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R13

THE PRELIMINARY ASSESSMENT OF ENVIRONMENTAL PLASTICITY AND GENETIC DIVERSIFICATION ON THE ESTABLISHMENT SUCCESS OF A HIGHLY INVASIVE FRESHWATER FISH, *PSEUDORASBORA PARVA* IN TURKEY

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Biological invasions are now considered one of the most major causes threatening the conservation of biodiversity. Studies of population genetic on non-native species have become significant part in the study of biological invasions. While increased genetic diversity and high environmental tolerance of a species are usually associated with successful establishment and colonization of new environments, importance of these factors in successful biological invasions is still poorly known. A highly invasive freshwater fish, the topmouth gudgeon (*Pseudorasbora parva*) was introduced into Europe in 1960s and has become widely distributed throughout Western Europe occurring particularly lakes and reservoirs. However, despite its fast dispersal and wide-spread distribution within three decades in Turkey, there has been no study carried on genetic structure and ecological differences of establishment success on this species in Turkey. Therefore, we sampled three reservoirs and one stream situated spatially along western part of Turkey. Fishes were collected by using electrofishing from shallow parts of the water bodies. Various environmental variables were measured in the field. Values of optima (uk) and tolerance (tk) of the species were calculated for the measured environmental variables. Muscle tissue samples were taken from each specimen and used in DNA extraction. Amplifications of mitochondrial COI gene (DNA barcode) were carried out using different combinations of two universal primer pairs. Phylogenetic analyses were conducted using MEGA 5.0 and DnaSP 4.5. Pairwise genetic distance among haplotypes were determined using the Kimura 2-parameter method. A phylogenetic network of haplotypes was constructed with the MJ method using Network 4.6. Bootstrap method with 1000 replicates was used to calculate the variance of the difference. Optimum and tolerance values were significantly higher in reservoir populations northerly located than the stream population in southern part of Anatolia. Likewise phylogenetic network showed that four populations clustered under four haplotypes suggesting high levels of population differentiation. Results of this preliminary study clearly demonstrate high phenotypic plasticity of *P. parva* in Turkish waters. Elevated environmental plasticity and genetic diversification may provide this species successfully colonize new ecosystems, and established self-sustaining populations, which can negatively impact the resident biota.

SS06

THRESHOLDS AND NONLINEARITY BETWEEN THE TEMPORAL EXTENT OF INTERMITTENCY AND STREAM ECOSYSTEM PROCESSES, A MESOCOSMS APPROACH

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The frequency and duration of intermittency in rivers is increasing due to the combination of more frequent and longer droughts and rising water demand. Intermittency has effects on stream biodiversity, ecosystem processes, and ecosystem services; and is an international concern because of the accompanying ecological, economical and political conflicts. Its relevance has fostered plenty of studies on intermittency, but the relationship between the temporal extent of intermittency and its effects on stream ecosystems is not clearly understood, therefore limiting our capacity to predict effects of increasing intermittency extent on stream ecosystems.
Our objective was to characterize the relationship between the temporal extent of intermittency and stream ecosystem processes. Our research hypothesis was that the effects of intermittency extent on the ecosystem processes would be not linear, and that different thresholds might be identified for different processes. Because of different thresholds for each process, we also hypothesized that the balance between processes would change with increasing intermittency extent. To test these hypotheses, the effects of intermittency on stream ecosystem processes were evaluated in artificial streams; by allowing no flow of water through the mesocosms during 5 lengths (0, 1, 3, 6, 12, and 20 days). Ecosystem processes were assessed as 7 biofilm functional end-points (e.g., maximum photosynthetic efficiency) in 2 different biofilm compartments: epilithic and epipsammic.
The effects of intermittency extent were not even among ecosystem processes, as the response of ecosystem processes to intermittency was linear in some cases and non-linear in others. In fact, thresholds were identified for processes such as community respiration, whereas other processes such as primary production changed linearly. Furthermore, the recovery of the processes with the flow onset strongly depended on the decrease in those processes occurred during the intermittency, so that resilience was directly proportional to the resistance of some of the measured processes. The characterization of the relationship between intermittency extent and several ecosystem processes is a step forward to mechanistically comprehend of the response of ecosystems to intermittency, which is basic to predict the effects of intermittency on stream ecosystems.

R02

UNIVERSAL MICROARRAYS FOR THE EVALUATION OF FRESH-WATER QUALITY BASED ON DETECTION OF PATHOGENS AND THEIR TOXINS

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Monitoring the quality of drinking water is of paramount importance for public health. The threat of waterborne diseases in Europe will predictably increase in the future as the human population increases, as a result of globalization and of climate change. Development of an efficient tool to monitor various aspects of water quality represents an essential milestone.
The Project µAQUA aims to design and develop a universal microarray chip for the high-throughput detection in water of viruses, bacteria, cyanobacteria and cyanotoxins, diatoms and protozoa. After being produced, the universal microchip will be validated in different type of waterbodies around Europe by several partners. µAQUA also aims to identify cyanophages potentially capable of mitigating the periodical blooming of toxic cyanobacteria in drinking water reservoirs.
Lake Sapanca is one of the monitoring sites for the Project. It is a drinking water reservoir with mesotrophic character and has a toxic cyanobacteria, Planktothrix rubescens, blooms in the metalimnion in summer months and surface in winter. After a successful completion of the universal microchip, it will be a user-friendly, inexpensive and rapid tool for semi-continuous water monitoring and will allow not only the early detection of health hazards, but will also contribute to evaluating the effectiveness of possible measures taken.

R03

DISTRIBUTION OF MODERN FRESHWATER OSTRACODS (CRUSTACEA) IN TANGRA YUMCO, CENTRAL TIBETAN PLATEAU

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Ostracods are bivalved micro-crustaceans which live in broad aquatic habitats (e.g., oceans, estuaries, lakes, springs, streams and ponds) and have specific optimum environmental tolerance. They molt about 8 times before reaching maturity and their valves are well preserved especially in lake sediments. For extant species, studies of living representatives provide ecological information to assess their palaeoenvironmental sigininifcance.
Here, we investigated modern ostracods in Tangra Yumco area (30°45′–31°22′N, 86°23′–86°49′E, 4549 m a.s.l, closed basin lake with a catchment ~8220 km² and a surface area of 836 km^2), central Tibet, using qualitative and quantitative methods of analysis to improve the interpretation of fossilized associations. A study on the distribution of modern ostracods from freshwater habitats of Tangra Yumco lake system was conducted in September 2011 and June 2012. Surface sediments were obtained with the use of a hand net or an Ekman grab (scraping max 2 cm) and then preserved in 95% ethanol. Ostracods (dead and living) were counted separately from >200 µm sieve residues of fourty six (46) sediment samples. Ostracods were identified to the species level based on the morphology of valves and soft part analysis of selected specimens. Species richness remains unchanged for the two sampling periods. We identified at least ten modern ostracod species in the Tangra Yumco area. Within the lake, the typical species are *Leucocythere dorsotuberosa* f. *typica* Huang, 1982. *Leucocytherella sinensis* Huang, 1982, *Limnocythere inopinata* (Baird, 1883) *Fabaeformiscandona gyirongensis* (Huang, 1982) and *Candona xizangensis* Huang, 1982*.* Small streams are characterized by *Tonnacypris* spp. and *Ilyocypris* sp., and temporary waters by *Heterocypris incongruens* (Ramdohr, 1808). Both the lake and the flowing waters contained *Candona candida* (Müller, 1776) and in a modern stream, the species *Potamocypris villosa* (Jurine, 1820), represented by a single observed valve only, was identified. Multivariate analyses indicate that the environmental factors (i.e. depth, pH, temperature, conductivity, dissolved oxygen concentration, and alkalinity) are responsible for the variability in ostracod assemblages within a specific aquatic habitat.
Our results highlight the endemic characteristics of modern ostracods of Tibet. We confirm the usefulness of ostracod association from ancient lake sediments for reconstructing past aquatic habitats, lake levels and salinity.

R09

COMPARISION OF HEAVY METAL CONCENTRATION OF FISH IN A SHALLOW EUTROPHIC LAKE

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Selected heavy metals Nickel, Chrome, Copper, Manganese, Zinc, Cadmium, Lead, Iron, Aluminium, and Arsenic concentrations were determined in gills, liver and muscle of *Carassius auratus, Rutilus rutilus and Blicca björkna* collected from shallow - turbid lake, Manyas Lake (Turkey). Metal concentrations in most cases were high in gill and low in muscle or in liver. However, from time to time, lower amount of Copper and Zinc concentration were measured in muscle and higher value was recorded in liver of the fishes. Our results suggest that according to international criteria and Turkish regulations, heavy metal concentrations were markedly above the permissible levels for fish.
Key words; Heavy metal concentration, Manyas lake, *Carassius auratus, Rutilus rutilus, Blicca björkna*

R11

POPULATION GENETIC STRUCTURE OF CHUB (*SQUALIUS CEPHALUS*) SHAPED BY HYDROELECTRIC POWER PLANTS IN RHINE, AAR, LIMMAT AND REUSS

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To satisfy the increasing energy consumption during the last century, the large Swiss midland rivers Rhine, Aar, Limmat and Reuss were transformed by a chain of hydroelectric power stations. The fragmentation, habitat loss and lowered flow velocity had severe consequences for aquatic species. Here we address the impact of fragmentation on the genetic structure of fish populations by focusing on the chub (*Squalius cephalus*) as a model species.

The chub fulfills two important aspects: Chub cope better than other river fish species with altered habitats. The effects of fragmentation *per se* can be thus tested with less noise from other factors. Secondly, chubs are not stocked. For this study 2133 chubs from 48 sites were genotyped using 10 microsatellites loci. An isolation-by-distance (IBD) approach with Partial Mantel tests was used to assess the effects of barriers and their passability through fish ladders while accounting for waterway distance. The spatial population structure was was determined with the Bayesian clustering algorithm implemented in TESS.

The IBD results show a population genetic structure strongly shaped by fragmentation with only marginal contributions of waterway distance. The Bayesian clustering without admixture indicates four differentiated subpopulation corresponding to river catchments, which merge after their confluence.

This large scale fragmentation impact study on a common species highlights that existing fish ladders do not allow for enough gene flow. Even chub with good swimming capacity cannot maintain their initial population connectivity. To improve fish ladders, future investigation should also consider the migration behavior of non-commercial fish species.

R01

MAYFLY MATING STRATEGIES: A MOLECULAR STUDY ON *BAETIS RHODANI*.

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The variation in mating strategies of natural populations of most mayfly (Ephemeroptera) species and its population genetic consequences remain poorly explored. Some species have no males and are obligately parthenogenetic, while others have both sexual and asexual populations. Females in sexual populations of many species are thought to have a capacity for facultative (occasional) parthenogenesis (tychoparthenogenesis). This can have genetic and ecological implications. Genetic diversity may be reduced because of a lack of recombination; furthermore egg hatching rates from tychoparthenogenetically reproducing females are lower. Here we tested for evidence of tychoparthenogenesis in a widespread European mayfly species, *Baetis rhodani*. We sampled populations throughout Europe that are subject to different climates and belong to divergent mitochondrial populations, and used a combination of mitochondrial and nuclear markers to genotype egg masses and estimate the number of parents. We suggest that knowledge of the mating strategies and their geographical variation within species can be an important component of ecological and population genetic studies.

SS13

COMBINING PALEOLIMNOLOGY AND MODELLING TO STUDY THE EFFECT OF LOCAL FORCINGS ON LAKE FOOD WEBS VULNERABILITY AND RESPONSE TO CLIMATE WARMING

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While considerable insights on the ecological consequences of climate change have been gained from studies conducted on remote lakes, little has been done on lakes under direct human exposure. Ecosystem vulnerability and responses to climate warming might yet largely depend on its ecological state and thus on local anthropogenic pressures. We tested this hypothesis through a paleolimnological approach on three temperate large lakes submitted to rather similar climate warming but varying intensities of analogous local forcings (changes in nutrient inputs and fisheries management practices). Changes in the structure of the cladoceran community were considered as revealing for alterations, over time, of the pelagic food web. Trajectories of the cladoceran communities were compared between the three study lakes (Lakes Geneva, Bourget and Annecy) over the last 70-150 years. Generalized additive models were used to develop a hierarchical understanding of the respective roles of local stressors and climate warming in structuring cladoceran communities. The cladoceran communities were not equally affected by climate warming between lakes. In Lake Annecy, which is the most nutrient-limited, the cladoceran community was essentially controlled by local stressors, with very limited impact of climate. In contrast, the more eutrophicated Lakes Geneva and Bourget were more sensitive to climate warming, although the magnitude of their responses and the pathways under which climate warming affected the communities varied between the two lakes. Finally, our results demonstrated that lake vulnerability and responses to climate warming are modulated by lake trophic status but can also be altered by fisheries management practices through changes in fish predation pressure.
Keywords: climate change, cladoceran, nutrient, top-down control, time-series modeling, paleo-ecology, sub-fossil remains

SS12

LIFE BALTCOAST - EXPERIENCES OF AN INTERNATIONAL PROJECT

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The aim of the LIFE BaltCoast project (2005-2012) was the rehabilitation of the Baltic coastal lagoon habitat complex by grazing with hardy livestock races, mowing, removing of unwanted vegetation, restoring of natural hydrology, predator control and preventing eutrophication. 14 partners in five countries with 34 project sites were involved. An international project of this size and duration with many changes in partner structure is a big challenge in administration. On the other hand the experience exchange in a dedicated multinational workgroup is an advantage which cannot be reached by a national project. Important features of this collaboration were repeated expert visits at all sites along with regular meetings and conferences. Different mentalities, viewpoints and experience background of experts and partners from different countries often led to surprising new approaches and organisational blindness could be overcome. The monitoring of species, the monitoring of effects as well as the implemented measures took benefit from this increase of experience.
Another important feature of the project was the so called "fine-tuning of measures". Often the first implementation of measures did not lead to the expected result or habitat demands of species were not 100% fulfilled. Especially in hydrological measures a perfect preplanning is difficult, because often important parameters are not known in advance. The long project duration combined with certain flexibility in budget included the chance of a second try based on expert experience. This applies also to ongoing measures like grazing or predation control. "Learning by doing" was often crucial to achieve the goals of the project.

SS04

NON-GLACIAL STREAMS AS BIODIVERSITY HOTSPOTS IN GLACIATED ALPINE CATCHMENTS

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Many glaciers on the globe have significantly receded during the last decades in response to climate change. Most studies in this context have focused on biotic assemblages in glacial-fed (kryal) streams, suggesting a high potential loss in macroinvertebrate diversity in kryal streams as glacier-flow contributions diminish. Alpine basins also comprise a large number of non-glaciated (krenal, rhithral) streams likely inhabited by macroinvertebrate assemblages different than those common to kryal streams. We examined macroinvertebrate assemblages in 45 non-glacial streams within 5 different glacial catchments in the Swiss Alps. The data were used to determine their contribution and role in the overall biodiversity of alpine catchments. We found an astonishing high diversity of macroinvertebrates in these streams with 27 taxa found in individual streams and about 70 taxa in over 45 genera in 13 orders being identified overall (species IDs are still being collated). The abundance (range ca 260-4000 individuals per sample), taxonomic richness (alpha diversity) and assemblage composition (beta diversity) differed highly between streams, suggesting their role as habitat for non-glacial specialists and as potential refugia for alpine species in general. Potential abiotic factors influencing the community composition were identified. These results indicate that non-glacial streams contribute significantly to the biodiversity of alpine running waters and may play an important role in sustaining alpine biodiversity under landscape transformation resulting from climate change.

SS01

TAXONOMIC AND FUNCTIONAL CLASSIFICATION OF FREE LIVING NEMATODES IN A SOUTHERN EUROPEAN ESTUARY: NEW INSIGHTS ON THE FUNCTIONING OF THE ECOSYSTEM

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Estuaries are transitional areas where environmental and biological components vary from freshwater to marine waters. Species living in estuaries cope with the variability inherent to these systems, presenting an ability to withstand stress, both natural and anthropogenic. The upper reaches of estuaries (Freshwater-Saltwater Interface) are characterized by a natural impoverishment of the biotic communities and the evaluation of this area must be performed by applying techniques that are designed for both freshwater and transitional waters, in order to correctly asses its ecological status.
By applying Biological Traits Analysis (BTA) and Taxonomic Distinctness to the nematodes community, this study will discuss how nematodes' features can be useful in investigating the functioning of a Portuguese estuary (Mondego estuary) and the utility of the application of different approaches along the estuarine gradients, in conservation and management plans.
The results showed that the distribution patterns of each one of the traits (feeding type, life strategy, tail shape and body shape) along the estuary mirrored the patterns of genera distribution. Furthermore, traits and genera distribution presented to be related with salinity, grain size variables and nutrients. Taxonomic distinctness of nematodes assemblages showed that euhaline stations were more taxonomically related that expected by chance and, although presenting reduced taxonomic breadth, they may not be considered as perturbed conditions.
The application of BTA and taxonomic distinctness to nematodes communities improved our understanding of diversity-function relations. Their application as metrics to assess ecosystem's ecological status should be viewed as complementary tools, and their sensitiveness to specific variables should be investigated.

SS07

MICROBIAL PROCESSES ACROSS THE DRY-WET HYPORHEIC BOUNDARY IN A MEDITERRANEAN RIVER

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River physical sediment properties (considering surface and hyporheic zones) are linked with microbial metabolism which determines major biogeochemical processes. In the Mediterranean rivers this physical-biological depth structure is further affected by water scarcity periods and thus at the sediment depth profile the rapid changes and gradients in water content determine changes in the microbial metabolism. We investigate sediment physical properties together with some microbial parameters at the sediment biofilms and interstitial water (from up to 1 m depth) at the downstream of Tordera River. A number of locations were selected according to the channel processes including a gradient of hydrological conditions. Sediments at different depths were used to determine organic matter content, C/N ratio, the particle size distribution and sediment texture. In addition, extracellular enzyme activities and microbial functional diversity by the Biolog EcoPlates were measured. Preliminary results show that the nutrient content and microbial activity of the interstitial water were similar at all depths indicating a high hydraulic conductivity within the depth profile. Although organic matter content was similar at all sediment depths, a gradient of decrease in β-glucosidase and leucine-aminopeptidase activities in depth in wet sediment columns were measured. In the driest sediments low activity was measured at all depths. Similarly, functional richness and diversity decreased in depth, especially at the wet sediment columns. The results suggest that higher functional diversity and microbial activity is kept at surface water saturated sediments.

SS10

INTERACTIVE EFFECTS OF IONIC SILVER AND PHOSPHORUS ON AQUATIC FUNGI AND LEAF LITTER DECOMPOSITION

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Forested headwater stream functioning is intimately linked to leaf litter decomposition ensured by microbial decomposers, mainly aquatic hyphomycetes, which transfer allochthonous carbon to higher trophic levels. Yet, if individual impacts of contaminants and environmental conditions on decomposition have been well studied, assessment of their combined effects remains limited. In particular, interactions between the toxic effects of metals (ionic silver (Ag), a re-emerging contaminant through Ag-nanoparticles salting out) and phosphorus (P) level, a key chemical element that often limits detritus decomposition, have scarcely been tested.

We carried out a microcosm study with a *consortium* of ten hyphomycete species aimed at 1) testing if the toxic effect of Ag on the decomposition process could be, at least partly, overcome when microorganisms benefit of high P availability, 2) verify if these effects were mediated by changes in aquatic hyphomycete community structure, and finally 3) assess the potential interactive effects of Ag and P on leaf litter consumption rate by the key detritivore *Gammarus fossarum* (Crustacea Amphipoda). Fifteen combinations of metal and nutrient conditions were tested, i.e. 5 concentrations of Ag (0, 0.1, 1, 10, and 100 µgAg.L^{-1}) and 3 concentrations of P (20, 100 and 1000 µgP.L^{-1}).

Leaf litter decomposition and fungal biomass were significantly increased by P-level. Ag significantly reduced leaf litter decomposition, but only at the highest tested concentration, independently of P-level. On the contrary, P and Ag levels interactively affected fungal biomass. Both P-level and Ag concentrations exerted significant effects on fungal community structure, but no effects were reported on the whole species richness. Finally, P and Ag-level significantly interacted on *G. fossarum* feeding rates: high Ag concentrations reduced leaf litter consumption while low P content in leaf litter intensified *G. fossarum* feeding rate (compensatory feeding).

Considering the high level of contaminant needed to impair the decomposition process, it is unlikely to observe a direct effect of Ag on litter decomposition *in situ.* However, subtle Ag effects, in relation to nutrient levels in the systems, could be expected. In particular, due to compensatory feeding mechanisms on low P leaf litter, shredding invertebrates could increase their ingestion of polluted resources which could, in turn, represent a major threat to ecosystem.

SS14

ADVANCING A NEXUS APPROACH TO THE SUSTAINABLE MANAGEMENT OF ENVIRONMENTAL RESOURCES: INTRODUCING THE UNITED NATIONS UNIVERSITY INSTITUTE FOR INTEGRATED MANAGEMENT OF MATERIAL FLUXES AND OF RESOURCES (UNU-FLORES)

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The United Nations University (UNU) is the academic arm of the United Nations. It bridges the academic world and the UN system, its overarching them being sustainability. In pursuing its mission UNU performs problem- and policy-oriented research and offers postgraduate programmes, focusing in particular on problems and needs of developing countries. By doing so, UNU's role is to enhance individual capacities (via research and postgraduate education), but also institutional capacities and functioning as a think tank for the UN system and the UN member states. In line with this general UNU strategy, UNU-FLORES will engage in capacity development in a broad sense in the area of sustainable use and integrated management of the environmental resources water, soil and waste. Its main goal is to advance a nexus approach to the sustainable management of environmental resources.

According to the 'twinning' strategy of UNU additional campuses of its existing and future institutions, such as UNU-FLORES, shall be established in developing and transitional countries. The twinning concept foresees a close interaction of the twin campuses both in research (joint projects) and teaching activities (exchange programmes for students and lecturers). For UNU-FLORES Mozambique has been identified as suitable location of a twin institute. A Memorandum of Understanding has been signed in December 2012 between UNU, the Government of Mozambique (represented by the Ministry of Science and Technology) and the Eduardo Mondlane University in Maputo, Mozambique. By establishing and strengthening strong partnerships within the region, UNU-FLORES, Maputo, is envisioned to act as a regional hub for integrated management of material fluxes and of the resources water, soil and waste.

SS12

HOW TO RESTORE EFFICIENTLY THE HABITAT OF THE PEARL MUSSEL *MARGARITIFERA MARGARITIFERA* AND THE THICK SHELLED RIVER MUSSEL *UNIO CRASSUS* - LESSONS LEARNED BY LIFE

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From 2005 to 2011 the LIFE Nature Project „Restoration of pearl mussel populations in the Ardennes" took place on the river Our close to the three country border Luxembourg, Belgium and Germany.
The main intent of the project was to reduce the amount of fine sediments and nutrients entering the river system, being a major threat for the freshwater mussels and other aquatic organisms. The objectives therefore were restoration measures to improve the water and substrate quality, the support of the mussels host fish population, *Salmo trutta fario* and the culture of juvenile mussels.
The restoration measures included fencing of the riversides to avoid cattle treading, felling non-native spruce forest and replanting with appropriate tree species, enhancing tributaries for fish migration and adding gravels to the river Our. A monitoring programme was set up in order to control the efficiency of the different actions.

While restoration measures on the tributaries like the suppression of migratory obstacles were obviously a success for the fish population, it was rather difficult to show an effect on the reduction of sediments and nutrients inside the river Our. On the large scale of the river Our catchment basin, with more than 600 km^2, the entrance of unknown amounts of fines are numerous, so that the positive effect of the restoration is possibly overlapped by this non resolved erosion.

A further LIFE Nature Project "Restoration of the *Unio crassus* rivers in the Luxemburgish Ardennes" (2012 to 2018) deals with the conservation of the thick shelled river mussel in the river Our and the river Sûre on the Belgian border.
To get a clearer relation between restoration measure and effect, from now on the strategy changes towards a smaller scaled project. Therefore, after an initial mapping phase of the hot spots of erosion, inside the project area a tributary of about 5 km^2 is chosen. A monitoring program is set up in order to define the initial status quo and to follow very close the different steps of restoration. Measures like installing fences on the riversides or water evacuation grids on agricultural and forestry roads will be designed in order to reduce the input of fine sediments in the aquatic ecosystem. With the guidance of the national chamber of agriculture agro-environmental measures will be implemented on agricultural land. Results from this strategy can give an orientation for the successful implementation of further measures on a larger scale.

SS08

FLOW REGULATION AFFECTS CARBON FLUX IN MEDITERRANEAN RIVERS

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Mediterranean rivers are subject to multiple threats as a result of global change. One of these impacts is flow regulation by dams, which has been increasing especially in the last decades. The effects of flow regulation on river biota and hydromorphology have been extensively studied, but the effects on carbon flux are still poorly known. We studied reaches upstream and downstream from large reservoirs at three tributaries of the Ebro River (Spain): Cinca, Montsant and Siurana. We hypothesized increased concentration of benthic particulate organic matter (BPOM), suspended particulate organic matter (SPOM), and benthic chlorophyll (Chl-a) below the dams, and higher primary production (PP) and ecosystem respiration (ER). Sampling campaigns were performed in winter, autumn and summer. Five sites were located along each reach. In each site 5 samples of BPOM were taken with Surber nets (0.09 m^2, 0.2 mm mesh), 3 samples of SPOM in 2 litre tanks that were filtered (Whattman GF/F), and 4 samples of periphyton scraped from rocks to calculate the Chl-a and ash free dry mass. Dissolved oxygen, temperature, atmospheric pressure and level loggers were placed at the beginning and end of each reach to calculate metabolic rates using the double-station open-channel method. Additionally, level loggers were placed at each reach during the whole study. All comeasured variables increased below dams, being the experimental (ratio between experimental and control reaches) highest for Chl-a (I/C = 13.2), followed by BPOM (I/C = 6.18) and ER (I/C = 6.06), The impact was smaller for PP (I/C = 2.37) and SPOM (I/C = 1.99). Our results show that flow regulation has a considerable effect on the carbon flux of river ecosystems.

