèmes Aquatiques, Lyon - France

The structure of invertebrate communities and derived metrics is usually employed for assessing the stream water quality. However, such biomonitoring tools are insufficiently general to be applicable across large geographic areas and may lack specificity for separating types of human impact. We sampled the invertebrate communities of 10 sites distributed along 3 rivers of the Rhône basin impacted by different human activities. The Morcille river (46°09 N 4°35 E) is mainly impacted by pesticides, the Amous river (43°59 N 4°06 E) receives acid mine drainage and the Bourbre river (45°33 N 5°26 E) suffers from urban pollution. We combined a usual taxonomic and a more functional approach using the biological and ecological traits of taxa. Taxa richness demonstrated difference across sites associated to impacts ($R^2=0.439$, $P < 2.2e^{-16}$). Functional biological trait diversity assessed by quadratic entropy slightly better separated impacted from unimpacted sites ($R^2=0.528$, $P < 2.2e^{-16}$). In addition, using the functional biological trait diversity enabled the assessment of the specificity of types of impacts since the metric response showed a gradient of decrease from urban to pesticide impacts with acid mine drainage effects laying in-between.

The first two axes of a correspondence analysis of the taxa by site composition mainly showed differences among rivers ($R^2=0.287$). The first two-axes of a fuzzy correspondence analysis of the trait by site composition enabled a slightly better discrimination of sites ($R^2=0.378$) with especially the separation of pesticide perturbations. Trait associated to these patterns concerned reproduction types, feeding habits, life duration, aquatic stages, respiration types, and reproduction cycles. In impacted sites, organisms generally had traits frequently associated with resistance to perturbation. For example, they reproduced in vegetation or had terrestrial clutches; they mainly used tegument for respiration, had short life cycles and infrequent adult and egg aquatic stages. Moreover, impacted communities showed a simplification of trophic networks as assessed by feeding groups. We conclude that the use of biological trait information in biomonitoring may improve our understanding and interpretation of human impacts on stream invertebrate communities and overall stream ecological integrity.

Responses of pesticide impacted biofilms in a translocation experiment in river

Ursula DORIGO¹, Annette BERARD¹, Bernard MOTTE², Bernardette VOLAT¹, Agnes BOUCHEZ²,
Bernard MONTUELLE¹

¹ -Cemagref, 3 quai Chauveau, 69 336 Lyon - France

² -INRA, Avenue de Corzent, 74203 Thonon - France

A translocation experiment was conducted in field within the Morcille river, a small French river draining a vineyard watershed (Beaujolais, 60km north of Lyon), to investigate the recovery of biofilms from pesticides. Biofilms were grown on artificial glass substrates glued on Plexiglas plates which were fixed to the riverbed both in a pristine (the reference) and in a pesticide impacted site of the river. Biofilms stemming from the latter one were transplanted to the pristine site after a colonization period of five weeks. The PICT (Pollution-Induced Community-Tolerance) concept was used to investigate the effects of pesticides on community composition and function and to monitor the recovery of the toxicant exposed community, once transplanted to the pristine site. Biofilms were collected at t_0 (at translocation time), and one, three and five weeks after translocation both from the reference and the transplanted Plexiglas plates. The tolerance towards Diuron (a model herbicide for photosystem II inhibition and present in the Morcille river) was measured by photosynthesis short-term inhibition assays in laboratory to obtain dose-response curves and to calculate EC_{50} values. Structural changes of prokaryotic and eukaryotic communities inhabiting biofilms were examined by DGGE (Denaturing Gradient Gel Electrophoresis) of PCR-amplified 16S and 18S rRNA gene fragments. This study shows a 10-fold increase in tolerance (EC_{50} value) of the toxicant-exposed community when compared to the pristine community before translocation and a rapid recovery after translocation. DGGE analyses confirmed changes in the eukaryotic and prokaryotic community composition rather than changes in the total number of species, when comparing biofilms before translocation, pointing towards moderate and discontinuous contamination level in the downstream section of the Morcille river.

***Scenedesmus quadricauda* - a promising microorganism for selenium-enriched algal biomass production**

Irena DOUSKOVA, Jiri MACHAT, Dasa UMYSOVA, Milada VITOVA, Jiri DOUCHA, Vilem ZACHLEDER

Institute of Microbiology ASCR, 379 81 Třeboň - Czech Republic

Nowadays selenium is considered not only as a pollutant, but also as an essential microelement, which has a great influence on human and animal health. There is a high incidence of selenium deficiency in Europe, caused by low concentration of selenium in farmland and therefore in the whole food chain. Supplementation by inorganic selenite salts is regarded as less efficient and more risky, than the using of organically bound selenium. The most appropriate form of selenium in nutrition is selenomethionine. We selected a strain of *Scenedesmus quadricauda*, which is able to grow fast even in the presence of high selenite concentration and therefore is suitable to produce biomass of high selenomethionine content. Prospectively this biomass can serve as a source of selenomethionine in food and feed supplements. We achieved the desired Se-enrichment by adding sodium selenite to the inorganic nutrient medium and we also investigated the effect of sulphur-poor media on the biomass composition. The experiments took place in a laboratory-scale photobioreactor equipped by artificial illumination. Quantification of total selenium is a routine task if ICP-MS (inductively coupled plasma mass spectroscopy) is available. On the other hand the selective determination of selenium species is very demanding. In this paper we present the results of two principally different analytical approaches. Sequential fractionation of the biomass was carried out to ascertain the total selenium content in the separate fractions; this can serve as an estimation of individual selenium forms quantity. The alternative is to employ HPLC connected with ICP-MS for the purpose of proper selenium species determination. The most important output is obviously the amount of selenomethionine, but we also examined the content of selenomethionine, selenomethionine-Se-oxide, selenite, and methylseleninic acid. The speciation technique is difficult, because the selenium species are quite unstable and it can shift among each other during the sample preparation. The comparison of the results obtained by these different approaches is presented.

This work was supported by the Grant Agency of Academy of Sciences of the Czech Republic (grant no. A600200701), project EUREKA of Ministry of Education, Youth and Sports of the Czech Republic (no. OE221) and by Institutional Research Concept no. AV0Z5020903.

Climate driven changes on phytoplankton communities structure and algae species seasonal development in Latvia's freshwaters

Ivars DRUVIETIS

University of Latvia, Faculty of Biology, 1010 Riga - Latvia

Last decades of mild winters warming had considerably effects on the development of phytoplankton communities in Baltic region. Since phytoplankton species composition responds very rapidly to changes in the environment, it was stated that water temperature, light as well as level of water and amount of nutrients are factors determining phytoplankton species diversity, numbers of individuals and biomass rate not only in Latvia's lentic waters but also in the bigger freshwater bodies - Daugava River 3 Hydro Power Plant reservoirs. In the case of Cyanobacterial biomasses also the water temperature had a significant effect: the highest biomass values of *Microcystis* spp., *Anabaena* spp. in Latvia's lentic environments are recorded in the last week of July and in August. Diatoms and also cryptophytes and chlorophytes tend to ignore temperature. In most of Latvia's lentic waters, phytoplankton succession can be interpreted in terms of r- and k-strategies: r-strategists dominate in the early phase of succession. Summer growth starts with a dominance of *Cryptomonas* spp. and *Pandorina morum* and in very high amount of small flagellates. Diatom plankton is characteristic for all types of inland waters in late autumn and winter. It is difficult to explain, due to climate driven changes, the expansion of the large nuisance alga *Gonyostomum semen*. Not only in Latvia, but in the all Baltic region *G. semen* have invaded mostly lakes with soft brown water. Besides more than 20 years ago *G. semen* was considered as rare species for Latvia. In the last 5 years this species is commonly found not only in dystrophic and dyseutrophic lakes but in macrophyte type lakes and ponds.

Food sources of Arctic char (*Salvelinus alpinus* L.) in two Arctic lakes with contrasting fish communities

Antti ELORANTA, Roger I. JONES

University of Jyväskylä, 40014 Jyväskylä - Finland

The food web structure, and particularly the feeding behaviour of Arctic char, were studied in two Arctic lakes (Kilpisjärvi and Saanajärvi) situated in the northwestern tip of Finland. The two lakes differ in their area and in the complexity of their fish communities. The aims of this study were (1) to compare the relative contributions of benthic and pelagic energy sources in the feeding of char and (2) to evaluate how this relative contribution might change during the char lifespan and during the growing season. Both gut content analysis and stable isotope analysis of carbon and nitrogen from fish muscle and liver tissues were used to examine the char energy sources and the food web structures in the two lakes. Samples were collected from early spring to late autumn in 2006 and included biofilm, zooplankton, benthic macroinvertebrates and fish. According to preliminary results, in the smaller Saanajärvi with its simple fish community, char were heavily reliant on benthic energy sources. In this lake, the smallest char were utilising a wide variety of prey depending on what was most available at the time, whereas the largest char were cannibalistic. In contrast, in the larger Kilpisjärvi with its more diverse fish community, the largest char fed mainly on small, planktivorous whitefish (*Coregonus lavaretus*, L.) and therefore were indirectly more reliant on pelagic energy sources. Since most Arctic lakes have rather simple food webs and fish communities, our results suggest that benthic energy sources probably mainly support the top consumers in such lakes.

Conservation of Mediterranean Temporary Pools in Apulia (Southern Italy): definitions, principles, problems

Paola ERNANDES, Leonardo BECCARISI, Vincenzo ZUCCARELLO

University of Lecce, 73100 Lecce - Italy

The Mediterranean temporary ponds are characterised by the alternation of flooded and dry phases, and host rare plants and animals, which are exclusive and well adapted. These are hygrophylous ecological systems characteristic of the Mediterranean regions, and are subject to periodic changes of their floristic composition during an annual cycle. Their importance is recognized at international level in the resolution VIII.33 of the Ramsar Convention; at an European level (Directive 92/43/CEE) are classified as priority habitats (code 3170). The definition of the Directive follows the phytosociological criteria. However, knowledge about the ecology and the distribution of these habitats is still fragmentary, neither guidelines exist for their management.

Relatively to Apulia, five sites were identified for Net Nature 2000: 4 in the province of Lecce and 1 in Brindisi. Preliminary investigations allowed us to find another 31 of these environments. We have found that the presence of the particular place-name "lake", which is diffused in Apulia and indicated in the past important water supplying sites, is always designating temporary ponds. These lakes are fed exclusively from meteoric waters and represent the first type of Mediterranean temporary ponds in Apulia. Clay layer with low hydraulic conductivity, can support a superficial water table to which the habitat of the Mediterranean temporary ponds is associated. This is the second types of ponds that has been observed in several localities of Southern Apulia. The third types is created by erosion of rock layers. Their water supply comes entirely from rainfall. This type is mostly distributed into the southern part of the studied area, on the reliefs of the Murge and in the Taranto province. A last types of temporary ponds is recovered in proximity of the coast on a limestone plateaus interested from a groundwater impermeable layer. Relatively to the conservation, the first problem is to exactly locate them geographically because of their small dimensions. These environments are often in contact with anthropic areas which may represent a factor of threat for the species present. Specific studies are needed to fill the gap resulting from the insufficient information and the little attention given to these habitats.

Influence of intensive fish farming on macroinvertebrate community structure in Apennine streams (Italy)

A. FABRIZI¹, E. GORETTI¹, C. MARCUCCI¹, A. DI VEROLI¹, L. SCOPETTA¹, M.V. DI GIOVANNI¹, R. SELVAGGI², R. CEREGHINO³

¹ –Dip. Biologia Cellulare e Ambientale, Università degli Studi di Perugia, Perugia - Italy

² –Dip. Chimica, Università degli Studi di Perugia, Perugia - Italy

³ –Univ. Paul Sabatier, 118 route Narbonne, 31062 Toulouse - France

Intensive fish farming may severely impact stream water quality downstream from the facilities. The extent of disturbance in the receiving streams depend on the amount of water which is drained upstream from the fish farm with respect to baseflows, and on the effectiveness of water treatment before the outlet. Such type of activity has been recently intensified in the catchment basin of the Nera River (Apennine Mountains – Italy). For instance, in the Valnerina valley, twelve trout production units are now established. Our aim was to assess the ecological quality in streams of the Valnerina valley, using the structural and functional attributes of biological communities as indicator (EU Directive 2000/60/CE). The study was conducted in the spring 2005. Twenty-four sampling sites were characterized for macroinvertebrate communities, 1 upstream and 1 downstream site for each fish farm. Physical and chemical parameters were also recorded at each site. We used a fuzzy-coding approach of macroinvertebrate biological and ecological traits, combined with taxa density records and classical biological quality indices, to assess changes in macroinvertebrate diversity. Overall, intensive fish farming adversely affected the benthic diversity in the Valnerina stream system, whatever the ecological or biological metrics we considered. Specifically, the alteration of the benthic community was greater in small water courses, where the most sensitive taxa (*Isoperla*, *Protonemura*, *Amphinemura*) were eliminated downstream from the facilities.

A non-native population of *Xenopus laevis* in Sicily feeding during the reproductive period

Francesco Paolo FARAONE, Francesco LILLO, Gabriele GIACALONE, Mario LO VALVO

Dipartimento di Biologia Animale, Università di Palermo – Palermo, Italy

An extensive meta-population of *Xenopus laevis* (Daudin, 1802) was found in Sicily in 2004. This anuran, probably escaped from biology laboratories, currently occupies an area of about 170 km², exploiting a remarkable number of agricultural ponds, a large artificial reservoir and two hydrographical basins.

We carried out biweekly samplings about food habits in an agricultural pond (20X35m) near Partinico (Province of Palermo). Based on spawn finding and mating call detection, the spawning period approximately lasted one month and a half (from 3 Apr to 16 Jun 2006). Mating and spawning period started when the water temperature reached diurnal values of 20°C. In this period 110 adult and sub-adult specimens were collected by using a net pulled on the bottom of the pond. The stomach contents, obtained by stomach flushing, were preserved in 90% alcohol and then identified by using a stereoscopic microscope.

The observed frequencies of the prey in the total stomach contents showed that Zygoptera larvae are the most frequent *taxon* (82.5%) followed by: Ephemeroptera larvae (59.4%), Chironomidae larvae and pupae (57.2%), Cladocera (38.5%) and Anisoptera larvae (37.4%).

The presence of *Xenopus* eggs and tadpoles, respectively in 22.0% and 4.4% of stomachs, showed the tendency to cannibalism. The evaluation of frequencies on fully-grown and juvenile specimens showed a greater trend to egg ingestion by the latter (25.0% vs. 5.3%). The ingestion of sloughed skin is frequent too (31.9%).

The evaluation of the mean frequency of ingested items showed the highest values for Cladocera and Copepoda, respectively with 12.59 and 4.35 specimens per stomach, followed by chironomids with 1.84 specimens.

This research was partially funded by an ex-60% grant, year 2005

Diet, microdistribution and fine structure of *Euthyplocia hecuba* (Ephemeroptera: Euthyplociidae) nymphs

Stefano FENOGLIO¹, Tiziano BO¹, Elżbieta ROŚCISZEWSKA², Artur CZEKAJ

¹ -University of Piemonte Orientale, Department of Life and Environment Science, 15100 Alessandria - Italy

² -Jagiellonian University, Department of Systematic Zoology, 30-060 Krakow - Poland

Euthyplociidae are a tropical and subtropical group of Ephemeroptera. Apart some taxonomic studies, few or no information are at the moment available about these organisms. Aim of this study was to improve the knowledge of some aspects of the biology and ecology of *Euthyplocia hecuba* (Hagen 1861) nymphs. The study was conducted in the Río El Padre, a tributary of Río Cangrejil, located in the Caribbean slope of Honduras. In this study we examined: a) the microdistribution and the microhabitat preference, b) the diet, and c) some fine morphological aspects of the nymphs: in particular we realized a description of mouthparts, legs and gills by using a SEM microscope. *Euthyplocia* nymphs are specialized burrower mayflies, that inhabit soft and fine substrata. In this substratum, they are able to excavate tunnels and pass through fine substrata, thanks to particular morphologic adaptations. The digging is facilitated by: i) the presence of long and curve mandibles, with lateral lines of robust tooth-like appendices, useful to move fine elements of soft-bottom habitats; ii) compact and shovel-like tibiae and robust claws; iii) massive femura of hindlegs, that allow a powerful shove into the sediment. To survive in depositional environments, away from turbulent, fast-flowing and well oxygenated waters, this group of mayflies has evolved particularly adapted morphological elements, among which the gills play a key role. While reophilous mayflies, such as Heptagenoidea, have lamellar gills, Euthyplociidae have dagger-like gills, surrounded by very long filaments. Filamentous tracheal gills usually have a greater respiratory efficiency than lamellar tracheal gills, due to tracheoles which can be found in the respiratory epithelium directly under the cuticle. The diet of these organisms is completely detritivorous, and the long bristles present in the mandibles and in the other mouthparts create a conic-shaped net structure, that intercepts and conveys fine particles of organic detritus. Immature stages of *Euthyplocia* are highly specialised organisms, with specific adaptations for the life in a specific river microhabitat.

Distribution and trophic role of invasive crayfish, *Procambarus clarkii* in "Preola and Gorgi tondi" Natural Reserve (Sicily, Italy): a study case

Eleonora FERRANTE¹, Stefania D'ANGELO², Arturo ZENONE¹, Gianluca SARÀ¹

¹ -Dipartimento di Biologia Animale, University of Palermo, Palermo, Italy

² -WWF, Mazara del Vallo (TP), Italy

Biological invasion and human impact on ecosystems are a real and substantial threat for biodiversity, especially in Mediterranean wetlands. *Procambarus clarkii* is an endemic North American crayfish species that was introduced into Italian freshwater ecosystems. Since 1990, *P. clarkii* has been found in many ponds and streams of Northern and Central Italy. It is a polytrophic, aggressive and prolific species, characterized by a broader range of distribution so as in the 2005, it was also found in Sicily. Starting in May 2005, this study was carried out for one year in the "Lago Preola e Gorgi Tondi" natural reserve (Mazara del Vallo, Sicily). The aim of the experiment is to quantify the effects of *P. clarkii* presence inside protected areas by: i) analysing abundance and distribution; ii) studying habitat preferences and iii) identifying upper competitors. Crayfishes were sampled bimonthly by net traps in two areas characterized by different habitat (mud and rocky substratum), in three different sites. Results showed that *P. clarkii* population has almost colonized all habitats, though muddy substratum warrants better trophic availability, at least during the first colonization steps. Moreover, density of population is lower in the study area than in the other Italian freshwater ecosystem. Indeed, upper competitors, like the endemic turtle *Emys trinacris* and migratory or non-migratory birds, play a crucial role in the population dynamics relating to abundance and distribution of red crayfish.

Geographic distribution and environmental correlates of fish species predated by otters in Southern Italy

Romina FUSILLO, Manlio MARCELLI

Dipartimento di Biologia Animale e dell'Uomo Università di Roma "La Sapienza", 00185 Rome - Italy

Rivers and streams of Southern Italy received less scientific attention in the past than those of Central-Northern parts of peninsula. In particular large scale studies on distribution patterns and environmental correlates of fish assemblages are still scarce. High predators may be used as biological samplers to outline the distribution of their prey. We used data from otter *Lutra lutra* diet, estimated by faeces analysis, to describe fish assemblages in 43 stream stretches of Southern Italy. The study area included 16 river basins from Molise to Calabria Region, and covered the entire otter range distribution. Literature showed that the otter behaves usually as a generalist fish-eater. Accordingly, we found a good correspondence between fish assemblages as estimated through electrofishing and diet analysis. Several studies describe the fish assemblages as hierarchically influenced by large-scale as well as local factors. In this study we analysed large scale spatial trends and different scale environmental correlates (climate, land-use, drainage area and local habitat descriptors) of fish species preyed by otters. We used GLMs and Canonical Correspondence Analysis to analyse respectively fish richness and species composition. Twenty-four fish species from 10 families were recognised in otter faeces, of which ten native and others exotic or introduced. Most species were Cyprinids. Fish richness varied among sampling sites from 1 to 10, and increased along a longitudinal gradient from west to east. In particular western sites were dominated by brown trout, eel and some gravel spawner and generalist Cyprinids; eastern assemblages appeared enriched by the presence of spined loach, plant spawner Cyprinids, Perciformes and exotic species. Species richness increased with increasing drainage area and decreasing altitude. Plant spawner cyprinids, spined loach, perch and exotic species were especially associated with large drainage areas and upstream reservoirs. At local scale the water temperature was the main correlate of fish richness and species composition, but also water pollution and stream shading showed a correlation. Human-altered land cover and low precipitation appeared associated with areas where higher fish richness was found. Further direct investigations on native species seem needed to assess conservation status and future trends of fish communities in Southern Italy.

Species presence and abundance in relation to nutrient supply and geomorphological characteristics of the artificial lake Velenjsko jezero (Slovenia)

Mateja GERM¹, Zdenka MAZEJ²

¹ -National Institute of Biology, Ljubljana - Slovenia

² -ERICo Velenje; Environmental Research and Industrial Co-operation Institute, Velenje - Slovenia

The relation between presence and abundance of macrophytes and environmental factors was studied in the young artificial lake Velenjsko jezero (Slovenia). The concentration of TC, TN and TP in the lake sediment, water and aboveground biomass of macrophytes was established, as well as physico-chemical and geomorphological characteristics of the lake were determined. Among the 9 species of *Chara* sp., *Nuphar lutea*, *Najas marina*, *Najas minor*, *Potamogeton crispus*, *Potamogeton lucens*, *Potamogeton nodosus*, *Potamogeton pectinatus* and *Myriophyllum spicatum*, thriving in the lake, *Potamogeton pectinatus* and *Najas marina* prevailed. Plants differed in their growth form and life cycle. The concentration of TC, TN and TP in the above-ground biomass of macrophytes was measured to estimate the availability of nutrients in the lake environment and the level of plant's nutrient-use efficiency. Phosphorus and nitrogen contents in majority of studied macrophytes were found to be generally higher than the critical concentration for phosphorus and for nitrogen during the whole season. Seasonal variations were detected in the absolute contents and in the carbon:nitrogen:phosphorus (C:N:P) ratio in individual macrophyte species. Significant differences were evidenced among macrophyte species in the lake regarding the nutrient concentrations in their tissues. The macroalga *Chara* sp. showed the lowest nutrients contents, while the highest amount of nutrients was observed in the species with floating leaves *Nuphar lutea*. Both the dominant species *Potamogeton pectinatus* and *Najas marina* can tolerate high wave motion and being anchored in a thin layer of loose sediment. It was assumed that geomorphological properties of the lake were one of the key factors, which influenced the macrophyte abundance and distribution. The lake is deep with steep slopes along the majority of the lakeshore. It is an opened area, where strong wind blows and the sediment is unstable. Favourable condition in the lake especially for *Najas marina* and the strategy of this species as a summer-annual plant with a rapid and short life cycle, quick propagation from seeds and very extensive root systems, enable this species to grow successfully and dominate in the lake.

Study of some biological characters of *Gambusia holbrooki* on the adjusted channel of Gomishan Lagoon

Rasul GHORBANI, Masoud MOLLAEI, Abdolmajid HAJIMORADLOO

Gorgan university, Beheshti, 49138-15749 Gorgan - Iran

Gambusia holbrooki is an exotic species in the Caspian Sea and without economic value in aquaculture. Some biological characters of this species were studied on the adjusted channel of Gomishan Lagoon during 2001-2002. The fish were captured using of beach seine (mesh: 8 mm). During a 9 months sampling period, 705 specimens were caught and fixed in 10% formaldehyde. 270 individual fish were dissected for examining their feeding regime and identified by numerical method. Results demonstrated that sampled fish were mostly female. The length and weight of the examined fish were 23-68 mm (48.7 ± 12.42 mm) and 0.083-4.05 gr (2.05 ± 1.12 gr), respectively. The population showed an allometric growth pattern. Reproductive peak was in the summer when most of the fish were pregnant. The minimum and maximum value of condition factor were on December and July, respectively. The dominant preys in fish were insects and nereidae.

Phytobenthonic zoo-community of stream Kerka, Hungary (2003-2006)

Dénes GÓR, Csaba DEÁK, István GYULAI, Gyula LAKATOS

University of Debrecen, Department of Applied Ecology - Debrecen, Hungary

In connection with hydrobiological and conservational revealing and monitoring of Kerka stream, data of scientific literature are not complete enough. Hydrological and hydrobiological measurements on the lower parts of the stream started in the early nineties. The Kerka stream is situated in the south-western part of Hungary. The total catchment area of Kerka is 1762 km² and its length in Hungary is 53.7 km. Our investigations on the stream Kerka began in summer 2003 and were repeated every year till 2006. Five sampling sites were chosen along the stream from border to mouth. Water depth, transparency, water temperature, pH, dissolved oxygen and oxygen saturation were measured in the field. The list of the occurring macrophyte species was also noted. In the laboratory suspended solids, nutrients (nitrogen and phosphorus forms), concentration of chlorophyll *a*, and COD were measured and calculated. Periphyton samples were taken on submerged and emergent macrophytes and occasionally from stones (pebbles-gravels). Altogether 99 aquatic invertebrate taxa were identified during the four years. High species richness was found in the case of Trichoptera, Mollusca, Diptera and the Ephemeroptera. Considering Diptera order, on the basis of the distribution of individuals Chironomids dominated in 2003-2005 while Simuliids prevailed in 2006. The highest number of individuals (656 571 ind m⁻²) was found in the samples taken from the stem of Flowering-rush (*Butomus umbellatus*) in 2006. Based on the functional feeding guilds analysis it was found that, grazers and predators in 2003, generality grazers in 2004 and grazers, predators and detritus feeders in 2005 and 2006 were dominant.