R13

ECOLOGICAL EFFECTS CAUSED BY CHINESE POND MUSSEL (*SINANODONTA WOODIANA*) (BIVALVIA, UNIONIDAE)

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The Chinese pond mussel (*Sinanodonta woodiana*) was observed in Hungary in 1983 in the first time (Petro, 1984). This huge mussel occupied almost all Hungarian waters by now, and spread worldwide with the fish transport (Watters, 1997), but wasn't found nor in the Balaton, neither the inflow waters, canals, or creeks between until 1998. Only the outflow Sió drain-canal was infected by *Sinanodonta woodiana* in that time. This canal was continuously investigated from 1994 to 1996 (Kiss, 1997).

In 2006, however, some 5-6 years old *Sinanodonta woodiana* were found in the lake, but these specimen were already adults (Majoros, 2006). Based on these observations, the possible enter should have been occurred in around 1998-2000, so the estimated age of the population is about 12-14 years now. Females produce glochidia after the 3rd year, threfore now the 3rd, 4th generation should develop in the pond. Recently *Sinanodonta woodiana* reached 30-60 % in numbers, and 50-80 % in biomass (Benko-Kiss, et al. 2011).

In 2012 a small collapse of *Sinanodonta woodiana* population was observed in the South-west basin - some thousand mussel carcasses raised up to the surface, but the ratio of the collected fresh empty shells, and the survived animals showed that approximately 20-30 % of the biomass disappeared from the *Sinanodonta woodiana* population.

Earlier data from 1992-94 and the data from 2011-12 showed the decrease of the native *Anodonta cygnea* which were replaced to *Sinanodonta woodiana*. The decrease also was present in *Anodonta anatina* as well. The ratio of *Unio pictorum* and *Unio tumidus* although remain the same, the presence and frequency of this two species were not changed.

Simulations - based on previously determined biological data of *Sinanodonta woodiana* - showed that this huge mussel can develop very huge biomass (20-50 tons/ha), but the population will inevitably collapse 12-20 years after the settlement, depending on the water type and trophic level. These collapses may occur usually in July, from year to year, as it happened in some Hungarian waters. If these event occur in places preferred by tourists, unsuitable circumstances for waterside tourism is caused.

R10

LONG-TERM TRENDS OF WATER QUALITY AND METABOLISM IN TWO CONTRASTING STREAMS

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Streams and rivers are dynamic ecosystems and their physico-chemistry, structure and functioning show patterns that change across temporal and spatial scales, governed by both natural variation and human-related disturbances. Understanding the variability of these patterns is particularly significant for guiding water management and restoration efforts. Thus, there is an increasing interest in continuous monitoring of water quality and analysis of real-time, long-term data series. Here we analyze temporal patterns and trends of water characteristics during 10 years at two contrasting streams: one relatively unpolluted (Urumea), the other subject to severe industrial and urban pressures interacting with natural variation (Oria). We also calculated metabolic metrics using the open, single station method in order to give insight into the functional status of the streams. The patterns of discharge were similar. Floods occurred evenly distributed throughout the years, with a parallel frequency and timing, and dry periods were relatively short. Water temperature showed strong seasonality in both streams, but annual differences were greater in the stressed stream, since water got hotter in summer while winter temperatures were similar. The rest of the physico-chemical variables −conductivity, pH, concentration of organic matter (OM) and turbidity− were significantly higher, more variable and more influenced by discharge in the impaired stream. Conductivity and concentration of OM responded negatively to discharge, whereas pH and turbidity increased with discharge. In the case of pH, it showed the opposite relationship in the unpolluted stream, what reflects the different lithology at the basins. Oria is a calcareous basin, while sandstone and schist predominate in Urumea. Regarding long-term trends, only the amount of material suspended in water showed a clear increasing trend in both streams, but differed in quality. Concentration of OM increased in the unpolluted stream and turbidity in the polluted one, reflecting the differences between the impacts in both basins. Concerning metabolism, GPP and ER were higher in the polluted site, where both followed marked seasonal patterns. In Urumea, only GPP showed clear seasonality, similar to the one temperature showed.

R04

A NEW METHOD OF IDENTIFYING HISTORICAL *DAPHNIA* SAMPLES

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Identification of species and hybrids is an important task to track evolutionary change and understand its ecological consequences. There is a growing knowledge about hybridization pattern in the *Daphnia longispina* complex. To study the extent of hybridization, the well-established microsatellite markers require long, and almost intact DNA. Thus, old samples preserved with formaldehyde or diapausing eggs preserved in the lake sediments cannot be assessed with that method. Therefore, we aim to develop SNP genotyping method, which will have discriminatory power for species and hybrid identification. By comparing the *D. galeata* transcriptome with the *D. pulex* genome, we are designing primer pairs for randomly chosen genes. After the sequencing and alignment of these genes for each species in the complex (*D. cucullata*, *D. galeata* and *D. longispina)*, candidate SNPs are identified. To confirm their specificity, we are using genetically well-defined clones from species and hybrids of several *Daphnia* communities. Finally, we aim to develop a reliable, cost-efficient, single multiplex assay for the identification of the species in the *D. longispina* complex. We are optimizing the assay via SNaPshot Multiplex kit. In order to validate the results, we are applying the developed assay for the samples, which was previously analyzed with microsatellite markers. Based on the results, we can compare the resolution of SNP and microsatellite markers. We think that the assessment of samples with low-quality DNA will become finally available with this new method.

R12

AQUATIC MACROPHYTE DIVERSITY ASSESSMENT: VALIDATION OF A NEW SAMPLING METHOD FOR CIRCULAR-SHAPED LAKES

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We propose and validate a new sampling method to assess the presence, abundance and distribution of macrophytes in circular-shaped lakes according to the requirements of the Water Framework Directive (WFD2000/60/EC). The results of the macrophyte survey in the Italian volcanic lakes (IVL), obtained using this method are also discussed.
The IVL system comprises 12 deep, hard-water lakes and contains approximately 94% of the total freshwater volume of central and southern Italy.
The sampling proposed is based on randomly selected transects homogeneously distributed around the perimeter of the lake. The number of the transects is proportional to the lake's size. The method was validated on six IVL using computational resampling procedures (the second order jackknife) on a total of 126 transects.
According to our results, charophytes dominate aquatic vegetation in Italian volcanic lakes and the macrophyte distribution in IVL is similar to that described in northern Europe for the *Chara*-lake type. Macrophytes were present in each of the transects and 57 species were detected. Species diversity is highest at shallow depths, whereas the most abundant species, such as *Chara polyacantha* and *C. tomentosa*, are located at an intermediate depth between the shoreline and the maximum growing depth (Zc). *Nitella opaca* and *Chara globularis* dominated vegetation at Zc down to 26 meter.
Using resampling procedures, we show that the proposed approach identifies more than 75% of the overall species richness through a moderate sampling effort. Since varying levels of diversity were identified, we may assume that using species richness for environmental assessment purposes can lead to errors caused by the sampling method.

SS12

LIFE NATURE FOR FRESHWATER ECOSYSTEMS: EXAMPLES AND BEST PRACTICES ON THE RESTORATION OF RUNNING WATERS.

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The LIFE Programme has been the European Union's funding instrument for the environment since its approval in 1992. It is composed of three strands (LIFE Nature and Biodiversity, LIFE Environment Policy and Governance and LIFE Information and Communication).
Since its establishment 21 years ago, the LIFE Nature and Biodiversity component (formerly LIFE Nature), has co-financed a total of 1 348 projects, providing some € 1.2 billion, and mobilising a further €1.2 billion in other public and private contributions. This continuous source of targeted financing has radically changed the capacity of many countries and regions to care for and manage Natura 2000 sites.

LIFE projects actions are varied and can encompass the development of management plans and other policy documents, support for the enlargement of the Natura 2000 network, improving knowledge of species and habitats, direct conservation actions, capacity building and awareness raising. The results of the first assessment of the conservation status of species and habitats (Article 17 report), which was published in 2010, highlight the importance of LIFE as the sole source of funding for the conservation, restoration and management of certain species and habitats at EU level.
Most LIFE projects targeting habitat restoration have resulted in the sites concerned achieving favourable conservation status.

Freshwater habitats, with more than 300 projects co-financed, are one of the habitat types that have been most often targeted by LIFE (together with forests and grasslands).
Some examples of projects actions on freshwater habitats include: improving water quality; managing water levels; restoring river ecosystems; improving habitats of freshwater species (such as the water pearl mussels and riverine fishes, plants and birds); controlling and eradicating invasive alien species; managing river basins and Natura 2000 sites; enhancing habitat connectivity, restoring floodplains, re-meandering rivers and involving relevant stakeholders (such as farmers, anglers, shipping companies, etc.).

This communication will present some examples and best practices from successful LIFE Nature projects targeting freshwater ecosystems, and particularly running waters, with the aim to contribute to the active dissemination of the results.

PS3

THE LIFE PROGRAMME: MORE THAN 20 YEARS IMPROVING FRESHWATER ECOSYSTEMS IN EUROPE

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The LIFE Programme has been the European Union's funding instrument for the environment since its approval in 1992. It is composed of three strands (LIFE Nature and Biodiversity, LIFE Environment Policy and Governance and LIFE Information and Communication). Since its establishment 21 years ago, LIFE has co-financed nearly 4 000 projects, providing some €2.8 billion, and mobilising a further €3.8 billion in other public and private contributions. This continuous source of targeted financing has radically changed the capacity of many countries and regions to care for the EU's environment. Of the nearly 4 000 projects co-financed by the LIFE Programme since 1992, more than 900 have concerned water issues and ecosystems.
LIFE projects have been especially strong in delivering results on water quality and quantity targets and in monitoring and improving the conservation status of freshwater habitats. They have provided integrated approaches that have helped water authorities to adopt good water management solutions aimed at meeting the requirements of the Water Framework Directive (WFD). LIFE has contributed, in particular, to the implementation of river basin management plans (RBMPs) through the integration of data capture, modelling and management techniques. One of the strengths of the LIFE Programme is that it has funded many projects that have developed solutions tailored to the differing needs of the Member States in terms of water scarcity, quality, quantity and efficiency, offering targeted solutions at a local level. LIFE has co-financed a large number of river and wetland restoration projects. Water projects have favoured the increase of biodiversity and the conservation of threatened species and provided support for the enlargement of the Natura 2000 network.
LIFE funding has provided excellent examples of stakeholder involvement that have helped in reconciling the contrasting economic interests that place stress on our water bodies and in promoting cooperation for effective policy implementation. This communication will give a general overview of the LIFE Programme and of its support for practical ways improving and managing freshwater ecosystems in Europe.

R03

STREAM METABOLISM IN A MACROPHYTE-DOMINATED STREAM – CONTINOUS MEASUREMENTS FOR ONE YEAR

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Gross primary production (GPP) and ecosystem respiration (ER) are integrative metrics that reflect variations in stream function, such as biomass and energy flow. Seasonal changes in stream metabolism have been previously identified, but little is known about what is controlling whole-stream metabolism on a long and short-term scale in macrophyte-rich streams. We predicted that seasonal variation in whole-stream metabolism would reflect variation in macrophyte abundance, light, and temperature, whereas day-to-day variation would reflect variation in light and hydraulics. We quantified continuous stream metabolism, structural parameters and benthic algae biomass in a macrophyte-rich reach and an upstream control with no macrophytes for one year. Preliminary results show that ER is higher at the no-macrophyte reach throughout the year, while there is no difference between the reaches in GPP. Furthermore, GPP peaked in late spring, which corresponded with high light availability, but low macrophyte abundance. The water chemistry showed several seasonal variations, where for example SRP was constant during winter and increased 6-fold during spring and summer, which could be due to fertilizers from agriculture. Our results indicate that whole-stream metabolism reflect daily and seasonal patterns in temperature, light, and shading from the riparian corridor.

R13

INVASION OF *PECTINATELLA MAGNIFICA* IN TREBONSKO PROTECTED LANDSCAPE AREA AND BIOSPHERE RESERVE (CZECH REPUBLIC)

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Pectinatella magnifica is a non-native species in Europe, originating from North America. The first published occurrence of bryozoans (*P. magnifica,* Leidy) in the Czech Republic is dated in 1929. This first occurrence comes from the Vltava River in Prague and another one has been reported from several locations in the Elbe River twenty years later. In recent years (since 2003 ongoing) *Pectinatella magnifica* has been reported especially from the Trebonsko Protected Landscape Area and Biosphere Reserve, South Bohemia in localities of Trebon’s pond systems. During the past decade of this area monitoring, two types of strategies were observed in its spread: i) spread over larger distances associated with Luznice river flow or ii) classical expansion, based on absolute distance from affected areas.

In this study we present data collected during the summer season 2012 from detailed monitoring of affected freshwater sites in Protected Landscape Area Trebonsko. It can be concluded, that both strategies mentioned above led to increase the concentration of *P. magnifica* in the area thanks to detailed examination of 21 localities with different management and trophic level (ponds, flooded sand and gravel pits).

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R14

GENETIC CHANGES IN FRESH WATER HYDROBIONTS AS IMPORTANT INDICATOR OF ENVIRONMENTAL STRESS

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Anthropogenic pressure can disturb ecosystem homeostasis. It results in drastic environmental changes, some of which can threaten human health. Therefore, there is a need for constant monitoring of the quality of water, soil and air. Most of existing bioindicator assays estimate environmental stress consequences on features, which have genetic changes in their base. The chromosome level of genome organization allows to reveal different disturbances induced by physical, chemical or biological factors, contributing to general response on the organism level. Therefore one can use genetic changes as first sign of increasing anthropogenic or other pressure on the environment.
Hydrobionts being a part of single ecosystem may reflect different negative influences of environment on organisms community in whole.
Advantages of used objects - their widespread and systematic diversity, different environment, the presence of life-cycle stage enabling to use cytogenetic approach. We checked the possibility to estimate the state of fresh water in North-West Russian region with help of *Asellus aquaticus*.
Long-term studies in apparently clean sites (distant isolated natural or artificial fresh water reservoirs in the Saint-Petersburg area) have shown that the mitotic disturbances level in *Asellus aquaticus* dividing eggs has varied only slightly between 1.6 - 2.2% over the last 15 years with the average value 1,8%. In areas inside the city or near large sources of anthropogenic pollution cytogenetic analysis showed greater levels of mitotic disturbances (up to 16,6%) which generally coincided with the presumed levels of pollution.
The results of this study are in a good agreement with earlier data on mitotic disturbance frequency in dividing cells of terrestrial *Porcellio scaber* samples collected at corresponding sites in the Saint-Petersburg area. The estimation of mitotic disturbances by the same method in dividing cells of *Jaera albifrons* in several coastal sites of the White and Barents seas showed that mitotic disturbances level depends on anthropogenic pressure in a similar manner.
We conclude that estimation of mitotic disturbances frequencies could serve as a powerful method of prognostic evaluation of the fresh water state.

R02

GLOBAL DIVERSITY OF THE MAYFLY FAMILY PROSOPISTOMATIDAE (INSECTA, EPHEMEROPTERA), EXPLAINED IN TERMS OF HISTORICAL BIOGEOGRAPHY.

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Ephemeroptera are widely recognised as one of the key taxa comprising the fauna of freshwater ecosystems. In many cases their diversity, both in terms of number of described species and their ecology, is not well recorded. This is particularly so for the obscure family, the Prosopistomatidae. Recent collecting efforts have more than doubled the number of species recognised in Europe, Africa, the Middle East, Asia and the Pacific Islands. The stem-group lineage can be traced back to Mesozoic fossils, and molecular dating using a relaxed Bayesian clock method calibrated using fossil dates, clearly shows the antiquity of the family. Based on molecular dating, crown group species are shown to have originated during the Cretaceous, with the oldest species occurring in Asia, suggesting dispersal from this region via the Pacific Islands as far as northern Australia, and simultaneously via Europe and the Middle East to Africa. The Madagascan species are of similar age to, or younger than the African species, and are not old enough to have been the product of variant speciation due to post-Gondwanan continental drift, a previously held view. The European species are younger than most of the African species (less than 2 Myr old) and show a close relationship with some of the African species, suggesting re-colonisation of Europe following Pleistocene glaciations. Despite the long history of their lineage, the Prosopistomatidae are sensitive to environmental change, and understanding their evolution helps to make predictions about the continuation of this lineage under changing climatic conditions.

R02

IS INTRASPECIFIC DIVERSITY OF AQUATIC HYPHOMYCETES ON DECOMPOSING LEAVES IN STREAMS RELATED TO SEASON?

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Aquatic fungi, particularly aquatic hyphomycetes, play a key role in the decomposition of riparian plant litter (e.g. twigs, leaves) in low-order forested streams. It is also recognized that the season, by affecting water temperature, is important in structuring aquatic hyphomycete communities. Recently, by using molecular data, some authors found that aquatic hyphomycetes could present high intraspecific diversity. However, it remains to explore if season can affect genetic diversity by excluding or favoring certain aquatic hyphomycete populations.
In this study, we examined population diversity of three species of aquatic hyphomycetes, namely *Articulospora tetracladia*, *Tetrachaetum elegans* and *Tricladium chaetocladium*, commonly found on decomposing leaves in seasons of maximum litter accumulation in streams (spring and autumn). Fungi were isolated from single conidia collected from oak leaves decomposing in a stream in spring and autumn along one year. Pure cultures grown in 1% malt extract for 15 days were used for DNA extraction and amplification, using ITS1 and ITS4 primers. DNA sequences were generated, aligned, and consensus sequences were used to analyze intraspecific diversity (MEGA4). Neighbour-Joining trees based on ITS showed substantial population diversity for *A. tetracladia*, but not for *T. chaetocladium* or *T. elegans*. In a general way, *A. tetracladia* appeared to exhibit seasonal cohesiveness because most isolates from different seasons grouped into distinct phylogenetic clades. In addition, divergence between isolates of *A. tetracladia* and *T. chaetocladium* from different seasons was higher than within isolates from the same season. Further studies at longer temporal scales should be conducted to better comprehend population genetics of aquatic hyphomycetes.
FEDER-POFC-COMPETE (FCOMP-01-0124-FEDER-013954) and the Portuguese Foundation for Science and Technology supported this study (PEst-C/BIA/UI4050/2011 and PTDC/AAC-AMB/113746/2009) and S. Duarte (SFRH/BPD/47574/2008).

R05

BENTHIC FOOD WEBS UNDER THE INFLUENCE OF AGRICULTURAL LAND-USE AND URBANIZATION

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In the light of global biodiversity loss and the subsequent efforts to preserve or even restore ecosystems, it is more important than ever to understand the determinants of species assemblages. Stream macroinvertebrate food webs are complex and especially challenging to comprehend. In this study, the stable isotope ratios of nitrogen and carbon were measured to investigate macroinvertebrate assemblages and food web structures at eight low-land river sites along a gradient of agricultural land-use and urbanization. The more impacted downstream sites can clearly be distinguished from the more pristine upstream sites by their higher $\delta^{15}N$ value due to fertilizer application and sewage treatment plant effluents. Higher $\delta^{13}C$ values indicated sites relying more strongly on allochthonous energy input. The most complex food-webs and highest biodiversity was found at the two most natural sites. The results will be discussed in regards to river restoration (prioritization) and constraints on the dispersal of aquatic invertebrates to restored streams.

R01

MATE GUARDING IN RELATION TO SEASONAL CHANGES IN THE ENERGY RESERVES OF *GAMMARUS FOSSARUM* AND *G. PULEX*

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Energy storage compounds provide energy for fundamental processes, e.g. growth or reproduction, and the energetic condition of an organism is affected by demands that change in response to the environment, life cycle or behaviour. Recent studies investigated the effects of single factors on the energy metabolism and energy storage compounds in freshwater gammarids. However in their natural habitat, individuals are affected by various factors simultaneously. Therefore, field studies should provide a better insight into the natural variability of energy storage compounds and into the physiological background of ecological processes.
In this study we investigated the sex-specific seasonal changes in major energy storage compounds (triglycerides, glycogen) in the two common central European freshwater amphipods *Gammarus fossarum* and *G. pulex*. Additionally, particular emphasis was placed on the reproductive periods of both species in the investigated populations, because lipids are known to be related to reproductive activity.
The dynamics of stored energy followed a seasonal pattern in both species and sexes. Stored energy reached a peak in late winter, but was depleted in late summer and early autumn. In both species, the energy reserves of males were drastically depleted shortly before the cessation of precopulatory mate guarding in the field. Considering the results of direct calorimetric studies on the standard metabolic rates of gammarids *in vivo,* the poor energetic condition suggests that male individuals might lack the energy for mate guarding and thus offers a bioenergetic explanation for the reproductive period in these two widespread species.

SS12

STREAMS AND THEIR VALLEYS IN THE ARNSBERG FOREST

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The Arnsberg Forest is one of the largest contiguous areas of forest in North Rhine-Westphalia. It is situated at the northern edge of the Sauerland area, south of the river Möhne.
This LIFE project aims to preserve and develop the mountain streams, alluvial forests and bogs of the Arnsberg Forest together with their typical flora and fauna. Black alder (*Alnus glutinosa*), brown trout (*Salmo trutta*) and bullhead (*Cottus rhenanus*), kingfisher (*Alcedo atthis*) and black stork (*Ciconia nigra*), golden-ringed dragonfly (*Cordulegaster boltonii*) and keeled skimmer (*Orthetrum coerulescens*) are just a few of the more remarkable representatives.

In some areas the length of stream courses has been nearly halved by channelization.
In addition ditches drain some of the floodplains.

Monotonous spruce woodland dominated the alluvial landscapes in a large portion of the project area before the LIFE project started. In spruce forests woody debris hardly ever enters the streams, no leaves are available for the food chain and a lack of light is to be stated especially in younger forests.

Approximately 30 km of stream courses and alluvial forest are to be restored and the development of typical alluvial forest vegetation is to be initiated. Goals to be achieved are: Recreation of the natural stream courses, development of near-natural shallow stream profiles, closure of drainage ditches, placement of large woods, and elimination of obstacles to meandering. In addition migration obstacles for fish and makrozoobenthos will be removed.
A central focus in the river valleys of the Arnsberg Forest is the restoration of near-natural deciduous forests. Alder alluvial forests that are exposed to light will replace the dark monotonous spruce woodland. Creation of a near-natural water balance regime in the restored stream courses will promote the development of a natural, diverse vegetation mosaic.

SS12

IMPLEMENTATION OF LIFE

Belting H.

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LIFE could only be to accomplish a proposal. But this would fail. In reality it is much more finding compromises between habitat requirements of different species and requirements of local or regional stakeholders. Involving stakeholder is a need and can be a real challenge.
LIFE work is SITE work. LIFE projects have to be involved with the local socio-economic context. Public awareness is essential for each project and even more important for the After LIFE Period, when the budget is expended. Public awareness is basic for fundraising in the next period. Activity in site should never be reduced to “in sight of the site”.

R06

INTERACTIONS BETWEEN RECALCITRANT AND LABILE ORGANIC CARBON IN STREAMS - CAN STREAM BIOFILMS MEDIATE PRIMING EFFECTS?

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Inland waters - such as streams, rivers and lakes - are increasingly recognized as important components in the global carbon cycle. Dissolved organic carbon (DOC) in these systems is diverse in structure, origin and reactivity, and a fraction of it is regarded as recalcitrant to microbial degradation. In soils, degradation of recalcitrant carbon is often controlled by the availability of labile carbon sources. This is due to so-called priming effects (PEs). Mounting evidence suggests that PEs are also important in aquatic ecosystems but there are so far very few studies addressing this topic. Biofilms are vital components of aquatic ecosystems. In stream biofilms, heterotrophic bacteria and algae coexist in close proximity, exposing the bacteria to both recalcitrant DOC (RDOC) of terrestrial origin and labile organic carbon from the algae. We hypothesized that this makes stream biofilms hotspots for PEs. We performed two experiments, designed to represent two contrasting environments in streams to test our hypothesis. In the first experiment, plug-flow bioreactors were used to mimic a sub-surface stream sediment environment (hyporheic zone). Heterotrophic bacterial communities were grown in the dark and exposed to upwelling of groundwater rich in RDOC. Labile dissolved organic carbon sources (LDOC) were added, resembling those that are produced by algae in the overlying benthic zone. In the second experiment, benthic biofilms including both algae and heterotrophic bacteria were kept in microcosms under different light intensities to stimulate differential algal exudation, a source of LDOC. In both experiments, an isotope-labeled plant extract serving as a model of terrestrial RDOC was added. This allowed us to separate the metabolism of RDOC from other carbon sources, thus enabling detection of priming effects on the RDOC. The concentrations and isotopic ratios of respired CO_2, biomass and DOC were monitored throughout both experiments. Our results suggest that priming effects are not of major importance in the hyporheic zone. Additions of LDOC to bioreactors did not lead to an increase in RDOC uptake. However, preliminary results indicate that algal exudation may have a stimulating effect on RDOC degradation in benthic biofilms. Both studies shed light on carbon and inorganic nutrient dynamics in streams, highlighting that stream biofilms are not only processing solutes, but are also important sources of DOC and inorganic nutrients.

SS12

LIFE+ "EMS - DYNAMIK + HABITATE": ENHANCING RIVER DYNAMICS AND HABITAT DIVERSITY

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A LIFE+ project has been initiated in 2010 to deal with the problems discussed in the talk “The renaturation of the River Ems: concept and implementation”. The major objective of the project "Ems - Dynamik und Habitate" is the initiation of selfdynamic lateral morphodynamic processes. The District Government of Münster is the project executing organisation.
Within the framework of this project, the course of the River Ems was lengthened and widened along a section of about 4 kilometres nearby Einen (Warendorf). The restoration measures were implemented in three phases. The first phase in 2010 mainly consisted of building three new river meanders: a secondary floodplain with cut banks, slip-off slopes and point bars was actively formed. In the second phase (2011), three “initial channels” were excavated. These were narrower and shallower than the original riverbed, thus leaving the river to self-sufficiently form its new bed and surrounding floodplains. As the Ems is running solely through sandy underground, these measures have proven particularly successful. The third and last phase, which has just been completed, included the widening of the riverbed at several locations, the reopening of connections between the Ems and its tributaries and the construction of three fish ladders. Additional measures, such as removing the stony river bank stabilisation structures, securing neighbouring acres against floods and the installation of dead wood in the floodplains have been realized in all three phases.
All these measures aim at reducing the degradation of the riverbed, facilitating natural river erosion and sedimentation dynamics and thereby strengthening existing and developing new floodplain areas. The diversity of floodplain habitats, especially alluvial forests, is to be increased considerably.
The whole project is constantly monitored to measure the success for the species and habitats covered by the Habitats and Birds Directive. Successes have already been detected, for example for relevant bird (e.g. *Alcedo atthis*) and fish species (e.g. *Cobitis taenia*).
The project will be finished in the end of 2014, including all building measures, public awareness campaigns and a final report to the EU commission.

SS08

THE ROLE OF BENTHIC INVERTEBRATES IN THE PHOSPHORUS FLUX IN LAKES, WITH EXAMPLES FROM OLIGOTROPHIC LAKE KRIVOE AND EUTROPHIC LAKE DONGHU

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Phosphorus is the most important macronutrient in freshwater ecosystems, which determines the level of their primary production. Enrichment of the freshwater ecosystems by nutrient of allochthonous and autochthonous origin leads to the intensive development of planktonic and benthic producers (algae and macrophytes) and increases eutrophication. Aquatic organisms are important contributors to the P flux within the freshwater ecosystems; however their input can be different depending of their trophic groups and trophic status of lake. Basic mechanisms of transformation of phosphorus during the life of benthic animals can be direct or indirect. In the process of feeding the animals assimilate the energy that goes into the somatic and generative growth of organisms, and subsequently returned to the ecosystem as a result of the destruction of animal detritus and also a significant part of phosphorus is excreted in urine and feces. We studied comparatively structure of zoobenthos (species composition, abundance, and biomass) in lake ecosystems of two types, oligotrophic Lake Krivoe (typical for Northern Russia) and eutrophic Lake Donghu (largest urban lake in China); measured experimentally the rate of excretion of dissolved phosphorus by dominating taxa of zoobenthos and calculated flow rates of phosphorus through zoobenthos in different areas of these lakes. It is shown that the main flow of dissolved phosphorus passes through communities of coastal areas (0-3 m depths). The significant differences in the contribution of benthic animals to P flux were found between the central and coastal areas of lakes due to spatial differences in taxonomic composition of benthos and its biomass distribution and also differences in the oxygenation level of the bottom sediments. When hypoxia was found, that are common trait in the central part of eutrophic Lake Donghu in hot summer, the role of animals in phosphorus excretion was negligible. As shown by the study, amphipods and aquatic insect larvae predominated in good oxygen conditions have the highest intensity of the specific phosphorus excretion rate than other benthic invertebrates (oligochaetes and molluscs). In spite of high latitude and temperature differences between lakes, phosphorus excretion mediated by benthic animals in the coastal area (with normoxia) of the eutrophic lake was only 1.5 times higher than in the oligotrophic lake Krivoe.

SS06

HYDROLOGICAL EXTREMES AND THE BIOGEOCHEMICAL HEARTBEAT OF MEDITERRANEAN TEMPORARY STREAMS

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Hydrological connectivity through the catchment and along the stream network regulates the timing and the magnitude of terrestrial inputs to stream ecosystems as well as their metabolism and biogeochemical cycling. Mediterranean temporary streams experience not only a strong seasonality in hydrological connectivity but also frequent hydrological extreme events, from floods to droughts, which further add variability to the stream biogeochemical responses. In this talk, we will provide empirical evidence of how this characteristic hydrological framework affects nutrient cycling and transport at different spatial scales in Mediterranean catchments (catchment-, section-, and reach-scale). We will also compare the biogeochemical responses in Mediterranean temporary streams with those in other type of streams.

PS7

BUYING AND SELLING FRESHWATER ECOSYSTEMS: THE PROMISE AND PITFALLS OF RESTORATION AND MITIGATION IN THE MANAGEMENT OF FRESHWATERS

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We increasingly recognize the value of services provided to humans by natural freshwater ecosystems, with new programs being developed to remediate and restore value to historically degraded wetlands, rivers and coasts aim through government regulation or ecosystem service markets. Unfortunately our ability to trade or sell natural capital credits is advancing far more rapidly than our empirical understanding of how ecosystems can be managed to produce these commodities and how to appropriately measure and quantify this natural capital. In this data vacuum, a limited set of restoration approaches have become widely used, accepted and often required by regulators without sufficient evidence that these approaches are in fact achieving their intended goals. To fully engage in the political process that requires and funds restoration and mitigation markets freshwater scientists must evolve from describing pathways of degradation and critiquing modern restoration projects towards building ecologically rigorous design scenarios. I will use examples from my own research to illustrate to explore several key research challenges for freshwater science. We must develop more diverse approaches for restoring multiple ecosystem services. We need to find ways to better match the scale and longevity of ecosystem mitigation projects to the degradation they are intended to offset. We must develop honest indicators of ecosystem service production.

R09

ECOLOGICAL POTENTIAL OF CZECH MANMADE LAKES BASED ON FISH COMMUNITY

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Following the European Water Framework Directive 2000/60/EC (WFD) the ecological potential of heavily modified water bodies should be classified on biological quality elements. One of them is the fish fauna. In recent years, the typology and response to stressors was revealed for natural water bodies, but for manmade lakes (reservoirs) as heavily modified water bodies, which are to some extent a transitional type between lake and river we are missing sound assessment systems. The typology is not clear yet and the philosophy of classification is beginning to evolve gradually. During last eight years we sampled 17 different deep stratified manmade lakes from different parts of the Czech Republic, eight of them repeatedly. Sampling was done using Nordic multimesh gillnets with standardized design in all habitats (5-6 benthic, 3 pelagic habitats) and with respect to longitudinal gradient. To establish the assessing criteria we used basic characteristics of fish community structure e.g. composition and abundance of reproductive and trophic guilds and species tolerance to eutrophication. The first round of analysis showed significant response of the fish community and some species to the eutrophication and some natural characteristics like altitude and reservoir morphology.
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R04

CHARACTERIZATION OF MICROBIAL BIODIVERSITY IN THE PELAGIC ZONE OF ALPINE LAKES USING HIGH THROUGHPUT SEQUENCING

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The influence of rising air temperature is expected to be particularly pronounced in alpine ecosystems as they are typically inhabited by cold-adapted stenothermic species which would become extinct. In a similar vein it has been suggested that alpine lakes with a low average water temperature during summer are most vulnerable to a warmer climate, as a sudden rise in temperature would significantly shift species occurrence towards more opportunistic species such as bloom-forming cyanobacteria.
In order to characterize pelagic bacterial community composition in relation to average water temperature we used ultra-deep sequencing of the 16S rRNA gene as amplified from five alpine lakes of the Niedere Tauern region (1700-2118 m a.s.l.) during the years 2009-2011. The lakes differed significantly in summer mean water temperature by approx. 4°C, which was rather due to local influences than due to the influence of the altitude. In general the lakes were of an oligotrophic state (Phosphate: 1.8-7.7 µg L^{-1}) and the absolute bacterial numbers were correlated with phytoplankton biomass as indicated by chlorophyll a (R^2 = 0.17-0.67, $p<0.001$). Maximum Chlorophyll a values coincided with highest phototrophic cyanobacterial abundance.
The sequences were processed and analysed using the QIIME pipeline. A total of 272,571 sequences including the hypervariable region V3 and 594,260 sequences including V6 (average length 534 bp) were obtained resulting in 9,366 OTUs and 16,751 OTUs, each (97% similarity). The most important phyla comprised proteobacteria (52% (V3); 56% (V6)), bacteroidetes (22%, 18%), actinobacteria (9%, 9%) and (non-chloroplast) cyanobacteria (5%, 4%). The highest cyanobacterial abundance in more productive lakes was confirmed and within cyanobacteria the genera Cyanobium (0-76%) and Synechococcus (24-63%) were identified most frequently. Other cyanobacteria such as Limnothrix and Anabaena occurred specifically in some lakes.
Surprisingly, the lowest species diversity was observed in the lake with the lowest summer mean temperature (~8°C.) implying that specific cold-adapted species might competitively exclude bacterial species occurring in warmer lakes. Indeed the respective communities differed significantly and consistently in bacterial community composition suggesting that the annual variation in growth period (e.g. ice cover duration) within lakes did not lead to pronounced seasonal variation in bacterial community composition.

SS07

IMPACT OF LONG-TERM FLOODING ON THE HYDROLOGY AND BIOGEOCHEMISTRY OF A NORTHERN BOG IN ONTARIO, CANADA

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Climate change and impoundment construction may lead to rising water tables in many northern peatlands. In this work the hydrological and biogeochemical effects of flooding were studied at a peatland in southern Ontario, Canada, that was partly flooded 60 years ago. By a comparison of sites of increasing distance to the lake, the effects of inundation on the peatland biogeochemistry were identified. The approximate range of lake water intrusion into the peatland was determined using ^{18}O in water. Furthermore the local hydrology was analyzed by looking at distributions of hydraulic conductivity and small-scale groundwater flow patterns. By measuring nitrate, phosphate, ammonium, sulfate and DIC, CH_4 and DOC in the lake and groundwater the chemical and biogeochemical influence of the inundation was determined. Gas fluxes of CO_2 and CH_4 at the site were analyzed using a static chamber approach. The findings indicate that the infiltration of water from the lake at these sites occurred in time periods of higher lake levels. During summer these locations were only fed by precipitation and the previously infiltrated surface w ater was diluted or replaced. Nutrient concentrations in the lake water were generally lower compared to the peat pore water. The main solute entering the peatland with the intrusion was sulfate, which also influenced methane concentration patterns. Vertical flow seemed to be an important hydraulic process and control on solute transport at the study site, which has not been described to this extent previously. Additionally, indications for a discharge of groundwater into the peat during a flow reversal were found, though the assumed low permeability of underlying layers should not allow for this process. While the impact of reservoir creation on hydrologic processes appeared to be limited, the changes in water table, soil moisture and vegetation patterns had large impacts on trance gas fluxes to the atmosphere, especially on methane, whose emissions were several times higher than at reference sites. These changes also went along with increased methane concentrations belowground.

R14

THE EFFECTS OF EXPOSURE TO LOW DISSOLVED OXYGEN ON THE FITNESS OF INCUBATING SALMONID EMBRYOS; A FIELD AND LABORATORY INVESTIGATION.

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The survival of benthic spawning salmonid species is a complex and multifaceted process involving a wide range of interactions at different life-stages. One of the most important of these stages is the incubation period. Prior to spawning, the maternal salmonid constructs a redd in the hyporheic zone of the river, into which eggs are deposited and must remain until hatching. During this period survivorship is highly variable and is largely dependent on four main factors: oxygen availability, water quality, disturbance of incubation environment and removal of metabolic waste (Greig *et al*. 2006).
The effects of low oxygen levels on developing embryos has received much attention with impacts observed to range from sub-lethal effects such as modified growth (Kirkland 2011), altered physiological features (Seager *et al.* 2000), reduced growth rate (Miller *et al*. 2008) and delayed hatching (Roussel 2007) to total mortality (Malcolm *et al*. 2011).
It has been argued the accumulation of fine sediments in redds results in a reduced rate of interstitial flow, lower delivery rates of oxygen and subsequently reduced survival and fitness of incubating embryos (Soulsby *et al*. 2001). However, recent observations have shown that the accumulation of fine sediments can have a minimal impact on in-redd dissolved oxygen levels when compared with the effect of upwelling groundwater (Sear *et al*. 2012). Indeed, the role of upwelling low dissolved oxygen groundwater in creating periods of lethal levels within the egg zone has been observed (Malcolm *et al*., 2008). The influence of deoxygenated upwelling water in the hyporheic zone varies over very short spatial and temporal scales and the extent of its influence within salmonid redds has strong implications for embryonic survival.
The aim of this study is to better understand the biological response of incubating salmonid embryos to epochs of low dissolved oxygen. This will be achieved through a combination of laboratory experiments and field research in an area known to be subject to epochs of low dissolved oxygen. In particular, the study seeks to explore the effect that varying magnitude and duration of hypoxia have on embryonic development, the relative effects on embryonic development of hypoxia at varying stages in the incubation period and the extent of the sub-lethal effects on hatched alevin vitality.

SS13

MODELLING THE IMPACT OF INVASIVE DREISSENID MUSSELS IN A LARGE LAKE (LAKE ERIE, USA-CANADA)

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The invasion of dreissenid mussels has drastically altered aquatic ecosystems in North America including Laurentian Great Lakes. According to the nearshore-shunt hypothesis mussels are expected to redirect nutrients and energy to the benthos, and to have their greatest impact in shallow, well mixed nearshore areas. However, these processes are difficult to assess with measurements in the field and results are often confounded by hydrodynamic effects and spatial variation, whereas modelling that includes 3-dimensional spatial complexity and hydrodynamic processes can provide insights across a range of temporal and spatial scales. We used a 3-D hydrodynamic and ecological model (ELCOM-CAEDYM) that includes routines to describe nutrient cycling, phytoplankton dynamics, mussel energetics and the physical-biological processes controlling food particle availability proximate to the mussels to evaluate the potential of dreissenid mussels to alter the spatial distribution and dynamics of phytoplankton in Lake Erie. Mussel-mediated decreases in mean phytoplankton biomass were highly sensitive to the assigned mussel population size. In the relatively deep east basin, mussels were predicted to decrease phytoplankton in both nearshore and offshore zones, even during periods of thermal stratification but especially during the spring phytoplankton maximum. Spatially, impacts were associated with mussel distributions but could be strong even in lake areas without high mussel biomass, consistent with advection from areas of higher mussel biomass. The results supported the nearshore shunt hypothesis that mussel impacts on phytoplankton should be greater in nearshore than offshore waters and also supported suggestions that continued expansion of mussels is an important factor in trends to lower plankton productivity in some of the world's largest lakes.

R11

EMERGENCE BEHAVIOUR OF THE BALKAN GOLDENRING (*CORDULEGASTER HEROS* THEISCHINGER, 1979) IN HUNGARIAN UPSTREAMS

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The Balkan Goldenring is a Natura 2000 indicator and species of community importance also a strictly protected dragonfly in Hungary. *C. heros* is a narrowly distributed, Central and Southeastern European endemic taxon. Despite of this, its spatial distribution patterns and ecology are poorly known. The aim of this study was to explore the emergence behaviour of *C. heros* properly, including description of the schedule and dynamics of emergence, the sex ratio and the emergence-site selection of the species, furthermore understanding causal relationships. Exuviae were collected regularly in the same periods of two consecutive years: from the middle of May to the end of July in 2011 and 2012 at two upstream sections in Mecsek Mountains (SW Hungary). At each site a 200m long and 10m wide section on both side was visited at 6-3-6 day intervals. Riparian vegetation and surface of the ground were checked thoroughly. For each detected exuviae the distance from the bank and from the ground, and the substrate of emergence were recorded. Main morphometric parameters were measured, the sex was also determined. Riparian habitats of the streams were mapped in detail. In our presentation we demonstrate the characteristics of emergence period, namely, that the emergence of *C. heros* was relatively poorly synchronized and long-drawn, suggesting the species is a ‘summer species’ regarding its emergence behaviour. Strong differences were detected in measured distances and substrate preference between sampling sites and in comparison two shore-sides at the same site. In case of a sampling site the larvae crawled farther horizontally than at the other site, but the vertical distances showed quite the contrary. Based on this fact, it appears likely that the *C. heros* larvae must climb in vertical direction for the perfect ecdysis. Both the distances covered and the selected emergence substrates are clearly under the influence of the availability of the different kind of substrate-types: the composition of the riparian vegetation and other structural elements of the shoreline. Exploring and understanding the life history of lesser known endangered species, such as *C. heros*, is crucial for species management, so our results may be particularly important in conservational aspect.

R05

ESTIMATING FUNCTIONAL DIVERSITY OF ZOOPLANKTON TAXA: COMPARISON OF C, N ISOTOPIC SIGNATURES OF ORGANISMS ALONG LAKE MORPHO-EDAPHIC GRADIENT.

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Increasing concern on biodiversity consequent to human impacts on the environment provides a basis for quantifying the role of organisms in transferring matter and energy through the trophic web, i.e. paths and processes responsible for ecosystem functioning. Aquatic environments, and freshwater in particular, have been identified as extremely sensitive to biodiversity loss consequent to human activities. To understand and ultimately prevent loss of ecosystem functioning, however, impact of environmental variables on operational diversity has to be estimated. A possible approach to quantify roles and understand vicariance, is by applying carbon and nitrogen stable isotopes analyses. By measuring carbon and nitrogen isotopic signatures, organism food sources and position level along food webs are tracked, thus providing quantitative estimates of bi-dimensional niches. We applied C and N stable isotopes analysis to zooplankton taxa from lakes to compare how and whether taxa specific isotopic signatures vary along a morpho-edaphic gradient. Analyses were performed on zooplankton taxa from 11 lakes of the same subalpine region, collected in two seasons representative of different degrees of carbon fractionation and nitrogen enrichment. We provided basic information for understanding the possible impact of environmental variables, such as algal nutrient enrichment and lake size, on the complexity of between-taxa interactions which are crucial for estimating vulnerability of lacustrine ecosystems to human impacts.

SS03

DIVERSITY AND DISTRIBUTION OF STONEFLIES (PLECOPTERA) IN THE CZECH REPUBLIC OVER FIVE DECADES

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Global biodiversity has been changing at an alarming rate as a result of the impact of anthropogenic activities. Major threats to freshwater diversity result from proximate influences of urbanization, industry, land-use change and watercourse alterations. However, knowledge on their effects on aquatic insects is limited, since reliable historical data for comparison are nearly missing. An unusual data set of Plecoptera allows us to estimate diversity and distribution changes at 175 streams in the Czech Republic between two periods, 1955–1960 and 2006–2011. We found substantial overall decline in Plecoptera diversity. Three-quarters of the species studied declined in their number of occurrence, 48% of which were estimated to be undergoing a reduction of > 30%. Taxonomic dissimilarity between the contemporary and previous assemblages was primarily caused by changes in species richness; however, the role of species replacement was not negligible. Plecoptera showed a complex response to habitat change including loss of pollution-sensitive species and habitat-specialists as well as eurytopic species which, in some cases, counterbalanced their losses by concurrent colonization of new sites. We documented the restriction of species ranges and apparent changes in altitudinal preference throughout the area in some species.

SS12

THE IMPORTANCE OF BEING NATURAL: ROLE OF WETLAND TYPE ON THE MAINTENANCE OF RIVERINE VEGETATION

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In Europe, up to 80% of natural riverine aquatic habitats have been lost in the last century due to alteration of hydrological regime and catchment exploitation. In this context, one of the main question is: how do site origin (natural or artificial) and edaphic features (morphology and hydrology) influence hydro-hygrophilous plant assemblages diversity in presence of high level of anthropogenic alteration? In order to investigate this, during the 2008 growing season (July to late September), a vegetation survey was conducted in 30 lentic and 30 lotic aquatic habitats along the lower Oglio River reach, a mid-size, altered and nutrient-rich left tributary of the Po River (Northern Italy). Overall, 233 sampling plots along 85 transects were sampled leading to the identification of 7 different macro-typologies of vegetation with a clear predominance of riparian vegetation units. Overall, our data revealed i) low levels of colonization by vascular plant communities in persistent water bodies, where monophytic free-floating carpets (e.g., lemnid mats) and phytoplankton were the dominant vegetation; and ii) the affirmation of highly opportunistic, non-native and invasive plant communities (e.g., *Phragmites australis* subsp. *australis*, *Amorpha fruticosa*, *Bidens* spp., and *Amaranthus* spp.) in riparian and seasonally emergent sediments. A strong dependence of vegetation distribution and plant community assets on site origin was noted showing the tight link between the structural complexity and vegetation diversity in riverine aquatic habitats. Such evidence suggests the irreplaceable role played by natural riverine aquatic habitats in conserving aquatic vegetations diversity within overexploited floodplains.

R04

THE MACROINVERTEBRATE RIVER OF LIFE: UNDERSTANDING SPECIES RICHNESS AND TRAIT VARIABILITY THROUGH EVOLUTIONARY HISTORY

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In the tree of life, species richness is not equally distributed among lineages and understanding this disparity is a key challenge in macroevolutionary ecology. Assuming a constant rate of species diversification through time, species richness should be positively correlated with lineage age. Similarly, but often ignored, older lineages should have had more time for accumulating functional and ecological diversity, and more available niche space for doing so, resulting in a wider lineage niche breadth. If both assumptions were met, the disparity of lineage richness and niches across the tree of life would be explained by time. Alternatively, this disparity would be related to other factors, such as ecological limits that regulate lineage richness and niches at equilibria. In order to investigate these hypotheses in the freshwater macroinvertebrate tree of life, a resolved phylogenetic relative-time tree based on multigene data set of 5.43 kb for 238 genera within 143 families (> 95% of freshwater families in Europe) was constructed. The relative stem age of each monophyletic freshwater lineage (a total of 18 lineages with presumably independent origin of freshwater habitats) was related to available information on taxonomic richness, 61 biological traits (surrogates of functional niche), and 41 habitat requirement variables (surrogates of ecological niche). Ecological niche breadths were significantly related to lineage age for all macroinvertebrate groups, whereas functional niche breadths were only significant for insects. However, taxonomic richness within a lineage was not related to lineage age. This leaves an intriguing difference in the degree of taxonomic and functional-ecological diversification. We are currently testing if the variation within these lineages is dependent on their age. If these family-level sublineages indeed are more diverse in the older lineages, functional-ecological diversity of a lineage arose early and possibly constrained diversification of younger lineages once these entered the aquatic zone. All these results imply that the study of the tree of life, or the "river of life" for freshwater macroinvertebrates, should imply not only the analysis of species diversification but also how species partition and modify their niches through evolutionary time.

SS05

PRINCIPLES OF LAKESHORE RESTORATION: A CASE STUDY OF LAKE VELENCE, HUNGARY

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The changes of lakeshores affect the whole lake's ecosystem and the material-cycle, thus they are worth getting special attention during the spatial planning, nature conservation and restoration activities. The purpose of this study is to provide a scientifically based background for lakeshore restoration. First, a critical literature review was carried out, resulted in the classification of lakeshore determining factors, functions and in the classification of earlier lakeshore restoration efforts. It is clear, that in many cases, rehabilitation is applied as a tool to reduce external nutrient loadings to the lake, whereas providing better conditions for recreation is also in the focus of several studies, planning processes.
In the second step, an assessment was performed to characterize the ecological and landuse conditions of Lake Velence (Hungary). The most suitable shore sections for lakeshore restoration were selected, based on the results of the assessment. The following factors have been considered: wave exposure, land use, existing shore fortification, property conditions, local regulations. In the third step, personal interviews were conducted with the representatives of the local governments and authorities, so that the results can be evaluated also having in mind the standpoint of those concerned.
It is found that 4% of the lakeshore are excellently suitable to change shore fortification. The results made clear, that lakeshore restoration just can be implemented in the future with the cooperation of the different stakeholders, based on detailed information of the lakeshore's condition, having both the ecological and economical aspects in view. The method and the results can be applied in several parts of spatial planning and ecological restoration practice, in compliance with WFD directives.

R01

HIGH RESOLUTION DYNAMICS OF *PLANKTOTHRIX RUBESCENS* IN LAKE LEDRO (EASTERN ITALIAN ALPS) IN RELATION TO ENVIRONMENTAL CONDITIONS

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Among the Cyanobacteria, the phycoerythrin-rich, potentially toxic *Planktothrix rubescens* creates recurrent blooms in several oligo-mesotrophic and thermally stratified lakes. Lake Ledro (z_{max}: 48 m) is a subalpine hardwater lake (650 m a.s.l.) located in SW Trentino (Eastern Italian Alps). It is a modified lake exploited for hydroelectric production. After a massive *Planktothrix rubescens* surface bloom occurred in the lake during the winter 2009/2010, the Autonomous Province of Trento funded a research project aimed at studying the physical, chemical, and biological factors promoting the development of *Planktothrix* populations. The seasonal abundance, and vertical and horizontal distribution of *Planktothrix rubescens* were studied at high spatial resolution by using *in vivo* spectrofluorimetry with a BBE Fluoroprobe from June 2011 to December 2012. Environmental and meteorological variables were measured on discrete samples and *in situ* by multiparameter probes and instrumentations fixed on a platform moored to the lake bottom. The horizontal distribution of *Planktothrix* was evaluated by measurements made with the fluorometric probe along the maximum length of the lake. The high spatial frequency measurements showed a strict positioning of the cyanobacterium in 2-4 m thick water layers located just below the euphotic depth (10-18 m, in summer), with biovolumes ranging between 4 and 12 $mm^3\ l^{-1}$. High resolution horizontal fluorometric measurements highlighted the presence of a stable layer of *Planktothrix* over the lake thalweg. The thickening was characterized by differences in both abundance and depth at the extremities of the water basin. The development of *Planktothrix* was associated to the presence of microcystins in the lake, with concentrations, ranging from 0.5 to 9 µg l^{-1}. The recent *Planktothrix* outbreaks during the very last years fostered a complementary paleolimnological investigation aimed at defining the historical development of *Planktothrix* in Lake Ledro. Using cyanobacterial pigments, the analyses of the varved sediment cores, still in progress, will allow to evaluate the secular fluctuations of this species in relation to climatic variability, human impact and lake basin management.