Aquatic macrophytes in high quality lowland streams of Latvia

Laura GRINBERGA¹, Andris URTANS², Gunta SPRINĢE³, Lelde ENGELE³

¹ -*Institute of Biology, University of Latvia, Salaspils - Latvia*

² -*North Vidzeme Biosphere Reserve, Salacgriva - Latvia*

³ -*University of Latvia, Salaspils - Latvia*

Aquatic macrophytes are an important component of small streams ecosystems. In the assessment of ecological conditions of surface waters, macrophytes are an appropriate tool for environmental management and research. Despite their rather wide amplitude of habitat preference macrophytes react to comparatively long-term environmental stress. As a result changes in species composition and abundance can be easily observed.

Macrophyte surveys of medium-sized lowland streams in Latvia were undertaken as a part of the EU-funded STAR project. This study was aimed to compare the ecological quality of 9 streams in 3 river basins in different regions of Latvia. Macrophyte community structure, i.e., composition, richness and diversity in lowland streams reaches with high ecological status (the best available quality) were investigated. Total number of sampling places was 27.

Lowland streams are characterized by a variety of non-vascular and vascular plant species. The most abundant macrophyte species were identified. Site conditions were explored by applying standard macrophyte habitat surveying techniques: Mean Trophic Rank methodology (MTR), Macrophyte Biological Index of Rivers (IBMR) and Ellenberg Nitrophyllous Index. Variations in MTR, IBMR and Ellenberg Index were analyzed. The results demonstrate their natural variability.

The comparison of species abundance in spatial scale resolution of streams shows that in the upper part dominance of bryophytes is higher than downstream. The dominance of vascular species increased with the distance from the source. In most cases, the number of species indicating higher trophic status is higher in lower reaches than upstream.

None of the three macrophyte indices used alone for assessment of stream ecological status fully represent the actual ecological status of streams. Thus, in order to assess the ecological quality of streams a combination of all three indices is needed.

Patterns of fish distribution in dry-season stream pools in temporary streams

M. ILHÉU, P. GUILHERME, J.M. BERNARDO

Department of Ecology, University of Évora - Évora, Portugal.

The South of Portugal and a large part of the Iberian Peninsula has very hot and dry summers. Most of the rainfall is concentrated from late autumn to early spring. In summer no surface flow is observed and streams present long dry reaches with some isolated pools. During this period fish are subject to extreme conditions, particularly in the shallower pools. In this study, 128 pools were characterized in all stream orders (from first to fourth) of the Degebe River Basin (South of Portugal). Fish assemblage were evaluated and related to water volume and depth, physical, chemical and biological parameters (algae biomass). Habitat heterogeneity and pool size increase from upstream to downstream and present a positive correlation with species richness and diversity. Age/size structure and species composition were determined by stream order and pool depth. Pools in upstream reaches were dominated by small cyprinid fishes, mostly YOY while larger fish, dominated by barbels and nase, tend to occupy deeper and larger pools located in the downstream orders which usually persist through summer except during severe droughts. In these pools, no critical environmental conditions were noticed. Smaller and shallower pools in downstream reaches were dominated by pumpkinseed sunfish, which may be related to potential interactions between native and exotic species. Results reflect the different species strategies of resistance and resilience to drought periods in temporary streams and emphasise the importance of emigration, extinction and colonization processes in regional trends in species composition.

Temporal and spatial changes of the Bílina River ecosystem (Northwest Bohemia, Czech Republic)

Ladislav HAVEL, Petr VLASÁK, Katerina ARONOVÁ

T. G. Masaryk Water Research Institute, 160 62 Prague 6 - Czech Republic

Most of the Bílina River catchment area (1070.9 km²) is situated in the North Bohemian Brown Coalfield. About 2/3 of the river's total length (84.2 km) flows through one of the most industrial region of the Czech Republic (opencast coal mining, chemical industry, power plants, high population density). Majority of the riverbed is regulated or changed; corresponds to "heavily modified water body" according to Water Framework Directive (2000/60/EC). This situation negatively influences ecosystems both of the Bílina river and its tributaries. The first complex ecological study of the Bílina River was performed in 1994-1996. Its results documented considerable water pollution by BOD, COD, N-NO₂, N-NH₄, phosphorus, heavy metals (Hg, As), PAHs, PCBs. Macrozoobenthos community was composed of the most resistant species (leeches, chironomids, molluscs), morphological deformations were frequent. No fish population occurred in most of the profiles surveyed. The results of the present research (has been performed since 2004) document water quality improvement (both maximum and average concentrations of most parameters have decreased), pollution is still high in some parts of the river. Sediments and biofilms are contaminated by heavy metals (As, Cd, Hg, Ni, V) and specific organic pollutants (PCBs, pesticides), no perceptible changes in macrozoobenthos and fish communities have been found. Based on the results of the present research the Bílina River can be divided in five parts: 1. r.km 84.2-71.0: relatively unpolluted almost natural stream in the Krusné Hory Mountains; 2. r.km 71.0-55.5: prevailing municipal pollution (BOD, COD, N-NH₄, total phosphorus, microbial contamination); 3. r.km 55.5-30.0: industrial (suspended solids, heavy metals, specific organic pollutants) and municipal pollution; 4. r.km 30.0-6.0: part with self-purifying power, sources of municipal pollution (the rest of natural meanders remains between r.km 17.6-15.9); 5. r.km 6.0-0.0: industrial and municipal pollution. Five of seventeen tributaries of the Bílina River are significantly polluted: the Srpina stream, the Bystřice stream, the Zdírnický Potok stream (prevailing municipal pollution); the Bílý Potok stream, the Klísský Potok stream (industrial and municipal pollution). Despite the improvement of its quality, the Bílina River remains the risk for pollution of the Elbe River and subsequently for the North Sea.

Regulation of *Chlamydomonas reinhardtii* cell cycle by mitotic inhibitor, WEE1 kinase

Monika HLAVOVÁ¹, Vilém ZACHLEDER¹, James G. UMEN², Katerina BISOVÁ^{1,2}

¹ -Institute of Microbiology, Czech Academy of Sciences, 379 81 Třeboň - Czech Republic

² -The Salk Institute for Biological Studies, CA 92037 La Jolla - USA

Progress through the eukaryotic cell cycle is tightly controlled by the activity of kinases named cyclin-dependent kinases (CDKs). CDKs are serine-threonine kinases highly conserved from yeast to mammals to plants. CDK activity is tightly regulated through several mechanisms including phosphorylation. CDK phosphorylation is mediated by two groups of proteins: cyclin-dependent activating kinases (CAKs) and WEE1 kinases. CAKs are responsible for the activating phosphorylation within the T-loop (Thr161) of the CDKs while WEE1 kinase executes the inhibitory phosphorylation within ATP binding site (Thr14, Tyr15) of CDK. Phosphorylation by WEE1 enables the inactivation of CDKs until the G2/M transition when Thr14 and Tyr15 residues are abruptly dephosphorylated by Cdc25 phosphatase leading to the activation of CDK-cyclin complex and trigger of mitosis. In the model organism, green alga *Chlamydomonas reinhardtii* there is one homologue of WEE1 kinase; its transcription is precisely regulated. The WEE1 transcript is present only during S/M phase implying conservation of its role as a mitotic regulator. We prepared vectors containing hairpin structures of a part of WEE1 cDNA for specific downregulation using RNAi. This construct was cloned under *Chlamydomonas* specific inducible promoter. We followed the effect of expression of this construct on the progression through the cell cycle, cell size and activity of cyclin-dependent kinases.

This work was supported by the Grant Agency of the Czech Republic no. 204/06/0102, by the Grant Agency of Academy of Sciences of the Czech Republic no. IAA500200614, and by Institutional Research Concept no. AV0Z5020903.

Regulation of *Chlamydomonas reinhardtii* cell cycle by B-type specific cyclin-dependent kinase

Monika HLAVOVÁ¹, Mária ČÍZKOVÁ¹, Vilém ZACHLEDER¹, James G.UMEN², Katerina BISOVÁ¹

¹ -Institute of Microbiology, Czech Academy of Sciences, 379 81 Třeboň - Czech Republic

² -The Salk Institute for Biological Studies, CA 92037 La Jolla - USA

Cell cycle is in all eukaryotes regulated by cyclin-dependent kinases (CDKs). CDKs are serine/threonine kinases homologous to products of CDC28/cdc2 genes of budding/fission yeast. In higher plants (and algae analyzed so far) there are two types of kinases involved in the cell cycle regulation, A- and B-type CDKs. A-type CDKs are homologous to both yeast and mammalian CDKs and are present throughout the cell cycle both as transcript and protein; only their activity is regulated. On contrary B-type CDKs are specific for plants and algae and show a remarkable regulation on the level of transcription. In higher plants are B-type CDKs present only during G2 and M phases of the cell cycle. In the model organism, green alga *Chlamydomonas reinhardtii* there is one homologue of each A- and B-type CDK; the transcript of A-type CDK is present constitutively during the cell cycle while the B-type CDK transcript is precisely regulated being expressed only at commitment point and during S/M phase. We prepared vectors containing both A- and B-type CDKs under galactose inducible promoters and have shown that both CDKA and CDKB are able to complement temperature sensitive mutation in CDC28 gene in budding yeast. We constructed a CDKB hairpin for specific downregulation using RNAi. We placed this construct under *Chlamydomonas* specific inducible promoter. We followed the effect of expression of this construct on the progression through the cell cycle, cell size and activity of cyclin-dependent kinases.

This work was supported by the Grant Agency of the Czech Republic no. 204/06/0102, by the Grant Agency of Academy of Sciences of the Czech Republic no. IAA500200614, and by Institutional Research Concept no. AV0Z5020903.

Mollusc communities of floodplain water bodies of a large lowland river (lower Bug River, Eastern Poland)

Ewa JURKIEWICZ KARNKOWSKA

University of Podlasie, 08-110 Siedlce - Poland

The present study aimed at describing composition, species richness, dominance patterns and diversity of mollusc communities, as well as frequency of occurrence of individual species in water bodies located within selected parts of the active and former floodplains of a large, natural lowland river. Suitability of molluscs in the ordination of the investigated habitats was evaluated. The studies were carried out in the years 2004-2006 in left-bank part of the Bug River valley (2.5-6.5 and 50-152 km of the river course) in 74 water bodies heterogenous as regards size, location, hydrological dynamics, connectivity with the main river channel and successional stage. 52 mollusc species were found - 36 gastropods and 16 bivalves. At individual sites from 0 to 25 species were noted (2 - 30 including molluscs found only as empty shells). From 0 to over 300 individuals per sample were collected in individual water bodies. Mollusc communities of the investigated habitats exhibited considerable species diversity (H' about 2-3 in most habitats). β diversity within investigated fragments of lower Bug river floodplain ranged from 3.7 to 4.3 and reached the value of 4.5 at the scale of the whole area of the investigations. *Planorbarius corneus*, *Lymnaea stagnalis*, *Bithynia tentaculata*, (*Anisus vortex*, *Viviparus contectus*, *Radix labiata*, when empty shells were included) were the most frequent species ($F \geq 50\%$) and significant components of malacofauna of the study area. Mollusc communities within particular fragments of the floodplain, as well as in individual habitats considerably differed in dominance patterns. PCA and hierarchical clustering basing on the occurrence of molluscs enabled to distinguish 2 main groups of water bodies: 1) larger, permanent and usually younger ones, 2) shallow, substantially drying up, representing advanced successional stages, as well as temporary ones. Generally larger, younger and hydrologically stable water bodies were inhabited by mollusc communities showing higher species richness and diversity, than observed in shallow habitats representing advanced successional stages and temporary ones. High biodiversity within the investigated area resulted mainly from considerable habitat diversity and less from species richness of individual water bodies.

Decline of cold-water fish and changes in predator-prey relationship in the fish community of Lake Peipsi: interaction of natural factors and human impacts

Andu KANGUR, Külli KANGUR, Peeter KANGUR, Tõnu MÖLS

Centre for Limnology, Estonian University of Life Sciences, 61101 Rannu - Estonia

We examined how long-term changes in the fish community of large shallow north temperate Lake Peipsi (3555 km², mean depth 7.1 m) are related to fluctuations in water level and temperature as well as to lake eutrophication over a period of several decades. Commercial fishery statistics from 1931 to 2006 and daily data of water level and surface water temperature were used. Regression analysis revealed a significant decrease in the length of the ice covered period and earlier ice-off dates. The duration and mean water temperature of the hottest period (water T >20 °C) have significantly increased during the last 8 decades. Since the 1930s, the commercial fish catch has decreased twofold. Smelt *Osmerus eperlanus* (L.), the previous dominant in the fish community, has strongly decreased on a long-term scale. The regression analysis revealed a significant negative effect of hot summers on the abundance of smelt population with a lag of 1 and 2 years. The long period of increase in the abundance of vendace *Coregonus albula* (L.) was followed by a collapse of its stock in the late 1980s: the main reason was cumulative effect of sequential extreme weather events (extraordinary hot summer and earliest ice-off dates). The flourishing of pikeperch *Sander lucioperca* (L.) preceded the collapse of vendace. On long-term scale the fish community of Lake Peipsi has shifted from clean- and cold-water species like vendace, whitefish *C. lavaretus* L. and burbot *Lota lota* (L.) to more pikeperch preferring productive warm and turbid waters. Great changes occurred in the predator-prey relationship (pikeperch versus smelt and vendace). Cumulative effect of eutrophication and warming of the aquatic environment coupled with cyanobacterial blooms and siltation of spawning grounds pose threat to long-term survival of clean and cold-water fish species in Lake Peipsi.

Changes in spatial distribution of phosphorus and nitrogen in large north-temperate lowland lake

Küllli KANGUR, Tõnu MÖLS

Centre for Limnology, Estonian University of Life Sciences, 61101 Rannu, Estonia

We investigated changes in the spatial distribution of nitrogen (N) and phosphorus (P) in Lake Peipsi (3555 km², mean depth 7.1 m) using limnological data from 1970 to 2005. Lake Peipsi is elongated in north-south direction, while the major part of the catchment area is situated to the south of the lake. The study clarifies differences in nutrient content between the northern and southern parts of the lake (lake polarity) and indicates possible causes of eutrophication of this large international lake. The results show a steady gradient in total P (TP) and total N (TN) content along the lake: the northern and deepest part, Lake Peipsi s.s., is significantly less loaded with nutrients than the southern and very shallow part, Lake Pihkva, into which the main inflow, the Velikaya River discharges. However, the long-term temporal patterns of N and P polarity are different. Statistical analysis, using technique of parametric functions in the framework of general linear analysis provided by SAS procedures GLM and MIXED revealed that the polarity of N compounds has been relatively stable over the years and can be related to differences in natural conditions between the lake parts. Our study indicates that the in-lake N concentrations are quite stable in long-term scale and internal processes (e.g. N₂ fixation by cyanobacteria and heterotrophic bacteria, bacterial denitrification) can largely compensate for year-to-year changes in the external N load. On the contrary, the increasing polarity of TP content is the primary eutrophication phenomenon in the lake and shows clearly that input of P from the south is increasing. Our results confirm that the input of P is the main reason for anthropogenic deterioration of Lake Peipsi ecosystem.

Plankton changes in a eutrophic lake with a history of toxic cyanobacterial blooms after sewage diversion

Matina KATSIAP¹, Elisabeth VARDAKA^{1,2}, Evaggelia MICHALOUDI¹, Spyros GKELIS¹, Konstantinos Ar. KORMAS³, Maria MOUSTAKA-GOUNI¹

¹-School of Biology, Aristotle University of Thessaloniki, Thessaloniki - Greece

²-Department of Fisheries and Aquaculture Technology, Alexander Technological Educational Institute of Thessaloniki, Nea Moudania - Greece

³-Department of Ichthyology and Aquatic Environment, Volos - Greece

Long-term limnological studies are lacking in Greece. Nevertheless, in Lake Kastoria, a shallow lake with a history of toxic cyanobacterial blooms, studies on cyanobacteria have been made for several years whereas nutrients and zooplankton have been studied only for short periods. The objective of this study was to assess the ecological status of Lake Kastoria after sewage diversion using physical, chemical and biological data. Here we present a synthesis of our original and published data from 1994 to 2005. Four years after sewage diversion, external total phosphorus (TP) loading was low while in-lake TP and cyanobacteria biomass remained high except for a short period following an increased flushing of the lake. During this period, the ratio of numbers of large cladocera (>0.5 mm) to total numbers of cladocera was increased due to the presence of *Daphnia* species. Ten years after sewage diversion (summer of 2005), cyanobacterial blooms were short-lived, *Microcystis aeruginosa* still dominated but the former protagonists of the lake's plankton, *Limnothrix redekei* and *Cylindrospermopsis raciborskii*, were not observed. Pronounced changes in other phytoplankton groups such as dominance of diatoms and chlorophytes and an increase of species diversity were recorded too. Rotifers almost exclusively comprised the zooplankton biomass in September of 2005. Flushing of the lake during spring, a critical period for cyanobacteria dominance in plankton, in association with meteorological conditions such as summer storms affected negatively cyanobacteria, particularly the filamentous ones. These recent changes in the lake's plankton, revealing an improvement in lake's water quality, may indicate an important role of flushing in the lake's restoration.

Occurrence of saprotrophic fungi and fungus like organisms in Supraśl River and its several tributaries in Podlasie Province of Poland

Bożena KIZIEWICZ

Department of General Biology, Medical University - Białystok 8, Poland

Studies concerning the occurrence of some fungi and fungus like organisms, collected in Supraśl River and its several tributaries in Podlasie Province of Poland, were made in the years 2005-2006. Bait methods were used to isolate the fungi from water bodies. Twenty five fungal species included 4 of class Chytridiomycetes, 16 of class Peronosporomycetes, 3 of class Zygomycetes, 2 of class Anomorphi, 2 of class Hyphomycetes were found. The most commonly encountered species in the rivers were *Achlya americana*, *A. polyandra*, *Aphanomyces laevis*, *A. irregularis*, *Dictyuchus monosporus*, *Leptomitus lacteus*, *Pythium gracile*, *Saprolegnia ferax* and *S. parasitica*. The physical and chemical analysis revealed that the water of Supraśl River and its tributaries had higher content of ammonium nitrogen and phosphate than recommended in the first class degree of cleanliness. The content of nitrogen forms of studied water are typical of the second and phosphate of the third class degree of cleanliness.

Cladocera remains in sediment of Zalavari Pond and Keszthely bay of the Lake Balaton

János KORPONAI¹, István GYULAI², Mihály BRAUN³, László FORRÓ⁴, Judit NÉDLI⁴, István PAPP⁴, Gyula LAKATOS²

¹ -West Transdanubian Water Authority, Dept. Kis-Balaton, H-8360 Keszthely, Hungary

² -Department of Applied Ecological, University of Debrecen, H-4010, Debrecen, Hungary

³ -Department of Inorganic Chemistry, University of Debrecen, H-4010, Debrecen, Hungary

⁴ -Department of Mineralogy and Geology, University of Debrecen, H-4010, Debrecen, Hungary

⁵ -Department of Zoology, Hungarian Natural History Museum, H-1088, Budapest, Hungary

The Lake Balaton is largest shallow lake in Europe and the Zalavari Pond is a small open water wetland of Kis-Balaton Reservoir. Historically Kis-Balaton Reservoir was the 5th basin of the Lake Balaton until middle of the 19th century. Its status depended on water regime of Lake Balaton. In humid years when water level of the lake was high then open water dominated, while it was wetland when climate was dry. We tried to reconstruct this water level changes by Cladocera remains.

Trophic gradient can be seen from the Keszthely basin to Siófok Basin in the Lake Balaton. Keszthely basin is eutrophic while Siófok basin is oligotrophic. One core was taken at the deepest part of Keszthely basin, and another one in the Zalavari pond.

Significant differences were found in quality and quantity of Cladocera remains along the sediment cores. The upper layers are rich in remains but there is weak in 14-20 cm layers. Lake Balaton has chydorids rich sediment, dominant species belongs to *Alona* genus. *Alona rectangula* characterizes upper layers, while *Alona quadrangularis* and *A. affinis* are dominant in the deeper ones. *Chydorus sphaericus* is also numerous along the cores, but it occurs in highest number in the uppermost layers. *Bosmina coregoni*, *Bosmina longirostris*, *Daphnia cucullata* and *D. cucullata* x *galeata* hybrid species are the numerous in the recent plankton, but except bosminid they are rare in the sediment due to weak chitinization of carapace of last ones. *Bosmina longirostris* occurs along the core, but *Bosmina coregoni* is on the uppermost, youngest layers indicating the changes in trophic status of the basin.

The sediment core from the Zalavari pond is rich in chydorid remains, dominants are *Chydorus sphaericus*, several *Pleuroxus* species. Most frequent *Alona* species are *Alona rectangula*, *A. quadrangularis*, *A. affinis* and *A. guttata*. *Simocephalus* species are numerous in recent plankton, but no remains in the sediment. Amount of planktonic *Bosmina longirostris* remains and *Pediastrum* colonies could reflect to higher water level, weak macrophyte vegetation.

The study was supported by the Hungarian Scientific Research Fund T 049098 and National Office Research and Technology 3B022_04 BALÓKO.

Storage of lipid and protein by the shredder *Echinogammarus berilloni* (Catta) (Amphipoda) as affected by resource quality changes in streams

Aitor LARRAÑAGA, Ana BASAGUREN, Jesús POZO

Faculty of Science and Technology, University of the Basque Country, 48080 Bilbao - Spain

Several studies address the importance of organic matter quality on the dynamic of populations, and even of communities, in small streams that depend on allochthonous sources of matter and energy. Nevertheless, the majority of studies focus on population level changes and few studies pay attention to changes happening at the individual level, even though this is the unit affected by any environmental change. To attempt this approach we compared lipid and protein storage by the detritivorous taxa *Echinogammarus berilloni* below two human disturbances affecting organic matter quality in streams: 1) substitution of native deciduous forests by eucalyptus plantations (eucalyptus leaf litter has low quality due to low nutrient levels and presence of toxic compounds) and 2) nutrient enrichment of waters (nutrient presence in the water enables to improve overall leaf quality in benthos due to a faster conditioning). The sites selected for the study were first sampled quantitatively to get density and biomass data in late winter in 2003. The same sites were resampled in late winter of 2005, this time trying to collect at least 30 individuals of the whole size range at each site. Lipid and protein amount of each individual collected in the latter sampling occasion was determined using spectrophotometry-based protocols. Results showed that density and biomass of *E. berilloni* was lower if eucalyptus cover was higher in the basin, but no relationship was observed between nutrient enrichment and density and biomass of *E.berilloni*. However, storage of lipid and protein showed a clearer pattern. In eucalyptus sites individuals showed less lipid and more protein amount in their bodies than the ones in native forest sites. On the other hand, this taxa showed more lipid and less protein in nutrient rich sites comparing to nutrient poor sites. In conclusion, changes in the offer of resource of good quality affect lipid and protein storage by *E. berilloni*, and therefore, could affect energy dependant processes as reproduction.

Validation of a three-week amphibian metamorphosis study assaying the African Clawed frog (*Xenopus laevis*) for the detection of thyroid active substances

S.L. LARROZE, D.B.P. PICKFORD, D.R.P. LEONARD

Institute for the Environment, Brunel University, UB83PH Uxbridge - UK

The OECD (Organization for Economic Cooperation and Development) is developing new protocols to test chemicals for thyroid activity, and which may therefore have an impact on amphibian metamorphosis. Six different laboratories, including ours, participated in the phase II validation exercise to assess the practicality, inter-laboratory variability and sensitivity to three chemicals with different modes of thyroid disrupting activity. *Xenopus* larvae were exposed from developmental stage 51 (Nieuwkoop and Faber) for 21 days to four different concentrations of each thyroid active chemical or a control. Thyroxine (T4), the native prohormone, was selected as a reference compound for agonist activity on the thyroid axis. Perchlorate (PER) which is an antagonist inhibiting the iodine uptake by the thyroid gland, and Iopanoic acid (IOP) as a reference compound for modulation of peripheral TH action by inhibition of monodeiodinase activity. We randomly took a subsample of five tadpoles per tank at day seven of the test where we measured different endpoints; developmental stage, whole body length, snout-vent length, hind limb length, wet weight and histological analysis of the thyroid gland. These endpoints were also measured at day 21, the test termination day. We observed that T4 accelerates the tadpole metamorphosis and IOP induced an asynchronous development as the tadpole's developmental stages were abnormal (front versus back). The PER data for the external endpoints (length and weight) did not show a significant effect on the tadpoles development. Histological analysis is currently being undertaken to assess whether any of these chemicals exerted adverse effects on the tadpole's thyroid gland. The implications of the OECD protocols for the UK and EU will be considered.