R04

CONTROL OF DENSITY ON THE GROWTH OF EUROPEAN EEL POPULATION IN THREE CONTRASTING TEMPERATE SYSTEMS

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Growth is known as a key parameter for the management of the endangered European eel. Growth rate, together with other processes, directly impacts reproductive success by affecting age and size at maturity as well as fecundity. There is huge variability of growth rates among European inland habitats, with growth rates decreasing from south to north of Europe. This contrasted pattern is strongly influenced by environmental factors such as temperature. These variables have a strong influence on the productivity of the watershed and on their carrying capacity. However, few studies take into account the population structure of each watershed, including eel's density, which also has an impact on the carrying capacity. Indeed, a habitat can accommodate a limited number of individuals before reaching saturation, thereby causing density-dependent phenomena on growth by limiting the availability of food. But effects of intra-specific competition on growth rates are difficult to identify because it requires a precise monitoring of individuals and the possibility of estimating the density of different sites sampled.
In this work, three sites were sampled between 2008 and 2012 to study effects of density on growth rate. Eel growth rates (mm/year) were estimated for > 150 mm individuals using mark-recapture methods (PIT-tags). In the first site, a closed pond in Camargue, the density is enhanced every year experimentally by adding a significant numbers of recruits in order to achieve saturation level. The two other sites are small natural catchments, the Oir in Normandy and the Frémur in Brittany. Both watersheds have the same latitude which means almost the same environmental pressures on their eel population. However, the Fremur is one of the European watersheds with the highest density of eels (0.25 ind/m^2) and is known to have reached the saturation, unlike the Oir where the density of eel is quite low (0.09 ind/m^2).
Results show that growth rate decrease sharply as density increase in the experimental design. Moreover, Spatial and temporal variations in growth rates were observed in the "unsaturated" natural system and were mainly explained by environmental factors. In the "saturated" system, growth rates were stable and homogeneous in the entire watershed suggesting that whatever the location, habitat is always limited by productivity. All these results highlight that growth can be influenced by environmental factors but that density can act as an inhibitor.

R05

TROPHIC NICHE VARIABILITY OF THE INVASIVE AMPHIPOD *DIKEROGAMMARUS VILLOSUS* IN THE RIVER ELBE

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The Ponto-Caspian amphipod *Dikerogammarus villosus* is one of the most successful aquatic invaders of the last 15 years. Its successfulness has mostly been related to high growth rates, short generation times and the large reproductive capacity. To which extent its feeding behavior contributes to the invasion success and which functional role *D. villosus* plays in our ecosystems is still subject to considerable debate. Most laboratory experiments revealed strong tendencies towards carnivory, whereas field experiments and SEM studies of the mouthparts showed a number of different feeding modes. Since the majority of studies generated these diverse results the (trophic) position of *D. villosus* in the benthic food web still remains unclear.

We investigated whether trophic niche variability is systematically related to resource availability associated with different shoreline types in the river Elbe. Therefore, we sampled *D. villosus* at four different shorelines (standard groyne, parallel groyne, rip-rap and natural shore) three times within one year. At each shoreline, the different habitats were sampled separately. Individuals were analyzed size-specifically concerning their stable N and C isotopic signature to trace the consumed food resource and to determine their trophic position.

The results of the stable isotope analysis show differences in trophic position to depend upon habitats but also on the seasons of the year. Moreover, we did not find a significant relation between body size and trophic level contradicting the current opinion that larger individuals are more predaceous than smaller ones.

SS13

LONGITUDINAL CONNECTIVITY ENHANCEMENT PRIORITIES FOR STREAM FISHES: A SPATIAL GRAPH APPROACH

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Freshwater systems are severely impacted by the limitation of longitudinal connectivity due to the construction of instream structures like weirs and dams. The infringement of longitudinal connectivity imperils freshwater fish species worldwide. There is thus the need for numerical tools that aid decision-makers to correctly allocate resources to priority restoration actions. This work provides a novel methodology to prioritize removal or connectivity enhancement of barriers. It is based on spatial graphs, that represent structural units as nodes and relationships between them as links, and uses habitat suitability modeling (Boosted Regression Trees) to weight the nodes. To exemplify the application of this procedure we use the Tagus River network and evaluated the impact of the dams therein (29 built between 1928 and 2004) on two species (*Luciobarbus bocagei* (Barbel) – representing large potamodromous; and *Squalius pyrenaicus* (Chub) – representing small water-column residents) and on the combination of the two. The models presented a good predictive power, according to the results of the cross validation (AUC – 0.825; 0.863, for the barbel and chub respectively). Results show that dam construction on the Tagus was responsible for 49.8 – 54.3% reduction of connectivity and actions to promote connectivity in 7 of the implanted dams would produce a connectivity increase of 37.1 – 40.1%; proving that correct allocation of resources is of paramount importance. This prioritizing method, allows modeling the impact of the deletion or insertion of a full barrier on a river network, facilitating resource allocation and minimizing impact of new barrier implantation.

SS03

THE GLOBAL FRESHWATER BIODIVERSITY ATLAS – TOWARDS A UNIFYING ONLINE INFRASTRUCTURE FOR FRESHWATER BIODIVERSITY POLICY AND RESEARCH

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Scientific results and spatial data from different disciplines related to freshwater biodiversity remain scattered and are often difficult to access. To address this challenge we are developing a new internet-based, interactive atlas to combine various maps in a central facility. The aim of the “Global Freshwater Biodiversity Atlas” is to improve visibility and accessibility of freshwater biodiversity related maps and support decision-making and policy development through visualisation of major research results.
The atlas is part of the EU FP7 project BioFresh. As a highly collaborative initiative it is developed in cooperation with major global partners and will include data from diverse sources.
The “Global Freshwater Biodiversity Atlas” is structured thematically and combines maps and articles on recent and predicted freshwater biodiversity, freshwater resources and ecosystems, pressures and drivers of biodiversity as well as conservation and management efforts in a unifying framework. It has a mainly global focus but will also feature many continental contributions and selected local scale topics.
Researchers and organisations are invited to contribute to this initiative and increase the visibility of their published maps by featuring them on the Global Freshwater Biodiversity Atlas.

PS5

STABILITY AND EXTINCTIONS IN COMPLEX FOOD WEBS

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Recent evidence suggests that the global ecosystems are currently exposed to a wave of species' extinctions. In this context, addressing the consequences of species extinctions for natural ecosystems has become one of the most urgent scientific questions. However, experimentally-induced extinctions in natural ecosystems are generally logistically limited, sometimes ethically questionable and generally restricted to short-term and small-scale designs. In contrast, model analyses of complex food webs offer a promising tool for understanding general signatures in extinction risks across specific ecosystems. Allometric trophic network models combine realistically parametrized or natural trophic structures (“who consumes whom”) with allometric scaling models of the population parameters. The latter includes empirically-derived relationships between population-averaged body masses and the physiological rates (respiration, production, maximum consumption) and interaction parameters (handling time, attack rates). Applications of these allometric trophic network models showed that (1) primary extinctions increase with the species' trophic levels, (2) the risks of triggering secondary extinctions depend on characteristics of the community (exponent of the abundance-mass relationship), the network (e.g. diversity,), and the species that is initially lost (e.g., its body mass). Conceptually, these predictions are supported by removal experiments suggesting that allometric trophic network models may elucidate general profiles of extinctions in complex food webs.

SS03

FISH-SPRICH, AN OPEN ACCESS DATABASE OF FRESHWATER FISH SPECIES RICHNESS ACROSS THE WORLD: RECENT ACHIEVEMENTS AND FUTURE DIRECTIONS

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A growing interest is devoted to large-scale approaches in ecology, for both plants and animals. In particular, macroecological studies allow examination of the patterns and determinants of species richness of various organism groups across the world, which might have important implications in the prediction and the mitigation of the consequences of global change. Here, we provide richness data for freshwater fishes, which, with more than 13,000 described species, represent a quarter of all vertebrate species. We conducted an extensive literature survey of native, non-native (exotic) and endemic freshwater fish species richness and the resulting database, called Fish-SPRICH, includes data from more than 400 bibliographic sources including published papers, books and grey literature sources. Fish-SPRICH contains richness values at the river basin grain for 1054 river basins covering more than 80% of the earth's continental surface. This database is currently the most comprehensive global database for native, non-native and endemic freshwater fish richness available at the river basin grain. The Fish-SPRICH database already permitted to accurately map global species richness patterns of native, endemic and non-native fish species richness, and might be of interest to analyze cross-taxon congruence in global richness patterns. In the same way, the Fish-SPRICH database could be of interest for regional studies on fish diversity, such as biodiversity gradient approaches or species-area investigations.

R03

STREAM ECOSYSTEM RESPONSES TO MOORLAND VEGETATION BURNING ACROSS NORTHERN ENGLAND

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Controlled burning of vegetation (predominantly heather and grass) in peat covered moorlands of the UK is undertaken mainly to increase production of red grouse. Red grouse shooting contributes to the rural economy and is seen as a traditional leisure activity for some, but there are widespread concerns that vegetation burning can have detrimental effects on peatland terrestrial and freshwater ecosystems. Between 2010-12 we examined spatial and seasonal dynamics of stream physicochemistry and benthic macroinvertebrates from rivers in five peatland catchments that are managed via rotational vegetation burning and compared these with rivers in five intact catchments with no recent history of burning. Rivers in burned catchments typically had higher benthic POM, organic suspended sediment and higher concentrations of dissolved Al and organic carbon. There were significant differences in benthic macroinvertebrate richness, diversity and dominance, community composition and functional feeding groups between burned and intact catchments, suggesting that management of peatlands by vegetation burning had an effect on aquatic ecosystems. A series of mesocosm and river reach experiments suggest that sediment erosion from burned areas of the catchment is a key driver of macroinvertebrate community change in these streams.

SS03

EFFECTS OF HUMAN DISTURBANCES ON WOODY RIPARIAN RICHNESS AND RIPARIAN QUALITY AT DIFFERENT SPATIAL SCALES IN A MEDITERRANEAN RIVER BASIN.

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In this study, we aim i) to identify what anthropogenic factors better explain both woody riparian richness and ecological riparian quality as well as, ii) to determine if these factors can affect differently depending on the spatial scale considered. For this, general linear models (GLM) were performed to test the effect of different variables related with hydrogeomorphological alteration and land use disturbances both at local and basin spatial scales over taxonomic richness and the riparian quality index (RQI). Finally, from a management perspective, breakpoint regression analyses were applied in order to identify any possible significant thresholds affecting relationship among riparian quality and the more significant anthropogenic pressures. All the analyses were done over a dataset resulting from the prospection of 56 perennial freshwater river and stream reaches in the Segura river basin (SE Spain), covering the anthropogenic gradient in this area. Agriculture, dam regulation and habitat modification were the variables that better explained the variability of both riparian features. While agriculture was more important for woody plant richness, the other factors showed a greater importance in explaining riparian quality scores. Richness seems to be mainly influenced by variables acting at basin scale and riparian quality by factors at local scales. Finally, breakpoint regression analyses found critical limits for habitat modification (184 index score), basin (33,9%) and local agriculture surface (57.7%). These values must not be exceeded if we want to conserve acceptable quality values. On the other hand, riparian quality showed a linear negative relationship with dam regulation resulting in a progressive impairment of riparian condition as hydrological disturbance increased. Our results are important to improve the riparian management in Mediterranean areas, as they allow the definition of alteration breakpoints that must be considered by water authorities.

SS10

MACROINVERTEBRATE COMMUNITIES OF STREAMS: UNDER THREAT BY DIFFERENT SOURCES OF PESTICIDES

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More than 10 years after the adoption of the EU Water Framework Directive, the majority of German rivers and streams are still at risk of failing to achieve the good ecological and chemical status by 2015. Pesticide contamination of streams is a major stressor for stream ecosystem health preventing the achievement of a good status. Pesticides enter water bodies from a variety of sources, ranging from point sources as municipal wastewater treatment plants (WWTPs) to more diffuse sources as fields, orchards or allotments.
Very often, the effects of pesticides add to other stressors like organic pollution or hydromorphological degradation of the streams. A promising approach to assess the effect of one specific stressor is the use of species traits (ecological, physiological and behavioural traits). The trait-based bioindicator system SPEAR (SPEcies At Risk) calculates the fraction of species sensitive to a specific type of contaminant (e.g. pesticides,) in the macroinvertebrate community. $SPEAR_{pesticides}$ has been shown to be an effective tool for identifying community effects of pesticides (insecticidal toxicity) and offers an increased realism for the risk assessment of pesticides on the ecosystem level.
Based on governmental monitoring data of four German federal states, we analysed the insecticidal effects of pesticides, coming from different sources, on the structure of the macroinvertebrate community. In Hesse, Germany, we showed that in many streams both pesticides and oxygen-depleting substances coming from WWTPs affect the macroinvertebrate community significantly and cause a change towards species that can tolerate pesticides and/or oxygen deficiency (Bunzel et al., 2013). Based on data from Saxony, Saxony-Anhalt and Thuringia, we revealed that beside agricultural land also allotments and orchards can be a significant source for pesticides.
Our findings emphasize the need to take all significant pesticide sources into consideration in the management of river basins under the EU Water Framework Directive to achieve good ecological status of our stream ecosystems.

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SS12

FLOODPLAIN RESTORATION FROM THE FISH PERSPECTIVE: EFFICIENCY CONTROL AT THE RIVER LIPPE

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The Lippe is a middle-sized river in Northrhine-Westfalia that has been regulated nearly completely in the 19. and 20. century. Several projects like “LIFE+ Lippeaue” in Hamm are working to restore river and floodplain to a near natural state. Measures to do this include removing bank reinforcements, widening and rising the river bed, lengthening the river course by building new bends, restoring small tributaries, flood channel systems, oxbow lakes, ponds and other lentic water bodies, closing drainage ditches and removing summer embankments that used to separate the river from the floodplain. Longitudinal connectivity is restored by laying down weirs or by building fish passes around barriers that cannot be removed.

A study of the fish fauna before and after the implementation of such measures is a very good tool for an evaluation. Fish can react quickly and often spectacularly to habitat improvements. Standardized electrofishing was used in the Lippe floodplain, partly in long-term studies.

Most fish populations increased after the measures. In the Lippe, these were especially species like dace (*Leuciscus leuciscus*) and nase (*Chondrostoma nasus*) that need shallows for spawning and as habitat for juveniles. Before the restoration, shallows were quite rare. In the floodplain sunbleak (*Leucaspius delineatus*), ten-spined stickleback (Pungitius pungitius) and other pioneers colonized the new ponds and lakes before other species followed.

The increase of the endangered burbot (*Lota lota*) is an example for a special success. The burbot population in the Lippe is one of the last in Northrhine-Westfalia. Adult fish live in the river. They spawn in winter in small tributaries, and the larvae do best in inundated floodplains in spring. After the restoration of the lateral connectivity and a near natural flood regime, burbot reproduce again successfully in most years and the population is growing.

R07

IMPACT OF ELECTRON DONOR AND ACCEPTOR AVAILABILITY ON MINERALIZATION OF PEAT FROM A CANADIAN BOG

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Peatlands are important carbon sinks. Different redox conditions influence the decomposition of peat to carbon dioxide (CO_2) and methane (CH_4). This study aims to characterize constraints of peat decomposition under different redox conditions. Peat from the ombrotrophic bog Mer Bleue, Canada, was incubated for 73 days. Electron acceptor availability was varied by the addition of sulfate, nitrate (at a final concentration of 1 mmol l^{-1} each) and oxygen (21 % in the headspace) and electron donor availability by hydrogen addition (1 % and 10 % in the headspace). Routinely monitored CH_4 and CO_2 headspace concentrations served to calculate initial production rates and to determine if decomposition stagnated after a certain release of CO_2 and CH_4. Initial CO_2 production rates ranged from 607 to 1080 nmol g^{-1} d^{-1} for anaerobic treatments; the rate was 2095 nmol g^{-1} d^{-1} for the oxygen exposed treatment. Initial CH_4 production ranged from 15 to 180 nmol g^{-1} d^{-1} and was significantly lower for treatments with electron acceptor addition than for treatments with electron donor addition. A relevant slow-down of CH_4 production was identified only for the treatment with high hydrogen partial pressures. Slow-down of initial fast CO_2 production occurred after 35 days, when 38 µmol g^{-1} (d. w. peat) had been released; only the aerobic treatment showed a higher CO_2 release before slow-down. We interpret that the slow-down in CO_2 release was rather due to decreasing substrate quality than to the accumulation of dissolved end products as CO_2 and CH_4 degassed into the incubation headspace. Methanogenesis was diminished in the presence of nitrate, sulfate and oxygen and presumably by homoacetogenesis in the treatment with high hydrogen partial pressures.

SS12

CONTROL OF AQUATIC INVASIVE SPECIES AND RESTORATION OF NATURAL COMMUNITIES IN IRELAND (CAISIE)

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The focus of the EU Life+ Nature and Biodiversity project ‘Control of Aquatic Invasive Species and Restoration of Natural Communities in Ireland’ (CAISIE) was to contribute to the halting of biodiversity loss in Ireland. The project commenced in September 2009 and focused on two geographical areas: (1) Lough Corrib and (2) the Grand Canal and Barrow Navigation. The project concluded in January 2013. The CAISIE Project was developed in response to the increasing threat from aquatic invasive species in Ireland’s Inland waterways. This particularly reflected the threat posed by the Curly-leaved waterweed (*Lagarosiphon major*) in Lough Corrib and the recognition of the Grand Canal and Barrow Navigation as a significant pathway for the spread of aquatic invasive species throughout Ireland.

The principal focus of the CAISIE Project in Lough Corrib was to undertake an extensive programme of measures to control the invasive Curly-leaved waterweed and to elucidate its impacts on the native biodiversity. During the project three principal methods were developed to control the growth and spread of Curly-leaved waterweed in Lough Corrib. These were light-exclusion using jute matting, mechanical cutting using V-blades and manual removal by scuba divers *via* hand-picking. The use of jute matting in particular proved to be both novel and effective, and has been the subject of a scientific paper. Before control operations commenced, some 92 hectares of Lough Corrib was infested with Curly-leaved waterweed. By the conclusion of the project < 10 hectares of weed remained. As a result of this work native plant species have re-established in treated lake areas and large areas of water have been re-opened for angling and boating.

Most sites on the Grand Canal and Barrow Navigation that were infested with a range of invasive species (including Japanese knotweed, Himalayan balsam, Giant hogweed, Nuttall’s pondweed) have been successfully treated.

CAISIE drove biosecurity policy in Ireland and has been integral to the development of many of the new biosecurity initiatives currently in use. In addition, a suite of practical tools to tackle any future incursions has been developed for institutional staff and stakeholders.

R03

FRESHWATER GASTROPODA FAUNA OF THE PROVINCE ANTALYA AND EFFECTS OF HABITAT DISTURBANCE ON DISTRIBUTION OF FAUNA.

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This study is aimed to determine the distribution of freshwater Gastropoda species in the province Antalya and effects of habitat disturbance on these taxa. For that reason sampling studies have done in chosen stations. The results were evaluated together with the results of previous malacological studies. Antalya region is rich in terms of wetlands and freshwater fauna. Moreover, Antalya is an important area where intensive tourism and agricultural activities occur. Thus, the water resources under intense ecological stress that comes from anthropogenic origin. Species distribution on this area which is of malacozoogeographic importance, is affected ecological factors, as well as by paleogeographic and hydrogeographic effects.

SS06

FROM PERENNIAL TO TEMPORARY STREAMS: CLIMATE CHANGE AS A DRIVING FORCE IN COMMUNITIES´ TRAITS?

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Portugal has faced an unusual dry fall/winter in 2011/2012, which leaded to events of complete dryness in typically temperate perennial streams. Are these typical perennial streams becoming temporary? And how will these modifications be reflected in riverine communities? To evaluate changes, we have compared the proportion of biological traits expected to be related with potential resilience/resistance to drought before the dryness event (spring 2011) with the proportions after rewetting. This comparison was done in two moments: immediately after rewetting and in the following spring. The temperate communities were also confronted with the Mediterranean ones in order to verify if the drought caused a shift in the temperate communities towards typically Mediterranean communities of temporary streams.
Communities' traits proportions just after rewetting were different from the ones found in the spring 2011 (Permanova, pairwise test; t= 1.921, p=0.012) and similar to the ones found in the Mediterranean type (Permanova, pairwise test; t=1.932, p=0.012), while in the following spring, traits proportions became similar to the ones in spring 2011 (t=1.288, p>0.05) and different from Mediterranean (t=1.558, p=0.047). When looking into diatoms', traits proportions were not different between temperate samples (spring 2011, after rewetting and spring 2012), but higher proportions of species with the trait categories mobile and small size (biovolume 5 to 299 μm^3) were found in temperate samples when comparing to Mediterranean samples (ANOVA, Fisher method; F=7.060, p<0.05 and F=4.329, p<0.05, respectively). For macroinvertebrates, traits proportions were different between all temperate samples. Also, we found a significant reduction of individuals with aquatic passive dispersal and swimmers just after the drought (ANOVA, Fisher or Tukey test; F=5.256, p<0.05 and H=8.540, p<0.02, respectively) which were similar to Mediterranean traits proportion.
Besides the differences obtained, we found a recovery in traits proportions with potential resilience/resistance to drought in the temperate sites after a drought period for both macroinvertebrates and diatoms, however in the last ones that recovery seemed faster.
In our perspective, community traits could be shifting in temperate streams with increasing temporary regime, but not necessarily towards Mediterranean trait community depending on traits analyzed.

R04

PATTERNS OF INORGANIC CARBON ASSIMILATION IN THE MODEL LAKE LA CRUZ: ISOTOPIC ^{14}C VS ACTIVE FLUORESCENCE METHODS.

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During the last decades studies on autotrophic inorganic carbon assimilation have been a central issue in limnology. Different techniques have been used and discussed. In this work we combine the classic ^{14}C technique with the “in situ” active fluorescence, as well as using of the later in controlled (light and nutrients) laboratory experiments. The combined use of both techniques allowed obtaining complementary data to better understand inorganic carbon assimilation patterns. The work was performed in the “model” Lake La Cruz, a small meromictic karstic lake with a seasonal strong thermal stratification and a permanent carbonate oversaturation with annual whiting events. Lake La Cruz seasonally develops a sharp thermocline from April to October, allowing for the establishment of dense thin layers of photosynthetic organisms stratified within the vertical profile, also with the development of a highly productive deep chlorophyll maximum (DCM). The main photosynthetic microorganisms observed were autotrophic picoplankton (APP), larger eukaryotic phytoplankton, and photosynthetic sulfur bacteria. Despite the diversity of photosynthetic microorganisms found in Lake La Cruz picoprokaryotic microorganisms dominate inorganic carbon assimilation and biomass. Oxygenic photosynthesis is the most important process of inorganic carbon assimilation accounting for 89.7% (164 g C m^{-2} yr^{-1}) of total inorganic carbon assimilation, where APP is responsible of 80% of this assimilation. Anoxygenic photosynthesis represents 2.8% (5.1 g C m^{-2} yr^{-1}) and dark inorganic carbon assimilation 7.5% (13.8 g C m^{-2} yr^{-1}). At the end of the stratification period (October) dark inorganic carbon assimilation becomes an important source of carbon for the lake with the 20% of the total inorganic carbon assimilation, mostly occurring (73%) in the hypolimnion. To a better understand of the ecological strategies behind the dominance of the picoprokaryotic fraction (both in biomass and inorganic carbon assimilation), in Lake La Cruz, we compare different photosynthetic features obtained with ^{14}C and active fluorescence methods with a characterization of microorganism’s populations through microscopy, flow cytometry and HPLC-chemotaxonomy, and later with laboratory experiments. A complex combination of light quality, nutrient dynamics and the effect of whiting events appears as key factors for this picoprokaryotic dominance in Lake La Cruz.

SS12

EX-SITU BREEDING OF NATIVE UNIONIDS OF LAKE BANYOLES (CATALONIA), IN THE CONTEXT OF A LIFE+ PROJECT

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Lake Banyoles is the second largest natural lake in the Iberian Peninsula. It is one of the first places in the Iberian Peninsula where planned massive fish introductions. Among other ecological effects, the proliferation of alien fish directly explains the actual rarity of native fish, which constitute the natural host for their parasitic larvae. Due to this situation, a dramatic regression of the 4 native unionoids of this lake (*Unio mancus*, *U. ravoisieri*, *Potomida littoralis*, and *Anodonta anatina*) has been observed.
Over the past decades, an ecological improvement of this natural site has occurred, thanks to a management geared towards the preservation of natural heritage. However, nowadays the main challenge for the management of the lake and its surroundings is to be found in the invasive alien species. “Projecte Estany” (LIFE 08/NAT/E/000078) is a four year project, from 2010 to 2013. The main objective is to design and implement a large scale intervention to combat, slow down and revert the decline in species and habitats of Community interest through the control of invasive alien species, the population strengthening of seriously threatened native species, and restoration of key patches of riparian habitats.
For the recovery of two *Unio* species, a breeding laboratory has been set up. During the two first years of the Project, several methodologies have been tested in order to obtain mussel gloquidia (larvae), to optimize fish infections, and to achieve a way to growth up juveniles.
Up to 3 different native fish species have been tested as host for local *Unio* larvae: *Barbus meridionalis, Squalius laietanus*, and *Salaria fluviatilis*. All them have demonstrated their capacity to play as host and to release viable juveniles, but due to its bigger size, now only the two first are used for posterior intensive mussel breeding, joint with *Luciobrabus graellsii*. Protocol implemented and first results on captive breeding of Unio species are shown.

SS09

EXPLORING THE EFFECTS OF SECONDARY SALINISATION ON STREAM AQUATIC COMMUNITIES: A MESOCOSMS APPROACH

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Secondary salinisation is a global and growing threat that affects many rivers and streams in the world. In the Freshwater Ecology and Management research group (F.E.M. University of Barcelona) we have developed a mesocosm facility to explore the effects of secondary salinisation on the aquatic communities and the stream ecosystem functioning. Stream mesocosms allow for examination of the aquatic communities under controlled experimental conditions, isolating the effect of salinity from any other potentially confounding factors. The mesocosm consists of 12 artificial flow-through stream channels relying on water pumped from a diversion channel of the Llobregat River (Barcelona, Spain). The pump provides a continuous supply of water to a 4000-L tank. A second 2000-L tank is filled with a salt-saturated solution (250 g l^{-1}), which is a mix of freshwater coming from the river and common table salt (NaCl). We conducted a first experiment in which Invertebrate communities were subjected to three treatments of salt-concentrated solution at conductivities of 1.5, 2.5 and 5 mS cm^{-1} during 72 hours to mimic the salinity pulses common to Mediterranean rivers subjected to mining pollution during runoff events. There was a significant overall effect, but differences between individual treatments and the control were only significant for the highest salinity treatment. The community response to salinization was characterized by a decline in total invertebrate density, taxon richness and diversity, an increase in invertebrate drift and loss of the most sensitive taxa. A second experiment explored the effect of very short (2h of duration) salt releases of different magnitude (5, 10 and 15 mS cm^{-1}) on the algal and the invertebrate community and some aspects of the ecosystem functioning (fungal biomass and leaf decomposition. The treatments had a significant effect on the algal and invertebrate density and on the community composition, but not on the taxa richness. Leaf consumption declined with treatment, while fungal biomass registered an U-shaped response (being highest in the moderate treatment conditions). More recent experiments (from which only preliminary results are available) analyzed the effect of salt disposal on invertebrate predation through the use of biomarkers.

R07

TRACE METALS IN A RESERVOIR FOR PUBLIC WATER SUPPLY (SÃO PAULO STATE, BRAZIL): PALEOLIMNOLOGICAL STUDY

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A paleolimnological study was conducted to investigate historical accumulations of trace-metals into Juquery reservoir, used for public water supply (São Paulo State, Brazil). A gravity corer was released in three areas of the reservoir: in the limnetic zone, in the headwater area and in the catchments area for public water supply. The core was sliced every two cm and stored in a sealed plastic bag. One core was used for metals determination (Cd, Cr, Cu, Ni, Pb, Zn, Mn, Al and Fe) in accordance with USEPA method 3050B, and dating (^{210}Pb). The other core was used for determination of organic matter and particle size. With the exception of Cu, all metal concentrations were in accordance with backgrounds values. For Cu, the highest concentrations were found in recent sediments. This result is consequence of copper sulphate application for algal blooms control. Among the sampled areas, the catchments area for public water supply was better protected over time, with lower rates of accumulation for trace-metals. Canonical discriminant analysis indicated that the variables that significantly differentiated the three sampled areas were related to the conservative elements aluminum and iron, manganese and size fractions. These data indicate that the main differences are due to lithological variations and to the dynamic operation of reservoirs that provide larger particle size fraction in the areas of greatest energy. Although still considered a protected ecosystem, evidence of degradation of Juquery reservoir is already being reflected in the sediments as consequence of the urban development recorded in the area. It is necessary that public policies are actually applied against the degradation of these important ecosystem, specially reducing the inputs of nitrogen and phosphorus in Juquery reservoir’s tributaries, in order to reduce the algal biomass and, consequently, stop the application of copper sulphate otherwise, reservoir’s 'good quality' will be at risk.

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R07

PRIMING EFFECT IN FRESHWATER ECOSYSTEMS: RESPONSE OF LAKE WATER DISSOLVED ORGANIC CARBON TO LABILE C PULSES

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Although the quantitative relevance of freshwater organic carbon (OC) processing is broadly accepted, the pathways of C cycling in inland waters are still poorly understood. Identifying the factors constraining the mineralization of OC is crucial for a general understanding of the carbon cycle. One factor which has received large interest recently, is the priming effect that refers to small inputs of labile OC sources that trigger the degradation of previously un-reactive OC. Although this phenomenon has been extensively studied in soils, it has only been hypothesized in freshwater systems.

We performed a multifactorial microcosm experiment to test the conditions under which priming may be observed in freshwater pelagic systems. We assessed the effect of pulses of three different sources of labile C over dissolved OC consumption using water from lakes with different trophic state to test a variety of OC quality. We also analyzed the effect of nutrient availability and the role of cell attachment to a surface. Despite the broad range of conditions tested, a single case of significant priming coinciding with an increased decomposition rate was observed. Our results suggest that priming in lake water is unlikely to happen or having an important effect on the C budget. We discuss why the water column is not the most suitable environment for priming to take place and we suggest some conditions and spatial hotspots where priming is more likely to occur.

R12

WAVELET ANALYSES AS A NOVEL TOOL FOR EVALUATING HYDROLOGICAL CONSEQUENCES OF GLACIER MELTING

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Worldwide, the rapid shrinking of glaciers in response to ongoing climate change is currently modifying the glacial meltwater contribution to streams in glacierized catchments. Significant changes in hydrological and water-quality regimes measured in glacier-fed systems over the last decades are likely to have profound consequences on the rich and peculiar aquatic biodiversity in those glacierized catchments. Indeed the shrinkage in ice cover is expected not only to reduce taxon turnover in proglacial river systems but also to affect local richness at downstream reaches. Quantifying the contribution of glacier run-off to stream discharge is therefore of critical importance to evaluate potential impact of glacier retreat on aquatic biodiversity. However this task has challenged both glacier hydrologists and ecologists over the last 20 years due to the structural complexity of the glacier-stream system interface. Here we propose a new methodological approach based on wavelet transform analyses on water depth time series to quantify the glacial influence in glacierized catchments. We performed water depth measurement using water pressure loggers over one year in 15 stream sites in two glacier-fed catchments in the Ecuadorian Andes (> 4000 m). We determined the global wavelet spectrum of each time series and defined the Wavelet Glacier signal (WGS) as the difference between the global wavelet power spectrum value at 24 hours scale and his corresponding significance value. To test the relevance of the WGS we compared it with the percentage of the glacier cover in the study catchments. We then tested whether one month data could be sufficient to reliably quantify the glacial influence. As expected we found the WGS of glacier-fed streams decreased downstream with the increasing of non-glacial tributaries. We also found that the WGS and the percentage of the glacier cover in the catchment were significantly positively correlated and that one month data was sufficient to quantify the glacial runoff contribution at a given site and to compare the glacial influence between two sites provided that the water level time series were acquired over the same period. Besides we found that our method permits to detect glacial signal in supposedly non-glacial sites, thereby evidencing glacial meltwater infiltration. The WGS therefore appears as a powerful and cost effective tool to study the physical consequences of rapid glacier melting on stream in glacier-fed watersheds.

R11

PERVERSE EFFECTS OF EUTROPHICATION'S REMEDIATION OPERATIONS IN A MEDITERRANEAN COASTAL LAGOON (BIGUGLIA, CORSICA).

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The Biguglia lagoon is a shallow, brackish, semi-enclosed Mediterranean coastal ecosystem where eutrophication is increasing for several years. Exchanges with sea water are very limited (sand accumulation). Freshwater inputs in the northern part of the lagoon are said to carry important amounts of fertilizers that further accumulate in the lagoon. In parallel, the confinement of the southern part of the lagoon facilitates phytoplankton biomass accumulations that led some years ago to dystrophic crises involving toxic cyanobacteria. The cleaning out of the main canal that provide freshwater to the southern part of the lagoon has been realized in 2009 to enhance water circulation and alleviate such ecological crises. A monthly monitoring has been implemented in 2010 (i) to document the impacts of this remediation action on the abiotic characteristics of the lagoon, and (ii) to evaluate its consequences on phytoplankton communities. Three stations have been studied to identify the main taxonomic groups (microscopy), to quantify their pigment composition (HPLC), and to assess their photosynthetic performances (Phyto-PAM).

A bundle of evidences suggest that this operation led to unexpected results. Environmental parameters patterns revealed that the renewal of water masses was very weak with important time lags between the different stations. Salinity footprints indicated the succession of two main hydrological sequences that depended on rainfall and associated runoff. Contrasted food webs developed accordingly, with a shift from autotrophy (first sequence, northern part of the lagoon) to heterotrophy (second sequence, southern part of the lagoon). Important biomass of picophytoplankton was recorded during the inter-season that was associated to nutrient regeneration processes. Ultimately, dinoflagellates dominated microphytoplankton with a clear and lasting dominance of *Prorocentrum minimum*. Phyto-PAM analyses revealed that the effective photosynthetic efficiency of *P. minimum*-dominated assemblages decreased continuously during the second hydrological sequence. Different hypotheses have been examined. We conclude that *P. minimum* bloom persistence is sustained by mixotrophic strategies, with complex compromises between phototrophy and heterotrophy justifying fluorescence observations. *Prorocentrum minimum* blooms might constitute in the near future a new but challenging issue for the management of the Biguglia lagoon.

SS12

THE LIFE+ PROJECT "ALOSA ALOSA": MEASURES FOR THE CONSERVATION AND THE RESTORATION OF POPULATIONS OF THE ALLIS SHAD IN EUROPE - PART 3: PRELIMINARY RESULTS OF RESEARCH ON THE CAUSES FOR THE DECLINE OF A FORMERLY VITAL ALLIS SHAD POPULATION IN THE SOUTHWEST OF FRANCE.

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The Allis shad, a native European clupeid anadromous fish species, formerly colonized large parts of the eastern Atlantic Ocean, the North Sea and the western Mediterranean Sea and rivers draining therein, has become extinct from nearly the entire historical distributional range during the first half of the 21st century. The main reasons were over-fishing, habitat losses due to river engineering measures and water quality deterioration. Remaining populations in some rivers in the Southwest of Europe, amongst these one of the biggest and most vital, the Gironde-Garonne-Dordogne (GGD) population, remained despite intensive fisheries on a stable level for decades. Both fisheries harvest and counts on monitoring stations indicate a rapid drop of adults returning to the rivers for spawning from 2003 onwards. A moratorium which prohibits the traditional fisheries on Allis shad was announced in 2007 however, neither didn't cause a stabilization nor an improvement of the situation. Parallels between a) decreasing numbers of juvenile shads before emigrating to the Sea and b) adult returners with 3 to 5 years delay (the time required for reaching maturity depending on the sex) point to the probability, that the decline is attributed to influences acting during the freshwater phase, from spawning of adults in spring to the emigration of juveniles in late summer. Studies thus focus on the migratory patterns, spawning site and fish pass utilization as well as on habitat preferences and mortalities of the young-of-the-year. Preliminary results indicate that, at least under the current size of the spawner stock, only a very small amount of the shads uses the fish passage facilities to climb the dams in order to spawn on the historically important spawning sites in the middle and upper parts of the rivers, but spawning is widely restricted to the sections downstream the dams. Besides insufficient availability of spawning grounds an increasing deterioration spawning habitat quality is under discussion. Although we were able to quantitatively sample juveniles in their river habitats for the first time, the results are by now too scarce to allow indications to possible bottlenecks.

SS12

MAINTAINING QUALITY URBAN ENVIRONMENTS FOR RIVER CORRIDOR USERS AND STAKEHOLDERS. THE EU LIFE'S QUERCUS PROJECT RESULTS IN TRANSFORMING AN INNER CITY RIVER CORRIDOR PARK BY APPLYING THE PRINCIPLES OF DESIGNING OUT CRIME.

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The EU LIFE funded QUERCUS project aimed to maintain Quality Urban Environments for River Corridor Users and Stakeholders or, put another way, to create Rivers for People. The partnership was led by Lewisham Council (London, UK) and included the towns of ‘s-Hertogenbosch in the Netherlands and Chester in the UK. In all locations the objectives of QUERCUS were:

- **To increase use and enjoyment of the urban river corridor**
- **To see a decrease in crime and fear of crime**
- **To improve habitats for wildlife**

The recent history of urban development, diversion based flood prevention schemes and the perception of rivers as being a problem has led to urban rivers being hidden, enclosed in concrete or simply ignored. Local Authorities have been reluctant to invest in their rivers perceiving that any improvements made would soon be spoilt through neglect and vandalism, adding to their reputation as crime hotspots.

The QUERCUS project worked to change the poor perception of the river corridor by working with Council officers, developers and the public. This started by putting the river at the centre of development proposals, working with the local community and ensuring the upkeep and management of any existing and proposed river improvements.

Transferring the approach of Designing Out Crime from a ‘hard’ housing context and testing it in the ‘soft’ natural environment was central to delivering a successful project. Through implementing a landscape design that promoted increased visibility and clear lines of sight, encouraging greater use and ownership and clarifying the function of each part of the open space, opportunities for anti-social behaviour and criminal activity have been reduced. This has resulted both in users feeling safer and an improvement in environmental quality.

In Lewisham’s Ladywell Fields where a new river channel was brought into the park, the before and after surveys showed use of the park increased by over 250% and people’s perception of feeling safe went up from 42% to 78%. Local schools were encouraged to use the park as an ‘outdoor classroom’ with children then bringing parents to see ‘their park’ at the weekend.

The re-naturalised and accessible river corridor forms a central part of Lewisham’s environmental legacy with improved recreational facilities alongside areas of nature conservation. The initial works, costing around €1m have levered in a further €3m to enhance the rest of the park which has since won a number of regional and national awards.

SS08

A CONCEPTUAL FRAMEWORK FOR UNDERSTANDING MULTI-SCALED CAUSE-EFFECT RELATIONSHIPS BETWEEN TERRESTRIAL AND AQUATIC ECOSYSTEMS

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To make broad-scale inferences about terrestrial-aquatic linkages, ecological studies should span and integrate across multiple spatial scales. Because ecological conditions have not been continuously and consistently monitored across broad scales, broad-scale knowledge is often developed by extrapolating from fine-scale studies. This extrapolation is often misleading because (a) processes at one spatial or temporal scale interact with processes at another scale (i.e., cross-scale interactions; CSIs), leading to non-intuitive relationships, and (b) we do not adequately understand broad-scale (i.e., regional) controls of ecosystem processes. Our objective is to present a framework and approach for studying multi-scaled relationships, including different types of CSIs, that addresses challenges in quantifying multi-scale cause-effect relationships between terrestrial and aquatic ecosystems. We compiled nutrient and organic carbon data from 2,000 lakes in the Midwest and Northeast U.S. We quantified aquatic and terrestrial drivers at two important spatial extents: the local and the regional. We modeled the effects of regional and local predictor variables on lake nutrients and organic carbon to assess the importance of CSIs in modeling these relationships across a broad spatial extent. We found that CSIs were important for understanding broad-scale variation in lake nutrients and organic carbon. The effect of local wetland extent on lake total phosphorus concentrations (TP) differed across regions and was explained by a CSI in which local wetland effects on TP was related to the regional agriculture cover. For lakes in high agriculture regions, the presence of local wetlands was negatively related to TP, whereas the relationship was reversed in low agriculture regions. In contrast, although the effects of local wetlands on total nitrogen concentrations differed across regions, we did not detect any CSIs. The effect of local wetlands on organic carbon (OC) differed across regions and a CSI existed in which the effect of local wetlands on OC was related to regional groundwater flow. For lakes in regions of high groundwater flow, we found no effect of local wetlands on OC, whereas in regions of low groundwater flow, there were positive effects of local wetlands on OC. Our results show that scientists must consider multiple spatial extents and CSIs that are specific to response variables in order to better understand variation in terrestrial-aquatic linkages.

R03

SPATIAL SYNCHRONY IN STREAM FISH POPULATIONS: INFLUENCE OF SPECIES ECOLOGICAL AND LIFE-HISTORY TRAITS.

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Spatial synchrony in population dynamics (*i.e.* the way spatially distant populations rise and fall together) has been found in almost all major taxa from parasites to insects, fish, amphibians, birds and mammals. It is generally considered that dispersal among populations and synchronous stochastic effects of density independent factors are the two principal mechanisms involved in spatial synchrony. Actually, very few studies have related the degree of spatial synchrony to the ecological characteristics and/or life-history traits of species. Yet, understanding which characteristics are involved in population synchrony is of great interest as it can improve our knowledge of population dynamics. The goal of this study was to determine species attributes that may explain the variation in the degree of spatial synchrony between 27stream fish species in France. To do so, we used generalized least square models, accounting for phylogenetic relatedness between species. More precisely, we tested single relationships as well as the influence of multi-predictors by considering all possible models that possessed three covariates or fewer. We then used AICc to determine which model was the best to explain the degree of spatial synchrony.
From single predictor models, we found that four traits (rheophily, fecundity, life-span and parental care) among the 19 considered were significantly related to the degree of spatial synchrony of species. Our best multi-predictor model explained 47% of interspecific variation in spatial synchrony. Moreover, we found that species associated with low fecundity, large egg size, high parental care investment and long incubation period (*i.e.,* K strategy) were significantly more synchronous than r-strategist species.
These results show that taking into account the biological and ecological characteristics of species can provide promising insights into our understanding of spatial population dynamics. As spatial synchrony is known to influence the risk of population extinction, our findings could also have important implications for management of spatially-structured populations.

R10

DEGREE-DAYS IN FISH SCIENCE: AN ARGUMENT FOR THE STANDARDIZATION OF BASE TEMPERATURES.

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Fish growth is largely determined by the ambient temperature of the environment, which can be quantified using degree-days (°C·day) summed over some period of interest. Although the degree-day approach has been used for decades in agronomy and entomology, it has received limited attention in fish science until recently. Degree-day calculations incorporate a base temperature (T_o) below which fish do not grow (or grow very slowly). However, our review of the freshwater literature shows that as many as 7 T_o values are being used to calculate degree-days for any one species, and that justification for these values is rarely provided. This variation in T_o limits our ability to compare degree-day values and growth rates across waterbodies and studies. In this study, we use a large database of freshwater fish records and air temperatures to determine i) how variation in T_o affects the ability of degree-days to explain variation in immature growth rate both within and among waterbodies, and ii) the scope for using standardized T_o values in future studies of fish growth. We focused on immature individuals so that growth patterns were not confounded by the allocation of surplus energy to reproduction.
Our database consisted of 50,239 fish records representing 8 species from 66 waterbodies in Ontario, Canada and 21 waterbodies in Minnesota, USA. Within a waterbody and regardless of species, we found a broad range of T_o values (spanning 20ºC in some cases) that were equally effective at explaining variation in growth. This result stems from the high level of correlation between degree-days at different bases, and depends largely on the range of temperature values experienced at a given latitude. However, our results also suggest that fish growth among waterbodies is best described by a single, species-specific T_o value. Taken together, these findings argue for a set of standardized T_o values for describing fish growth (e.g., 0, 5, 10, and 15ºC). Standardization would i) eliminate the need to identify T_o values for each waterbody and study; ii) facilitate coherent and compatible data sets, comparative studies (e.g., multi-species studies, meta-analyses) and studies at broad spatial scales; and iii) promote the use of degree-days in future research.

R09

THRESHOLDS FOR RECOVERY FROM CYANOBACTERIAL BLOOMS

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Two lakes in Berlin underwent pronounced reduction of their total phosphorus (TP) loads, resulting in an exponential decline of annual mean inlake concentrations from 600-800 µg/L to 30 µg/L (Lake Tegel) and <20 µg/L (Schlachtensee). Numerical modeling of their P budgets disproved the assumption that redox-sensitive P release from the sediments was a threshold mechanism key to success; instead decreased external loading determined when sediments acted as a sink or source of P. However, the phytoplankton biomass response showed very clear and abrupt TP-thesholds in both lakes: resource efficiency for TP increased as TP decreased, reaching a maximum at TP ~50 µg/L and then dropping steeply as cyanobacteria no longer dominated once summer TP concentrations remained below 25 µg/L. Statistical evaluation of phytoplankton data from >3000 samples from 210 European water-bodies confirmed this pattern: relative to all of the samples in the data base samples with elevated biomass of *Microcystis spp., Limnothrix spp*. and *Anabaenea spp.* were 4 times more likely to occur above a TP threshold of 50 µg/L.; *Aphanizomenon* spp. and *Planktothrix agardhii* were 5 times more likely to attain high biomasses at TP > 90 µg/L.

R08

EFFECT OF CLIMATE ON ANNUAL NET PRODUCTION OF THE AQUATIC MOSS SPECIES DREPANOCLADUS TRIFARIUS GROWING IN A HIGH-ARCTIC LAKE IN GREENLAND

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Aquatic mosses are often the only kind of macrophytes in High Arctic lakes. Despite the low nutrient availability and short ice free periods the mosses often create massive stands on the lake bed even in deeper lakes. The mosses most likely constitute an important component in the overall ecology of the lakes as primary producers and food resource for secondary producers, and thereby as important organisms in carbon and nutrient cycling. Aquatic mosses in High Arctic lakes must content with extreme seasonal variation in day length and temperatures that will affect their growth rate during the year. Previous studies have identified annual growth bands in aquatic mosses from a temperate lake reflecting that leaves were larger and were produced more frequently in summer than during the rest of the year. Growth bands could then be used to reconstruct growth back in time. Growth bands are also present in Drepanocladus trifarius (Pseudocalliergon trifarium (F. Weber & D. Mohr) Loeske) in Lake Sommerfuglesø in North East Greenland.
The overall objective of the project was to describe the ecological function of aquatic mosses in High Arctic lakes with low nutrient availability. More specifically we would first verify the growth reconstruction method in the High Arctic lake by comparing in situ measurements of annual net production with growth bands in D. trifarius. Second, we used this method to reconstruct annual net production six years back in time and relate net production to climatic factors.
Net production in direct measurements was higher than the present year's net production and the recent complete growth band. Growth bands were therefore not representing any time period longer than one year, but did represent a period longer than the present growth season's production. The reconstruction method was thus verified. Annual net production was 2-3 mgDW for D. trifarius in Lake Sommerfuglesø, and there was a strong relationship between annual net production and the prolongation of snow cover on the lake and thus light availability. Predicted future increase in snow precipitation in the area will therefore also affect the production of the moss and consequently affect the carbon and nutrient cycling in High Arctic lakes.

SS01

DIAGNOSTIC TECHNIQUES FOR RAPID MOLECULAR IDENTIFICATION OF AQUATIC ANIMALS

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Hydrobiologists often face problems with identification of samples collected in the field (e.g. incomplete specimens lacking important diagnostic structures, indeterminable larval specimens, lack of experience). But, employing molecular techniques and using molecular characters, these difficulties can be overcome. For determination of biological samples, sequences of gene fragments (usually mtDNA gene for cytochrome oxidase subunit I – Bar Codes) are likely the most accurate. However, sequencing requires external service or expensive sequencing machine with experienced users, the conditions, which are usually not met in common praxis focused on monitoring or in smaller teams not primarily equipped for doing molecular analyses.
We have tested several molecular approaches for their power to determine biological samples reliably, and compared them regarding costs, experience required and equipment demands. The molecular techniques were tested using model groups of aquatic invertebrates (riffle beetles, caddisflies, moluscs, planktonic crustacea) and fish (Gobiidae, Salmonidae). The specimens were freshly collected in the field (representing fauna of Slovakia), determined by experienced experts using morphological characters and barcoded using Bar Code fragment of the mtDNA gene for cytochrome oxidase subunit I (COI). Afterwards, the same samples were used for RFLP, SSCP, TTGE and asPCR techniques. For RFLP, suitable restriction enzymes were selected based on COI sequence, for TTGE and asPCR shorter fragments of COI were amplified using newly designed internal primers. The data on reliability, procedures and costs were recorded and compared. Until now, from the techniques tested, RFLP was selected as the most appropriate candidate approach. Beside that, the web based application is developed including all necessary information for molecular determination using tested approaches, and also determination modules for each type of molecular data and each tested taxonomic group. The web application will be updated continuously by newly obtained data on different taxa.
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Key words: determination, DNA, macroinvertebrates, Gobiidae, Salmonidae, RFLP

R02

A SMALL-SCALE POPULATION GENETICS OF AQUATIC INVERTEBRATES IN ALPINE LAKES (TATRA MTS, SLOVAKIA): "THE *AGABUS* CASE"

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Alpine and subalpine lakes and small ponds of glacial origin represent one of the most remote and undisturbed aquatic environments. Many of the aspects, like recovery from anthropogenic pollution, lake classification, or potential impact of climate change on these ecosystems are of great scientific interest at present. Although fauna of these remote water bodies often serves to describe these aspects, the population genetics and phylogeography of the local inhabitants (especially macroinvertebrates/aquatic insects) is still omitted. The knowledge of intraspecific genetic variability based on proper and sensitive molecular methods - not only in large scale (between mountain ranges), but mainly within smaller mountain areas - is crucial for understanding of distributional trends or detection of possible refugia of certain species. Subsequently, such data contribute to targeted conservation of threatened and vulnerable species and their biotopes.