Effects of algal products on oxygen dynamic in artificial phototrophic biofilms

Joséphine LEFLAIVE, Evelyne BUFFAN-DUBAU, Yvan NICAISE, Loïc TEN-HAGE

Laboratoire d'Ecologie Fonctionnelle, Toulouse - France

Epilithic biofilms are benthic microbial aggregates formed by an association of autotrophs and heterotrophs, prokaryotes and eukaryotes micro-organisms. They can represent a major part of the primary production in certain hydromorphologic conditions. The phototrophic component of the biofilms is subjected to biotic constraints, as competition and grazing pressure by micro- and macro-invertebrates, in addition to environmental constraints. The aim of this study was to determine how the functioning of such biofilms could be affected by the presence of different algal products. A modification of their functioning would affect respiration and photosynthesis and thus would result in a modification of oxygen metabolism. Parameters of oxygen dynamic such as vertical microdistribution and production rate were used to measure the effects of the algal products on the biofilms. These products were two cyanobacterial toxins, microcystin-LR and anatoxin-a, two diatom compounds, eicosapentaenoic (EPA) et 2E,4Z decadienal (DD) and extracts from an allelopathic benthic green alga, *Uronema confervicolum*. The DCMU (3-(3,4-dichlorophenyl)-1,1-dimethylurea), a photosynthesis inhibitor, was used as a positive control. Experiments were designed with two sort of artificial biofilms: mixed biofilms composed by both diatoms and cyanobacteria and biofilms with diatoms only. Microelectrodes were used to measure oxygen microprofiles.

Two different experiments were made. In the first one, oxygen profiles were measured in one point of the biofilm before and two hours after the addition of the product. In the second one, 8 profiles were measured in the biofilm before and after 3 days of exposure to the product. In that case, the spatial heterogeneity of the biofilms was taken into account. The results indicated a significant decrease in the oxygen production rate of diatom biofilm in presence of EPA, DD and *U. confervicolum* extracts after 2 hours or after 3 days of exposure. EPA and DD are released into the environment when diatoms are grazed. This means that grazers may have negative impacts on biofilms in addition to the consumption of diatom cells. Microcystin-LR affected significantly the mixed biofilms, with a 50% decrease in oxygen production rate after 2 hours of exposure. This indicates that biofilms may be negatively affected by cyanobacterial proliferation by chemicals in addition to light decrease.

Limnological studies on Monticchio Lakes (Potenza, Italy)

Barbara LEONI¹, Letizia GARIBALDI¹, Alba VARALLO¹, Giuseppe MORABITO², Piero GUILIZZONI², Andrea LAMI², Aldo MARCHETTO², Claudio SILI², Rosario MOSELLO²

¹ -Università degli Studi di Milano Bicocca, Milano - Italy

² -ISE, CNR, Verbania Pallanza - Italy

Monticchio lakes are two adjacent maar lakes, connected by a short stream, within a caldera on an ancient volcano (Mt. Vulture) in the Basilicata region of Southern Italy. In this poster we discuss the results of limnological and paleolimnological studies carried out in 2005 on these lakes and relation between plankton assemblages and environmental factors. Both lakes are meromictic, with anoxic hypolimnium, but they show contrasting trophic status: the smallest Lago Piccolo (38-m deep) is oligotrophic, with low concentration of nutrients, high Secchi disk transparency, low primary productivity and poor in zooplankton. In this lake, the low phosphorus concentration is related to the high amount of iron carried into the lake by the inflow of groundwater. On the contrary, the largest Lago Grande (35-m deep) is eutrophic, with a relevant macrophyte coverage. In this lake, phytoplankton assemblage is dominated by species typical of eutrophic environments: Cyanoprokaryota in summer, and mixotrophic flagellates during the mixing periods. The composition and the structure of the zooplankton community are typical of shallow lakes. In summer the diversity and abundance of mesozooplankton taxa (e.g. Cladocera) significantly decrease. The high density of invertebrate predators (Diptera, genus *Chaoborus*) seems to play a major role in structuring zooplankton assemblage.

A short sediment core of Lago Grande was analysed in order to identify the trophic state of the lake before the recent development of tourism. The profiles of plant pigment concentration and of diatom composition indicate that before the half of the twentieth century the trophic status of the lake was yet high, and its deeper part was anoxic, while a further increase in the last decades was also evident.

Studies on the pelagic zooplankton of the deep subalpine Lake Iseo

Barbara LEONI, Rossana CARONI, Alba VARALLO, Letizia GARIBALDI

Università degli Studi di Milano Bicocca, 20126 Milano -Italia

The analysis of pluri-annual series (1998-2006) of zooplankton data in Lago d'Iseo, the fourth largest Italian lake is presented. The trends in population densities of the different taxonomic groups are compared with trends in the most important physical, chemical and biological parameters, and discussed considering the recent thermal dynamics evolution of Lago d'Iseo. The effects of thermal changes and vertical mixing on taxonomic structure and biomass of zooplankton assemblages and interspecies interactions are analysed.

Development of a typology for coastal lagoons in the Balearic islands, Spain

Paloma LUCENA, Isabel PARDO, Maruxa ÁLVAREZ

Área de Ecología, Universidad de Vigo, 36310 Vigo - Spain

The typology required by the Water Framework Directive (WFD) is mainly aimed towards the differentiation of relevant surface water bodies with respect to their natural type, as well as the establishment of specific reference conditions for these types. A total of 33 lagoons were sampled in the Mediterranean Balearic archipelago, Spain. Moreover, according to their heterogeneity and extension, several water bodies within some of these lagoons were differentiated. Thus, in total, 56 water bodies were studied in each of the four field surveys carried out during 2005 and 2006. Each sampling campaign was focused on the water chemistry, phytoplankton and benthic macroinvertebrates and sampling and analyses were done in accordance with standardised methods. Water bodies were differentiated using the system B of typology, as defined in Annex II of the Directive. Among the factors to be used in this System, and given that tidal range and size were irrelevant for the studied Mediterranean lagoons, the salinity range was the only obligatory factor used to classify the water bodies into types. However, due to the broad range of salinity (mean annual values ranging from 0.5 to 70‰) that characterise the lagoons of this archipelago, and supported by the analysis of the macroinvertebrate dataset, a three-level typological classification is suggested to define the studied Mediterranean lagoons. Therefore, the coastal lagoons of the Balearic island could be split into one of these three types: oligohaline (up to 5‰ of salinity), mesohaline (6-26‰) or euhaline (>27‰).

The primary production of aquatic macrophytes and their epiphytes in two large shallow lakes (Lake Peipsi and Lake Võrtsjärv) in Estonia

Helen LUUP¹, Tõnu FELDMAN^{1,2}, Tiina NÖGES¹

¹-Limnological Centre of Institute of Agricultural and Environmental Sciences - Estonian University of Life Sciences, 61101 Rannu, Tartumaa, Estonia

²-Institute of Zoology and Hydrobiology - University of Tartu, Tartu, Estonia

In shallow lakes with large littoral zones periphyton can have an important share of the total annual production. In many waterbodies, the contribution of the periphyton community to production is greater than that of the phytoplankton. In a shallow lake with a large presence of submersed macrophytes, epiphyton becomes an important component of its primary productivity and a major regulator of nutrient fluxes.

We investigated primary production of submersed macrophytes and epiphyton (June - August) in 2005. We measured primary production monthly on dominant macrophytes in both lakes in Lake Peipsi *Potamogeton perfoliatus* and in Lake Võrtsjärv *Potamogeton perfoliatus* and *Myriophyllum spicatum* using modified ¹⁴C method.

In Lake Peipsi the production of *Potamogeton perfoliatus* was high in June and in August and low in July. Epiphyton production was low in June and July and maximum production was in August.

In Lake Võrtsjärv the production of *Potamogeton perfoliatus* was reverse of Lake Peipsi low in June and August and higher in July. Epiphyton production was during the studied period on same level. The production of *Myriophyllum spicatum* in Lake Võrtsjärv had a different pattern the maximum production was in June and minimum in August. Epiphyton production maximum was also in June and low in July and August.

Although the *Potamogeton perfoliatus* was the same macrophyte species in both lakes the primary production patterns were different. Even the primary production in same lake on different macrophytes was different.

Change in macrophyte communities in the Norfolk Broads

Genevieve MADGWICK, Carl SAYER, Thomas DAVIDSON, Dan HOARE

Department of Geography, University College London, WC1E 6BT London - UK

The Norfolk Broads, a series of shallow lakes in the East of England, were once famed for their clear water and luxuriant growth of aquatic plants. Over the last 100 years the area has faced increased pressure from the tourist industry as well as domestic and agricultural pollution, and now many broads only have a few species or have lost them altogether. During this period, many observations of plant species found in particular Broads were recorded by botanists and naturalists who published their findings or pressed specimens for herbaria. By collating these historic records, this study looks at the changes in community composition and their timing over the last 150 years in a series of broads and relates these to the timing and nature of external pressures. In addition sediment cores taken from these broads and analysed for macrofossil remains are compared to the historic records and evaluated as a complementary method of determining past macrophyte communities.

Spatial distribution and diversity of plant-associated invertebrates in a lotic-lentic ecosystem (Lake Posta Fibreno, Central Italy) and water quality monitoring

Luciana MASTRANTUONO, Valentina DI VITO

Department of Animal and Human Biology, University "La Sapienza", 00185 Rome - Italy

A survey on plant-associated invertebrates in Lake Fibreno was carried out for the first time in 2004 with the aim to evaluate the fauna composition, distribution and diversity, and to define the lake ecological status. The basin (surface area: 0.3 km²; maximum depth: 15 m) is an original example of a lotic-lentic system, located in Central Italy in a Reserve classified as a Special Area of Conservation (SAC, European Union Directive 92/43/EEC). The lake originates from a complex of groundwater and surface karstic springs belonging to the Marsica hydrogeologic system and comprises a wide reed stand crossed by canals and the only floating island of the South Europe (diameter: about 30 m). High flow and constant temperature (10-11 °C) characterize the lake water, which discharges in the Fibreno river at a flow of about 10 m³.sec⁻¹. Aquatic vegetation and invertebrates were collected bimonthly with a hand dredge in six stations during one year. Ten typically lotic/lentic plant taxa were collected, which colonized mostly the 0-3 m depth range and were distributed according to water flow regimes. High numbers of zoological groups (28) were found, comprising 94 taxa, mostly represented by insects (34) and secondarily by nematodes, oligochaetes, gastropods and crustaceans, thanks to the assemblage of invertebrates typical of lentic and lotic waters. The presence of indicator taxa and the measure of some bioindices performed on the invertebrate community have indicated an oligo-mesotrophic condition, with a trophic gradient varying from oligotrophy to mesotrophy according to different plant composition and lake hydrodynamics. Although some signs of eutrophication were revealed by high phosphate contents in the water, high concentration of organic matter in the sediments, disappearance of vegetation with respect to the past years, extensive growth of the sulfumbacterium *Thiopedia rosea* on the bottom, the plant-associated invertebrate community still showed a good ecological status following the positive effect of dilution-removal of nutrients caused by the continuous water flow of the lake.

Size-structure of aquatic insect larvae during colonization

Renata MATONIČKIN KEPČIJA, Mirela SERTIĆ, Marko MILIŠA, Ivan HABDIJA, Biserka PRIMC-HABDIJA, Ines RADANOVIĆ

Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb - Zagreb, Croatia

Colonization of aquatic insect larvae was investigated in a second order woodland stream by using trays filled with natural substrate. Patterns of colonization differed significantly between seasons. Highest number of taxa was recorded during the winter (64), and lowest during the summer colonization experiment (38). Density fluctuated strongly during each seasonal experiment, with synchronized first peak after 2 weeks of colonization during spring, summer and autumn. Other observed peaks were consequences of mass colonization of first-instar larvae, especially in late spring. During the winter there were two mass colonizations by simuliid prepupal larvae, probably due to downstream drift. Biomass fluctuated mostly during the winter. During the summer experiment biomass was on average 11 times lower compared to the winter experiment. Abundance-biomass curves suggested seasonal differences in size structure, which was confirmed by seasonal patterns of size classis. Larvae of first (out of five) size class made up 35,5 % of all colonizers during the spring, highest share of 54,1 % during the summer, 40,8% and 17,5% during the autumn and winter. The percentages of first size class had significant positive correlation with temperature. Seasonal colonization patterns reflected life history attributes of aquatic insects.

Fish based ecological assessment in Mediterranean temporary streams: effects of temporal variability

P. MATONO, J.M. BERNARDO, M. ILHÉU

Department of Ecology, University of Évora, - Évora, Portugal.

Fish fauna composition is relevant in the ecological status assessment of rivers because of its sensitivity to different kinds of pressures. In the South European countries, namely Portugal, the development of biotic indexes applied to fish are still in the beginning and these are mostly based on expert judgement rather than on sensitivity analysis.

Mediterranean rivers, particularly Iberian ones, show peculiar environmental and biological features. These streams are shaped by predictable seasonal events of flooding and drying over an annual cycle, presenting also a strong inter-annual variation on flow regime. The ecological plasticity of many fish species and the dynamics of the river network occupation, represent a relevant obstacle in the development of a responsive fish index. Fish assemblages are adapted to natural environmental variability (both spatial and temporal) which may mask the effects of anthropogenic disturbance.

This study focus on the variation of the recently developed Portuguese Fish Index along the last 10 years. Fish data were collected from 12 sites, located in temporary streams of south Portugal.

Phylogenetic characterization of the culturable bacterial community inhabiting three Antarctic lakes

Luigi MICHAUD, Consolazione CARUSO, Santina MANGANO, Viviana BRUNI, Angelina LO GIUDICE

Department of Animal Biology and Marine Ecology, University of Messina, 98166 Messina - Italy

The diversity of the culturable planktonic bacteria inhabiting Antarctic freshwater environments was examined by culturing and genetic fingerprinting methods. During the Austral Summer 2004-2005, water samples were collected from three lakes: Crater Cirque (CC), Luther Peak (LH) and Inexpressible Island (INI). Total heterotrophic bacteria were counted by epifluorescence microscopy after DAPI staining. Colony forming units (CFUs) were determined after incubation on R2A agar plates at 4 °C in the dark for one month. Colonies were selected, picked and purified according to differences in color and shape. More than 450 strains were isolated and screened: 197 from CC, 146 from LH and 135 from INI. A preliminary amplified ribosomal DNA restriction analysis (ARDRA) was carried out on 16S rDNA amplified via PCR, in order to cluster the isolates according to the restriction profile they showed. At least two representative isolates per cluster were selected for further characterization; to elucidate their taxonomic position, conventional phenotypic and phylogenetic analyses were performed. Results led to the identification of the isolates as members of various phylogenetic groups such as α -, β - and γ -Proteobacteria, Actinobacteria and Bacteroidetes. In addition, some isolates were affiliated to previously uncultured bacteria. Among the α -Proteobacteria, the genera *Rhodopseudomonas* and *Acidovorax* were detected, while the γ -Proteobacteria were mainly represented by members of the genus *Pseudomonas*. *Simplicispira* and *Polaromonas* genera were among the β -Proteobacteria. Members of the genus *Flavobacterium* were very common among the Bacteroidetes. Several Actinobacteria were closely related to unknown Antarctic bacteria. Differences in species composition were observed between the isolates retrieved from the lakes investigated. Although isolates used through this study represented a small fraction of the entire bacterial community, the results here reported contribute to the knowledge on bacterial Antarctic diversity, providing information which cannot be achieved by the culture-independent approach alone and enlarging the knowledge about their ecophysiology.

Seasonal variability of diel phytoplankton cycles in a shallow lake (L. Candia, N. Italy)

Giuseppe MORABITO, Alessandro OGGIONI, Karin SPARBER

CNR - Istituto per lo Studio degli Ecosistemi, 28922 Verbania/Pallanza - Italy

Investigations on phytoplankton dynamics carried out over appropriate time scales can provide useful information towards a better understanding of the ecology of the algal populations.

The patterns of phytoplankton distribution and the spatial and temporal heterogeneity was investigated on a short temporal scale in Lake Candia (Northern Italy), a small shallow lake (max depth 7 m). The measure of the space-time distribution of phytoplankton by means of a fluorometric probe (Fluoroprobe by BBE Moeldaecke) allowed to describe the diel dynamic of the spring (26-27 April), summer (22-23 August) and autumn (25-26 October) assemblages. The daily vertical and spatial distribution of phytoplankton was investigated in eleven stations, carrying out measurements every 4 hours. At the same time the surface (0.5 m) and deep currents (4.5 m) were measured by means of float drogues, in order to evaluate the effect of the horizontal movements of the water masses on the phytoplankton distribution.

During each of the three seasonal cycles was observed a significant difference in the vertical displacement of the major algal groups: Bacillariophyceae/Chrysophyceae, Cyanobacteria, Cryptophyceae (except in August) and Chlorophyceae (except in April). The vertical profiles clearly showed that each group occupied different water layers during the day, probably according to their respective ecological preferences. However, a comparison of the vertical profiles showed that the position of most of the groups (Cyanobacteria, Chlorophyta, Bacillariophyceae/Chrysophyceae) along the water column changed across the day.

The analysis of the data pointed out also the existence of a significant variability in the spatial distribution among the sampling stations, in particular for the group of Cyanobacteria in April and in August and of Cryptophyceae in October. These differences were analysed taking into account the effect of allochthonous disturbances, such as wind, current and nutrients input.

Epilithic diatoms and water quality of mountain streams in the Giant Mountains and Bohemian Forest (Czech Republic) under the influence of recreational activity

Adéla MORAVCOVÁ¹, Ota RAUCH², Linda NEDBALOVÁ^{1,2}, Jaromír LUKAVSKÝ²

¹ -Charles University in Prague, Faculty of Science, Department of Ecology, 128 44 Prague 2 - Czech Republic

² -Institute of Botany, Czech Academy of Sciences, 379 82 Třeboň - Czech Republic

The Giant Mountains and the Bohemian Forest (Czech Republic) represent a unique and valuable collection of mountain ecosystems in Central Europe. Their altitude and parallel orientation, combined with diverse geological and geomorphological structure, determine their importance as centres of European biological diversity. The region played a key biogenic role as a bridge between the two mountain migratory centres situated in Europe and in Asia. It is also necessary to emphasize the hydrological importance of both mountain ranges in the Central Europe with respect to water supply of densely populated lowlands in the Czech Republic. Water ecosystems, especially mountain streams, are particularly sensitive to any anthropogenic disturbance, and integrate various effects caused by human activities. Together with direct changes in the management of watershed areas and long distance transport of pollutants, increasing recreational activity represent an important factor influencing these ecosystems.

We have studied the chemical composition and structure of diatom assemblages in selected streams loaded with sewage originating from recreational activities within the two mountain areas. Sites above and below discharge of both treated and non-treated effluents were compared.

The pollution influenced some of the investigated streams to a marked degree. According to the multivariate analysis, diatom species composition was controlled predominantly by the type of stream and discharge. However, some environmental variables connected with anthropogenic pollution (TDN, TDP) also had statistically significant influence on changes in species relative abundances ($p < 0.05$). Increased values of nutrients led to changes in the structure of diatom assemblages, which was represented by a shift from oligotrophic species to species with high tolerance to organic pollution.

Low discharge connected with low snow accumulation in winter and hot long summer was identified as the most critical factor for mountains streams under study. Increasing impact of recreational activities, together with current prognosis of climatic changes represent a potential risk for these unique freshwater ecosystems.

Seasonal periodicity of phytoplankton in the Slapy Reservoir (Czech Republic)

Linda NEDBALOVÁ^{1,2}, Jan FOTT², Jaroslav HRBÁČEK³, Lucie KRUTÍLKOVÁ², Evzen STUHLÍK⁴

¹ -Institute of Botany, Academy of Sciences of the Czech Republic, Třeboň - Czech Republic

² -Charles University in Prague, Department of Ecology, Prague 2 - Czech Republic

³ -Biology Centre AS CR, Institute of Hydrobiology, České Budějovice - Czech Republic

⁴ -Hydrobiological station Velký Palenec, Blatna, Czech Republic

Seasonal development of phytoplankton in the central part of the eutrophic canyon-shaped Slapy Reservoir, Czech Republic (L=44 km, z_{max}=53 m, T_{mean}=37 days) was studied in 2003-2006. Weekly sampling interval of the ~euphotic layer (0-4 m) revealed detailed information on the timing and shape of phytoplankton peaks, not clearly detected by previous monitoring carried out in three-week intervals. The phytoplankton biomass (expressed as chlorophyll-a concentration) formed usually three sharp peaks during the vegetation period. The lowest values (below 1 mg m⁻³) regularly occurred close to the winter solstice. In conditions of low impact of loss factors as grazing by zooplankton or sedimentation, the irradiance was thus confirmed as the most important factor driving phytoplankton dynamics in winter months. In winters with little or no ice cover (2003/04, 2004/05), the winter minimum was followed by an exponential increase under conditions of almost continuous mixing. After the onset of thermal stratification the increase continued due to markedly improved light conditions in the epilimnetic layer, until the first seasonal maximum was reached. After the sudden decline of the spring peak (30-60 mg m⁻³ chlorophyll a), the clear-water phase occurred in late May or early June. The pattern of the two summer peaks was especially in 2006 more complex, due to their dependence on a set of less predictable factors. Concerning species composition of peaks, a regular pattern was also observed. Typically, the spring maximum was formed by fast growing cryptomonad flagellates (*Plagioselmis nannoplanctica*, *Cryptomonas* spp.) and small centric diatoms from various genera. The other two peaks were less clearly qualitatively defined. The dominance of large colonial diatom species (*Asterionella formosa*, *Fragilaria crotonensis*) was typical for early summer peaks. The occurrence of cyanobacterial blooms and planktonic desmid *Staurastrum planctonicum* characterised the late summer peaks. However, colonial diatoms were often present, too. Overall, the present study describes a striking similarity in the pattern of seasonal development of phytoplankton in a large temperate reservoir. Both external and internal forcing are discussed.

***Daphnia* species and the genetic diversity of their populations in Lake Balaton, Hungary**

Judit NÉDLI¹, László FORRÓ¹, János KORPONAI²

¹ -Hungarian Natural History Museum, Department of Zoology, Budapest - Hungary

² -West Transdanubian Water Authority, Dept. Kis-Balaton, Keszthely, Hungary

Opinion is divided on the taxonomical status of *Daphnia* species occurring in Lake Balaton, the largest shallow lake in Europe. Some experts report *D. cucullata* G. O. Sars, 1862 and *D. galeata* G. O. Sars, 1864 from the lake, while others recorded *D. cucullata* and *D. cucullata* x *galeata* hybrids. Lake Balaton consists of five large basins. Differences between the basins in trophic level, abundance of zooplankton species and other characteristics can be substantial. Our aim was to elucidate the controversy over the taxonomical status of the *Daphnia* species in the lake and to show whether the differences between the five basins are reflected in the genetic composition of the *Daphnia* population. Zooplankton was sampled between 2002-2004 several times during the breeding season; a towed plankton net (60x60 cm netframe, 200 µm mesh size) was used from a motorboat for sampling. Gravid females were picked up randomly from the samples and frozen at -65 °C. Allozyme surveys were carried out using cellulose acetate gelelectrophoresis to reveal allele frequencies at three enzyme loci (aspartate amino transferase - AAT, phosphoglucose-isomerase - PGI and phosphogluco-mutase - PGM). We analysed 1281 gravid female specimens: 957 of which proved to be *D. cucullata*, 323 *D. cucullata* x *galeata* hybrid and only one specimen *D. galeata*, according to the species specific alleles of the AAT enzyme locus. Among the male specimens we discovered 9 *D. cucullata* and 7 hybrids. Populations were characterised by the frequency of alleles, heterozygosity, presence of multilocus genotypes and Nei's genetic distance. No differences were found in the presence of the multilocus genotypes in *D. cucullata* populations between the five basins. Genetic distances between hybrid populations from Keszthely and Tihany basins; and *D. cucullata* populations from the five basins were low. The geographical distance and differences in ecological characteristics of the basins do not result in genetic isolation of the populations. Both Wright's F- statistics and Nei's genetic distance indicated large differences between *D. cucullata* and the hybrid populations, however the differences within the taxa are minor.

Research was financially supported by the Hungarian Scientific Research Fund, T49098 and T32165 contracts.