The Tatra Mountains represent western part of the Carpathian arch. Despite relatively small area, about 110 permanent lakes and many other small ponds remained there after the last Ice age (ca 10.000 years ago). In 2009, the study of genetic variability of model alpine macroinvertebrates began, primarily with aquatic beetle *Agabus bipustulatus solieri* (Coleoptera: Dytiscidae), representing aquatic insects with the whole life cycle aquatic and restricted possibility of long-range motion. The DNA of 366 specimens from 61 standing water bodies of 16 different mountain valleys was isolated. Partial cytochrome b – 343bp mitochondrial DNA fragment was used for haplotype analysis. Within the *A. bipustulatus solieri* samples, 22 haplotypes were identified. The dominant haplotype occurred in 230 specimens (63 %). Only 7 haplotypes were present in more than one of the sampled valleys. High proportion of the lakes is characterized by the single haplotype and majority of the haplotypes is restricted to only one of the sampled valleys. AMOVA results showed that molecular variance was higher within valleys than among valleys. Consistent more detailed analysis of microsatellites subsequently combined with results of genetic variability of another model aquatic invertebrates will put together the puzzle of population-genetics trends in aquatic invertebrates of alpine regions.

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SS03

WHEN BIODIVERSITY IS A PRESSURE: COMBINING BIOFRESH AND THE EUROPEAN ALIEN SPECIES INFORMATION NETWORK (EASIN) TO EVALUATE FRESHWATER BIODIVERSITY IN EUROPE

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Introductions of invasive alien species (IAS) are considered one of the main pressures to freshwater ecosystems. IAS *per se* and their potential interaction with other stressors can cause ecological impacts on native communities and their ecosystem functions, resulting in a significant threat to biodiversity. In Europe, more than 40% of threatened freshwater fishes have been identified to be affected by IAS. To strengthen the efforts of reducing biodiversity loss, policy responses considering IAS are increasingly being adopted. One of the Aichi Biodiversity goals aiming to reduce the direct pressures on biodiversity by 2020 focuses on the identification, control and eradication of alien species and the prevention of new introductions. The European Commission stresses the need to combat IAS through the EU Biodiversity Strategy (EC 2011), the development of an EU strategy on IAS (EC 2008) and in the context of the Water Framework Directive.

To meet these objectives, the development of networks and the creation of databases that provide accurate and updated data is urgently needed. The European Alien Species Information Network (EASIN) is a good example of data compilation and harmonization from a variety of existing information sources that offers public access on European alien species taxonomic classification, spatial distribution, pathways of introduction and level of impact. The EASIN web tools and services follow internationally recognized standards, and can be utilized freely and independently by any user, while ownership of the data is properly cited and linked. Our first aim here is to share solutions, based on the EASIN approach, for the compilation and public accessibility of primary data.

Another relevant example is the Biofresh data portal, which aims to provide open access global information on the distribution, status and trends of global freshwater biodiversity. By combining the tools provided by EASIN on freshwater alien species with BioFresh-related biodiversity data, our second aim is to link the capabilities of both platforms and exemplify their joint use by reporting current trends of IAS as a driver of freshwater biodiversity loss at the EU level. We foresee our approach will encourage further coordination of different information systems towards protecting freshwater biodiversity, and will provide valuable information for the challenging management of freshwater ecosystems in the era of IAS.

SS12

THE LIFE+ PROJECT "ALOSA ALOSA" PART 2: BREEDING TECHNIQUES FOR ALLIS SHAD, IMPROVEMENT OF KNOWHOW DEALING WITH NATURAL CONSTRAINTS, DEVELOPING OF BLACK-BOX TO MONITOR PRACTICES AS SUPPORT OF CONSERVATION AND RESTORATION MEASURES.

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The Allis shad is an andromous specie with a high level of requirements in order to fulfill its entire biological cycle successfully. As the specie uses the ecological strategy of the number, it is really sensitive to anthropological and environmental pressures. Then when the population collapse like in the Rhine basin, it is necessary to use restocking operations to restart the biological cycle of the specie. Unlike salmon, Allis shad wasn't attractive for private fishfarmer, the heavy costs weren't attractive regarding to the competition with fishermen and needs. Nevertheless, knowhow to breed shads was developed to fulfill very specific purposes, like scientific studies or restocking programs of American shads. During the first life project "Allis shad", a synthesis and a transfer of knowhow from other program (and other species) has been made. Then, it was possible to start fishfarming activity safely and by that fulfilling a prerequisite for the restoration of this specie. The protocol of production of Allis shads is developed around wild spawners trapped in the wild during the anadromous run. The price to pay to start restocking is to decrease natural reproduction in the "mother basin". However, by constantly improving the breeding process and the well-being of spawners, the number of fish obtained by one adult caught in the wild has been increased from 9,000 in 2008 to around 50,000 in the last three years. At the beginning, the method to produce eggs was based on implants and injections of hormones during a short time. But, it appeared that even after a hormonal stimulation, an adult can recover the ability to spawn on a natural basis. This improvement provided a bigger amount of eggs with the same number of spawners. By the way, increase of fishfarm yield can become an issue regarding to topics like genetic diversity and the health of stocked fish or the possibility to check the efficiency of what is done. That's why, tools are curently developed or improved to monitor and assess the production step by step as well as results in the wild. By now larvae are mass-marked by means of an Oxytetracycline. Soon, a protocol of parental assignment could provide more information concerning the fate of stocked fishes in the wild and the diversity of the broodstock.

SS04

FOOD WEB STRUCTURE IN A HARSH GLACIER-FED RIVER

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Glacier retreat is occurring across the world, and associated river ecosystems are expected to respond more rapidly than those in flowing waters in other regions. The environment directly downstream of the glacier snout is characterised by extreme low water temperature and channel instability but these habitats may become rarer with widespread glacier retreat. In these extreme environments food web dynamics have been little studied, yet they could offer opportunities to test food web theories using highly resolved food webs owing to their low taxonomic richness. This study examined the interactions of macroinvertebrate and diatom taxa in the Ödenwinkelkees river, Austrian central Alps between 2006 and 2011. The webs were characterised by low taxon richness (13-22), highly connected individuals (directed connectance up to 0.19) and short mean food chain length (2.00-2.36). The dominant macroinvertebrates were members of the genus *Diamesa* (Diptera) and had an omnivorous diet rich in detritus and diatoms as well as other Chironomidae. Simuliidae (typically detritivorous filterers) had a diet rich in diatoms and evidence of predation on Chironomidae larvae. Food webs showed strong species-averaged and individual size structuring but mass-abundance scaling coefficients were larger than those predicted by metabolic theory, perhaps due to a combination of spatial averaging effects of patchily distributed consumers and resources, and/or consumers deriving unquantified resources from microorganisms attached to the large amounts of ingested rock fragments. Comparison of food web structural metrics with those from 62 published river webs suggest these glacier-fed river food web properties were extreme but in line with general food web scaling predictions, a finding which could prove useful to forecast the effects of anticipated future glacier retreat on the structure of aquatic food webs.

R08

EXTINCTION RISK IN FRESHWATER ECOSYSTEMS: HOW PERVASIVE IS CLIMATE CHANGE?

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The world is entering a major extinction crisis, the so called “Sixth Extinction”, and this is particularly true for freshwater ecosystems that are among the most threatened on Earth. Synergies and tradeoffs between various impacts could strongly affect species' persistence at different spatial and temporal scales, altering single-species distributions and communities' biodiversity.
In recent years, increasing attention has been directed to the identification of immediate and delayed extinction events driven by environmental change. While progress has been made using theoretical models, application to empirical data has been rare.
In this study, present and future freshwater fish distributions were used to disentangle stochastic from deterministic processes, in order to quantify the role of climate change as a driver of species extinctions. For freshwater fish species, climate change may inflate population extinction rates in two ways: i) extirpation from a river basin because no climatically suitable habitat remains (deterministic extinction), or ii) increase in stochastic extinction probability due to shrink in climatically suitable area within a river basin. Species distribution models (SDMs) were used to infer present and 2080s suitable habitat for fish species in French river basins. Then, an empirically derived extinction-area relationship was used to predict stochastic population extinction rates. Background extinction rates were computed on the basis of species' current distribution assuming no environmental change, and climate-driven deterministic and stochastic extinction rates were computed following future climatic changes, and their anticipated consequences on species' ranges by 2080s. By comparing climate-induced with background extinction rates, a global-warming magnifying factor was estimated, reaching a value of 35-fold the stochastic extinction rates for the most impacted species (bullhead, *Cottus gobio*) at the national French scale, and up to 1400-fold at the basin scale. Moreover, many other species will persist within the basin although severely reduced. Assuming no further climate change, these residual populations will then undergo stochastic processes, resulting in delayed extinction risk due to their reduced distribution. An overlooked climate-induced extinction debt to be paid later, for which conservation measures are still possible.

R09

BIOMARKERS AND BIO-INDICATORS: COMBINING THE BEST OF TWO WORLDS IN RIVER QUALITY ASSESSMENT

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The development and use of biomarkers in environmental research has increased considerably over the last two decades due to their ability to detect both acute and chronic toxicological impacts. However, ecological assessment is mainly based on the use of bio-indicators; for example, the Water Framework Directive uses selected biological quality elements (BQE) to quantify disturbance of surface water bodies. We examined the possibility of combining these distinct levels of organization to obtain “the best” of these two approaches in environmental quality assessment, namely sensitive ecological information and evidence of cause-effect relations. We tested this hypothesis at sites in several northern Portuguese rivers covering a quality gradient ranging from reference conditions to high disturbed. The fish gill is the first target where pollutants tend to act first, provoking detectable histopathological and biochemical change. Gill histopathological samples obtained from three native fish species were qualitatively and quantitatively analyzed and the lipid peroxidation and glutathione-S- transferase activity were determined. Multivariate methods based principally on non-parametric multiple regressions, combined with the individual patterns of those biological variables along the disturbance gradients (assessed at different spatial scales, expressing water quality, soil use or habitat disturbance) highlighted metrics that can be used for integrated assessment purposes. Filament epithelium proliferation, necrosis and GST activity were the principal biomarkers discriminating between different classes of ecological status while the most useful variables for BQE in quantifying disturbance were related with specific invertebrate traits and metrics and fish guilds instead of assemblage composition.

R01

EFFECTS OF PHOSPHORUS CONTENT IN DETRITUS ON LIFE-HISTORY TRAITS, BEHAVIOR AND PHYSIOLOGY OF A HEADWATER STREAM DETRITIVORE

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Ecological stoichiometry, that is, the study of mass balance of multiple key chemical elements during ecological interactions, is a powerful ecological theory that has recently been generalized to many ecosystem types. Since in primary producer-based ecosystems, most primary production is never consumed by herbivores and will ultimately reach the detritus pool, detritus-based ecosystems are dominant on Earth. In such ecosystems, detritivores represent one of the most important trophic level. Yet, despite detritivores' importance through their role in nutrient cycling, effects of stoichiometric constraints on their life history traits are still poorly documented.

Forested headwater streams constitute representative detritus-based ecosystems relying on leaf litter inputs as the main energy and nutrient source for their functioning. Leaf litter is quickly colonized by aquatic hyphomycetes, which are known to improve the quality of detritus, enabling nutrient and energy transfer to higher trophic levels.

In this study, we manipulated leaf litter nutrient content of two common riparian tree species differing in their initial biochemical composition, i.e. alder (*Alnus glutinosa*) and maple (*Acer pseudoplatanus*). To this end short-term phosphorus (P) addition was applied on leaf litter precolonized by aquatic hyphomycetes (4 treatments). Thus, leaf litter of distinct stoichiometric quality was used to feed a detritivorous invertebrate commonly found in headwater streams, *Gammarus fossarum* (Crustacea Amphipoda). We tested the impact of leaf litter phosphorus content on some key life-history traits, such as P homeostasis and growth, as well as on physiological status, behavior (locomotor activity and ventilation) and survival of *G. fossarum* individuals.

Phosphorus content of resources was positively related to detritivores' growth rate, survival, locomotion, and energetic status. On the contrary, it did not alter *G. fossarum* elemental composition, suggesting that these detritivores are able to maintain their elemental homoeostasis.

This study sheds new light on the importance of phosphorus content of detritus for detritivores and paves the way for further studies aimed at transferring ecological stoichiometry concepts to detritus-based ecosystems.

R13

MEDITERRANEAN RIVERS WITH LOW HYDROMORPHOLOGICAL IMPACTS CONSTITUTE A REFUGE FOR NATIVE FISH AND AMPHIBIANS, IN FRONT EXPANSION OF EXOTIC AQUATIC SPECIES: THE CASE OF SEVERAL BASINS IN NORTHEAST CATALONIA.

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Several fish surveys in some Mediterranean rivers in northeast Catalonia have been done from 2006 to 2011. These rivers include a wide range of hydromorphological situations, from pristine status to highly degraded situations with hard modifications of flow regime, river bed, riparian forest and even the presence of artificial barriers. Over 300 stations have been sampled, all along 7 hydrologic basins. Fish surveys were based on passive capture techniques. In each sampling station between 3 and 8 small fyke-nets were left on the river along a day, at least, to estimate relative density (CPUE). This capture technique has been useful to detect other species of aquatic fauna, mainly herpetofauna. All the amphibians potentially present have been captured.
In the surveyed rivers 7 native freshwater fish are present, and till 11 species of amphibians can appear on these river habitats. On the other hand, a large number of exotic fish and other aquatic fauna have been established in the area, and have appeared on surveys.
Non altered Mediterranean rivers, with a low or none hydromorphological impacts, are the principal refuge for all these native species, where on the other hand the presence of exotic species is generally very low. These rivers have orders between 3 and 4, mainly. On the lowland plains, in natural conditions, this kind of rivers are typically intermittent during summer, when most of the river bed is dry and the only refuge for fish are isolated pools. In contrast, most of the principal fluvial axis of the area (orders above 4), with high degree of hydromorphological transformations, are intensively invaded with exotic species, native species are absent or scarce, both fish and amphibians.
In this context, only some well preserved Mediterranean rivers arise as refuges for native species in front the progressive establishment and expansion of exotics in impacted fluvial rivers. Unfortunately, these refuges constitute isolated river sections in the context of basins widely modified.

R01

PHOTOTAXIS AND POLAROTAXIS HAND IN HAND: NIGHT DISPERSAL FLIGHT BEHAVIOUR OF AQUATIC INSECTS DISTRACTED BY TWO SYNERGISTIC OPTICAL CUES

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Substantial and harmful effects of different kinds of light pollution have been widely revealed. In the environment the numbers of man-made light sources and polarizing surfaces have extremely increased in the last century. It has long been known that night dispersal flight behaviour of aquatic insects can be distracted by artificial lights. In the last decade the phenomenon of polarized light pollution was discovered. The combined effect of photopollution and polarized light pollution has never been studied yet. We hypothesized and revealed with choice experiments that positive phototaxis and polarotaxis can synergistically govern the night flight behaviour of aquatic insects. In our experimental design four combinations of two optical cues reflected from horizontal test surfaces were offered at the same time: illuminated matte canvas (phototaxis alone), non-lit shiny black plastic sheet (polarotaxis alone), illuminated black plastic sheet (photo- and polarotaxis simultaneously) and non-lit matte canvas (control). Aquatic beetles and bugs were mass-trapped during three hours per night over five days in 2011 at the shore of a temperate saline marsh. All together, more than 46 000 specimens belonging to 79 taxa of aquatic beetles and bugs were captured. Two-way-ANOVA, Two-way-ADONIS and multidimensional scaling were used to explore effects of the optical cues and their interaction on species and assemblage level. In general, the most attractive setting was the illuminated shiny black plastic sheet, which displayed the synergistic effects of photo- and polarotaxis. The effects of the interaction can be detected in hourly numbers of individuals and numbers of species, as well as in assemblage level. The interaction significantly affects almost all of the studied night-active species. The illumination of a strongly and horizontally polarizing artificial surface considerably strengthens the detrimental effects of photopollution and polarized light pollution.

SS08

CONTINUOUS MEASUREMENT OF CARBON AND NUTRIENT DYNAMICS IN STREAMS IN FORESTED CATCHMENTS UNDERGOING GLOBAL CHANGE

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Global change is impacting the forests of the western United States through much more than simply warming temperatures. Earlier snowmelt, more rain and less snow, greater vapor pressure deficits in spring and fall, forest dieback, and catastrophic forest fires are fundamentally changing the character of forested catchments throughout the western United States. Our interdisciplinary research team has deployed continuous measuring in situ sensors for temperature, conductivity, pH, turbidity, dissolved oxygen, nitrate, and phosphate throughout the year to study ecosystem production and respiration and nutrient dynamics in a high elevation mountain stream in New Mexico experiencing global change (East Fork Jemez River). Multi-year deployment has allowed us to measure ecosystem production, ecosystem respiration, and nutrient availability and uptake under 1) variable spring snowmelt conditions, 2) strong and weak summer monsoon precipitation, and 3) before and after a major catastrophic fire in the catchment. Strong snowmelt and monsoon conditions reduce primary production and ecosystem respiration rates. Weak snowmelt conditions and weak or delayed summer monsoons produce higher rates of primary production and ecosystem respiration by well-developed biofilms, filamentous green macroalgae and aquatic macrophytes within the stream. Strong diurnal fluctuations in nitrate and phosphate accompany high rates of primary production and ecosystem respiration. Catastrophic fire in the catchment in late June and early July of 2011 has dramatically altered both nutrient concentrations and ecosystem processes after precipitation events. Phosphate and nitrate increases, turbidity peaks, dissolved oxygen and pH sags, conductivity increases, and increased detrital organic matter inputs have all been byproducts of the major fire that burned most of the forested headwaters of this mountain valley stream. Dramatic changing catchment characteristics are very likely to be the strongest impacts of global change on the streams and rivers of the western United States.

SS03

IDENTIFICATION OF KEY BIODIVERSITY AREAS IN FRESHWATER ECOSYSTEMS: A CASE STUDY ON THE APPLICATION OF BIODIVERSITY DATA IN THE BALKANS.

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Freshwater ecosystems and associated biodiversity are under serious threat with a significant proportion of the world wetlands destroyed and approximately 25% of the 23,000+ freshwater dependant species assessed for the IUCN Red List of Threatened Species™ extinct or at risk of extinction. The major threat to freshwater species is habitat loss or degradation. Site based conservation action, such as through protected areas, is therefore considered a key tool for combating species loss in freshwater ecosystems. However, protected areas are rarely set up to specifically target freshwater species such that spatial overlap between protected areas and freshwater species is poor with conservation benefits to freshwater species often incidental. An important step towards more effective conservation of freshwater biodiversity is expansion of the existing protected areas network to provide more effective coverage of freshwater species, combined with a shift in management of existing protected areas towards including targeted protection of freshwater species. Such an approach requires the mobilisation of large data sets on the distribution and status of freshwater species to inform the process.
IUCN and partners have been conducting large scale assessments of the status and distribution of freshwater species since 2002 and are now, through the current EU-funded project
BioFresh (www.freshwaterbiodiversity.eu), using these data to identify important sites of freshwater biodiversity as the foundation for expansion of existing protected areas to better represent freshwater biodiversity. The taxonomic focus is on freshwater fishes, molluscs, dragonflies and damselflies, aquatic plants and crayfish, and the initial geographic focus is Europe.
Here, we present results from the first stage of a Europe wide analysis of these large species datasets, focused on the Balkans. We identify river and/or lake sub-catchments that meet the criteria for being important sites of freshwater biodiversity, currently known as Freshwater Key Biodiversity Areas (KBAs), and evaluate how well they are represented within the existing network of protected areas, with particular attention to the Natura2000 network and the developing Emerald Network within non-EU member states.

SS06

TEMPORARY RIVERS: A CHALLENGE FOR FRESHWATER SCIENCE

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For several centuries, river research has focused on perennial rivers. Temporary rivers are a very recent addition to the field, although they comprise more than half the length of the global river network. Rivers that naturally, periodically cease to flow are found on every continent and are increasing in response to climate change and water abstraction. Many once-perennial rivers, including very large rivers such as the Nile, Indus, Yellow, Amu and Syr Darya, Rio Grande and Colorado are now running dry.
Empirical knowledge and theory in river science has emerged from studies of perennial rivers. Concepts that have guided studies of biological communities and biogeochemical fluxes, and material exchange between rivers and the atmosphere, land, ocean and groundwater presume perennial flow and continuous hydrological connectivity. In temporary rivers, however, the complete loss of hydrological continuity affects virtually all ecological processes, including the evolution, dispersal and habitat selection of aquatic and terrestrial species. Therefore, our views of the roles that rivers play in maintaining biodiversity and controlling material fluxes will change significantly when temporary rivers are fully integrated into regional and global analyses.
Temporary rivers are complex ecosystems characterised by alternating drying, dry, and flowing phases; this three-phase cycle generates dynamic mosaics of aquatic flowing (lotic), stagnant (lentic) and terrestrial habitats across river landscapes. The biotic communities in the lentic and terrestrial habitats have been overlooked until recently, and their recognition will alter our views of biodiversity in temporary rivers. Similarly, incorporating these habitats into particulate organic matter and nutrient transformation pathways will change our views of the roles of rivers in global and regional carbon and nutrient cycles.
The concepts, questions, approaches and methodologies from lotic, lentic, and terrestrial ecology need to be integrated and applied to temporary rivers to increase our knowledge and manage these rivers more effectively. Coupled terrestrial and aquatic approaches to study temporary rivers will not only help advance the science of temporary rivers, they will also help us to identify general ecological processes and issues, develop new theories and models, and design management plans and policies Temporary rivers are model ecosystems to bridge the gap between terrestrial and aquatic ecology.

R14

THE EFFECTS OF EMERGING POLLUTANTS IN THE REPRODUCTION OF THE SNAIL *PHYSELLA ACUTA:* AN *IN SITU* BIOASSAY IN IBERIAN BASINS.

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In situ bioassays are desirable tools to study the effects of fluvial pressures in aquatic communities. In order to test the relationships between river pollution and invertebrate community function an *in situ* bioassay was carried out in three Mediterranean basins: Ebro, Llobregat and Júcar. Adult individuals of the freshwater snail *Physella acuta* were transplanted in specially designed cylindrical cages. End-points included mortality, number of clutches, eggs per clutch, total number of eggs and embryo development after 8 days. Results were contrasted with lab temperature controls (16ºC and 23ºC) and normalised by degree-days (DD). The organisms tested reflected high resistance and adaptability to the different environmental conditions found in the studied basins, making them appropriate to test sub-lethal responses. Significant changes in *P. acuta* reproduction parameters were detected in all rivers. The number of clutches (clutches number·snail^{-1}·DD^{-1}) decreased in the Ebro and Llobregat respect to control, and towards downstream. On the other hand, the number of eggs per clutch (egg number ·clutch^{-1} ·DD^{-1}) increased significantly in the Llobregat and in the Júcar respect to control, and increasing towards downstream. The total number of eggs was lower respect to control in the most polluted site of the Llobregat, and in two sites of the Ebro.
Changes in embryo development were detected in some sites downstream the Júcar and the Ebro. The complete development of snails was delayed and the number of juveniles was lower respect to control in these sites.
The results were contrasted with specific data of different emerging compounds found in water that can be potential Endocrine Disrupting Compounds (EDCs) and directly affect the reproduction of snails because of its high estrogenic capacity (Jobling *et al*., 2004; Oehlmann *et al*., 2006; Schmitt *et al*, 2010). Partial redundancy analyses (RDA) were used to check correlations between reproduction parameters and EDCs (concentrations and Estrogenic Equivalent Quotients).
This study provides evidence of the usefulness of *in situ* bioassays as a tool to test possible relationships between specific pollutants and physiological responses in order to assess the environmental toxicological risk (Schmitt *et al*, 2010).

SS12

LIFE ENVIRONMENT - OVER 20 YEARS CONTRIBUTING TO PROTECT FRESHWATER ECOSYSTEMS

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LIFE Environment - over 20 years contributing to protect freshwater ecosystems
The LIFE Programme has been the European Union's funding instrument for the environment since its approval in 1992. It is composed of three strands (LIFE Nature and Biodiversity, LIFE Environment Policy and Governance and LIFE Information and Communication).

Since its establishment 21 years ago, the LIFE Environment Policy & Governance component (formerly "LIFE Environment"), has co-financed a total of 1 940 projects, providing some € 1.2 billion, and mobilising a further €3.6 billion in other public and private contributions. This continuous source of targeted financing has radically changed the capacity of many countries to care for and manage freshwater ecosystem.

Regarding water, LIFE has supported over 400 projects that foster the implementation of EU water policy by addressing a wide range of issues, including urban water management, industrial wastewater treatment, river basin monitoring and improving groundwater quality. Some 200 of these projects have focused on the implementation of the Water Framework Directive and on the adoption of River Basin Management Plans aiming to improve the ecological status of all EU waters. Projects have also tackled problems of water shortages and droughts by encouraging water-efficient and water-saving strategies. LIFE funding for these water related projects, has provided some €217 million and mobilised a further €427 million.

This communication will present some LIFE Environment project examples and best practices targeting freshwater ecosystems. Special attention will be given to the work undertaken by LIFE in order to involve and raise awareness among different stakeholders –specially from the agriculture and industry fields- in the better management of the freshwater resources.