Effect of reduced light and dissolved oxygen concentration on submerged macrophytes

Jordie J.C. NETTEN

Wageningen University, 6700DD Wageningen - The Netherlands

Functioning and biodiversity of freshwater ecosystems are threatened by the invasion of floating plants. A shift in the competition between submerged and floating macrophytes can be the result. This has major economical and ecological consequences for the region. The probability of a shift may be enhanced by global change. An ecological impact of these floating mats is that they create dark and anoxic conditions underneath. As a consequence, life under these mats is put under stress. In wind-exposed lakes the mats with floating plants may move around causing repeatedly dark and anoxic conditions in the underlying water. Here the effect of such periods on submerged macrophytes is studied. It is anticipated that the combined effect of low oxygen and light causes a much stronger negative effect on the viability of the plants than the separate factors.

To test this hypothesis, various experiments will be conducted. Experiments will focus on the effect of light reduction, reduced dissolved oxygen concentration and a combination of the two. Effects will mainly be measured by means of plant viability and ability for total inorganic carbon (TIC) uptake from the water.

The set up is with 10L buckets with a Smart & Bako growth medium and additional nutrients at non-limiting concentrations. Buckets will be placed under shading cloth to reduce light and/or bubbled with N₂/air - gas to reduce the dissolved oxygen concentration of the water. Depletion will have different levels. Plants will be placed in monoculture with high densities. Various submerged plant species will be tested (*Elodea* sp., *Potamogeton* sp., *Myriophyllum* sp. etc.). Preliminary results will be ready as of May 2007 and possibly presented at the 5th Symposium for European Freshwater Sciences.

Use of PCR based technologies for risk assessment of a cyanobacterial bloom in Lake Midmar, South Africa

P.J. OBERHOLSTER¹, A.-M. BOTHA²

¹ -CSIR Natural Resources and the Environment, Pretoria - South Africa

² -Dept. of Genetics, University of Pretoria, Pretoria - South Africa

Toxic freshwater cyanobacterial blooms are potential health hazards in water supply reservoirs and therefore predicting bloom events is an important goal of monitoring fresh water programmes. The recent identification of the *mcy* genes in the production of microcystin synthetase for the first time provides an avenue to study microcystin production at a genetic level. This paper reports analysis of a winter cyanobacterial bloom by use of quantitative real-time PCR, ELISA and PP2A methods for detection of strains present and determination of their toxigenicity in Lake Midmar South Africa. We further investigated the taxonomic composition of phytoplankton at different sampling sites and the physical and chemical changes caused in the surface water of Lake Midmar by waterfowl. Our study clearly demonstrates that the interaction between low surface water temperatures and productivity was overshadowed by the response to nutrients and nutrient availability. We also confirmed the presence of the toxic cyanobacterial strains through the use of molecular markers that detect the presence of some of the *mcy* genes in the *mcy* gene cluster that is able to synthesize microcystin toxins in *Microcystis* spp. These technologies can in future be used by water plant managers to assess the risk of cyanotoxins in water reservoirs of South Africa.

Variability of absorption coefficients in Italian lakes: implications about regionalisation of algorithms

Alessandro OGGIONI¹, Gabriele CANDIANI², Claudia GIARDINO², Giuseppe MORABITO¹

¹ CNR - Institute of Ecosystem Study, 28922 Verbania Pallanza, Italy

² CNR - Institute for Electromagnetic Sensing of the Environment, 20133 Milano, Italy

This study presents the spectral absorption coefficients of phytoplankton, nonalgal particle and coloured dissolved organic matter (or gelbstoff, or yellow substances), measured in 17 Italian lakes. Fifteen of these lakes are located in the sub-alpine region and include both large deep lakes (e.g., Maggiore and Garda) and small high-altitude basins (e.g., Boden and Paione); the remaining two lakes (Monticchio Piccolo and Monticchio Grande) are instead located in the south of Italy. For each sample, a water volume of about 2 litres was collected at lake surface. The absorption coefficients of samples were further measured in laboratory using a spectrophotometer (Perkin-Elmer Labda 2). The absorption spectra of particles retained onto the Whatman GF/F filters were measured using the filter-pad technique. The absorption spectra of nonalgal particles were measured after the bleaching of phytoplankton pigments. The absorption spectra of phytoplankton were hence derived by subtracting nonalgal absorption spectra from particle absorption spectra. The absorption spectra of coloured dissolved organic matter were measured using a 10-cm cuvette filled in with the filtered water. A baseline correction was then applied to all of the measured spectra. The absorption coefficients of nonalgal particles and coloured dissolved organic matter were modelled according to the well known exponential function, while the absorption coefficients of phytoplankton was modelled according to Bricaud method. A cluster-analysis was used to identify the number of relevant clusters describing the variability of exponential slopes of both nonalgal particles and coloured dissolved organic matter, as well as the spectral parameters describing the absorption coefficients of phytoplankton. Such analyses allowed to group the selected lakes according to their optical properties. The results seem to support the necessity of a regional parameterisation to improve the modelling of absorption coefficients in lacustrine waters. Implications about the processing of satellite data in water quality applications is highlighted as well.

The Diptera taxocoenoses in the Western Carpathian spring fens: preliminary results

Marketa OMELKOVA, Jindriska BOJKOVA, Rudolf ROZKOSNY, Michal HORSÁK, Jan HELESIC

Department of Botany and Zoology, Faculty of Science, Masaryk University Brno, 611 37 Brno - Czech Republic

Spring fens are unique habitats of dipteran larvae taxocoenoses, especial with respect to their diversity as well as abundance. Eight sites situated in the eastern part of the Czech Republic were sampled in order to study the composition and variability of these taxocoenoses. The samples of Diptera larvae were collected quantitatively in April, July, and September 2005. The diversity of larvae found in spring fens was surprisingly high. Totally, 25 families and 93 taxa of dipteran larvae were identified (chironomids were identified to the family level only). Three groups of study sites were distinguished using cluster analysis: tufa-forming fens, peat-forming fens, and *Sphagnum* fens. The substrate of tufa-forming fens showed a high percentage of the gravel and stony fractions. Calcium carbonate was deposited on the bottom as a crust or a cover of small organic particles forming fine sediments. Probably due to these environmental conditions larvae of Stratiomyidae (c.f. *Oxycera pygmaea*, *O. pardalina*, *O. meigenii*) and Psychodidae (e.g. *Pericoma calcilega*), which use the calcium for their body encrustations, occurred in calcareous fens in a high number. Such adaptations enable the complete larval development also during unsuitable environmental conditions in dry seasons. Larvae of Limoniidae, probably owing to their wide ecological valence, had a high proportion in taxocoenoses on all sites but reach the highest number of taxa just in calcareous fens (e.g. *Gonomyia lateralis*, *G. alboscutelata*, *Thaumastoptera calceata*). Interesting larvae of *T. calceata* built small cases analogically to Trichoptera. The substrate of peat-forming fens had a high amount of organic matter. This substrate type was preferred by larvae of Ptychopteridae and Ceratopogonidae and seemed to be also suitable for larvae of Syrphidae (*Melanogaster aerea*). Larvae of *M. aerea* pierce the aerenchym of plants to obtain air under the water surface. *Sphagnum* fens represented the most extreme sites with a low pH and a high share of organic matter produced by *Sphagnum*. In the taxocoenoses of this type Dixidae and Limoniidae distinctly predominated.

RAPD analysis and isoenzyme profiles some vendace (*Coregonus albula*) populations in Latvia

Jelena OREHA, Natalja SHKUTE

University of Daugavpils, Daugavpils - Latvia

Vendace (*Coregonus albula*) is a widespread fish in waters of the Holarctic. The vendace forms exhibit a great variation in morphological characters, which reaches the sub - species level. Since 1900 *Coregonus albula* has been artificially introduced in more than 30 Latvian lakes from Peipus and Ladoga lakes. *Coregonus albula* - vendace was registered in 30 Latvian lakes in the 30s of the last century. In the 90s of the last century vendace was registered only in 5 lakes. 108 samples of fish were analysed. The collecting of the material was carried out during 2004 - 2006 year from Nirzas, Lejas, Dridzas and Raznas lakes in Latvia and biochemical staining was used to analyse to estimate genetic variation of *Coregonus albula* in Latvia. Two morphological characters (mean length, mean weight) and mean age and sex of the fish samples from these populations were analysed by two - factor analyse. Random amplified polymorphic DNA - PCR (RAPD) markers and allozyme electrophoresis was used to study genetic variation and population's structure with and between populations from Latvian lakes. Muscle tissue homogenate was used for electrophoretic investigations on polyacrylamide gel. The eight enzyme system activities were studied (MDH, E.C. 1.1.1.37, ME, E.C. 1.1.1.40, EST, E.C. 3.1.1.-, G3PDH, E.C. 1.1.1.8, LDH, E.C. 1.1.1.27, AAT, E.C. 2.6.1.1, ADH, E.C. 1.1.1.1, SOD, E.C. 1.15.1.1). A distribution of genotypes in these isoenzyme systems was different. The numbers of loci in all investigated populations are analogical. 17 polymorphic loci were selected for genotype analysis of different vendace populations. The 40 random oligodecamers were used to amplify DNA from 108 fish samples from four populations. Mean of heterozygosity in different populations differs a little, but, in total, can say about genetic stability in investigated populations. The results of investigations show that there is a passable level of heterozygosity in investigated populations and it was relatively genetically stable.

Influence of a point source on nutrient storage in the benthic community in a Mediterranean stream

Jesús ORTIZ¹, Francesc SABATER², Eugènia MARTÍ³, M. Àngeles PUIG

¹ -Center for the Study of Mediterranean Rivers, 08560 Manlleu - Spain

² -Dep. of Ecology, U of Barcelona, 08028 Barcelona - Spain

³ -Center of Advanced Studies of Blanes, CSIC, 17300 Blanes - Spain

We aimed to examine the effect of nutrient inputs from a point source on the nutrient storage in the stream benthic community. We analyzed C, N, and P contents in water, benthic macroinvertebrates and their potential food resources in two reaches located upstream and downstream of a point source input in La Tordera stream (Catalonia, NE Spain). Periphyton and mosses had similar nutrient contents in the two reaches. The %C and %N in filamentous algae was also similar in the two reaches, but %P was two times higher below than above the point source. The content of N and P in CPOM, FPOM, and SPOM increased considerably below the point source relative to upstream. Differences in nutrient contents between the two reaches were highly variable among macroinvertebrate taxa, but lacked of a clear trend. Although, concentrations of dissolved nutrients were much higher at the downstream than at the upstream reach, benthic C and N standing stocks were quite similar between the two reaches. In contrast, P standing stock in benthic biomass compartments was three times higher downstream than upstream of the nutrient point source. The increase in P standing stock at the downstream reach mostly accumulated in resource compartments, in particular CPOM and FPOM. On average, in the two reaches macroinvertebrates represented a relatively low proportion of the C and P benthic standing stock, but they accounted for c.a., 15% of the benthic N standing stock. Major differences between the two reaches in nutrient standing stocks in the macroinvertebrate compartment were associated to a redistribution of stocks among feeding groups. At the upstream reach, nutrients were mainly stored in gatherers and scrapers while at the downstream reach nutrients were stored in higher trophic levels. Below the point source, nutrient standing stocks in predators and filterers increased up to six times relative to the upstream reach.

Unusual reproduction patterns and life cycles of some freshwater green microalgae

Pavel PŘIBYL, Vladislav ČEPÁK

Academy of Sciences of the Czech Republic, Institute of Botany, Centre of Phycology, 379 82 Třeboň - Czech Republic

We studied the impact of growth conditions on the mode of reproduction in some freshwater microalgal species of Chlorophyceae (*Botryosphaerella sudetica*, *Neochloris aquatica*, *Neochloris vigensis*, *Bracteacoccus minor*) and Xanthophyceae (*Trachydiscus minutus*). Under external conditions allowing maximal growth the microalgae reproduce asexually by multiple cell divisions and produce high amount of autospores or aplanospores. However, appropriate manipulation with external conditions led to the turnover of the reproduction pattern - production of motile stages; even the sexuality was induced in some species, where generative reproduction was not observed to date. For all species tested light quantity was found to be the crucial factor in the reproduction pattern. Production of zoospores and gametes was inhibited by light; motile cells emerged when algae were cultivated in darkness. We investigated the morphology of motile cells, the mode of sexual reproduction, and the efficiency of both motile stages production and mating events. The significance of described reproduction patterns under natural conditions is discussed.

Impact of the flood regime on the zooplankton density and community composition in the Daugava River, Latvia

Jana PAIDERE, Arturs SKUTE

Daugavpils University, 5401 Daugavpils - Latvia

Zooplankton densities and composition of zooplankton communities in the River Daugava, Latvia, were studied from April to October in 2005 and 2006. Periods of research were characterised by varying water hydrological regime in the River Daugava. The two maximal water level fluctuations were observed both in 2006 and 2005. The first floods, spring floods, were observed in April in both years. The second flush floods were observed in May 2005, while autumn flush floods were observed in September 2006 due to great rainfalls. Two different river spaces were compared and during the periods of high floods, the River Daugava got connected with its floodplain lakes. The floods affected longitudinal distribution and community composition of zooplankton. The highest similarity indices of zooplankton communities between the river habitats were during the falling and rising phases of flood. Low similarity was observed during the period of low water level, and the suggested heterogeneity between river habitats and communities was characterised by semi-plankton, littoral and benthic forms. The impact on zooplankton number taxa, density and biomass was more evident during the periods of flush floods both in 2005 and 2006. An evidently decreasing total biomass, density and number taxa were observed during the period of the water rising phase, impossible due to the wash out effect or organisms mortality. During the periods of water rising and falling phases, zooplankton communities were dominated by *Synchaeta oblonga*, *Keratella cochlearis* or substitute each other.

The study was supported by the VPD1/ESF/PIAA/04/NP/3.2.3.1/0003/0065 project.

Patterning Response Behaviour of Medaka (*Oryzias latipes*) to Toxic Substances Using an Adaptive Learning Algorithm

Y.S. PARK¹, C.W. JI², E.Y. CHA², T.-S. CHON², S.K. LEE³

¹ -Kyung Hee University, Dongdaemun, 130-701 Seoul - Korea (S)

² -Pusan National University, Geumjeong, 609-735 Busan - Korea (S)

³ -Korea Institute of Toxicology, Daejeon - Korea (S)

The behaviour of indicator specimens in response to sub-lethal doses of toxic substances has been used to detect contamination in aquatic ecosystems. Changes in the movement behaviors of medaka (*Oryzias latipes*) were analysed after being treated with toxic chemicals, Diazinon and Copper. Test specimens of medaka, *Oryzias latipes*, were observed individually in an aquarium (volume of water; 40 cm × 20 cm × 10 cm). The movement tracks of medaka were continuously recorded in two dimensions in 0.25 second intervals before (2 days) and after (2 days) the treatments of toxic chemicals at low concentrations using a digital image processing system both before and after the treatments. The movement data of medaka were divided in different time periods, and were accordingly patterned in an unsupervised manner by using the Self-Organized Map (SOM). Abnormal behaviours such as "shaking" and "no movement" were more frequently observed after the treatments of the chemicals. The lengths and angles for line movements of specimens were accordingly grouped by the SOM. The behavioural patterns observed during the short time periods were characteristically integrated to the behavioural patterns recorded for the long time periods. Movement patterns affected by toxic chemicals were effectively distinguished from those of unaffected movement patterns by the SOM.

Within-population differences in behavioural thermoregulation tactics in lacustrine brook charr (*Salvelinus fontinalis*, Mitchill)

Marc PEPINO, Pierre MAGNAN, Andrea BERTOLO

Département de Chimie-Biologie, Université du Québec à Trois-Rivières - Trois-Rivières (Québec) Canada

Thermo-sensitive radio transmitters were used to study the patterns of behavioural thermoregulation of 55 adult brook charr in an oligotrophic lake in southern Québec (Canada). The main objective of our study was to determine if there are different thermal strategies among individuals within a given population. We expect that differences in physiological and metabolic needs among individuals would result in different behavioural thermoregulation patterns. We used principal coordinates of neighbour matrices analysis (PCNM), a form of spectral analysis for irregularly interspaced data, to analyze temperature time series that were recorded for each individual every 30 minutes over a 1-month period (June-July). The PCNM analysis revealed at least three patterns. All individuals showed a circadian thermal cycle, suggesting that their thermoregulatory behaviour is under the control of factors related to photoperiod. Thermal patterns were associated with a shift from warmer layers during the day to colder layers during the night. However, the amplitude of the cycle and the variability in selected temperatures differed among individuals: One third of individuals showed a strict and well-defined periodicity (higher amplitude and lower variation in selected temperatures) while the others exhibited cycles of lower amplitudes and more variable selected temperatures. Nearly half of the latter group also showed a linear increase in their mean selected temperature with time, as summer progressed. Our analysis of the radio-tracking data suggests that the observed differences in thermal behaviour are related to a different use of the littoral vs. the pelagic zone. The use of distinct food resources (zoobenthos vs. zooplankton) might be related to different metabolic needs and, in turn, explain the differences in thermoregulatory behaviour.

Inter-site variability of leaf litter breakdown in reference headwater streams

Javier PEREZ, Jesús POZO

Basque Country University, Fac. Ciencia y Tecnología, 644 Bilbao - Spain

Litter breakdown, a key process in the stream functioning, can be considered as an indicator of the ecosystem health. This process, however, changes in space and time, and its variability under regional reference conditions should be well established before to be able to discern processing rates of impacted sites from those of pristine sites. The aim of this study was to analyze the natural inter-site variability of leaf litter processing in reference condition, headwater streams of the Basque Country (Northern Spain). We chose three streams in each one of three selected catchments. Breakdown experiments were carried out using alder leaf litter (*Alnus glutinosa* (L.) Gaertn.) incubated in 5mm mesh bags from November 2006 to the end of January 2007. Water temperature was continuously measured to integrate its effect on decay rates to make comparable results from different areas. Our results show little variation in the decay rate among streams. We observed differences between streams only in one of the catchments. This low variability in the processing rate under pristine conditions points to its potential incorporation in regional programmes to assess the stream health according to the European Water Framework Directive.

How lake recreational development affects invertebrates living on different natural substrata

Bernadette PINEL-ALLOUL, Simon DE SOUSA, Antonia CATTANEO

Dept. Sciences biologiques, Univ. de Montréal, C.P. 6128, succ. Centre ville, H3C 3J7 Montréal - Canada

The littoral zone of lakes is very productive and supports high biomass and diversity of benthic invertebrates. Invertebrate diversity mainly results from the presence of different substrata (rocks, sediments, macrophytes, woods) which increases the complexity and spatial heterogeneity of littoral habitats and offers refuge against predators. This study aims at understanding how lake recreational development affects littoral invertebrate communities on different natural substrata. The final objective is to evaluate the potential of littoral invertebrate community for monitoring early impact of lake residential development. We sampled benthic invertebrates in the littoral zone of 7 lakes of the Laurentian region of Quebec (Canada). We determined total biomass, size structure, and taxonomic composition of invertebrates living on sediments, rocks, submerged wood, and macrophytes. Four of the lakes were relatively pristine while three others were experiencing intense recreational development. Sediments and rocks were present in all lakes whereas wood was found only in undeveloped lakes and macrophytes only in the most perturbed lakes. In less developed lakes, total invertebrate biomass and individual size were the greatest on sediments, which offered complex habitats with leaves and coarse particulate matter. Rocks supported the lowest invertebrate biomass whereas biomass on wood was intermediate. Sediment-dwelling invertebrates were the most diverse and comprised large organisms, such as Anisoptera, Coleoptera, Ephemeroptera, and Gastropoda. Taxonomic composition was similar on the two hard substrata with a clear dominance of Chironomidae. In more perturbed lakes, total biomass of invertebrates was again the highest in sediments but differences among substrata were more subtle than in the undeveloped lakes. Invertebrate size structure did not differ among substrata but taxonomic composition clearly varied. Rocks were again dominated by Chironomidae. The largest difference was observed between the community in the macrophytes rich in large organisms (Gastropoda, Hydra, and Ceratopogonidae) and the community in the sediments dominated by aquatic worms (Oligochaeta and Nematoda). With increasing lakeshore development, total invertebrate biomass and size structure became similar on all substrata but the presence of macrophytes contributed a distinctive invertebrate fauna to the lakes.

Longitudinal zooplankton distribution and general limnology of a tropical Brazilian reservoir (Rosana- Paranapanema River)

Luciana PINTO SARTORI, Marcos GOMES NOGUEIRA

Laboratory of Aquatic Ecology – Zoology Dept., State University of São Paulo/UNESP Botucatu - Brazil

Brazil has most of its electric energy generated by hydroelectric power plants, and because of this many important rivers have been dammed to fulfill this demand. In the State of São Paulo, the Paranapanema River has now 11 hydroelectric power plants. In order to follow the limnological conditions of this river, both through its biotic and abiotic composition, series of studies have been performed on its series of reservoirs. The last one of them, Rosana Reservoir (Paranapanema River, SE Brazil), has been studied in order to describe the summer and winter longitudinal patterns of zooplankton during 2004 and 2005.

The zooplankton study was based in the sampling of 32 stations covering the 90 km of the main longitudinal axis of the reservoir. In each station a vertical haul (50 µm zooplankton-net) from the bottom to the surface was collected. In addition to the plankton sampling, measurements of water transparency, temperature, dissolved oxygen, pH, conductivity, suspended solids and chlorophyll-a were done in each point. Two additional stations were also sampled in the same way in the main lateral tributaries of the reservoir.

Species composition consist of 44 different taxa, from which 28 were cladocerans, while 9 were cyclopoids, 6 were calanoids and 1 was a harpacticoid. The most abundant and frequent zooplankton species were *Notodiaptomus* c.f. *henseni*, *Thermocyclops decipiens*, *T. minutus*, *T. inversus*, *Diaphanosoma birgei*, *Ceriodaphnia cornuta*, *C. silvestrii*, *Moina minuta*, *Bosmina hagmanni*, *B. longirostris*, *Daphnia ambigua* and *D. gessneri*. Zooplankton abundance was more important the lacustrine zone of the reservoir. From the seasonal point of view, the smaller densities occurred during the rainy period (summer), especially in the medium region of the reservoir - transition between lotic and lentic compartments. Among cladocerans Sididae and Moinidae predominated in the rainy period and Bosminidae in the dry (winter). Copepods, (mainly copepodids) were numerically dominant in almost the whole reservoir, except during the rainy period when cladocerans were very abundant in the lacustrine zone. The elevated precipitation in summer led to homogeneity in the water column, confirmed by temperature and dissolved oxygen profiles.

Aquatic fauna of the Ural mountain lakes

Vasily PONOMAREV, Olga LOSKUTOVA

Institute of Biology, Komi Science Centre, Ural Division, Russian Academy of Sciences, 167982 Syktyvkar - Russia

Within the Northern and Subpolar Ural the mountain lakes of the Pechora river Ural tributaries' basins are spread extremely uneven. In the Northern Ural they are relatively under- developed both in quantity and surface area. Northwards, the Ural lakes are more numerous and form quite large lake-river systems. In 1995-2006 the water invertebrates and fish population diversity in mountain and sub mountain lakes located in the western slopes of the Northern and Subpolar Ural was studied. Within the frames of the Russian Academy of Science national programs supported by the projects «TUNDRA» and «SPICE» the lakes located within the catchment area of the Pechora river II-III tributaries were explored. Around 200 species out of 10 taxonomic groups were revealed within invertebrate fauna. The basis of the bottom fauna is presented by the species with wide area and European species, as well as some species of Siberian fauna are revealed. At relatively low-level fish species diversity (the fish population of the explored Northern and Subpolar Ural lakes is comprised by 14 species), most of them are characterized by expressed uniqueness species diversity and complicated species structure. The fish communities structure of the lakes corresponds to the pattern widely spread among biological communities of high latitude zones which is expressed by one or two species dominating. The data obtained prove the high biological diversity of water communities of the mountain lakes, its connection of adaptive significance with Ural glacier period and the origin mainly specified by the inter influence of Siberian and European fauna within the zone of their contact in the borders area of the Pechora and Ob' rivers. Further perspectives of researches and conservation of the lakes and lake-river systems of the Ural located mainly within the specially protected nature territories of the federal level- nature protective institutions established for nature ecosystems conservation and historical-cultural heritage and scientific-research works (Pechoro-Ilychsky nature reserve) - are being discussed, also for regulated tourism organization and operations and for recultivation implementation of the disturbed nature complexes (National park "Yugyd va").

The Study of Mayflies (Ephemeroptera) ecology in Latvia's running waters (1986-2006)

Arkadijs POPPELS

Latvian Fish Resources Agency, 1048 Riga - Latvia

The aim of the study was to detect ecological distribution of Ephemeroptera fauna in the Latvia's running waters: in the natural small streams and in the streams with changed ecological conditions. Rhithron community was characterised by Ephemeroptera species typical for oxygen rich waters such as *Baetis vernalis*, *Caenis horaria*, *Ephemerella ignita*, *E. mucronata*, *Heptagenia sulphurea*, *H. lateralis*, *Ecdyonurus venosus*. Potamon community characterised by potamophyl species *Caenis rivulorum*, *Cloeon dipterum*, *Baetis rhodani*. These species always are stated in high abundance and biomass on the silt bottom and on the littoral part of the potamal stretches. Mixed community characterised by *Cloeon dipterum*, *Baetis niger*, *B. fuscatus* on the sand-mud mixed substrate. In man made Hydro Power Plant reservoirs ecological conditions changed: species typical for lentic waters - *Cloeon dipterum*, *Caenis horaria*, *C. moesta*, *Baetis niger* became dominant in the dammed reservoirs. Now 58 species belonging to 11 families are recorded in Latvia's inland waters.

Running waters are characterised by 44 species of Ephemeroptera. *Ephemerella notata*, *Siphonurus lacustris*, *S. armatus* and *E. carelica* were recorded for the first time in Latvia's lotic environments. Due to climate changes in the last decades, Ephemeroptera species characteristic for Central part of Europe are now common in Latvia.

Cyanophyta bloom and its effect on species diversity of water bodies

Zohreh RAMEZANPOUR¹, Blahoslav MARSÁLEK²

¹ -Dept. of Fisheries & Hydrobiology, MZLU, 613 00, Brno - Czech Republic

² -Botanický ústav AVČR, 603 65 Brno - Czech Republic

Phytoplankton species diversity was studied in two shallow ponds Zámecký (30.12 ha), Růzový (1.57 ha) and the Dyje River (mean depth 90 cm) in 2002 and 2003. The Dyje River flowing through the Lednice National Park, Czech Republic, is the main water source of both ponds. The quantitative phytoplankton samplings were carried out at biweekly intervals in spring and summer. Samples were fixed in Lugol's and formalin solution (3%) separately. Algal cells were counted using an inverted microscope Meopta. Extraction of microcystins from lyophilized biomass was performed by ultrasonication of 10 mg biomass in 1 ml of 50% methanol (v/v). The extraction was repeated twice and both fractions were pooled and analyzed by HPLC.

The study proved eutrophic status and heavy algal bloom in the Zámecký pond dominated by cyanophyta in summer. The main phytoplankton species involved in algal bloom were *Microcystis aeruginosa*, *M. ichtyoblabe*, *M. wesenbergii*, *M. flos-aquae*, *Anabaena flos-aquae*, and *Aphanocapsa* incert. Average concentration of microcystin was 964.8 $\mu\text{g}\cdot\text{g}^{-1}$ DW during the bloom.

Shannon-Wiener diversity showed negative correlation with time in each sampling site ($r=-0.5747$, $r=-0.5754$, $r=-0.3430$ in the Zámecký and Růzový ponds and the Dyje river respectively) with the increasing of the abundance of *Microcystis*. Lowest diversity was measured during algal bloom.

Drift activity of macroinvertebrates in an intermittent stream - a case study from the Czech Republic

Pavla REZNICKOVA, Petr PARIL, Jitka KRAJCOVA, Svetlana ZAHRADKOVA, Jan HELESIC

Department of Botany and Zoology, Faculty of Science, Masaryk university, 611 37 Brno - Czech Republic

This study was carried out in the Gránický brook, which is situated in one of the warmest and driest parts of the Czech Republic. The middle part of the brook dries up every summer (in the summer 2005 from June 26 to July 6, and from July 25 to August 14). This phenomenon is not common in the Central Europe's natural conditions. That led us to study the drift mechanism, which enables the survival of macroinvertebrates in the intermittent type of stream. Drift is natural in origin or can be caused by unfavourable conditions (catastrophic) and it can also serve as a recolonisation mechanism after drought. The aim of this study was to assess changes in (i) drift activity before and after drought to indicate the escape reaction of macroinvertebrates, (ii) drift activity in relation to the changes in community of benthic macroinvertebrates (bottom samples) and (iii) drift activity induced by flow regime and other abiotic parameters within the season.

Drift samples were taken at the same time of day (afternoon) in 2-3 weeks interval from April to October 2005. Drift net (mesh size 250 μm) was exposed for one hour, subsequently three times a day. The total abundances of animals were standardized to volume 1000 m^3 of water flowed through the net. At the same time quantitative samples of benthic macroinvertebrates were taken (from the bottom area of 0.1 m^2 , mesh size 250 μm).

The total abundances of all drifting macroinvertebrates increase with the increase of total precipitations between sampling dates. The highest values were observed in samples taken in a short period of flow return between two dry periods. The total abundance rapidly decreased in the drift samples taken six days before the first drought.

The numbers of drifting Ephemeroptera (the model group) positively correspond with their numbers in bottom samples. Their abundances in drift and bottom samples dropped to zero values before dry periods and after the drought they increased gradually. The presumption that benthic macroinvertebrates use drift as an escape reaction in pre-drought was not confirmed.

This project was supported by MSM 0021622416 and G426/H grants.

Benthic communities as service providing units in Danube Delta shallow lakes

Geta RISNOVEANU, Gheorghe IGNAT

University of Bucharest, Department of Systems Ecology, 050095, Bucharest - Romania;

The research results obtained in shallow lakes of the Danube Delta during the last few decades identified the benthic communities as important “service providing units” (SPUs). The paper assesses changes in communities structure, acknowledging that biodiversity loss threatens to disrupt greatly the functioning of ecosystems, with potentially significant consequences for local human communities. Eutrophication has been the key driver influencing the evolution of the Danube Delta aquatic ecosystems to their present conditions. This has resulted in reduction of the diversity of benthic communities and important changes to population structure. Community composition, species richness, abundance, spatial and temporal distribution of the constituent populations are important features of the SPUs in determining the level and resilience of service provision. Their quantitative assessment revealed the impact of environmental changes on the functioning of ecosystems and allowed translation of various changes into impacts on ecosystem resources and services provision. Effect traits that determine the ability of populations to provide the service and response traits that determine their response to change are discussed based on the field data. The analysis is focused on the major ecosystem functions: i) production (food supply for benthivorous fishes), ii) regulation (nitrogen and phosphorous cycling), iii) information (bioindicators). The paper provides important scientific data and knowledge about the role of benthic communities in ecosystem functioning, which are useful in developing strategies for conservation, restoration and rehabilitation of the “good ecological status” of water bodies under the EU-WFD.

Changes in the relative importance of the planktonic and benthic compartments of a mountain lake driven by anomalous meteorological conditions and the establishment of a charophyte

Giampaolo ROSSETTI, Ireneo FERRARI, Pierluigi VIAROLI

University of Parma, Parma - Italy

Lake Scuro Parmense (1527 m a.s.l., surface area = 1.16 ha, maximum depth = 9.3 m) is an oligotrophic lake of glacial origin located in the Northern Apennines (Italy). The lake is usually dimictic and ice-covered from late November to early May. A long-term limnological monitoring of this lake started in 1986. In summer-autumn 2003, peculiar conditions were observed, with scarce rainfall, unusually high air temperature, and a drastic reduction of the lake volume, which in turn greatly influenced the trends of hydrochemical variables and the seasonal succession of the plankton community. For the first time, stoneworts belonging to the genus *Tolypella* appeared and from May to August formed a dense meadow which completely covered the lake bottom. This resulted in a depression of the phytoplankton production (mean chlorophyll *a* concentrations in the water column $\leq 1 \mu\text{g L}^{-1}$) accompanied by negligible values of dissolved nutrients and high water transparency. These conditions, along with a prolonged summer thermal stability, had important effects through the pelagic food web. In fact, anomalies in the successional patterns of the zooplankton and in the life cycles of dominant crustacean and rotifer species were apparent when compared to the trends recorded in previous years. The end of the vegetative period of *Tolypella*, in September, coincided with a significant increase in the phytoplankton productivity (chlorophyll *a* peak of $6.90 \mu\text{g L}^{-1}$ at a depth of 4 m). The sequence of events observed in 2003 in the Lake Scuro Parmense can actually be viewed as one of the possible future scenarios for small, relatively shallow mountain lakes as a result of global warming and climate change. In particular, the combined effects mentioned above may favour a shift towards an increased role of the benthic compartment in terms of nutrient cycling and total ecosystem production, with profound impact on the phenology of lake processes.

Multi-year observations on zooplankton diversity and dynamics in a pond with variable hydrological cycle

Marco SEMINARA¹, Daria VAGAGGINI², Fiorenza G. MARGARITORA¹

¹-Dip. Biologia Animale e dell'Uomo, Univ. "La Sapienza", - Roma, Italy

²-APAT – Roma, Italy

A preliminary analysis about the influence of the hydrological cycle and the main environmental parameters on the composition and structure of the zooplankton community of a pond in the Natural Reserve of Castelporziano (Rome, Italy) during the period 1999-2005 is presented herein. The study pond, which can be classified as an astatic water body, did not dried up during twenty years until 2000. The variable climate caused the basin to dry out completely in summer 2001, 2002 and 2003; after that date, it came back to be perennial during 2004-2005. During the study period the zooplankton composition showed a group of common, eurytopic species which presence was not influenced by the hydrological cycle (i.e. *Daphnia obtusa*, *Eudiaptomus padanus etruscus*) and a succession of the remaining species (mainly rotifers and cladocerans) strictly related with the modifications of the hydrological cycle. The seasonal succession of the zooplanktonic species is influenced by some abiotic parameters (mainly volume and temperature).

A high diversity (over 30 species of rotifera, cladocera and copepoda) characterized the initial conditions (1999-2000) of the pond; a strong decrease in species richness (18 species) and diversity followed the first drought period (2001), with the disappearance of some taxa linked to aquatic macrophytes (i.e. *Simocephalus vetulus*, *Ceriodaphnia rectangula*). In the following period (2002-2003) during which the pond behaved as a temporary water body, some taxa, typical of small temporary waters (i.e. *Daphnia chevreuxi*, *Alona nuragica*) appeared for a short period of time, and species richness and diversity moderately increased. During the period 2003-2005 the permanently wet condition allowed species richness to increase, getting back to the values of 1999-2000.

Notwithstanding the fact that species richness and diversity were the same, the similarity in zooplankton community composition between the first and the last year of the study period was only about 50%, indicating that the perturbation caused a turnover of about one half of the species. These results suggest that the total species richness measured during the perennial phase can be interpreted as the carrying capacity of the environment.

Contribute to the knowledge of Tunisian amphibians: Notes on distribution, habitat features and phenology

Alessandra SICILIA¹, Federico MARRONE¹, Roberto SINDACO², Souad TURKI³, Marco ARCULEO¹

¹-Dipartimento di Biologia Animale, University of Palermo, Palermo - Italy

²-Istituto per le piante da legno e l'ambiente S.p.A., 10132 Torino - Italy.

³-Institut National des Sciences et Technologies de la Mer (INSTM), la Goulette - Tunisia

About 300 Tunisian water bodies belonging to different habitat typologies were sampled during the period 2004-2007, in order to improve the knowledge on amphibian fauna in Tunisia. In the sites where amphibians were observed, we recorded the terrestrial coordinates, the altitude, the reproductive parameters (presence and number of pairs, male calling activity, eggs, tadpoles) and, in several cases, the following environmental features: habitat typology, hydroperiod, electric conductivity, temperature, turbidity, and macrophyte coverage. The presence of all the seven species currently known with certainty for Tunisia has been confirmed: *Pleurodeles nebulosus*, *Discoglossus pictus*, *Bufo bufo*, *Bufo mauritanicus*, *Bufo boulengeri* (previously reported as "*Bufo viridis*"), *Hyla meridionalis* and *Rana saharica*. Conversely, no evidence on the occurrence in the country of *Salamandra algira*, actually considered as doubtful, was collected.

Our data improve the existing knowledge on the biology and distribution of amphibian fauna in North Africa: we report original data on distribution ranges, breeding phenology and habitat features of the observed species and, particularly, the first data on the ecology of the poorly known *Pleurodeles nebulosus*.

Seasonal changes in respiratory enzyme activity of microplankton, zooplankton and sediment communities in two lakes of different trophic state

Tatjana SIMČIČ, Anton BRANCELJ

National Institute of Biology, Ljubljana - Slovenia

Changes in the respiratory electron transport system (ETS) activity were studied in microplankton, zooplankton and sediment in two Slovenian lakes of different trophic state (i.e. meso-eutrophic Lake Bled and oligotrophic Lake Bohinj) during the year. It was shown that respiratory enzyme activity of communities differed between both lakes. In general, the values of ETS activity as well as their fluctuations were higher in Lake Bled than in Lake Bohinj. ETS activity was mostly changing with seasonal variation of temperature and changing composition of communities in the lakes. Estimation of respiratory carbon losses, calculated from ETS activities, showed that the total carbon loss m^{-2} was higher in Lake Bled than in Lake Bohinj. Contribution of particular community to total respiratory carbon losses differed between lakes. In Lake Bled the most of the organic matter was oxidized in sediment, while in Lake Bohinj plankton contributed similar or even greater percentage to total degradation of organic matter through respiration than microbial organisms in sediment. The main reasons for differences between investigated lakes are larger size and depth of Lake Bohinj and its lower trophic state. Thus, the intensity of energy flow throughout different communities showed the current conditions in both lakes. It is assumed that this could be useful indicator of the susceptibility of ecosystem to environmental changes due to natural process (i.e. aging) and anthropogenic factors that have direct or indirect effects on the processes in lakes.

Caddisfly Trichoptera drift characterisation in the dominating habitats of small streams in Latvia (preliminary results)

Agnija SKUJA

University of Latvia, Riga - Latvia

Drift samples were taken at the end of September of 2007 in the three lowland streams (Koja – catchment's area 73.4 km², Gauja Rivers basin; Strikupe – catchment's area 85.94 km², Venta river basin; Tumsupe – catchment's area 106.4 km², Daugava River basin) in four times per day and night (00.00-00.30, 06.00-06.30, 12.00-12.30 and 18.00-18.30). In the Koja stream samples were taken downstream to the CPOM - psammal habitat and downstream to the psammal habitat; in the Strikupe stream - downstream to the macrophyte - psammal habitat and to the CPOM -xylal - psammal habitat; in the Tumsupe - downstream to the riffle and downstream to the complex habitat with psammal, CPOM, xylal, macrophytes and lithal. Samples were taken with the six drift nets (frame size 0.25x0.25m²; mesh size 0.5 mm) at the each investigated stream reach cross section. The caddisfly taxa diversity and abundance of individuals in the drift samples was low. Eight taxa were stated in both the Koja stream and Strikupe stream, 14 taxa - in the Tumsupe stream. The family Leptoceridae were represented by the most abundant individuals. *Lasiocephala basalis* were the most abundant in the Strikupe and Tumsupe streams, *Oligoplectrum maculatum* - in the Koja stream. Caddisfly drift intensity and species diversity was higher during 00.00-00.30, lower - during 06.00-0.30 in the Koja and Strikupe streams. These results approve known from the literature. But different pattern were established for Tumsupe, because of impact (reduced water depth and current velocity) of small waterpower plant, the highest drift intensity was established during 18.00-18.30, when the current velocity and water level was the highest.

The investigation was supported by the European Social Fund (ESF).

Influence of the moss-covered travertine barriers on zooseston retention of the Plitvice Lakes (Croatia)

M. ŠPOLJAR, I. HABDIJA, B. PRIMC-HABDIJA, M. KUČINIĆ

University of Zagreb, Faculty of Science, Division of Biology, Zoology Department, Zagreb - Croatia

The influence of moss cover in the lotic and lentic parts on zooseston retention was examined from May to December 2000. The study was conducted in the hydrosystem of the karstic bararage Plitvice Lakes, in the short reaches such as channels, cascades and waterfalls that connect the series of large lakes. The objective of the study was to establish the role of moss cover as a organisms refuge from water turbulence. Zooseston structure in mosses of the lotic and lentic parts is linked to (i) water discharge, (ii) inflow of zooplanktonic organisms from the lakes and (iii) drifting organisms from benthos. Both the qualitative and quantitative structure of zooseston show distinct spatial and temporal fluctuation. Rotifers and ciliates prevailed in abundance and biodiversity in moss cover, while crustaceans avoid lotic parts with a fast current.

Distribution of benthic diatoms at high-quality sites of medium-size lowland streams

Gunta SPRINĢE¹, Leonard SANDIN², Evija ZEILISA³

¹ -Institute of Biology, University of Latvia, Salaspils - Latvia

² -Department of Environmental Assessment, Swedish University of Agricultural Sciences, Uppsala - Sweden

³ -Latvian Environmental, Geological and Meteorological Agency, Riga - Latvia

For the understanding of distribution of benthic diatoms that are defined by the Water Framework Directive as one of the biological quality elements for running waters, high-quality reaches from medium-sized lowland streams of Latvia, Ecoregion 15 (Baltic Province) were sampled in the frame of STAR project. A nested hierarchical sampling design (from three selected catchments, three streams in each with the best available high ecological status were sampled, and within each stream three reaches were sampled) was used to test a distribution of benthic diatoms. In total, 54 benthic diatoms samples (27 from hard substratum, e.g. stones and 27 from soft substratum, e.g. sand/silt) were collected and analysed. In general, in all of high quality sites dominating diatoms were Naviculacees and Monoraphidees, followed by Nitzschiacees and Araphidees. Monoraphidees dominated on the hard substratum, but Naviculacees on the soft substratum at the reach scale as well as the stream and river basin scale. The most typical species at high quality reaches was *Achnanthes minutissima*. This species belonging to Monoraphidees is highly sensitive to pollution and represents oligo-beta-mesosaprobic state. The numbers of individuals were higher on hard substratum in comparison with populations on soft substratum. In all three river basins the largest population was found for Naviculacees. In total, the structure of benthic diatoms is good representative for high ecological quality sites of medium-size lowland streams.

Nutrient dynamics and eutrophication patterns in two shallow lakes of Greece: Effects of macrophytes species richness on aquatic environment

K. STEFANIDIS, E. S. PAPASTERGIADOU

Department of Biology, University of Patras, Patras - Greece

In shallow Mediterranean lakes nutrient dynamics and processes, hydrological effects, and ecology of submerged macrophytes appear to have a crucial role for food webs. However, the ecology of Mediterranean lakes is less explored in comparison to those of north temperate zone. In this paper seasonal variations of environmental parameters, macrophytes, chlorophyll *a* and periphyton biomass were investigated in two shallow lakes of Northern Greece. Lake Orestiada is a eutrophic lake heavily affected by the urban environment of the adjacent town of Kastoria, while Lake Mikri Prespa is an important wetland strictly protected by international legislation (Ramsar convention, Natura 2000 network). Field studies were carried out during early June, late August and late October of 2006. Transparency (Secchi depth), conductivity, pH, dissolved oxygen and temperature were measured in situ while water samples were taken inside of the macrophyte stands for the analytical determination of inorganic nutrient (nitrate, nitrite, ammonium, soluble reactive phosphorus), alkalinity (carbonates, bicarbonates) and chlorophyll *a* concentrations following analytical standard methods (APHA 1989). The abundance of the macrophytes was recorded according to a five point scale and plant fragments from the most abundant species samples were taken for the estimation of periphyton biomass. Ordination and cluster analyses were used to examine patterns in community composition and relate these to environmental parameters. Nutrient characteristics of the water body and the distribution of submerged macrophytic species in the two shallow lakes are further discussed. Two-way ANOVA was performed for the whole data set in order to investigate significant variations among the seasons and between the two lakes. Additionally CCA was run in order to demonstrate the probable relationships between the most abundant hydrophytes and key measured parameters such as chlorophyll *a*, limiting nutrients and periphyton biomass. The preliminary results of this study suggest that both eutrophic lakes will probably require management actions to improve water quality and the aquatic environment.

Population growth and reproduction of the rotifer *Brachionus calyciflorus* fed with P-replete or P-depleted algal food.

Martina ŠTROJSOVÁ¹, Jaroslav VRBA²

¹ -University of South Bohemia, Faculty of Biological Sciences, CZ-37005 České Budějovice - Czech Republic

² -Biological Centre AS CR, Institute of Hydrobiology, CZ-37005 České Budějovice - Czech Republic

Population growth rates and egg production of *Brachionus calyciflorus* fed with different cell concentrations of an alga *Chlorella kessleri* were evaluated during six-day life cycle tests. *C. kessleri* was cultured under either P-limiting or P-sufficient conditions and added to low-mineral medium with *B. calyciflorus*. At identical concentration of P-replete or P-depleted algal cells, *B. calyciflorus* reached different growth rates and the egg production. Both growth rates and the egg production were enhanced on a diet composed of P-replete algae except for the feeding in the highest concentration of the cells, where rotifers produced maximum number of eggs per female but reached negative growth rates. On the other hand, rotifers were almost without eggs when P-depleted algae were added at the highest cell concentration. Moreover, rotifers fed with P-depleted algae, required ten times higher concentration of *C. kessleri* for reaching similar growth rates as those rotifers fed with P-replete algae.

The role of Chironomids in benthofauna formation of the Yarenga river (the Severnaya Dvina river system)

M.A. STUDENOVA, I.I. STUDENOV, A.P. NOVOSELOV

SevPINRO, Arkhangelsk - Russia

The gathering of 11 hydrobiological samples was conducted on 3 points of the Yarenga river in October, 1995. In general 30 taxons of invertebrates were found in these samples. The chironomid's larvae were determined on all points. Total number of chironomid's larvae was 78.8% from total number of invertebrates and biomass - 30.5% from total biomass. Number of chironomid's larvae was 960 sp. m⁻² in 85 km from the mouth, 8238 sp. m⁻² in 61 km from the mouth and 10761 sp. m⁻² in 27 km from the mouth of the Yarenga river. Biomass was 0.092 g m⁻² in 85 km from the mouth, 1,614 g m⁻² in 61 km from the mouth and 5.052 g m⁻² in 27 km from the mouth. Thus, the maximum number and biomass of chironomid's larvae was observed in 27 km from the mouth. The minimum number and biomass of chironomid's larvae was registered in 61 km from the mouth.

Palaeoecological study of lake Vysné Wahlenbergovo pleso (the Tatra Mountains, Slovakia): chironomids, climatic changes and acidification

Marek SVITOK, Vladimír KUBOVČÍK

Department of Biology and General Ecology, Faculty of Ecology and Environmental Sciences, Technical university in Zvolen, Zvolen - Slovakia

Larval head capsules of chironomid midges (Diptera, Chironomidae) taken from sediments of lake Vysné Wahlenbergovo pleso (the Tatra Mountains, Slovakia) were used to infer past environmental change. The deepest sample was dated back to 1790 AD. A total of 701 chironomid head capsules, belonging to 6 taxa, were found. Analysis of subfossil chironomid assemblages demonstrated that Vysné Wahlenbergovo pleso was oligotrophic throughout the past 200 years. In the recent developmental history of this lake, three stages can be distinguished: (1) "The pre-acidification stage" before the 1920s, (2) "The anthropogenic acidification stage" from the 1920s to 1980s, and (3) "The recovery of the lake" since the end of the 1980s. Chironomid community was relatively stable during the first stage. At the end of this stage, proportion of acid-sensitive species *Micropsectra radialis* declined. This trend was probably natural and may be related to climatic changes. In second stage, the total number of head capsules and productivity decreased drastically. Atmospheric inputs of sulphur increased by three- to four-fold between the 1950s and 1980s. The lake was strongly acidified with a depleted carbonate buffering system since the 1950s; pH was between 5.2 and 5.3. Oligotrophication is a typical feature of acidified lakes. Thus, decline of productivity was interpreted as an effect of anthropogenic acidification. The third period was characterised by an increase in *M. radialis* and a decrease in *Heterotrissocladius marcidus*. Observed changes in the chironomid assemblages may be the first response to decreasing acid deposition and subsequent increase of lake water pH. This interpretation was supported by the Bray-Curtis based RDA, where lake alkalinity and smoothed mean annual air temperatures explained almost 70% ($p < 0.01$) of variation in chironomid assemblages. In conclusion, the lake ecosystem was likely to be affected by both global climatic changes during the 20th century and inputs of atmospheric deposition since the 1950s.

This study was co-supported by the EMERGE project and Faculty of Ecology and Environmental Sciences (institutional project AE-III 3103). The recovery process will be further studied in the research project VEGA 1/4334/07.

Downstream effect of a polluted reservoir on water quality river in semi-arid Algeria

Amina TALEB¹, Nouria BELAIDI¹, James GAGNEUR²

¹-Biology Dpt, University of Tlemcen - Tlemcen, Algeria.

²-UMR LADYBIO, University Paul Sabatier - Toulouse Cedex 4, France.

The impact of the management of a polluted reservoir on the Tafna river in a semi-arid region has been highlighted using physico-chemical indicators. The Hammam Bougrarha reservoir collects heavily polluted waste water from the town of Maghnia (N-W Algeria) and from several factories. The quantitative and qualitative impact of water releases from dams on quality of downstream rivers has been assessed. Temperature, pH, conductivity, chloride, dissolved O₂, BOD, and nitrogen compounds have been surveyed between 1998 and 2001, after the construction of the dam. The change in each parameter is compared between sites located upstream and downstream from the dam.

The spatio-temporal evolution of the organic pollution indicators was highlighted by ANOVA and PCA analyses. By enhancing sedimentation of the organic matter, the reservoir makes possible a significant decline in the BOD downstream of the dam, but increases NH₄ concentration at the downstream sites. The pollution is diluted during high flow and dam water releases. Conversely, during low flow periods, mineralization of organic matter is higher in the lower Tafna.