R08

AIR TEMPERATURE, NOT WATER TEMPERATURE, CONSTRAINS THE DISTRIBUTION OF *SIALIS LUTARIA* (L.) IN MOUNTAIN LAKES

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Air and water differ in their respective heat capacity. Thus, under the current climate warming, freshwater and terrestrial organisms will not experience the same increase in temperature. For freshwater insect communities, with species performing part of their life cycle in each media, a puzzling situation may be underway. If the dependence on air or water temperature differs among them, the warming will change not only species distribution, but community composition as well. Here, we introduce the case of *Sialis lutaria* (Linnaeus) (Insecta: Megaloptera: Sialidae), a species broadly distributed in mountain lakes. The nature of its life cycle indicates that its distribution may either be air- or water-temperature dependent. Using data from a synoptic survey of 82 lakes, we analysed how the upper altitudinal limit of its distribution is conditioned by thermal restrictions. The results show that air degree-days, not water temperature, determine the upper altitudinal limit of *S. lutaria* distribution. Calculations indicate that *S. lutaria* is not able to complete its life cycle at altitudes higher than 2516 m a.s.l. in the Pyrenees (95% c.i. 2373-2660); based on the known number of degree-days necessary completing its cycle, on the relationship between degree-days and altitude, and on the number of ice-free days that can be expected for each of the lakes (also strongly correlated with altitude). Interestingly, the predicted value closely matches the altitude of 2550 m empirically observed. Additionally, we found that the biological cycle advancement (i.e., dominance of larval individuals of instars II and III within I-III) was inversely correlated with altitude. When calculated for standardised values, the slope of this regression was much closer to that calculated for air temperature than water temperature across altitude. This particular air dependence, together with the fact that this species can be easily found and recognised in field surveys, points to *S. lutaria* as an early indicator in freshwater systems, anticipating further changes in ecological communities under climate warming.

SS03

BIODIVERSITY DATA PUBLISHING IN FRESHWATER SCIENCES

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Biodiversity data is crucial for improving our understanding of species distribution and threats. This is especially the case for freshwater environments, which are heavily affected by the global biodiversity crisis. Unfortunately, a huge body of data gathered by scientists and water managers, is currently unavailable. Analysis of the available GBIF data for almost 50.000 species revealed that less than 1% of the 1.854 datasets (representing 7 million occurrence records) are freshwater specific, so there is clearly an urgent need for scientists in this field to adopt good data archiving and publishing practices. BioFresh (a EU-funded FP7 project) aims to mobilise freshwater biodiversity data, make them available through an on-line data portal and integrate them in large-scale models and tools. We are doing so by encouraging data publication through: (a) documenting freshwater related datasets in a metadatabase, (b) promoting data papers, (c) assisting data holders to submit data and (d) demonstrating the use of these datasets for large-scale analyses and models. We currently have registered around 150 datasets in our metadatabase (public release is pending for some of them as the metadata is being completed or checked) and have integrated the first primary biodiversity in the BioFresh data portal and Global Biodiversity Information Facility (GBIF). In parallel, we have been working with editors of 19 freshwater focused journal to encourage the submission of biodiversity data and have published a number of data papers.

SS08

SEVERE LOW FLOW PERIODS REDUCE THE HETEROTROPHIC PROCESSES IN ALLUVIAL FLOODPLAIN.

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Riverine floodplains and associated wetlands are among the most productive and dynamic of all temperate ecosystems. Heterotrophic processes involved in organic matter recycling, such as leaf litter decomposition and microbial mineralization, were recognized as an important component of these ecosystem functioning. These processes were greatly influence by the hydrology, and may be consequently affected by the global changes and related variations in water level.
In this study, we explored the effect of the low flow period on both the particular organic matter (POM) recycling and fine organic matter (FOM) mineralization, using the litter-bags method and microbial hydrolasic activity measurement, at surface and in interstitial zone of alluvial wetlands of the Rhône River (France). We first observed that the low flow periods reduced invertebrate contribution to the leaf litter decomposition at surface, but not in the interstitial zone. Secondly, contribution of microorganisms to the leaf litter decomposition was not affected by the low flow periods whereas the hydrolasic activities tend to decrease at the floodplain scale. These results suggest that increasing low flow periods may affect the riverine floodplain functioning, reducing heterotrophic processes and organic matter recycling.

SS06

EFFECTS OF HYDROLOGY ON THE RELATIONSHIPS BETWEEN BIOLOGICAL TRAITS OF MACROINVERTEBRATES ASSEMBLAGES AND ENVIRONMENTAL CHARACTERISTICS IN UNDISTURBED MEDITERRANEAN STREAMS

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The hydrological variability presented in Mediterranean streams, acts as an evolutionary pressure limiting communities of plants and animals and their biological traits. The main aim of this study was to analyze the relationships between biological traits of macroinvertebrate assemblages and environmental variables in undisturbed streams with contrasting hydrology (a perennial and a temporary one) during the desiccation process in summer drought. These streams were sampled in two different hydrological phases in 2009 and 2010: 1) at baseflow conditions, at the end of spring, when the pool-riffle sequence was patent and 2) in the dry period, when pools were connected by reduced runs in the temporary stream. To this end, we used an ordination technique (RLQ analysis), which links an environmental table (R) with a traits table (Q) through an abundance table (L). A major ordination axis explaining the distribution of taxa, their distinctive biological features, and the associated environmental variables was obtained, showing differences in biological traits between the temporary and the perennial stream and between the different hydrological periods. The perennial stream was characterized by taxa showing traits typical of more stable environments (e.g. medium-big body size, semi-voltinism, long-life span) associated to environmental factors indicating higher habitat heterogeneity and organic microhabitats. On the contrary, the temporary stream was represented by taxa with biological traits that favour resistence and/or resilence (e.g. multivoltinism, short-life span, smaller size, diapause and other resistence forms) associated to lower habitat heterogeneity and mineral microhabitats of medium size particles. In summary, this study showed the effects that summer drought, and some of its associated environmental factors, exerts on the taxonomic and functional organization of macroinvertebrate communites in Mediterranean streams. This work has been financed by the European project MIRAGE (FP7-ENV-2007-1) and the project I+D (CGL2010-21458) from the Spanish Ministry of Economy and Competitiveness.

SS13

STREAMBUGS: APPLICATION AND VALIDATION OF A STREAM INVERTEBRATES COMMUNITY MODEL

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For the preservation and rehabilitation of stream ecosystems, it is important to predict the effects of different management actions on the benthic invertebrate community. For that, an understanding of the effects of human impacts and changing environmental influence factors is needed. Mechanistic models can help to enhance this understanding and to predict the invertebrates community composition under different influences. Such a model should integrate the effects of all important influencing factors, such as temperature, current and water quality. The model should be validated by comparison with field data and improved if needed. A thorough analysis of the uncertainty in model outcome due to input and parameter uncertainty is needed to check for its credibility.

We apply the mechanistic model Streambugs, which uses functional trait and ecotoxicological databases, to predict the coexistence of invertebrate taxa at 30 sites affected by different environmental conditions within a catchment in the northeast of Switzerland. The model output comprising presence and absence of invertebrate taxa is compared to existing monitoring data. A Bayesian inference using Monte Carlo simulations is conducted to assess the influence of input and parameter uncertainty on model output and to learn about model components. We will present findings about site-specific occurrence of invertebrate taxa and about the strengths and weaknesses of the model.

R02

STOICHIO-METAGENOMICS OF OCEAN WATERS: A MOLECULAR EVOLUTION APPROACH TO TRACE THE DYNAMICS OF NITROGEN THRIFT IN NATURAL COMMUNITIES

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Recent studies in the emerging field of StoichioGenomics indicate that evolutionary change is constrained by material costs (reviewed in [1]). Here we extend this approach beyond lab model organisms to metagenomics in order to infer a picture of the effects of nitrogen availability on protein composition in natural communities. Nitrogen is a crucially limiting nutrient in oceans, and its availability varies substantially across latitude and longitude on surface waters (e.g., coastal and estuary regions are typically richer in nutrients than open ocean). Thus, oceans provide an ideal set of related ecosystems to study the effect of environmental nitrogen limitation on the evolution of protein composition in natural communities. With a bioinformatics approach based on Hidden-Markov-Models we have extracted sets of homologous sequences of proteins involved in the metabolic response to different levels of nitrogen availability from over 40 million sequences coming from 30 different samples (Global Ocean Survey, [2]). A parsimonious strategy of nitrogen allocation in proteins predicts protein nitrogen content to be lower in open ocean than in coastal and estuary communities. Indeed, our analysis of the evolutionary dynamics of sets of homologous proteins shows a signature of nitrogen thrift in variable, fast-evolving sequences in communities adapted to open oceans. These results directly link the environmental availability of nitrogen to different adaptive strategies of genome evolution, and reinforce the relevance of environmental nutrient availability in shaping evolutionary change.

1. TREE, 2010, 26:38-44
2. PLoS Biol., 2007, 5(3):e77

SS13

ASSESSING THE INFLUENCE OF RIVER FLOW REGIMES ON THE OCCURRENCE OF BENTHIC INVERTEBRATES

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The distribution of stream macroinvertebrates strongly depends on spatially and temporally variable hydrological conditions and discharge parameters. We analysed the influence of the hydrological regime on the occurrence of benthic invertebrates using species presence data and long-term gauge data across rivers in Europe. Data was analysed for general patterns describing species' occurrences in dependence of river discharge characteristics, and with respect to species' taxonomic and functional groups. We present first results of our study, in which the main goal is to generate ecological response functions for benthic invertebrates to stream discharge changes to support further climate-change related vulnerability analyses.

R03

ZOOPLANKTON FAUNA OF LAKE MANYAS (TURKEY) AND THEIR RELATIONSHIP BETWEEN SELECTED ENVIRONMENTAL PARAMETERS

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The aim of this study was to determine the zooplankton fauna and temporarily changes and the relationship between zooplankters and measured environmental parameters.
Lake Manyas is located in the western part of Turkey (40◦12′ N–28◦00′ E), and is an eutrophic lake, also known as Manyas Bird Paradise, entire area was declared a wildlife reserve in 1977, including 64 ha at Bird paradise that was accorded national park status in 1959. As of 1994, 10000 ha (65% of the lake's area) have been listed as one of Turkey's Ramsar sites. As it is a shallow lake, wind–induced turbulence gives rise to suspended particles during the whole season. To identify the zooplankters and selected water quality water samples were collected between July 2010 and February 2012, bimonthly. DO, EC, salinity, water temperature and pH were measured *in situ*, and water transparency was determined. The SPM, Chl *a* and nutrients analyses were performed in the laboratory using the standard methods. Zooplankton was collected in each station by filtering 12 L of water through a plankton net with 55 µm mesh size, preserved with 4% formaldehyde. To determine the relationship between dominant zooplankton species and their environmental parameters, the RDA (Redundancy Analysis) was performed.
During the study total of 50 taxa was observed, and 41 taxa of Rotifera, 3 taxa of Copepoda and 6 taxa of Cladocera identified. Rotifera comprised 81.2%, Copepoda 10.3% and Cladocera 8.5% of the total zooplankton. The changes were observed in the zooplankton composition and spatial distribution every two months. Cyclopoids in the winter with falling temperature values could not be determined, conversely they reached higher abundances during the summer months. Simultaneously, rotifers and cladocerans populations strongly increased in summer. Considering the incidence and number of individuals dominant taxa were selected and the relationship between dominant taxa and environmental parameters were analyzed. Some selected taxa showed significant differences between months (ANOVA; $p<0.05$). Zooplankton not showed significant differences among stations (ANOVA; $p>0.05$). Regarding to statistical analysis are formed groups depending on stations and time and it was determined that these groups affected by different physicochemical parameters at different rates.
Acknowledgements: This study was financially supported by Istanbul University Administrative Secretariat of Scientific Research Projects (ONAP) project 3197.

SS12

RESTORATION OF STREAMS AND THEIR FLOODPLAINS IN THE ARNSBERG FOREST

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This LIFE project aims to preserve and develop the mountain streams, alluvial forests and bogs of the Arnsberg Forest together with their typical flora and fauna. The presentation shows the situation when the LIFE project started, gives principles of restoration and examples of actions carried out.
Until synthetic fertilizers have been available, floodplains were of particular interest for farmers. Relatively good nutrient supply and flat surface in combination with good draining offers quite good conditions for grassland farming. Many of the floodplains in the Arnsberg Forest were used for agriculture before the beginning of the twentieth century. Then many of them were reforested with spruce trees. Agriculture as well as spruce forestry need well drained floodplains and profit from reduced flood risk.
In some areas the length of stream courses has been nearly halved by channelization, and longitudinal inclination has been nearly doubled. Serious consequences are:

- the streams cut deeper beds by bed erosion,
- transport capacity and bottom shear stress have strongly increased so that stream communities are stressed during flood flow,
- inundations of the floodplains have become rare, therefore natural processes caused by flooding are nearly missing, for example transport of seeds, sedimentation and transfer of material.

In addition ditches were built to drain some of the floodplains and – in the floodplains – little streams with lateral small catchment areas were straightened and dug out.
Nevertheless some near natural watercourses were preserved, and in some places sections of old natural stream beds remained beside the straightened streams. So the conditions for restoring streams and floodplains are good. And there are good models in nature for the restoration measures.
The main principles for restoration measures are

- activate still existing old natural stream beds, unless they have become valuable habitats,
- build new stream beds close to the geometry of natural watercourses as model in nature,
- new stream beds must be shallow so that even small floods flow into the floodplain,
- excavate alluvial loam but not the underlying alluvial gravels,
- don’t reinforce river banks, on the contrary put forest deadfall in the stream to activate self-dynamic development of the water body,
- close drainage ditches and restore small streams entering the floodplains from the side of the valley.

R02

A DECADE'S PERSPECTIVE ON THE IMPACT OF DNA SEQUENCING ON AQUATIC HYPHOMYCETE RESEARCH

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Until the recognition of the crucial role that fungi and specifically aquatic hyphomycetes play in plant litter decomposition in streams, limnologists largely ignored these organisms. The predominantly multiradiate (often tetraradiate) and sigmoid spores of aquatic hyphomycetes were early assumed to be due to convergent evolution and thus providing limited information on phylogenetic relationships. Conventional identification of aquatic hyphomycetes has been based on the morphology and development of conidia (mitospores) produced by anamorphic genera, and spore similarity was interpreted as indicator of close phylogenetic relationships. Unfortunately, the success of this approach is strongly tied to the availability of pure cultures that produce reproductive structures. On the other hand, DNA is ubiquitous and present in all stages of the fungal life cycle. Their use circumvents most of the hurdles associated with the conventional culture-dependent and microscopic techniques. In particular, sections of nuclear rDNA (18S and 28S rDNA and ITS) are considered to be ideal for the study of evolutionary relationships among fungi.
A decade has passed since DNA sequences of aquatic hyphomycete species have become available. They have illuminated aspects of their phylogeny and evolution that were inaccessible by conventional methods. Here we present examples of how the resulting information has modified our knowledge on aquatic hyphomycetes. Recently, by using ITS barcodes, we successfully assessed the intraspecific variation within *Articulospora tetracladia*. Also, we assessed, for the first time, the phylogeography of 6 aquatic hyphomycete species (*Anguillospora filiformis*, *Flagellospora penicillioides*, *Geniculospora grandis*, *Lunulospora curvula*, *Tetrachaetum elegans* and *Tricladium chaetocladium*) collected from streams of Southwest Europe and East Australia. Having access to larger DNA datasets will provide greater opportunities to expand the range of questions we can investigate concerning the evolution and ecology of aquatic hyphomycetes. Moving forward with next generation sequencing technologies will allow us to determine more accurately the true diversity and composition of fungal communities on environmental samples.
FEDER-POFC-COMPETE (FCOMP-01-0124-FEDER-013954) and the Portuguese Foundation for Science and Technology supported this study (PEst-C/BIA/UI4050/2011 and PTDC/AAC-AMB/113746/2009) and S. Duarte (SFRH/BPD/47574/2008).

R02

MOLECULAR SYSTEMATIC INVESTIGATION OF THE FRESHWATER GASTROPOD GENUS *GRAECOANATOLICA* (GASTROPODA: HYDROBIIDAE) IN WEST ANATOLIA

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Although looking morphological characteristics of the species of the Graecoanatolica genus was stated location of taxonomic, molecular systematics has not been investigated. İn this study, species of Graecoanatolica genus spreaded Western Anatolia region of Turkey and was indended to investigate the phylogenetic relation between species in different geographic regions and determination of the molecular characteristics.
To determine the molecular characteristics DNA were isolated and COI gene region on mtDNA obtained from total DNA was amplified by PCR. Then sequence arrays was determined. To compare species were evaluated 660 bç part of region of COI gene determined by DNA sequence analysis. Intraspecific and between species in certain ratios molecular differences were determined. The highest molecular difference was observed species which was diagnosed as Graecoanatolica pamphylica by morphological examination. The results of the available sequence was created phylogenetic tree by associating mtDNA COI gene sequences of different genus availabled in GenBank.
According to UPGMA and NJ tests analysis species which existing in Burdur and Egirdir Lake and was diagnosed as Graecoanatolica lacustristurca determined as different species molecular respects. Graecoanatolica pamphylica species in Antalya Kırkgöz spring have been identified far as molecular from Graecoanatolica genus.

PS8

THE ENVIRONMENT AFFECTS AQUATIC ORGANISMS – AND SHAPES THEIR ASSOCIATED BACTERIAL COMMUNITIES

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Bacteria in aquatic environments have primarily been regarded as free-living organisms responsible for degradation of dissolved organic matter although the importance of bacteria associated with particles and organisms, e.g. pathogens, has been well described. We know that bacteria are key players in all nutrient cycles even though the details of the ecological role of particle-associated bacteria in aquatic systems is yet largely unknown. Since both bacterial community composition and their physiological activities are strongly depending on environmental conditions, stressors alter the composition of bacteria associated with hosts, which in turn affects fitness and niche breadth of the hosts as seen in the following examples:
a) Increased temperature alters the community composition microbes associated with freshwater cyanobacterium *Microcystis aeruginosa* and these associated communities affect the quality and quantity of cyanobacterial toxins. A warmer climate will thus likely enhance the toxicity of cyanobacterial blooms by increasing the proportion of toxic cells within the bloom, and changing the toxicity of the produced toxin.
b) Food organisms of crustacean zooplankton are altered by environmental conditions and thus change the internal bacterial community composition of the crustaceans by providing different bacterial communities. In contrast, transplanting zooplankton into different environments does not lead to completely new bacterial communities.
c) Many aquatic ciliates harbor Bacteria, which perform nitrogen fixation. The host provides suitable conditions for their symbionts which results in nitrogen fixation even under high amounts of ammonium in the ambient water.
Here, I will give a number of examples of interactions between microbes and hosts which are affected by the environment. These interactions affect processes, which are potentially important drivers of carbon and nutrient fluxes in aquatic environments, but for which we still have a limited understanding.

SS04

GLACIERS RETREAT, RIVER HABITATS EMERGE AND CHANGE - BUT WHAT IS THE FATE OF SMALL RIVERINE BIOTA?

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Glaciers are highly sensitive to climate change. Thus, due to their dependence on glacier ablation, the thermal and hydrological regimes of glacial riverine networks must change as well. Yet, the consequences of these changes on the ecology of glacier rivers are poorly understood. This is partly because science knows little about the ecologically essential components of these rivers, including the microbiota (bacteria, nanoflagellates, protists, algae, fungi) and small invertebrate fauna (rotifers, nematodes, copepods, tardigrades). The present work focuses on both groups of organisms, especially their distribution within and between two contrasting glacier catchments of the Austrian Alps (Möll River catchment - MC); Kleinelendbach catchment - KC). The two catchments differ in main characters (size, glacierization, and glacier retreat patterns both during the study and over the last several decades); however, when considered together, they offer a model with which to study the relation between the different stages of change in glacier catchments and the basic ecological patterns thereof. These stages define harsh and less harsh habitat conditions on regional (catchment) and local (reach) scales, which in turn allows the differentiation of biotal patterns. Our results revealed that local but not regional harshness is crucial for the resemblance patterns of microbiota and invertebrates. Given that the microbiota from the less harsh sectors of the smaller KC catchment were similar to those from the roughest sector of the large MC catchment, i.e., the proglacial of the Pasterze glacier, the beneficial effects of rapid glacier retreat are proposed, at least for the smallest biota. Indeed, the regional species richness (gamma-diversity) was higher at the KC catchment for the majority of groups, except in the case of diatoms. Also in this study, the successional stages of the river reaches were found to be conducive to an evaluation of community patterns of primary and secondary successions. Specifically, biotal patterns show that the former was obviously delayed among algae and invertebrates in the MC proglacial. This response was consistent with the negative effects imposed by the unstable sediments deposited during the rapid retreat of the large ice masses of the Pasterze glacier. We conclude with assessments of the small biota food-web structures, wherein a close connection between bacteria, nanoflagellates, and small nematode Monhysterida species is likely.

R02

GENETIC DIVERSITY AND DISPERSAL POTENTIAL OF THE STONEFLY *DINOCRAS CEPHALOTES* IN A CENTRAL EUROPEAN LOW MOUNTAIN RANGE

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Aquatic insects are widely used as indicator taxa to assess the ecological state of streams and evaluate the success of restoration projects. Information on the intraspecific genetic diversity and the population connectivity for such indicator taxa is often lacking. These parameters, however, are of critical importance for restoration plans and conservation management, because 1) species sometimes consist of several cryptic species and 2) species can only recolonize restored habitats in their home range. Since gene flow can generally not be observed directly, molecular markers provide an ideal solution to assess the dispersal potential and evaluate species diversity.
We investigated the diversity and dispersal potential of the predatory stonefly Dinocras cephalotes using 323 specimens from 29 populations in the Sauerland, a low mountain range in Germany. With a 658 bp fragment of the mitochondrial cytochrome c oxidase subunit 1 gene (CO1), two distinct and diverse haplotype groups were found, separated by a minimum intraspecific p-distance of 4.3%, suggesting the presence of cryptic species. However, complementing analyses of the nuclear Wingless gene and three newly developed microsatellite markers clearly showed that individuals from both CO1 haplotype groups are interbreeding, and therefore D. cephalotes is a single valid species. Population comparisons indicated high connectivity between all populations, with only a few individual populations showing signatures of isolation. Based on the molecular data we conclude that dispersal is primarily achieved by the winged female D. cephalotes imagines.

SS05

REFERENCE CONDITIONS IN HIGHLY DISTURBED AREAS: AN ATTEMPT TO REDEFINE THE TYPOLOGY OF PORTUGUESE LITTORAL REGION BASED ON DIATOMS

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The central-western Portuguese littoral region is densely populated and largely cultivated, resulting in the absence of true reference sites. As a consequence, a wide abiotic and biological variability was included on one river type, the Littoral (L), during the implementation of the Water Framework Directive in Portugal. Here, as a first step to the redefinition of this type, we evaluate if the diatom communities and abiotic features of this region could be further divided into subsets of reference conditions that could be used for a more exact assessment of water quality.
After an intensive search for reference sites in the study area, forty streams covering as much as possible the existent abiotic variability were sampled. Additionally, data from previous studies carried out in this region were used to analyze a larger number of samples. From those, and after data analyses, only 10 sites were elected as least disturbed sites regarding their organic contamination and nutrients, hydrological, morphological alterations and land use in the region. Cluster analysis identified 3 groups of diatom communities with statistical differences (Permanova, Pseudo-F=2.991; p=0.001; groups 1 and 3: t=2.074 p=0.025; groups 1 and 2: t=1.574 p=0.049). Distance-based Linear Models (DistLM), forward selection, was performed to investigate the relationship between the 3 diatom assemblages, described by a resemblance matrix, and the abiotic variables. The variables that best described the community patterns were runoff, substrate, precipitation and drainage area (DistLM; R^2=0.94). Streambed substrate (but also precipitation and drainage area) explained the differences between diatoms in groups 1 and 3. Streams belonging to group 3 were characterized by sand streambed, low precipitation and drainage area values and species such as *Karayevia oblongella*, whereas group 1 streams were dominated by stones and higher precipitation and drainage area and species such as *Achnanthidium minutissimum* and *Cocconeis euglypta*. Streams from groups 1 and 2 were similar, but, runoff values were generally higher in group 2.
This study revealed that there is a wider abiotic variability and corresponding diatom communities' differences within the L-type. However, the number of reference sites is still insufficient for the redefinition of reference conditions. Therefore, further steps will be focused on modelling the reference communities of these sub-types without the use of reference sites.

SS08

IMPACTS OF DIVERSION HYDROPOWER ON STREAM ECOSYSTEM FUNCTIONING: THE ABSTRACT PROJECT

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Water abstraction is a prevalent impact on world rivers, and is expected to increase in the near future as a consequence of rising human population. Whereas the impacts of large reservoirs on river ecosystem structure and functioning are pretty well known, much less information is available on the effects of abstraction schemes based on low dams, like diversion hydropower plants, which often convert permanent reaches to temporary. Therefore, abstraction can have important impacts on river ecosystem functioning at both the local and the reach scale. The project ABSTRACT, funded by the Spanish Ministry of Economy and Competitiveness, aims to assess the impact of water abstraction on river ecosystem functioning. More specifically, it assesses its effects on channel form and sediment dynamics, on the storage and breakdown of organic matter, on the affinity of benthic substrata for dissolved nutrients, on the self-purification capacity of streams, on the importance of hyporheic vs surface processes, and on whole-stream metabolism. It does so by combining field and laboratory experiments. Here we show some results on litter storage and breakdown, and on associated biological communities.