Food web structure following fish manipulation in a shallow wetland lake with abundant submerged vegetation

István TÁTRAI¹, Kálmán MÁTYÁS², János KORPONAI², Ágnes GYÖRGY^{1,3}, Máté HAVASI^{1,3}, Tamás KUCSERKA^{1,3}, Piroska POMOGYI²

¹ -Balaton Limnological Research Institute of the Hungarian Academy of Sciences, Tihany - Hungary

² -Transdanubian Water Authority, Kis-Balaton Laboratory, Keszthely - Hungary

³ -Univesity of Pannonia, Limnology Department, Veszprém - Hungary

Plant coverage three years following fish manipulation reached a peak in August 2006 (>80 %) with the dominance of *Myriophylletosum spicatii* 27 %) (2.7 ha) and *Potametosum pectinati* (19 %) (1.9 ha) covering almost 50 % of the lake surface. There was a clear succession of macrophyte taxa and the response varied mostly according to the fish natural variability. In Major Lake abundance of cladoceran plankton had one peak (cca 400 ind L⁻¹) during the summer months both in the littoral and open waters. Copepods had two peaks in the littoral and one in the open water (> 800 ind L⁻¹). The cladoceran biomass did not exceed 2 mg ww L⁻¹ all over the year. The mean biomass of copepods for the period April-September was 3-4 times higher than that of cladoceran with early summer peak of biomass of >13 mg ww L⁻¹. Neither the abundance nor the biomass of crustacean zooplankton differed significantly between the habitats (t-test, $d_f=9$, $t=0,2-1,7$, $p> 0,05$). Phytoplankton biomass in Major lake was significantly reduced mainly by *Daphnia* only during the autumn. Instead of the high biomass of copepods, phytoplankton biomass was not controlled by them. In spite of that there was not a tendency in development towards inedible (mainly cyanobacterial) phytoplankton. The proportion of edible phytoplankton was >70% even during summer months. Daily filtration rate of crustacean plankton was low during the summer in the vegetated habitats. The highest calculated potential daily filtering rate (> 4 %) was found during the fall. This filtering rate, however, was sufficient to control phytoplankton biomass. There were great changes in the fish community structure following manipulation: dominant fish species were roach (*Rutilus rutilus*), ruffe (*Gymnocephalus cernuus*), 67 and perch (*Perca fluviatilis*). The new appearance of perch may indicate positive changes (spreading of macro vegetation) resulting a clear water state of the lake ecosystem formerly being in hypertrophic condition.

Methodology for assessment of hydromorphological degradation of rivers and its evaluation with benthic invertebrate communities; Alpine case study

Branka TAVZES, Gorazd URBANIČ

University of Ljubljana, Biotechnical Faculty, Department of Biology, 1000 Ljubljana - Slovenia

In Slovenia 27 different national river types have been identified in the hydroecoregion Alps. According to the EU Water Framework Directive methodologies have to be developed for evaluating the ecological status of every water body. The aim of this study was to develop a methodology for assessing the hydromorphological status and testing the developed method with benthic invertebrate community characteristics. Data from 126 sites belonging to 22 river types, affected by different range of hydromorphological alteration, have been analysed. Inventory of the hydromorphological features was done according to the River Habitat Survey (RHS), but for the evaluation of the hydromorphological features some new variables have been developed in order to emphasize the characteristics of local river features. Some of them were based on principles developed in the RHS methodology and were only slightly modified, others, like the measure of hydrological modification (HLM), took into consideration features not included in the RHS. Scores calculated based on features of channel, banks, riparian area and land use within 50 m of banktop were analysed separately but also combined into total scores for river habitat quality (RHQ) and river habitat modification (RHM). For hydrological changes the presence of dams and distances from them were considered and expressed as HLM. In order to maximise the number of comparable sites, differences between the river features from the reference sites of selected Alpine river types were tested, using Mann-Whitney U test. According to the results of the test the selected river types belonged to three different hydromorphological types. Correlations (Pearson Correlation) between hydromorphological degradation and benthic invertebrate metrics within those types were tested, but were not strong enough ($r < 0.6$). Subsequently correlations between hydromorphological parameters and benthic invertebrate metrics were tested within individual national river types, and these correlations were higher, reaching values of more than $r > 0.9$.

Environmental Monitoring of Pergusa Lake (Enna, South Italy) from 2001 to 2006, using zooplankton

Rosa TERMINE¹, Alessandro SACCA², Ornella SIDOTI², Guglielmo LETTERIO²

¹-*Sicilia Ambiente S.p.A., Via Roma. 353, 94100 Enna - Italy*

²-*Dipartimento Biologia Animale ed Ecologia Marina - Università di Messina, 98166 Messina - Italy*

Lake Pergusa (Enna, South Italy), located in the centre of Sicily, is an endorheic environment and it is fed only by precipitation. It has an oval shape with a perimeter of about 4.5 km. Its surface is now reduced compared to the past due to the numerous dry spells, as shown by several authors. The very peculiar characteristics of this environment make it a biotope of high social and naturalistic interest. For this reason, in 1995 a Special Natural Reserve, managed from Regional Province of Enna, was instituted. In 2003, additional inputs of water from the Ancipa Reservoir were started in order to increase the water-level of the lake, which was almost completely dry in 2002. Investigations on zooplankton were carried out from July 2001 to September 2006 by the Department of Animal Biology and Marine Ecology of the University of Messina and the Sicilia Ambiente Society, with a grant of the Regional Province of Enna, in order to monitor the status of this peculiar environment. Zooplankton samples were collected horizontally, twice a year, using a net with mouth diameter of 30 cm and mesh size of 200 µm. At the same time, water samples were collected for the analyses of the main chemical and physical parameters. The main results shown in our presentation are those from the samplings in 2004, after the water input, and in 2002 when the lowest lake level was recorded. These were compared with those collected in 1979, when the lake was considered in good "health status". Conversely, the samples collected from July 2001 to April 2002 showed the total absence of zooplankton. After the water addition, since February 2004, the samples showed a high density of organisms but a low biodiversity. The main group was represented by Calanoid Copepods, with the only species *Arctodiaptomus salinus* (females, males and copepodites), which constituted the 98% of the total zooplankton density. The remaining percentage was represented by cladocerans. This structure of the zooplankton assemblage was observed in all the samples collected until September 2006.

Spatial and temporal variation of coloured dissolved organic matter in two Estonian large lakes

Kaire TOMING¹, Helgi ARST², Tiina NÖGES¹, Birgot PAAVEL²

¹ -*Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences – Tartu, - Estonia*

² -*Estonian Marine Institute, University of Tartu, Tallinn - Estonia*

Attenuation spectra of coloured dissolved organic matter (CDOM) were measured from water samples in two large Estonian lakes, Peipsi and Võrtsjärv during 2001-2006. Altogether there were 328 measurement series, 231 in Peipsi (24 sampling stations) and 97 in Võrtsjärv (10 stations). These stations were more or less systematically distributed over the whole area of lakes. Usually the concentration of CDOM is characterized by its optical characteristics, attenuation or absorption coefficient of light measured from filtered water samples in some reference wavelength (mostly in the wavelength range of 380 - 440 nm). We chose for this the attenuation coefficient at the wavelength 380 nm. During observation period the temporal variation of this parameter showed a slight decrease from spring to autumn. Sometimes there has been observed rather high values in Peipsi in August-September. The spatial variation was remarkable in Peipsi, but was less expressed in Võrtsjärv. Obtained data were compared with those measured in Pärnu Bay (Estonia) in 2005-2006. There were six sampling stations along the Pärnu Bay, from the mouth of Pärnu River to the Gulf of Riga, which allows to show the decrease of CDOM when moving from the river mouth towards clearer waters.

Influence of waste water in marine ecosystem: preliminary data on benthic foraminifera assemblages and metal concentration in marine sediments

Luigi TRANCHINA, Maria BRAI, Antonio CARUSO, Claudia COSENTINO

Dipartimento di Fisica e Tecnologie Relative, Università di Palermo, 90100 Palermo - Italy

During autumn 2004 and spring 2006 several cruises has been performed to collect 70 samples from coastal marine sediments in Palermo Gulf; the aims of our work were:

- 1) to evaluate the quality of marine sediments by measuring metal concentrations (Cr, Cu, Hg, Pb and Zn);
- 2) to study distribution of benthic Foraminifera (unicellular Protozoa) and its relationship with physical and chemical parameters, both in marine water (pH, temperature, salinity) and in sediment (granulometry and metal concentrations);
- 3) to obtain a spatial map of metal concentrations in the gulf in relation to potential pollution sources.

Marine ecosystem of investigated area is highly influenced by freshwater inputs; in fact, four rivers flow into the Gulf of Palermo: Kemonia, Papireto, Oreto and Eleuterio. Kemonia and Papireto, characterized by limited discharge, were unified, canalized and buried during past centuries and actually flow into an area of the gulf called "Cala", together with municipal sewage.

Oreto river flows into the middle part of the gulf and its waters are probably mixed, in the last 2 km of the river, with industrial sewage. Eleuterio river flows into the eastern part of the gulf and several domestic sewage are discharged in these waters. In many cases "waters" of domestic and industrial sewage are discharged in the rivers, and consequently in the gulf, without any depuration treatment. Our data show that a strong correlation between metal concentrations and distribution of benthic foraminifera exists and the highest values of metals were measured in samples situated in front of river mouths, particularly Oreto river, and inside the Cala; this suggests that pollutants, transported by river freshwater, are accumulated in marine sediments and influence the life and distribution of benthic organisms, particularly Foraminifera.

Toxicity and accumulation of Selenium in *Scenedesmus quadricauda*

Dasa UMYSOVA, Irena DOUSKOVA, Milada VITOVA, Jiri MACHAT, Jiri DOUCHA, Vilem ZACHLEDER

Institute of Microbiology ASCR, 379 81 Třeboň - Czech Republic

Selenium is an essential micronutrient in the diet of many organisms, including humans. Although it is a powerful anticarcinogenic agent, at higher concentrations Se can be genotoxic and possibly carcinogenic. The toxicity of Se compounds is caused by the generation of reactive oxygen species (ROS), which can induce DNA oxidation. As the supplementation by inorganic selenite salts is less efficient than the using of organically bound selenium, the algal cells enriched by selenium can be used as an excellent source of Se-compounds. Green chlorococcal alga *Scenedesmus quadricauda* was found to be suitable to produce biomass with high content of organically bound selenium. The possibility of autotrophic as well as heterotrophic growth is an important feature of the *S. quadricauda* for its biotechnological application. In our experiments the cells were cultivated in an inorganic nutrient medium under an artificial illumination. We used a range of concentrations (10-400 mg L⁻¹) of selenium (added as Na₂SeO₃) to test its toxicity. Growth curves were assessed and vitality of cells checked by microscopy using autofluorescence of chlorophyll. Already the low concentrations (10-50 mg L⁻¹) of selenium decreased rapidly a growth rate of the wild type cultures. We determined the concentration of 100 mg L⁻¹ of selenium to be lethal for the wild type of *S. quadricauda*. Using a long-time exposure of the wild type to the high selenium concentration, we selected a fast growing strain able to grow well in the presence of selenium concentration up to 400 mg L⁻¹. This selected strain grows on the selenium concentrations of 100-200 mg L⁻¹ even faster than a wild type without selenium addition. Prospectively this adapted *S. quadricauda* strain could serve as a source of organically bound selenium in food and feed supplements.

This work was supported by Grant Agency of Academy of Sciences of the Czech Republic (grant no. A600200701), project EUREKA of Ministry of Education, Youth and Sports of the Czech Republic (no.OE221) and by Institutional Research Concept no. AV0Z5020903.

Assessing the impact of hydromorphological degradation on the benthic invertebrates in the rivers of the hydroecoregion Alps; single multimetric index for different types?

Gorazd URBANIČ¹, Branka TAVZES²

¹ - *Institute for Water of the Republic of Slovenia, Ljubljana - Slovenia*

² - *University of Ljubljana, Biotechnical Faculty, Department of Biology, Ljubljana - Slovenia*

The main objective of this study was to develop a method for river assessment based on the response of benthic invertebrates to hydromorphological degradation. In addition, the possibility of developing and using one multimetric index for different river types was tested. In Slovenia 27 river types were identified in the hydroecoregion Alps. In the current study the multimetric index was developed for 12 river types of the hydroecoregion Alps (northern Slovenia). Small, medium and large rivers with either carbonate or silicate geology were included in the study. For each river type sites representing different stages of hydromorphological degradation were investigated. At each site benthic invertebrates were sampled and hydromorphological features were recorded. For each of more than 290 biological metrics a response to hydromorphological degradation was tested using correlation analysis. Metrics were divided into four groups (richness/diversity, sensitivity/tolerance, compositional/abundance, functional). From each of the four groups one metric was combined in the multimetric index (MMI), which was developed separately for each river type. Metrics combined in the MMIs showed best type specific response to hydromorphological degradation gradient. From each metric group one metric that would respond best to hydromorphological degradation across all river types was searched for in order to be included in the MMI. However, no metric that would fulfil this requirement could be found, although metrics German Fauna index D04, number of EP taxa and [%] Gatherers/Collectors were combined in MMI for at least 8 river types.

Occurrence of *Giardia* and *Cryptosporidium* in the River Oreto (Palermo, Sicily).

Paola VALENTI, Florinda DI PIAZZA, Maria Antonella DI BENEDETTO, Francesco VITALE

Dipartimento di Igiene e Microbiologia, Università degli Studi di Palermo, Palermo - Italy

Cryptosporidium and *Giardia*, which are known to have a widespread distribution in raw water supplies have been suggested, within the past 25 years, as responsible for many waterborne outbreaks of infection in developing and developed countries. These protozoa produce robust (oo)cysts that are stable and can last for long periods (months) in the environment.

The aim of the present study was i) to investigate the occurrence of *Giardia* and *Cryptosporidium* (oo)cysts in River Oreto, that is crossing Palermo city and is mainly used for agricultural purposes, and ii) to evaluate the possible association with seasonality. In addition, iii) the molecular characterization of *Giardia* cysts was performed.

From September 2003 to August 2004 six samples were collected at four different times (one in autumn, one in winter, one in spring, three in summer). Samples (10 liters each) were analysed according to Method EPA 1623; the presence of the (oo)cysts was assessed by immunofluorescence with monoclonal antibodies. To characterize the *Giardia* cysts at the molecular level, a fragment of the TPI gene was amplified by PCR method, and the products were analysed by restriction fragments length polymorphism analysis.

Both parasites were detected in all the samples; *Giardia* (oo)cysts showed higher concentration than *Cryptosporidium*. The highest number of (oo)cysts was found in winter (*Giardia* cysts 6700/10L, *Cryptosporidium* oocysts 200/10 L) and spring (*Giardia* cysts 11187/10 L, *Cryptosporidium* oocysts 165/10 L). The pattern of occurrence of both parasites appeared temporally related to the level of rainfall trend.

Giardia cysts were typed as assemblage A genotype, responsible of human infections.

The results demonstrate the occurrence of these protozoa in surface water samples from Palermo area and suggest a potential risk for public health mainly related to the presence of *Giardia duodenalis* assemblage A. Moreover, the higher concentration of (oo)cysts during the rainy seasons might be associated to the removal of *Giardia* and *Cryptosporidium* (oo)cysts operated by washing away the soil into the river.

A circadian clock is not involved in the timing of cell division in the alga *Chlamydomonas reinhardtii*

Milada VITOVÁ, Katerina BISOVÁ, Monika HLAVOVÁ, Dasa UMYSOVÁ, Vilem ZACHLEDER

Institute of Microbiology ASCR, 379 81 Třeboň - Czech Republic

Circadian rhythms control many cellular processes in algae. Their role in regulating the course of cell cycle is, however, unclear and published results are controversial. To test the alleged circadian timing of cell division in algae, we examined asynchronous and synchronized cultures of the green alga *Chlamydomonas reinhardtii* in a wide range of both light intensity and temperature. The cultures were grown either at the continuous light or at alternating light/dark periods. The conditions fulfilled criteria for evaluation of circadian rhythms. Cell size and cell number were measured and commitment and cell division curves assessed. The length of the cell cycle varied widely with minimal values below and maximal values far above the circadian ones. The results were also confirmed by the use of previously described circadian clock mutant that we show is more probably affected in the growth rate than in circadian regulation. We have evidenced that the length of the cell cycle corresponding to circadian times can be attained only under relatively narrow range of growth conditions and even in this case the "circadian time" is a result of given growth conditions and not of any circadian gating. We conclude that circadian clocks do not play a role in the timing of *Chlamydomonas* cell division.

This work was supported by the Grant Agency of the Czech Republic (grant no. 204/06/0102), Grant Agency of Academy of Sciences of the Czech Republic (grant no. A500200614) and by Institutional Research Concept no. AV0Z5020903.

Water reclamation of the residual coal mining pit in Czech Republic.

Petr VLASÁK¹, Ladislav HAVEL¹, Zdeněk ADÁMEK²

1 -T. G. Masaryk Water Research Institute, 160 62 Prague 6 - Czech Republic

2 -University of South Bohemia, Research Institute of Fish Culture and Hydrobiology, 389 25 Vodňany - Czech Republic

The emergent Chabařovice lake (Northwest Bohemia, Czech Republic) is an example of the first continually and well documented water reclamation of residual coal mining pit in Czech Republic (flooding has started in 2001). The main risks for proposed recreational and sport lake uses are a high nutrient content in water of the controlled channel inflow (Ptot: 0.1-0.2 mg L⁻¹) and the substantial change in quantitative and qualitative parameters of fish population. Increasing abundance of planktivorous fish (spring CPUE in 2003: 2.8; 2005: 9.3) negatively affected great filter-feeders in zooplankton community. During 2001-2003 period the abundance of the great (>710 µm) *Daphnia* species (mainly *D. magna*) substantially decreased, while the abundance of small zooplankton species (*Daphnia longispina*, *D. cucullata*, *Ceriodaphnia* sp., *Bosmina* sp., Copepoda) increased. The biomanipulation, based on "top-down effect", has been applied to reduce the negative consequences of eutrophication. Stocking by 0+ asp was successful in 2002 and 2003. However stocking by 0+ pike and 0+ wels was almost unsuccessful in 2003, because of unexpected strong predatory pressure of the resident two age-class adult perch population (SL 185-321 mm in 2004). Since 2004 the abundance of great *Daphnia* species (*D. pulicaria*, *D. longispina*) has been increasing. This fact could be theoretically considered as the first result of biomanipulation. To support this trend, the lake was stocked by 0+ asp and by 3+ pikeperch, 1+, 2+ and 3+ pike and 3-4+ wels in 2005. Up to now the lake ecosystem is able to oppose both high nutrient input and increasing planktivorous fish population. Water quality complies with the requirements for recreational purposes: no water blooms, transparency between 2-7 m. Preselected biomanipulation strategy is supposed to substitute perch by nonplanktivorous predators. It requires continuous monitoring of fish community and - based on results of this monitoring - stocking the lake by predators of different feeding strategies. It is necessary to emphasize that the lake water quality will be much management-dependent in the future in general. Biological outlook on the water quality development is important but the recreational impact (inclusive of sport fishing mode) and management in general could not be underrated.

Invertebrate communities in temporary wetlands across a salinity and hydroperiod gradient in the Camargue (France)

Aline WATERKEYN¹, Patrick GRILLAS², Luc BRENDONCK¹

¹-Laboratory of Aquatic Ecology, 3000 Leuven - Belgium

²-Station Biologique Tour du Valat, Le Sambuc, 13200 Arles - France

For this study 30 temporary wetlands, differing in salinity and hydroperiod, were selected on the nature reserve of Tour du Valat in the Camargue (France). Sampling was conducted every two months to study the present spatio-temporal state of the invertebrate communities in these temporary wetlands. We found that hydroperiod and conductivity are important environmental factors that explain a substantial amount of the variability in the taxa/species composition of the macroinvertebrates and zooplankton. We also found that there is a significant temporal trend (succession) in the community structure and that this trend is dependent on the hydroperiod of the wetlands. In the Camargue global change and intensive water management are expected to alter the hydrology and salinity of wetlands, which could have a strong impact on the community structure. This will be further studied in a mesocosm experiment by exposing a pooled egg/seed bank of temporary wetlands to a range of hydroperiod and salinity regimes, simulating expected changes in wetland phenology. By studying these wetlands we hope to contribute to a better knowledge of the communities in the temporary wetlands of the Camargue, but also to gain information regarding the conservation of these unique habitats.

Analysis of sediments in urban lakes as a basis of an assessment of their degradation state and possibility of restoration

Ryszard WISNIEWSKI

Institute of Ecology and Environment Protection, N. Copernicus University, Torun - Poland

A particularly high degree of degradation of lakes in Poland is observed among over-eutrophicated urban lakes. For many years they were the direct receivers of untreated sewages. A transformed, impervious catchment area and run-offs of pluvial sewages accelerated the process of degradation. For a considerable number of urban lakes, the scientific documentation is relatively comprehensive. However, in most cases it concerns only studies on the water depths. Studies on the chemical constitution of sediments and particularly on the quantity and forms of phosphorus accumulated in bottom sediments are still scarce. It is a well-known fact that phosphorus can occur in bottom sediments in various forms characterized by different mobility. Apart from the phosphorus fraction analysis, the measurement of EPC-0 (equilibrium phosphate concentration) is useful. It is a measure of the sorptive capacity of sediments in relation to phosphates, informing about the degree of accumulation of various phosphorus forms in sediments of aquatic reservoirs. The present paper aims at evaluating the significance of studies on the bottom sediments for appropriate diagnostics of the condition of a lake and selection of the right reclamation method. The research was conducted in 2005 on five urban lakes. Four of them are lakes of small area, below 50 ha. One of them is characterized by very large area, exceeding 800 ha. All of them are shallow and demonstrate symptoms of significant over-eutrophication. Besides routine physico-chemical and biological analyses of the water depths, extended studies of bottom sediments were carried out. Analysis of chemical components of bottom sediments was included, such as: Ca, Mn, Mg, Fe, Al, Si, SO₄, the ratio Fe/P as well as analysis of the phosphorus fractions. Measurements of the sorptive capacity of sediments in relation to phosphates (EPC-0) were performed for sediments of each lake. The obtained results revealed a high variability of the studied parameters between morphometrically similar lakes and also spatial and temporal diversification within the same lake. It was found that the studied parameters of bottom sediments should be included in standard procedures for evaluation of the condition of lakes.

Changes in rotifer species composition and its abundance in an hypertrophic lake Eber (Afyon) Turkey.

Sibel YIGIT, Ahmet ALTINDAG, Burak YASIN

Ankara University, Faculty of Science, Dept.of Biology - Besevler- Ankara, Turkey

In this study, rotifer species composition and abundance were studied seasonally. The Eber Lake is gradually undergoing hypertrophic conditions. Aquatic plants cover 90% of the total surface area. *Phragmites* sp. is the dominant emergent species. The lake also receives a sewage discharge. Rotifer samples were collected seasonally between January and December 2006 at four stations. More than 30 species were found, the commonest of which were *Brachionus angularis*, *B. calyciflorus* and *Filinia terminalis*. According to these data, the abundance of rotifers was highest in spring. It is thought that, rotifer structure of the Eber Lake has been changing since the 1970's because of the untreated water from a sewage outlet. Moreover, a further and significant increase of the trophic state of the lake is expected. In addition, some physical, chemical and biological parameters (such as dissolved oxygen, pH, chlorophyll *a* and total nitrogen) were measured in the lake water during the study period.

Long-term changes of mayfly (Ephemeroptera) taxocene of a central european potamal river

Svetlana ZAHRAĐKOVA¹, Tomas SOLDAN², Petr PARIL¹, Pavla REZNICKOVA¹, Libuse OPATRILOVA¹

¹ -Institute of Botany and Zoology, Masaryk University, Brno - Czech Republic

² -Biological Centre, ASCR, Institute of Entomology, České Budějovice - Czech Republic

The mayfly taxocene of the Pannonian potamal river segment (the Jihlava River, Danube basin, the Czech Republic) has been investigated several times within the past 50 years in order to detect its long-term changes, their origin and consequences. The area investigated was influenced by (i) - pollution (local impact); (ii) - upstream and downstream construction of impoundments and changes of land use within the watershed area (regional changes); and (iii), undoubtedly, global climate changes. Three periods (early 1960's, late 1970's, and present status after 2000) have been evaluated with a special reference to ecological and life cycle traits of mayfly species found, based on detailed analysis of all season and semi-quantitative (kicking technique) samples. Simultaneously, key ecological variables concerning hydrological data (e.g. discharge regime and water temperature), climatic data (e.g. air temperature) as well as water quality (e.g. organic pollution) were collected. Although some of observed abiotic conditions of the studied river segment at present are quite similar to those occurring before the period of disturbances, the quantitative and qualitative changes in respective mayfly taxocene are evident, most probably reflecting the period of heavy disturbance in the second half of the last century. However the total species diversity now shows a loss of 5 species only (when taking into account initial research period), in fact altogether 10 species of the original taxocene were lost and ubiquitous species (most those of the genus *Baetis*) replaced the vanished species. Very sensitive, relict and specialized potamal species such as *Ephemerella mesoleuca*, *Choroterpes picteti* and, in a lesser extent *Isonychia ignota*, became most probably extinct in the area studied and their recovery is unlikely, due to the considerable fragmentation of a habitat by the presence of reservoirs as well generally low vagility of these species. On the contrary, some further, less sensitive potamal species (*Ecdyonurus insignis*) or those not specialized to strictly potamal habitat (*Oligoneuriella rhenana*, *Ecdyonurus torrentis* or *Paraleptophlebia submarginata*) missing during the second research recovered after 2000, most probably drifting from refuges in the Jihlava River tributaries.

This study was supported by the GACR 206/06/1133 and MSMT 0021622416 projects.

The initial study on Digenea larvae invasion to *Potamopyrgus antipodarum* populations in Poland

Elzbieta ZBIKOWSKA, Janusz ZBIKOWSKI

Nicolaus Copernicus University, 87-100 Torun - Poland

Potamopyrgus antipodarum - the prosobranch snail species from New Zealand - at present is a very common mollusk in Polish water bodies. During over 70 years this snail has colonized lakes, ponds and streams of northern, western and also southern part of Poland. *P.antipodarum* belongs to euryoecious species, because it occurs in many types of water bodies: brackish sea and inland waters, small and large rivers and lakes, ponds and anthropogenic reservoirs.

The quick expansion of this snail species depends on many elements. This mollusk can survive at salinity from 0 to 17 ‰, it reproduces parthogenetically and can be passively transported from place to place in ballast water of ships and also attached to swimming (e.g.fish) and flying (birds) objects. What is interesting in the expansion of this species in Europe there is a few cases of natural invasion of Digenea larvae in those snails. In New Zealand the prevalence of Digenea invasion in *P.antipodarum* populations exceeds 70%.

The main aim of our study was to check the natural parasite invasion in reservoirs and stream of Bory Tucholskie National Park, and to try if those snails can be experimentally infected with different Digenea larvae in field and laboratory conditions.

In the group of over 2000 snails we found only one specimen naturally infected with *Sanguinicola* sp. We noted the patent parasitic invasion in which oval sporocysts and mobile cercariae were observed.

In experimentally infected snails we observed metacercariae of 4 Digenea species: *Echinostoma revolutum*, *Echinostoma spiniferum*, *Echinoparyphium aconiatum*, *Rubinstrema opisthovitellinum*. All experimentally parasitized snails showed lower survival than control animals.

Probably the low prevalence of Digenea in *P.antipodarum* populations under study is caused by very bad adaptation between New Zealand host and European parasites.

Light level at the bottom as a factor influencing taxonomic composition and abundance of macrozoobenthos in extralittoral zone of shallow eutrophic lakes

Janusz ZBIKOWSKI¹, Jaroslaw KOBAK²

1 -Department of Hydrobiology, Institute of Ecology and Environmental Protection, Nicolaus Copernicus University, Torun - Poland

2 -Department of Invertebrate Zoology, Institute of General and Molecular Biology, Nicolaus Copernicus University, Torun - Poland

The aim of our research was to find out whether light level at the bottom influences biodiversity and abundance of zoobenthos inhabiting the muddy bottom of shallow lakes. To accomplish this, we studied the bottom fauna in 13 shallow lakes of different water transparency and depth for three years. Simultaneously with collecting the benthic samples, we measured the light intensity at different depths. We also calculated the vertical attenuation coefficient of light under water (E). To estimate the amount of light reaching the bottom, we multiplied the E value by the lake depth (D). This index (ED) is related to the shade level at the lake bottom (the higher ED, the less light reaches the bottom). We found that the light conditions at the bottom influence macrozoobenthos. ED value below 5 was necessary to maintain relatively high biodiversity and abundance of bottom fauna. Above this value, the share of typical deep-water zoobenthos taxa, such as *Chironomus* sp. and *Chaoborus* sp., clearly increased. We calculated that light intensity at the bottom as high as 500-600 lx was needed for development of diverse and relatively abundant bottom fauna. It constitutes only about 1% of radiation entering the water column. It corresponds to euphotic depth, which is the depth beyond which the light level falls below 1% of the surface irradiation and is considered too low to maintain a positive net photosynthesis of algae. The amount of light reaching the bottom must be high enough to enable the development of phytobenthos, which improves oxygen and food conditions as well. Obviously, if the incoming radiation and/or water transparency is higher, rich zoobenthic community can occur at higher depth.

Phytoplankton as a tool to investigate the ecological quality of river Adige (North East Italy): the project Planadige

Andrea ZIGNIN, Nico SALMASO

Istituto Agrario San Michele all'Adige, 38010 San Michele all'Adige - Italy

The assessment of water quality based on the phytoplankton abundance in rivers is more difficult to interpret compared to lake ecosystems because of the greater dependence from water discharge. Photosynthetic organisms belonging to potamoplankton (phytoplankton) may represent, under specific hydrological conditions, the larger fraction of organic matter in rivers, strongly affecting water quality and causing potential problems for the utilization of water resources for drinking purposes and recreational activities. High amounts of algal biomass could cause severe problems due to bad odours, clogging of treatment plant filters and to the development of toxins by cyanobacteria in low flowing rivers. The aim of this contribution is to describe briefly the results obtained from a preliminary research carried out in three stations located along a 25 km stretch of the lowland course of River Adige (NE-Italy). The River Adige is the second largest river in Italy; it originates in the Eastern Alps at 1550 m a.s.l., and flows into the Adriatic Sea. The total length of the river is 409 km and its catchment is about 12100 km². The results obtained in this research demonstrated a strong impact of physical factors (water discharge and related variables, i.e. suspended inorganic particles and water turbidity) on the control of phytoplankton biomass and selection of algal groups and species. Higher phytoplankton growth was observed only in combination with low river discharge and favorable climatic conditions. A larger limnological project (PlanAdige) has begun in 2007 considering five stations representative of the whole water course (from the Alpine region to the Po Valley). Therefore, a further aim of this contribution is to describe the main objective and the expected results of the new project in the light of the results obtained from previous investigations.

Application of PDMPO technique in the study of silica deposition in natural diatom populations in a eutrophic reservoir

Petr ZNACHOR, Jiří NEDOMA

Biology Centre, CAS, Institute of Hydrobiology - České Budějovice, Czech Republic

In July – October 2006 at weekly intervals, we measured silica deposition in the summer diatom assemblage at various depths in a eutrophic Římov Reservoir (Czech Republic) using PDMPO (the 2-(4-pyridyl)-5-[[4-dimethylaminoethyl-aminocarbonyl]-methoxy] phenyl)oxazole labelling technique. Fluorescence microscopy coupled with image analysis allows quantifying PDMPO fluorescence and a simple distinction between cells that are actively depositing Si and those that are not. Diatom assemblage was exclusively dominated by *Fragilaria crotonensis*, which formed pronounced subsurface maxima (2 – 6.5 m). Concentrations of the main nutrients (Si and P) were low over the whole season, however, at depth the nutrient availability was higher than at the surface. *Fragilaria* silica deposition rates were eight times higher at the surface than at depth. A half of the population was involved in silica deposition at the surface while only 20 % of active cells were found at depth. At the surface, silica deposition was limited by phosphorus deficiency. Silica deposition at depth was significantly constrained by low light availability despite the average light attenuation at depth was 1 %, which is supposed sufficient for photosynthesis. Both PDMPO per cell fluorescence and proportion of labeled cells showed to reflect the environmental condition under which diatom populations grow. Our study represents the first attempt to employ the quantitative PDMPO fluorescence measurements in the study of natural diatom populations.

Index to Authors of Oral and Poster Contributions

- Acuña** Vicenç 32
Adamczewski Tomasz 33
Adam O. 165
Adámek Zdeněk 143, 265
Agasild Helen 34
Aguiar Francisca 72
Akbulut Aydın 166
Akbulut Nuray Emir 166
Akçaalan Reyhan 168
Akkas Sara Banu 167, 178
Aktan Yelda 168
Alavi S.M. Hadi 115
Albertano Patrizia 154
Albuquerque António 72
Alfonso Giuseppe 169
Alper Alp 166
Altindag Ahmet 169, 268
Álvarez Maruxa 120, 223, 238
Álvarez Pérez Marta 35
Amarasinghe Upali 76, 96, 161
Amblard Christian 96
Ambrozič Spela 150
Andreu Rosa 170
Angelibert Sandrine 36
Antonopoulou Panagoula 36
Archambault Virginie 151
Arculeo Marco 103, 249
Argerich Alba 37, 70
Armengol Joan 52, 98
Arnous Mohamad Bashir 171
Aronová Katerina 210
Arst Helgi 259
Artemiadou Vassilia 38
Artigas J. 39
Artino Claudio 189
Aslanparviz Hasan 171
Auderset Joye Dominique 36
Babanazarova O.V. 39
Badot P.-M. 165
Baiamonte Giuseppe 172
Balode Maija 173
Balseiro Esteban 40, 43, 50, 111
Baraldi Francesca 174
Barda Ieva 173
Barlas Nurhayat 166
Barrat Segretain Marie-Hélène 149
Bartoli Marco 125
Basaguren Ana 219
Battin T. J. 104
Baudu Michel 96
Bayarı Serdar 166
Bazzanti Marcello 175
Beauchard Olivier 97
Beaumont W. 69
Beccarisi Leonardo 200
Becker Annette 73
Becker Vanessa 176
Beisel Jean-Nicolas 40
Beklioglu Meriem 41, 167, 178
Belaidi Nouria 177, 255
Bélanger Tommy 59
Bellabes Yasmine 183
Belmonte Genuario 169
Berard Annette 196
Berezina Nadezhda 42
Bergfur Jenny 135
Bernardo J. M. 209, 226
Bertolo Andrea 177, 239
Bertoni Roberto 43, 50, 111
Bertrand Frédéric 134
Bezirci Gizem 167, 178
Bily Michal 179
Bis Barbara 151
Bisová Katerina 211, 212, 264
Bitušik Peter 180
Bo Tiziano 181, 203
Bodelier P.L.E. 57
Boechat Iola G. 80
Boggero Angela 182
Bojkova Jindriska 44, 234
Bonacina Carla 183
Bonada Núria 45, 114
Botha A.-M. 232
Bottazzi Elisa 46
Bouchez Agnès 155, 196
Boudenne Jean-Luc 193
Bouhadad Rachid 183
Boven Liesbet 47
Bowes M. 93
Boyer Patrick 193
Bozelli Reinaldo 184
Brai Maria 260
Brancelj Anton 249
Braun Mihály 48, 81, 218
Brendonck Luc 47, 266
Briede Agrita 185
Brochet Anne-Laure 186
Brosse Sébastien 79, 87
Bruni Vivia 227
Bsor Tamar 76
Buffan-Dubau Evelyne 221
Buisson Laetitia 49

- Burgess** Amy 60
Butturini Andrea 35
Cabana Gilbert 59
Calles Juan 71
Callieri Cristiana 43, 50, 111
Campeau Stéphane 59
Candiani Gabriele 233
Cañedo-Argüelles Iglesias Miguel 51
Capra Hervé 92
Caputo Luciano 52
Caravati Emanuele 50
Carchini Gianmaria 35, 190
Carey Cayelan C. 53
Caroni Rossana 222
Carrias Jean-François 171
Caruso Antonio 187, 260
Caruso Consolazione 227
Castella Emmanuel 36, 119
Castelli Giuseppe 188
Cattaneo Antonella 54, 240
Çelik Kemal 166
Cellot Bernard 195
Cepák Vladislav 237
Cereghino Regis 55, 201
Cha E.Y. 238
Chandesris André 139
Chappin Terry 110
Charpin Marie 96
Chon T.-S. 238
Christensen John B. 75
Chróst Ryszard Jan 33
Cid Núria 56
Čiliak Marek 117
Cimino Antonio 187, 189
Čizková Mária 212
Coccia Cristina 175
Coci Manuela 57
Collier Kevin 163
Combroux Isabelle 58, 130, 149
Comoli Patrizia 126
Corno Gianluca 50
Cortes Rui Manuel Vitor 158
Cosentino Claudia 187, 260
Cottingham Kathryn L. 53
Coulomb Bruno 193
Crini G. 165
Cucco Marco 181
Czekaj Artur 203
Dahm Cliff 32
Dang Christian K. 58
D'Angelo Stefania 204
Darchambeau François 59, 67
Darwell Angela 190
Datry Thibault 61, 66, 136
Davidson Thomas 60, 225
Davis Jenny 63
Davies C. E. 69, 88
Davy-Bowker J. 113
Deák Csaba 207
Death Russell 64
de Bernardi Riccardo 157
De Cicco Marco 190
Defew Lindsey 191
Deigiorgi F. 165
Della Bella Valentina 175
Deluchat Véronique 96
De Meester Luc plenaria 27
Derka Tomás 65
Desbrosses Hélène 66
Descy Jean-Pierre 67
Desortová Blanka 192
de Sousa Simon 240
Devallois Valérie 193
Dewson Zoe 64
Diaz M. 68
Di Benedetto Maria Antonella 263
Di Giovanni M.V. 201
Di Nino Fiorant 146
Di Piazza Florinda 263
Di Veroli A. 201
Di Vito Valentina 225
Dodkins Ian 194
Dokulil Martin 68
Dolédec Sylvain 92, 109, 119, 195
Dorak Zeynep 168
Dorigo Ursula 196
Doucha Jiri 197, 261
Douskova Irena 197, 261
Dretakis Mihalís 36
Druvietis Ivars 198
Dugdale A. M. 106
Edwards F. K. 69, 88, 93
Ejsmont-Karabin Jolanta 87
El Alami Majida 45
Elliott J. Alex 69
Ellwood Neil T.W. 154
Eloranta Antti 199
Elosegi Arturo 70
Emmerson M. 88
Encalada Andrea 71
Engel Lelde 208
Ernandes Paola 200
Fabbri Filippo 190
Fabrizi A. 201
Faraone Francesco Paolo 202
Fastie Chris 110
Fayolle Stephanie 99
Feldman Tõnu 224

- Fenoglio** Stefano 181, 203
Fenwick Graham 61, 136
Ferrante Eleonora 204
Ferrari Ireneo 247
Ferreira M. Teresa 72, 85
Ferreira Veronica 71
Figuerola J. 78
Fischer Helmut 73
Fonollà Paula 74
Forró László 218, 231
Fott Jan 230
Franquet Evelyne 99
Friberg Nikolai 75
Fritz Hervi 186
Funicello Renato 154
Füreder Leopold 76, 96, 161
Fusillo Romina 205
Gafny S. 104
Gagneur James 177, 255
Gal Gideon 76
Gandolfi Andrea 174
García Liliana 120
Garibaldi Letizia 222
Gaudes A. 39
Gauthier-Clerc Michel 186
Gentili Gaetano 46
Gerino Magali 129
Germ Mateja 206
Ghorbani Rasul 207
Giacalone Gabriele 202
Giardino Claudia 233
Gilbert Daniel 160
Giller Paul S. 58, 78, 118
Gíslson Gísli Már 75
Giussani Gianluigi 131
Gkelis Spyros 216
Glémet Hélène 59
Gór Dénes 81, 207
Gomes Nogueira Marcos 241
Goretti E. 201
Grac Corinne 77
Graça Manuel A.S. 71, 77
Graham C.T. 78
Granier Romain 112
Green Andy J. 78, 186
Grenouillet Gael 49, 79, 97
Grey Jonathan 89
Grezzi Francesco 175
Grillas Patrick 266
Grinberga Laura 208
Gritzalis Konstantinos 151
Gruberts Davis 62
Gücker Björn 80, 104, 129
Guilherme P. 104, 209
Guilizzoni Piero 184, 222
Guillemain Matthieu 186
Gürevin Cenk 168
György Ágnes 256
Gyulai István 81, 207, 218
Haan-Archipoff Gisèle 149
Habdija Ivan 226, 250
Haggerty Roy 37
Hajimoradloo Abdolmajid 207
Hancock Barbara 82
Harrison Simon S. C. 58, 78, 91, 118
Havasi Máté 256
Havel Ladislav 210, 265
Hawkins Charles P. 138
Helesic Jan 44, 142, 234, 245
Herrmann Jan 83
Hildrew Alan G. 69, 83, 88, 93
Hlavová Monika 211, 212, 264
Hoare Dan 225
Holmgren Staffa 123
Honti Mark 84
Hoover Trent M. 132
Horsak Michal 44, 234
Hrbáček Jaroslav 230
Hudon Christiane 54
Hughes Samantha Jane 85, 158
Hugueny Bernard 97
Huisman Jef 159
Hulot Florence D. 87
Huszar Vera L. M. 140, 176
Ibañez Carles 56, 170
Ibbotson A. 69, 88
Ignat Gheorghe 246
Ilhéu M. 209, 226
Imanpour , J.N. 90
Istvánovics Vera 27, 84
Isumbiso Mwapu 67
Izagirre Oihana 70
Izydorczyk Katarzyna 102
Jacquet Stéphan 134
James Alex 64
Jansen Marcel A.K 58
Jasser Iwona 87
Ji C.W. 238
Jones Ian D. 69, 145
Jones J. I. 69, 88, 93
Jones Roger I. 78, 89, 144, 199
Joushide H. 90
Juge Raphaëlle 36
Jurczak Tomasz 102
Jurkiewicz Karnkowska Ewa 213
Kagalou Ifigenia 120
Kalinowska Krystyna 87
Kamenir Yury 91

- Kangur** Andu 214
Kangur Külli 214, 215
Kangur Peeter 214
Karaouzas Ioannis 151
Karaytuğ Süphan 166
Kari Katerina 60
Katsiapi Matina 216
Kavanagh Jane 91
Kaya Murat 169
Khara H. 90
Kirchesch Volker 73
Kiziewicz Bożena 217
Kobak Jaroslaw 271
Kormas Konstantinos Ar. 216
Korponai János 48, 81, 218, 231, 256
Kostrzewska-Szlakowska Iwona 87
Krajcova Jitka 245
Krutilková Lucie 230
Kubovčik Vladimír 254
Kučinić M. 250
Kucserka Tamás 256
Kurmayer Rainer 28
Laanbroek H.J. 57
Lachavanne Jean-Bernard 36
Lakatos Gyula 81, 207, 218
Lami Andrea 222
Lamouroux Nicolas 92, 109
Langdon Peter 60
Larned Scott 61
Larrañaga Aitor 219
Larroze S.L. 220
Lauridsen R.B. 69, 88, 93
Lazaridou Maria 38
Le Ber Florence 77
Lecerf Antoine 132
Ledger M.E. 156
Lee S.K. 238
Leermakers Martine 48
Leflaive Joséphine 94, 221
Leichtfried Maria 76, 95, 161
Leira Manuel 52
Le Jeune Anne-Hélène 96
Lek Sovan 79
Leonard D.R.P. 220
Leonardos Ioannis 120
Leoni Barbara 222
Leprieur Fabien 97
Letterio Guglielmo 258
Lillo Francesco 202
Lim Puy 49
Lindström Eva S. 28
Lo Brutto Sabrina 103
Lo Giudice Angelina 227
Loot Geraldine 79
Lopez Pilar 98
Loskutova Olga 242
Lo Valvo Mario 202
Lucena Paloma 223
Lukavský Jaromír 229
Lürling Miquel 140, 159
Luup Helen 224
Maasri Alain 99
Maberly Stephen 145
Machat Jiri 197, 261
Madgwick Genevieve 225
Magalhães Marco 158
Magnan Pierre 177, 239
Magny Michel 160
Maiolini Bruno 100
Malacarne Giorgio 181
Malmqvist Björn 101, 108, 124
Manca Marina 126, 157, 183, 184
Mangano Santina 227
Mankiewicz-Boczek Joanna 102
Marcé Rafael 98
Marcelli Manlio 205
Marchetto Aldo 133, 222
Marcucci C. 201
Margaritora Fiorenza G. 248
Marrone Federico 103, 188, 249
Marsálek Blahoslav 244
Martí Eugènia 37, 70, 74, 104, 129, 236
Martins Maria Joao 105
Massaferro Julieta 133
Mastrantuono Luciana 225
Matheson F.E. 106
Matoničkin Kepčija Renata 226
Matono P. 226
Matthaei Christoph 107
Matthijs Hans 159
Mátyás Kálmán 256
Mazej Zdenka 206
McKie Brendan G. 108
McNeely Camille 147
Medeiros Adriana O. 77
Médoc Vincent 40
Mendes Ana 85
Mérigoux Sylvie 66, 92, 109, 119
Mezquita Francesc 153
Michaloudi Evaggelia 216
Michaud Luigi 227
Miliša Marko 226
Milner Alexander M. 110, 156
Modenutti Beatriz 40, 43, 50, 111
Moghaddam Abbasali Aghaie 171
Mollaei Masoud 206
Möls Tõnu 214, 215
Montuelle Bernard 112, 155, 196

- Morabito** Giuseppe 113, 222, 228, 233
Morais Manuela 129, 151
Moravcová Adéla 229
Moreno-Ostos Enrique 98
Moret Jacques 130
Moscatello Salvatore 169
Mosello Rosario 133, 154, 222
Motte Bernard 112, 196
Moulla Mokrane 183
Moustaka-Gouni Maria 216
Muller Serge 146
Muñoz I. 39
Murphy J. F. 113, 156
Múrria Cesc 45, 114
Musil Jiri 115
Namiołko Tadeusz 105, 153
Nedbalová Linda 229, 230
Nédli Judit 218, 231
Nedoma Jiří 273
Netten Jordie J.C. 232
Nicaise Yvan 94, 221
Nirel Pascale M. 127
Nobelis Photis 58
Nöges Peeter 116
Nöges Tiina 29, 34, 224, 259
Novikmec Milan 117
Novoselov A. P. 253
O'Callaghan Richard J. 118
O'Driscoll John F. 118
Oberholster P.J. 232
Oertli Beat 36
Oggioni Alessandro 228, 233
Oieni Antonino 187, 189
Okgerman Hacer 168
Olafsson Jon S. 75
Olivier Jean-Michel 109
Omelkova Marketa 44, 234
Opatrilova Libuse 269
Oreha Jelena 235
Ormerod S.J. 113
Ortiz Jesús 236
Özatlı Dursun 166
Paavel Birgot 259
Paidere Jana 237
Paillex Amael 119
Papadimitriou Theodoti 120
Papastergiadou E. S. 252
Papp István 48, 218
Pardo Isabel 121, 223
Paril Petr 245, 269
Paris Andréanne 59
Park Y.S. 238
Pedrozo F. 68
Pelechata Aleksandra 122
Pelechaty Mariusz 122
Pella Hervé 139
Pepino Marc 239
Pérez Javier 239
Persson Jonas 123
Petraczek Simone 190
Petrin Zlatko 124
Petřivalská Karla 143
Phelan P. 78
Pickford D.B.P. 220
Pieri Valentina 188
Piggott Jeremy 107
Pinardi Monica 125
Pinel-Alloul Bernadette 240
Pinto Paulo 151
Pinto Sartori Luciana 241
Piscia Roberta 126, 183
Pomian-Srzednicki Ian 127
Pomogyi Piroška 256
Ponomarev Vasily 242
Poppels Arkadijs 243
Pozo Jesús 219, 239
Prasanth P.P. Ajith 161
Prat Narcís 45, 56, 114, 128, 170
Pretty James 83
Primc-Habdija Biserka 226, 250
Primicerio Raul 144
Proia Lorenzo 35, 190
Přibyl Pavel 237
Puig M. Ángeles 236
Pukacz Andrzej 120
Puntí Tura 128
Purina Ingrida 173
Pusch Martin T. 104, 129
Radanović Ines 226
Rambaud Maëlle 130
Ramezanpour Zohreh 244
Rauch Ota 229
Ravera Oscar 130
Reynolds C. S. 68
Reznickova Pavla 245, 269
Ribot Miquel 37
Riccardi Nicoletta 131
Richardson John S. 132
Riera J. L. 104
Rieradevall Sant Maria 51, 128
Risnoveanu Geta 246
Robertson Anne 82
Rocha Paula 77
Rodriguez-Gonzalez Patricia 72
Roger Marie-Claude 112, 195
Rogora Michela 133
Rolland Anne 134
Romagoux Jean-Claude 96

- Romani** A.M. 39
Rościszewska Elżbieta 203
Rossaro Bruno 182
Rossetti Giampaolo 46, 105, 144, 153, 247
Rozkosny Rudolf 234
Rubach Anja 30
Ruggiero Antonio 35, 55
Ruiz Zoe 60
Sabater Francesc 35, 37, 74, 104, 129, 236
Sabater Sergi 31, 39
Saccà Alessandro 258
Sagnes Pierre 66
Salmaso Nico 272
Sanchez Laura 112
Sanchez Marta I. 78
Sanders Ian 83
Sandin Leonard 135, 141, 251
Santos José Maria 85
Sapriel Guillaume 86
Sarà Gianluca 204
Sargos Denis 96
Sarmento Hugo 67
Sayer Carl 60, 225
Scarsbrook Mike 61, 136
Schade John 137, 147
Schicchi Rosario 172
Schoel Andreas 73
Scopetta L. 201
Seda Jaromir 183
Selvaggi R. 201
Seminara Marco 248
Sertić Mirela 226
Shaw Peter 82
Shisheleva S.V. 39
Shkute Natalja 235
Siccardi Federica 182
Sicilia Alessandra 249
Sidilev S.I. 39
Sidoti Ornella 258
Sili Claudio 222
Silveri Luana 100
Simčić Tatjana 249
Simmons Trey 138
Simon Ondrej 179
Sindaco Roberto 249
Skuja Agnija 185, 250
Skute Arturs 237
Smith J.P. 106
Snelder Ton 139
Soares Maria Carolina 140
Soldan Tomas 269
Solimini Angelo 104, 129, 141, 153
Souza Maria Betânia G. 159
Sparber Karin 228
Špoljar M. 250
Springe Gunta 185, 208, 251
Stefanidis K. 252
Straka Michal 142
Strasevicius Darius 101
Štrojsová Martina 253
Stuchlík Evzen 230
Studenov I. I. 253
Studenova M.A. 253
Sturt Michael M. 58
Svitok Marek 65, 117, 180, 254
Sychra Jan 143
Syväranta Jari 144
Szalóki Imre 48
Taleb Amina 177, 255
Tartari Gabriele 133
Tátrai István 256
Taumoepéau A. 106
Tavernini Silvia 144
Tavzes Branka 257, 262
Temporetti P. 68
Ten-Hage Loïc 94, 221
Termine Rosa 258
Thackeray Stephen 145
Thiébaud Gabrielle 146, 149
Thomas Steven A. 137, 147
Tierno de Figueroa J. Manuel 100
Tockner Klement 148
Toming Kaire 259
Tönno Ilmar 34
Tosenovský Evzen 152
Townsend Colin 31, 107
Tranchina Luigi 187, 260
Trémolières Michèle 58, 77, 149
Turki Souad 249
Trimmer Mark 83
Tudesque Loïc 79
Umen James G. 211, 212
Umysova Dasa 197, 261, 264
Urbanič Gorazd 150, 257, 262
Urtans Andris 208
Usseglio-Polatera Philippe 151
Uvíra Vladimír 152
Uvírová Ivona 152
Vagaggini Daria 248
Valenti Paola 263
van de Bund Wouter 153
Vandekerkhove Jochen 105, 153
Vande Voorde Johan 159
Varallo Alba 222
Varandas Oliveira Simone 158
Vardaka Elisabeth 216
Vervier P. 104
Viaggiu Emanuela 154

Viaroli Pierluigi 125, 247
Villeneuve Aurelie 155
Vincent H.M. 156
Visconti Anna 157
Visser Petra 159
Vitale Francesco 263
Vitova Milada 197, 261, 264
Vláčilová Alena 152
Vlasák Petr 210, 265
Vogler A.P. 114
Volat Bernardette 112, 196
Voreadou Catherina 36, 104, 129
Vrba Jaroslav 253
Vrede Tobias 123
Wall Adeline 160
Wasson Jean-Gabriel 139
Waterkeyn Aline 266
Weathers Kathleen C. 53
Węgleńska Teresa 87
Weliange Wasantha S. 76, 95, 161
Wells R.D.S. 106
Welter Jill 137, 147
Wisniewski Ryszard 267
Woodward Guy 69, 88, 93, 162
Yasin Burak 268
Yigit Sibel 169, 268
Yildirim Feriha 178
Yilmaz Ilkay 166
Young Roger 163
Zachleder Vilem 197, 211, 212, 261, 264
Zahradkova Svetlana 245, 269
Zamora-Muñoz Carmen 45, 114
Zbikowska Elzbieta 270
Zbikowski Janusz 270, 271
Zeilisa Evija 251
Zenone Arturo 204
Zignin Andrea 272
Zimmermann-Timm Heike 164
Zingel Priit 34
Znachor Petr 273
Zouakh Djamel Eddine 183
Zuccarello Vincenzo 200

LIST OF PARTICIPANTS

Algeria

Nouria Belaidi
Rachid Bouhadad
Amina Taleb

belaidi_nr@yahoo.fr
rbouhadad@yahoo.fr
taleb_14@hotmail.com

Argentina

Esteban Balseiro
Beatriz Modenutti

balseiro@crub.uncoma.edu.ar
bmode@crub.uncoma.edu.ar

Australia

Jenny Davis

J.Davis@murdoch.edu.au

Austria

Martin Dokulil
Leopold Füreder
Rainer Kurmayer
Maria Leichtfried
Wasantha Sena Weliange

martin.dokulil@oeaw.ac.at
leopold.fuereder@uibk.ac.at
rainer.kurmayer@oeaw.ac.at
maria.leichtfried@oeaw.ac.at
wasanthaweliange@yahoo.co.uk

Belgium

Liesbet Boven
François Darchambeau
Luc De Meester
Jean-Pierre Descy
Koen Martens
Aline Waterkeyn

liesbet.boven@bio.kuleuven.be
Francois.Darchambeau@fundp.ac.be
Luc.DeMeester@bio.kuleuven.be
jpdescy@fundp.ac.be
martens@naturalsciences.be
aline.waterkeyn@bio.kuleuven.be

Brazil

Iola Boechat
Reinaldo Bozelli
Björn Gucker
Luciana Sartori

iboechat@gmx.net
bozelli@biologia.ufrj.br
mail@bjoern-guecker.de
lpsartori@yahoo.com.br

Canada

Andrea Bertolo
Antonella Cattaneo
Bernadette Pinel-Alloul
John Richardson

andrea.bertolo@uqtr.ca
antonina.cattaneo@umontreal.ca
bernadette.pinel-alloul@umontreal.ca
john.richardson@ubc.ca

Croatia

Ivan Habdija
Mirela Sertić
Maria Spoljar

ihabdija@zg.biol.pmf.hr
msertic@zg.biol.pmf.hr
mspoljar@zg.biol.pmf.hr

Czech Republic

Michal Bílý
Kateřina Bisová
Jindřiska Bojková
Blanka Desortová
Irena Dousková
Ladislav Havel
Monika Hlavová
Adéla Moravcová
Jiri Musil
Linda Nedbalová
Marketa Omelkova
Libuse Opatřilová
Pavel Přibyl
Pavla Reznickova

michal_bily@vuv.cz
bisova@alga.cz
bojkova@centrum.cz
blanka_desortova@vuv.cz
douskova@alga.cz
ladislav_havel@vuv.cz
monika.hlavova@gmail.com
kytickar@centrum.cz
musil@vurh.jcu.cz
lindane@natur.cuni.cz
marketa.omelkova@seznam.cz
liba@sci.muni.cz
pavelxp@seznam.cz
pavlareznickova@seznam.cz

Michal Straka	michal.straka@centrum.cz
Martina Strojsová	martina.strojsova@seznam.cz
Jan Sychra	dubovec@seznam.cz
Jolana Tatosova	jolana@blatna.cuni.cz
Dasa Umysova	umysova@seznam.cz
Vladimir Uvira	uvirav@prfnw.upol.cz
Milada Vitova	vitova@alga.cz
Petr Vlasák	petr_vlasak@vuv.cz
Vilem Zachleder	zachleder@alga.cz
Svetlana Zahradkova	zahr@sci.muni.cz
Petr Znachor	znachy@hbu.cas.cz
Estonia	
Helen Agasild	helen.agasild@emu.ee
Andu Kangur	andu.kangur@emu.ee
Küllli Kangur	kylli.kangur@emu.ee
Helen Luup	luup@emu.ee
Tiina Nõges	tiina.noges@emu.ee
Kaire Toming	Kaire.Toming.001@ut.ee
Finland	
Antti Eloranta	anpeelor@cc.jyu.fi
Roger Jones	r.jones@cc.jyu.fi
Jari Syväranta	jasyvara@cc.jyu.fi
France	
Olivier Adam	olivier.adam@univ-fcomte.fr
Pierre-Marie Badot	pierre-marie.badot@univ-fcomte.fr *
Jean-Nicolas Beisel	beisel@univ-metz.fr
Anne-Laure Brochet	brochet@tourduvalat.org
Laetitia Buisson	buisson@cict.fr
Jean-François Carrias	j-francois.carrias@univ-bpclermont.fr
Bernard Cellot	cellot@univ-lyon1.fr
Regis Cereghino	cereghin@cict.fr
Isabelle Combroux	isabelle.combroux@bota-ulp.u-strasbg.fr
Gregorio Crini	gregorio.crimi@univ-fcomte.fr
Thibault Datry	datry@lyon.cemagref.fr
François Degiorgi	francois.degiorgi@univ-fcomte.fr *
Hélène Desbrosses	helene.desbrosses@free.fr
Valérie Devallois	valerie.devallois@irsn.fr
Sylvain Dolédec	sylvain@biomserv.univ-lyon1.fr
Daniel Gilbert	daniel.gilbert@univ-fcomte.fr
Gael Grenouillet	gael.grenouillet@cict.fr
Florence Hulot	florence.hulot@ens.fr
Nicolas Lamouroux	lamouroux@lyon.cemagref.fr
Anne-Hélène Le Jeune	A-Helene.LE_JEUNE@univ-bpclermont.fr
Joséphine Leflaive	leflaive@cict.fr
Maria Leitão	leitao@bieau.fr
Fabien Leprieur	leprieur@cict.fr
Alain Maasri	alain.maasri@univ-cezanne.fr
Sylvie Mérigoux	sylvie.merigoux@univ-lyon1.fr
Bernard Montuelle	montuelle@lyon.cemagref.fr
Catherine Oumarou	oumarou@biologie.ens.fr
Eric Pattee	7p.ce@wanadoo.fr
Maëlle Rambaud	rambaud@mnhn.fr
Anne Rolland	rolland@thonon.inra.fr
Pierre Sagnes	sagnes@biomserv.univ-lyon1.fr

Loïc Ten-Hage
 Gabrielle Thiébaud
 Michèle Trémolieres
 Philippe Usseglio-Polatera
 Aurelie Villeneuve

Germany

Helmut Fischer
 Winfried Lampert
 Martin Pusch
 Anja Rubach
 Heike Zimmermann-Timm

Greece

Matina Katsiapi
 Maria Lazaridou
 Eva Papastergiadou
 Catherina Voreadou

Hungary

Mihály Braun
 Dénes Górn
 Istvan Gyulai
 Mark Honti
 Vera Istvánovics
 János Korponai
 Judit Nedli
 Judit Padisák
 István Papp
 István Tátrai

Iran

Hasan Aslanparviz
 Rasul Ghorbani
 Javid Imanpour Namin
 Zohreh Ramezanpour
 Reza Vafaei

Ireland

Christian Dang
 Conor Graham
 Jane Kavanagh
 Richard J. O'Callaghan
 John F. O'Driscoll

Israel

Gideon Gal
 Yaron Hershkovitz
 Yury Kamenir

Italy

Giuseppe Alfonso
 Giuseppe Baiamonte
 Francesca Baraldi
 Rossella Barone
 Marcello Bazzanti
 Genuario Belmonte
 Roberto Bertoni
 Tiziano Bo
 Angela Buggero
 Elisa Bottazzi

tenhage@cict.fr
 thiebaut@univ-metz.fr
 Michele.Tremolieres@bota-ulp.u-strasbg.fr
 usseglio@univ-metz.fr
 villeneu@thonon.inra.fr

helmut.fischer@bafg.de
 lampert@mpil-ploen.mpg.de
 pusch@igb-berlin.de
 arubach@uni-koeln.de
 Heike.Zimmermann-Timm@pik-potsdam.de

mkatsiapi@yahoo.com
 mlazrid@bio.auth.gr
 evapap@upatras.gr
 voreadou@nhmc.uoc.gr

braun@tigris.unideb.hu
 gorden@freemail.hu
 istvan.gyulai@gmail.com
 mark@vkkt.bme.hu
 istvera@goliat.eik.bme.hu
 korponai.janos@nyuduvizig.hu
 judit.nedli@gmail.com
 padisak@almos.uni-pannon.hu
 asvanypista@citromail.hu
 tatrai@tres.blki.hu

aslprvz@yahoo.com
 ghorbaninasrabadi@yahoo.com
 javidiman@gmail.com; imanpour@guilan.ac.ir
 zohreh66@gmail.com
 orius131@yahoo.com

c.dang@ucc.ie
 grahamconor@gmail.com
 kavanagh.j@gmail.com
 r.ocallaghan@ucc.ie
 johndriscucc@yahoo.com

gal@ocean.org.il
 yaronhe@post.tau.ac.il
 kamenir@mail.biu.ac.il

giuseppe_alfonso@yahoo.it
 g_baiamonte@yahoo.com
 francesca.baraldi@iasma.it
 rossella.barone@unipa.it
 marcello.bazzanti@uniroma1.it
 genuario.belmonte@unile.it
 r.bertoni@ise.cnr.it
 bo@unipmn.it
 a.boggero@ise.vb.it
 buzzyhornet@yahoo.it

Cristiana Callieri	c.callieri@ise.cnr.it
Gianmaria Carchini	carchini@uniroma2.it
Consolazione Caruso	ccaruso@unime.it
Giuseppe Castelli	alisma@neomedia.it
Antonio Cimino	cimino@unipa.it
Manuela Coci	manuela.coci@unict.it
Claudia Cosentino	cosentino@differ.unipa.it
Riccardo de Bernardi	r.debernardi@ise.cnr.it
Lorenzo Di Tullio	lorenzoditullio@gmail.com
Paola Ermandes	paola.ernandes@unile.it
Angelisa Fabrizi	benthos@unipg.it
Stefano Fenoglio	fenoglio@unipmn.it
Eleonora Ferrante	eleonoraferrante@hotmail.com
Romina Fusillo	r.fusillo_lutria@libero.it
Barbara Leoni	barbara.leoni@unimib.it
Francesco Lillo	francesco.lillo@unipa.it
Bruno Maiolini	maiolini@mtsn.tn.it
Santina Mangano	smangano@unime.it
Manlio Marcelli	m.marcelli_lutria@libero.it
Fiorenza Margaritora	fiorenza.margaritora@mail.uniroma1.it
Federico Marrone	federico.marrone@unipa.it
Maria Joao Martins	maria.joaoartins@nemo.unipr.it
Luciana Mastrantuono	luciana.mastrantuono@uniroma1.it
Giuseppe Morabito	g.morabito@ise.cnr.it
Luigi Naselli-Flores	luigi.naselli@unipa.it
Peter Nöges	peeter.noges@jrc.it
Alessandro Oggioni	a.oggioni@ise.cnr.it
Antonino Oieni	azzisa@estranet.it
Monica Pinardi	monica.pinardi@libero.it
Roberta Piscia	r.piscia@ise.cnr.it
Lorenzo Proia	proialorenzo@hotmail.it
Francesco M. Raimondo	raimondo@unipa.it
Oscar Ravera	oscar.ravera@ise.cnr.it
Nicoletta Riccardi	n.riccardi@ise.cnr.it
Michela Rogora	m.rogora@ise.cnr.it
Giampaolo Rossetti	giampaolo.rossetti@unipr.it
Alessandro Saccà	asacca@unime.it
Vincenzo Saggiomo	saggiomo@szn.it
Marco Seminara	marco.seminara@uniroma1.it
Alessandra Sicilia	ale.sicilia@unipa.it
Luana Silveri	luana.silveri@mtsn.tn.it
Angelo G. Solimini	angelo.solimini@jrc.it
Karin Sparber	karin.sparber@studenti.unipr.it
Silvia Tavernini	silvia.tavernini@nemo.unipr.it
Luigi Tranchina	tranchina@differ.unipa.it
Paola Valenti	dibenedetto@igiene.unipa.it
Wouter van de Bund	wouter.van-de-bund@jrc.it
Emanuela Viaggiu	emanuela.viaggiu@uniroma2.it
Anna Visconti	a.visconti@ise.cnr.it
Andrea Zignin	andrea.zignin@iasma.it
Latvia	
Maija Balode	maija@hydro.edu.lv
Agrita Briede	agrita.briede@email.lubi.edu.lv
Ivars Druvietis	ivarsdru@latnet.lv

Laura Grinberga	laura.grinberga@gmail.com
Davis Gruberts	davis@dau.lv
Jelena Oreha	jelena.oreha@du.lv
Jana Paidere	jana32@inbox.lv
Arkadijs Poppels	apoppels@hotmail.com
Agnija Skuja	agnija@lanet.lv
Gunta Sprinģe	gunta.springe@lu.lv
New Zealand	
Russell Death	r.g.death@massey.ac.nz
Fleur Matheson	f.matheson@niwa.co.nz
Christoph Matthaei	christoph.matthaei@stonebow.otago.ac.nz
Mike Scarsbrook	m.scarsbrook@niwa.co.nz
Colin Townsend	colin.townsend@stonebow.otago.ac.nz
Roger Young	roger.young@cawthron.org.nz
Poland	
Tomasz Adamczewski	t.adamczewski@biol.uw.edu.pl
Iwona Jasser	jasser.iwona@biol.uw.edu.pl
Ewa Jurkiewicz-Karnkowska	karnkowska@ap.siedlce.pl
Bożena Kiziewicz	bkizbiol@amb.edu.pl
Joanna Mankiewicz-Boczek	mankiew@biol.uni.lodz.pl
Mariusz Pelechaty	marpelhydro@poczta.onet.pl
Andrzej Pukacz	andrzejpukacz@wp.pl
Jochen Vandekerkhove	jovan@uv.es
Ryszard Wisniewski	wisniew@biol.uni.torun.pl
Elzbieta Zbikowska	ezbikow@biol.uni.torun.pl
Janusz Zbikowski	jzbikow@biol.uni.torun.pl
Portugal	
Rui Cortes	rcortes@utad.pt
Andrea Encalada	andreae@ci.uc.pt
Teresa Ferreira	terferreira@isa.utl.pt
Manuel Graça	mgraca@ci.uc.pt
Samantha Jane Hughes	sammyno1@isa.utl.pt
Maria Ilhéu	milheu@uevora.pt
Marco Magalhães	
Republic of Korea	
Young-Seuk Park	parkys@khu.ac.kr
Romania	
Geta Risnoveanu	risnoveanugeta@yahoo.ca
Russia	
Olga Babanazarova	baba@bio.uniyar.ac.ru
Nadezhda Berezina	nber@zin.ru
Olga Loskutova	loskutova@ib.komisc.ru
Marina Studenova	marina.studenova@rambler.ru
Slovakia	
Peter Bitušík	peter@blatna.cuni.cz
Tomás Derka	derka@fns.uniba.sk
Milan Novikmec	novikmec@vsld.tuzvo.sk
Marek Svitok	svitok@vsld.tuzvo.sk
Slovenia	
Spela Ambrozič	spela.ambrozic@gov.si
Mateja Germ	mateja.germ@nib.si
Tatjana Simčič	tatjana.simcic@nib.si
Gorazd Urbanič	gorazd.urbanic@bf.uni-lj.si

South Africa

Anna-Maria Botha-Oberholster
Paul J Oberholster

anna.oberholster@up.ac.za
ambothao@postino.up.ac.za

Spain

Marta Álvarez Pérez
Rosa Andreu
Alba Argerich
Joan Artigas
Vanessa Becker
Nuria Bonada
Miguel Cañedo-Argüelles
Luciano Caputo
Núria Cid
Arturo Elosegí
Paula Fonollá Araujo
Andy Green
Aitor Larrañaga
Pilar Lopez
Eugènia Martí
Cesc Múrria
Jesús Ortiz
Isabel Pardo
Javier Pérez
Narcís Prat
Tura Puntí
Sergi Sabater

martaalvarez@ub.edu
rosa.andreu@irta.es
alba@ceab.csic.es
joan.artigas@udg.es
becker.vs@gmail.com
bonada@ugr.es
miguelca77@yahoo.es
lcaputga7@doct3.ub.edu
nuria.cid@irta.es
arturo.elosegi@ehu.es
fonolla@ceab.csic.es
ajgreen@ebd.csic.es
gvblaara@lg.ehu.es
marilopez@ub.edu
eugenia@ceab.csic.es
cmurria@ub.edu
jesus.ortiz@mitmanlleu.org
ipardo@uvigo.es
jperez029@ikasle.ehu.es
nprat@ub.edu
turapunti@ub.edu
sergi.sabater@udg.es

Sweden

Cayelan Carey
Jan Herrmann
Richard Johnson
Eva Lindström
Björn Malmqvist
Brendan McKie
Jonas Persson
Zlatko Petrin
Leonard Sandin
Sonja Stendera

cayelan.carey@ebc.uu.se
jan.herrmann@hik.se
richard.johnson@ma.slu.se
Eva.Lindstrom@ebc.uu.se
bjorn.malmqvist@emg.umu.se
brendan.mckie@emg.umu.se
jonas.persson@ebc.uu.se
zlatko.petrin@emg.umu.se
Leonard.Sandin@ma.slu.se
sonja.stendera@ma.slu.se

Switzerland

Sandrine Angélibert
Pascale Nirel
Amael Paillex
Klement Tockner

sandrine.angelibert@hesge.ch
pascale.nirel@etat.ge.ch
amael.paillex@leba.unige.ch
tockner@eawag.ch

The Netherlands

Jordie Netten
Maria Soares
Maria Souza
Suzanne Mekkins

jordie.netten@wur.nl
mcarolsoares@gmail.com
betania.goncalvessouza@wur.nl
Suzanne.Mekking@springer.com

Turkey

Nuray Akbulut
Yelda Aktan
Ahmet Altındag
Meryem Beklioglu
Gizem Bezirci
Fatma Çevik

emir@hacettepe.edu.tr
yaktan@istanbul.edu.tr
altindag@science.ankara.edu.tr
meryem@metu.edu.tr
gizembezirci@yahoo.com
fcevik@cu.edu.tr

Sibel Yigit
Feriha Yildirim
United Kingdom

Philip Boon
Angela Darwell
Lindsey Defew
Michael Dobson
Ian Dodkins
Francois Edwards
Alex Elliott
Nikolai Friberg
John H. R. Gee
Pernille Hammelsoe
Barbara Hancock
David Harper
Alan Hildrew
Iwan Jones
Ian Jones
Rasmus Lauridsen
Paul Leonard
Genevieve Madgwick
Kearon McNicol
Louise Miles
Alexander Milner
John Murphy
Anne Powell
Colin Reynolds
Anne Robertson
Roger Sweeting
Helen Vincent
Guy Woodward
Debbie Wright

USA

Vicenc Acuña
Charles Hawkins
John Schade
Steven Thomas

yigit@science.ankara.edu.tr
feriha2004@yahoo.com

phil.boon@snh.gov.uk
a.darwell@apemltd.co.uk
ldef@ceh.ac.uk
chiefexec@fba.org.uk
ir.dodkins@ulster.ac.uk
fed@ceh.ac.uk
alexe@ceh.ac.uk
n.friberg@macaulay.ac.uk
jhg@aber.ac.uk
pernille.hammelsoe@mks.blackwellpublishing.com
B.Hancock@roehampton.ac.uk
dmh@le.ac.uk
a.hildrew@qmul.ac.uk
iwaj@ceh.ac.uk
ianj@ceh.ac.uk
rasl@ceh.ac.uk
j.m.leonard@btinternet.com
gen_madgwick@yahoo.co.uk
JMcNicol@fba.org.uk
JMcNicol@fba.org.uk
a.m.milner@bham.ac.uk
jomu@ceh.ac.uk
JMcNicol@fba.org.uk
csr@ceh.ac.uk
a.robertson@roehampton.ac.uk
RSweeting@fba.org.uk
hmv486@bham.ac.uk
g.woodward@qmul.ac.uk
debbie.wright@oxon.blackwellpublishing.com

vicenc@sevilleta.unm.edu
chuck.hawkins@usu.edu
schade@stolaf.edu
stthomas5@unl.edu

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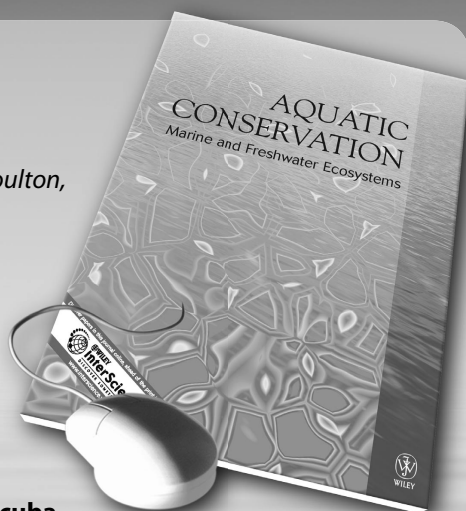
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