R13

DISTRIBUTION, THREATS AND CONSERVATION OF *A. PALLIPES* COMPLEX IN TRENTINO (ITALIAN ALPS)

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To fill the gaps existing in the knowledge of the distribution of crayfish species in Trentino (Italy), in 2010-2012 we surveyed fourteen lakes, six ponds and sixty-nine creeks and streams. We recorded twenty populations of the native *Austropotamobius pallipes* complex from four lakes, three ponds and thirteen creeks; three of these populations went extinct during the three years of our survey. Of the twenty-one extinct populations, four were replaced by the invasive alien species *Orconectes limosus*. Some populations of *A. pallipes* complex were infested with the parasite *Thelohania* sp. The recorded extinction of the native populations of *A. pallipes* complex occurred in the last century was probably due to habitat loss or modifications, in particular to the degradation of riparian habitats, to the spread of the alien species and the related transmission of the parasite *Aphanomyces astaci* which is lethal for *A. pallipes* and, in few cases, to overfishing. The environmental survey indicates that small creeks with well developed riparian vegetation and good hydro-morphological conditions flowing through mountain slopes can represent potential refuge and recruitment areas which can be reasonably expected to sustain populations of *A. pallipes* in favourable conditions for the foreseeable future, without significant management intervention. Nonetheless, a sustainable management of piedmont water bodies would allow preserving or increasing the number and density of the relict populations. The ongoing project LIFE-TEN (2013-2016) will promote the reintroduction of *A. pallipes* in appropriately-restored areas of the Adige River floodplain, and in lakes where this population went recently extinct. Haplotype characterization of the COI mitochondrial gene was conducted in 16 populations of *A. pallipes*, resulting in. 240 sequences which allowed identifying two haplotypes (one for two populations, the other one for the remaining 14). They are present respectively east and west of the Adige watershed, which represents their area of contact. The two populations with different haplotype are present in two different watersheds on the slopes of the same mountain, one of the two was probably relocated there by man in historical time. The haplotype characterization of the 16S mitochondrial gene is currently in progress to further analyze the biogeographical setting and identify available source populations for translocation and rearing aimed to the reintroduction program.

SS03

FRESHWATER BIODIVERSITY RESPONSE TO MULTIPLE STRESSORS: A COMPARISON OF PATTERNS IN LAKES, RIVERS, WETLANDS AND GROUNDWATER ECOSYSTEMS

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Multiple stressors are known to impact biodiversity and ecological status of freshwater ecosystems. Yet, the response of biodiversity to different stressors (e.g. eutrophication, hydromorphological alteration, land use) within various freshwater ecosystems (e.g. lakes, rivers, wetlands) may be different and may also depend on the organism group considered. We used European freshwater monitoring data and analysed the community-level biodiversity response (total richness, evenness, community structure) of several organism groups (fish, macroinvertebrates, macrophytes, zooplankton) to physico-chemical and hydromorphological deterioration and land use in several lentic and lotic ecosystems. Response patterns were determined by using Boosted Regression Trees and Generalised Additive Regression Modelling.

The comparison of response patterns among organism groups, stressors and ecosystem types revealed notable differences. The faunal biodiversity in lotic ecosystems, for example, was stronger related to physico-chemistry than to hydromorphology, while the flora revealed the opposite pattern. Across ecosystems, land use constituted an important threat to the diversity of fish, macroinvertebrates and macrophytes in rivers, of zooplankton in lakes, of ground beetles in floodplains and of crustaceans in groundwaters. Our results reveal organism group-specific responses of biodiversity metrics and hence suggest distinct survival strategies of the groups in different ecosystems. Although comparisons across ecosystems and organism groups are often limited due to scaling issues, we show that stressors may be generalised for large-scale biodiversity assessment, thus allowing of comparisons across ecological and administrative boundaries.

SS08

EFFECTS OF RIPARIAN PLANT DIVERSITY LOSS ON DETRITUS FOOD WEBS BECOME MORE PRONOUNCED AT LONGER TIMES

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We examined the potential long-term impacts of riparian plant diversity loss on diversity and activity of aquatic microbial decomposers and on the feeding behaviour and body composition of a stream invertebrate shredder. Microbial assemblages were obtained in a mixed-forest stream by immersion of mesh bags containing alder, oak and eucalyptus leaves, commonly found in riparian corridors of Iberian streams. Simulation of species loss was done in microcosms by including a set of all leaf species, retrieved from the stream, and non-colonized leaves of 3, 2 or 1 leaf species. Leaves were renewed every month throughout 6 months, and microbial inoculum was ensured by keeping a set of colonized leaves from the previous month. After 2 (short time) and 6 months (long time) of plant species loss, microbial diversity, leaf mass loss and fungal biomass were assessed in each leaf species. Leaves from all leaf treatments were used to feed invertebrate shredders. Molecular diversity of fungi and bacteria, as the total number of OTUs per leaf diversity treatment, decreased with leaf diversity loss. Fungal biomass on oak and eucalyptus leaves tended to decrease linearly with leaf species loss. Decomposition of alder and eucalyptus leaves was affected by leaf species identity, mainly after long time. Leaf decomposition of alder decreased when mixed with eucalyptus, while decomposition of eucalyptus decreased in mixtures with oak. Time led to an increase of the positive diversity effects on leaf consumption and FPOM production by the invertebrates. Regarding invertebrates' body composition, the % of C increased and the % of N decreased when animals were fed with leaves after long time of diversity loss. Moreover, leaf identity affected invertebrates' body composition after feeding, suggesting deviation from strict homeostasis. Results suggest that effects of leaf diversity on microbial decomposers depended on leaf species number and also on which species were lost from the system, especially after longer time. Also, leaf diversity affected leaf consumption and FPOM production by invertebrates, as well as animals' body composition. This may have implications for the management of riparian forests to maintain stream ecosystem functioning.

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R01

ENVIRONMENTAL FACTORS STRUCTURING MACROPHYTE ASSEMBLAGES IN ALPINE LAKES

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We evaluated the influence of 17 local (i.e., pH, conductivity or nutrient content), 6 catchment (i.e., catchment area) and 10 regional (i.e., altitude or geographic coordinates) variables on the taxonomic, functional composition (emergent species, submerged hydrophytes, floating-leaved hydrophytes, bryophytes and isoetids) and richness of macrophyte assemblages in alpine lakes. For that, we used 39 lakes located in the northwest of the Iberian Peninsula (altitude range between 1100 and 2100 m.a.s.l.) and sampled once in the summer of 2007, 2008 or 2010.
Local variables explained the large proportion of variation in the taxonomic, functional composition and richness, whereas de importance of catchment and regional variables was lower. Significant local variables (conductivity, alkalinity, percentage of mud and depth) explained 23.1% of the taxonomic composition whereas catchment (percentage of rock) and regional variables (Lat^2Lon) explained approximately 4%. The functional composition was explained by local (conductivity, ortophosphate and lake area) and regional variables (LatLon, Lon^3), with 36.5% and 9.4% respectively. Finally, 44% of richness variation was explained by local variables (chlorophyll a, lake area and Secchi disk).
The main conclusion of this study is that the functional structure of macrophytes in the studied lakes is more affected by geographic boundaries than individual species or richness values. These limits can be related to catchment geology characteristics that prevent the presence of all functional groups in all lakes.

SS13

ACCOUNTING FOR DETECTABILITY IN FRESHWATER SPECIES DISTRIBUTION MODELS: AN APPROACH BASED ON TIME TO FIRST DETECTION

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Imperfect detection (i.e., failure to detect a species when the species is present) is increasingly recognized as an important source of uncertainty and bias in species distribution modeling. Although methods have been developed to solve this problem by explicitly incorporating variation in detectability in the modeling procedure, their use in freshwater systems remains limited. This is probably because most methods imply repeated sampling (≥ 2) of each location within a short time frame, which may be impractical or too expensive in most studies. Here we explore a novel approach to control for detectability based on the time to first detection, which requires only a single sampling occasion and so may find more general applicability in freshwaters. The approach uses a Bayesian framework to combine conventional occupancy modeling with techniques borrowed from parametric survival analysis, jointly modeling factors affecting the probability of occupancy and the time required to detect a species. In addition, the approach may be used to develop both single species and multispecies models, the latter of which allow estimates of species richness, and the probabilities of occupancy and time to detection functions for rare species. The models developed using this approach are useful to estimate the effort required for efficiently sampling a species or group of freshwater species, and for extrapolating to entire catchments or regions the occupancy probabilities estimated from local sampling. To illustrate the method, we modeled large scale factors (elevation, stream order and precipitation) affecting fish distribution in a catchment located in north-eastern Portugal), while accounting for factors potentially affecting detectability at sampling points (stream depth and width).

R03

EFFECTS OF DISSOLVED ORGANIC NITROGEN (DON) ON PHYTOPLANKTON DEVELOPMENT IN LIMNIC ECOSYSTEMS

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In freshwater sciences, nitrogen gained increasing attention as an important resource potentially limiting phytoplankton growth. Most studies and all management approaches, however, are still restricted to inorganic nitrogen since dissolved organic nitrogen (DON) was considered to be unavailable for most of the photoautotrophs. In the meantime this assumption has been disproved for all aquatic systems. While research on DON in marine ecosystems substantially increased recently, in freshwater surprisingly little research has been carried out on its utilization by phytoplankton. Therefore, our present knowledge on DON utilization by phytoplankton is often based on single species experiments using a sole DON component, often in unnaturally high amounts mainly carried out with marine phytoplankton species. Thus, we know that some phytoplankton species can take up different DON fractions if they are available in high concentrations. This does not necessarily imply that phytoplankton would perform likewise in natural environments. Especially since the nutrient regime in marine environments differs from that of freshwaters. If inorganic nitrogen is available, would phytoplankton really need to rely on an organic nitrogen source?
To gain more information on DON in freshwaters we investigated the seasonal development of several DON components and performed bioassays with plankton communities using realistic nutrient concentrations. We experimentally addressed the question whether urea, dissolved free amino acids (DFAA), dissolved combined amino acids (DCAA) and humic acids differentially influence the growth of phytoplankton, both, in the lab as well as in phytoplankton communities of a polymictic, eutrophic lake. Uptake rates of DON were measured by mass spectrometry using ^{15}N labelling. These results are compared to the availability of DIN and discussed regarding their importance for seasonal phytoplankton development.

R03

NUTRITIONAL QUALITY OF RIVER SESTON FROM TWO LARGE LOWLAND RIVERS AND POTENTIAL CONSEQUENCES FOR FILTER-FEEDING CONSUMERS

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Constraints at the plant herbivore interface imposed by insufficient dietary quality of phytoplankton for filter-feeders has been a major focus of research in lake ecology over the last two decades. Surprisingly however, very little is known about the dietary quality of river seston for lotic filter-feeders and its specific determinants. Here, we investigated parameters that might determine the dietary quality of riverine seston such as nutrient stoichiometry, content of essential polyunsaturated fatty acids and taxonomic composition (via analysis of algal pigments) in two large lowland rivers in Central Europe, the rivers Rhine and Elbe. Regular sampling of various seston parameters in the two rivers allowed the distinction of spatial and temporal variation in seston composition and quality. Further, we derived fitness estimates of a common filter-feeding consumer, the Asian clam *Corbicula fluminea*, from both systems to assess potential feedbacks of seston quality on the body composition of the consumers. While there were also some temporal (i.e. seasonal) changes to be observed in seston quality, there were pronounced differences between the two rivers: The seston in the River Rhine showed consistently higher carbon : nutrient ratios but also higher contents of fatty acids than seston from the River Elbe. Depending on the relative importance of mineral nutrients and essential fatty acids in determining food quality of seston for benthic filter-feeders, there could be different consequences for *C. fluminea* feeding on seston in these rivers. Further, this may also translate into the clams' body composition and therefore have also consequences for predatory species higher in the food web.

R04

ENVIRONMENTAL STRESS ON METABOLISM IN DECOMPOSING LEAVES IN MOUNTAIN STREAMS

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Generally, temperature regime and nutrients play a pivotal role in metabolic activity of organic matter during breakdown process in running waters. In this study ETS assay (Electron Transport System) was used as a functional indicator of potential respiration. This method measure the oxygen consumption that would occur if all enzymes functioned at maximum in decaying leaves. The study aim was to assess metabolic differences in leaf litter between natural and polluted sites in mountain streams (the Beskidy Mountains). The metabolic activity was studied in four streams by exposing two leaf species (alder and oak) in two types of litter bags (coarse and fine). Respiration of leaf litter showed differentiated response with regard to acting stressor and to site characteristics. In general, metabolic activity was higher in alder leaves than in oak ones A negative effect of nutrient impact on leaf respiration was noted in both leaf species. The negative effect of stream pollution on ETS may be due to some toxic substances usually accompanying organic pollution. Advantages and disadvantages to use the ETS assay in functional stream assessment are discussed.

SS08

EFFECTS OF RESTORATION OF WOOD LOADING ON INSTREAM NUTRIENT AND LEAF RETENTION

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Instream wood enhances stream channel complexity, and influences flow dynamics and retention efficiency. Human activities tend to decrease channel complexity and instream wood, and thus, harm stream ecosystem functioning, As an attempt to restore physical heterogeneity and ecosystem functioning, dead wood was added in 4 headwater streams located in the North of the Iberian Peninsula following a BACI design. The 4 streams ranged in order from 1 to 4 and in average discharge from 0.026 $m^3 s^{-1}$ to 2.5 $m^3 s^{-1}$. Leaf retention was measured recording the distance travelled by *Gingko biloba* leaves. Phosphorous and ammonia retention were analysed by means of nutrient addition experiments. Introduction of large wood resulted in reduced water velocity in experimental streams, being differences larger during high flow periods. Despite these differences, the effects on nutrient retention were small as significant differences in nutrient uptake length were only detected in one stream. On the other hand, leaf retention increased especially in the larger streams, where average travel distance was reduced to about 10% of the initial distance.

R09

BENTHIC ALGAE IN STREAMS AND RIVERS OF NORTH RHINE WESTPHALIA, GERMANY: INDICATORS OF ECOLOGICAL QUALITY

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The State Agency for Nature, Environment and Consumer Protection (LANUV NRW) is responsible for the monitoring of the watercourses within the federal state of North Rhine-Westphalia (Germany) as prescribed by the European Water Framework Directive (WFD). Benthic diatoms and non-diatomaceous benthic algae are used for the assessment of the ecological status of streams and rivers according to the PHYLIB routine (Schaumburg et al. 2012). Between 2006 and 2011, benthic diatoms were sampled at 1525 sampling sites (2200 sampling events) and non-diatomaceous benthic algae were sampled at 706 sampling sites (872 sampling events). Species richness is high, with 837 taxa of diatoms (331 taxa present in at least 1% of the samples) and 285 taxa of non-diatomaceous benthic algae (106 taxa present in at least 1% of the samples). More than 80% of the common taxa are used in the assessment routine, providing a high level of reliable assessment results.

In total, 1258 water bodies were assessed by means of benthic diatoms. Out of these, 32% showed high or good ecological quality, 54% moderate ecological quality, and 12% poor or bad ecological quality. The data of non-diatomaceous benthic algae led to the assessment of 510 water bodies (42 % high or good ecological quality, 43% moderate ecological quality, and 15% poor or bad ecological quality).

Diatom taxa most frequently found were *Achnanthidium minutissimum var. minutissimum, Amphora pediculus, Navicula gregaria, Navicula lanceolata, Planothidium frequentissimum var. frequentissimum* and *Rhoicosphenia abbreviata*. Among the non-diatomaceous benthic algae, the following taxa were most frequently found: *Cladophora glomerata*, *Oedogonium*, *Vaucheria*, *Chantransia* – stages, *Closterium moniliferum*, *Phormidium*, *Stigeoclonium*, *Pleurocapsa minor*, *Spirogyra*, *Homoeothrix janthina*, *Closterium ehrenbergii*, *Closterium acerosum*, *Microspora amoena*, *Closterium tumidulum*, *Rhizoclonium hieroglyphicum, Chamaesiphon incrustans, Audouinella, Gongrosira incrustans, Ulothrix zonata, Homoeothrix varians, Chamaesiphon polymorphus.*

R05

EFFECT OF GLOBAL WARMING AND VEGETATION CHANGE INDUCED IN RIPISYLVES ON LITTER BREAKDOWN BY POPULATIONS OF *GAMMARUS PULEX* (AMPHIPODA) FROM THE RHÔNE RIVER VALLEY.

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The current thermal gradient measured along the Rhône River Valley between Dijon and Marseille (mean range: 5°C) is an opportunity to study the potential effect of the climate warming in natural conditions. This valley is characterised by a northern continental climate and a southern Mediterranean climate, with tree species adapted to each region. In case of warming temperatures, the Mediterranean vegetation could shift northward, implying a potential change in terrestrial organic matter breakdown by aquatic invertebrates from adjacent ecosystems. In order to study the functional consequences of this change, we used a key-species for the particular organic matter recycling, the crustacean amphipod *Gammarus pulex*. The consumption rate of vegetation from different origins by six populations coming from the North *vs.* the South of the valley has been measured. Some biomechanical parameters (toughness, thickness) influencing the consumption of leaf litter have been determined over the conditioning process. Our results suggested that the consumption of different types of leaves may be delayed over time according to the time required to get a conditioning sufficient for shredders and could affected by the temperature too. The presence of tough leaves in riparian vegetation may therefore constitute a reservoir of trophic resources available for aquatic organisms at the end of the winter, when soft leaves have been entirely consumed. The diversity of riparian vegetation may hence contribute to sustain the availability of feeding resources for adjacent hydrosystems.
Key-words: aquatic ecosystems, climate change, functional impact, leaf litter consumption, shredder, toughness

R04

NO EVIDENCE FOR FUNCTIONAL LITTER DIVERSITY EFFECTS ON DECOMPOSITION, FUNGAL DECOMPOSERS AND NUTRIENT DYNAMICS

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Theory on the relationship between functional diversity and ecosystem functioning predicts that mixing dissimilar leaf litter types enhances leaf decomposition because of complementary functional traits of individual species. However, previous investigations adopting a categorical classification of leaf litter functional diversity found no relationship between functional dissimilarity and leaf decomposition. Here we asked whether the distribution among species mixtures along continuous dissimilarity gradients defined by litter-chemistry can account for differences in three processes related to litter decomposition: leaf litter mass loss, fungal biomass accumulation, and nutrient immobilization. Using a pool of eight leaf species differing in litter quality and mixed in all possible pairwise combinations, we assessed three litter chemical constituents related to decomposition rate: lignin, nitrogen, and phosphorus. A series of dissimilarity measures, including Euclidean and Gower distance as well as dendrogram-based indices, were derived from these chemistry variables, generating dissimilarity gradients for mixtures of each individual leaf species. In a field decomposition experiment conducted in a stream with a rich assemblage of microbial decomposers and litter-consuming invertebrates, we found no relationship between functional dissimilarity and decomposition rate either for microbial decomposition or decomposition involving both microbes and invertebrates. This result was independent of the specific dissimilarity measure used. Likewise, there were no effects of functional dissimilarity on fungal biomass or nutrient immobilization, indicating that functional litter dissimilarity per se is insufficient to generate diversity effects on decomposition and associated processes, irrespective of the presence or absence of invertebrate litter consumers.

SS02

IN VITRO LEUKOCYTES RESPONSES OF THREE-SPINED STICKLEBACKS (*GASTEROSTEUS ACULEATUS*) TO HELMINTH PARASITE ANTIGENS

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Helminth parasites of teleost fish have evolved strategies to evade and manipulate leukocyte responses of their hosts. Responsiveness of leukocytes to helminth antigens may therefore vary depending on the degree of host-parasite counter-adaptation. Generalist parasites, infective for a number of host species, might be unable to adapt optimally to leukocytes from a certain host species, while specialist parasites might display high levels of adaptation to a specific host species. High levels of specific adaptations of specialist parasites may differ between host- parasite populations. Here, we test these hypotheses by *in vitro* exposure of head kidney leukocytes from three-spined sticklebacks (*Gasterosteus aculeatus*) to antigens from generalist fish parasites (*Diplostomum pseudospathaceum*, *Triaenophorus nodulosus*), a specialist fish parasite (*Ligula intestinalis*, infective for cyprinids) and parasites highly specialised to a single fish species as second intermediate host (*Schistocephalus pungitii*, not infecting- and *Schistocephalus solidus*, infecting *G. aculeatus*). *In vitro* responses of stickleback leukocytes to *S. solidus* antigens from six European populations, with *S. solidus* prevalence from < 1 % to 66 % were tested in a fully crossed experimental design. Leukocyte cultures were analysed by means of flow cytometry and a chemiluminescence assay to quantify respiratory burst activity. We detected decreasing magnitudes of *in vitro* response (immunogenicity) from generalist to specialist parasites and among specialists from *G. aculeatus* not infecting to *G. aculeatus* infecting species. Antigens from Norwegian (prevalence 30-50 %) and Spanish (40-66 %) *S. solidus* induced generally higher *in vitro* responses compared to *S. solidus* from two German (< 1 %) populations. In parallel, leukocytes from stickleback populations with a high *S. solidus* prevalence showed generally higher *in vitro* responses to *S. solidus* antigens in comparison to populations with low *S. solidus* prevalence. Within the specialist *S. solidus*, responsiveness of stickleback leukocytes to *S. solidus* antigens, as well as immunogenicity of parasite antigens (virulence) increased with the parasite prevalence in populations.

SS13

MORE THAN THE MEAN: STUDYING CLIMATE EFFECTS ON A LAKE ECOSYSTEM WITH A STATISTICAL WEATHER GENERATOR

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Climate Change effect studies have been a focus of many research projects in the past. Besides an increase in mean air temperatures it is expected that also climate variability will increase. Whereas the effects of higher temperatures gained a lot of attention, the latter attracted less notice.
Organisms in an aquatic environment are affected by a changing climate in several ways. Higher water temperatures directly affect physiology. But more than that, the whole aquatic habitat is dependent on physical properties driven by climate conditions. In lakes, mixing and stratification depend on air temperature as well as weather conditions, including strong wind events and the duration of warm or cold weather periods.
In this study, we addressed the sensitivity of phytoplankton development towards changed climatic conditions, by running “what-if” scenarios with a hydrodynamic-ecological lake model (DYRESM-CAEDYM). As meteorological input we used time series generated by a statistical weather generator (VG). VG allows differentiating between an increase in mean air temperature and in climate variability. It keeps dependency structures between meteorological variables and therefore goes well beyond scenarios with an exclusively constant increase in temperatures.
Our results show that the onset and the minimum of phytoplankton spring bloom are sensitive towards spring weather conditions. The prolongation of phytoplankton growth throughout the year is more probable under a warmer climate. An important finding was the importance of keeping dependency structures between meteorological variables, as lake stratification is not only a result of air temperature acting on the lake, but also other factors like radiation and humidity.
Compared to regional and global climate change models (RCM/GCM), the statistical weather generator is a tool that allows producing multiple realisations for climate scenarios, leading into a range of possible outcomes. Together with the possibility to separate between increasing mean temperature and increasing variability, VG helps towards a broader understanding of climate and weather driven mechanisms in aquatic ecosystems.

R09

CLIMATE CHANGE AND THE IMPLEMENTATION OF THE EU WATER FRAMEWORK DIRECTIVE

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Climate change (CC) will have many kinds of direct and indirect impacts on freshwaters. Much attention has been paid to the impacts on hydrological regime and water supply but less on the impacts on water quality and the structure of freshwater ecosystems. According to the EU Water Framework Directive (WFD) a good ecological and chemical status of all waters must be gained by 2015 or in some cases by 2021 or 2027. CC has not been explicitly mentioned in the text of the WDF but according to the EU White Paper “Adapting to climate change: Towards a European framework for action” CC must be considered in the river basin management plans and the next generation of these plans should be even “fully climate-proofed”. In addition to changes in hydro-meteorological and ecological conditions CC will have also socio-economical impacts which may also greatly affect the status of waters. Some issues of combining the concepts of CC and the WDF might be even called philosophical and the decisions of the necessary actions cannot be made on a purely scientific basis. From the point of view of adaptation to CC, as accurate regional climate scenarios as possible are necessary. Although the general trend is warming some other factors will have different patterns of change in different European regions. According to the present projections, e.g. summertime precipitation will decrease in the southern coast of the Baltic Sea whereas it will increase in the northern part. In northern Europe leaching of nutrients will also increase because the snow-covered period will be shorter but the spring peaks of nutrient input to lakes will be lower than today. In northern regions the profitability of agriculture will be better in the future which will contribute to nutrient loading. According to many studies CC will increase the leaching of humic substances at least in northern Europe. In many member states of the EU the reference conditions of the WDF, which are essential in the assessment of the status of waters, have been determined separately for the lake types depending on humus concentration (measured e.g. as colour of water). Colour has been considered to be a natural feature of lakes. CC will change this situation but water management actions cannot affect it. Because of the complexity of these phenomena, regional planning of adaptation to CC and river basin management should be much more combined than today, based on multidisciplinary research.

SS05

SHIP-INDUCED WAVES FAVOUR NEOZOA AND ALTER THE COMMUNITY COMPOSITION OF BENTHIC INVERTEBRATES

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Ship-induced waves affect aquatic ecosystems by altering the hydrodynamic regime in littoral zones. However, the long-term effects of ship waves on the community composition of benthic macroinvertebrates have rarely been quantified. In our study, we investigated the macroinvertebrate assemblages along a gradient of wave exposure. Sampling took place on a monthly basis from April to September 2008 at the Havel River. Principal Coordinate Analysis (PCO) revealed distinct community compositions at highly exposed sites compared to intermediately exposed and not exposed reference sites. There was a decrease in abundances of 7 taxonomic groups from a total of 15, especially insect taxa, while abundances of Crustacea increased with increasing exposure to ship-induced waves. The proportion of non-native individuals was significantly higher at exposed sites than at reference sites.
This study documents that ship-induced wave disturbance is detrimental for most taxa of benthic macroinvertebrates colonising littoral zones of navigational waterways. Conclusively, management should consider ship-induced wave disturbance as a severe anthropogenic stressor, especially regarding invasion by neozoa.

R09

BOTTOM- UP TYPOLOGY BASED MACROINVERTEBRATE MULTIMETRIC INDEX FOR EVALUATION OF HUNGARIAN STREAMS

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According to the normative definition of the Water Framework Directive (WFD) the ecological quality assessment requires such a biological index that takes into account specific aspects of the biological quality elements, such as composition, abundance and has multimetric features. Multimetric indices which fulfils these criteria have become important tools for the assessment of the water quality through Europe. The resulted index should be typology specific therefore the typology based on macroinvertebrate composition were established based on Self organizing neural network analysis. Neural networks based statistical analysis became more and more popular tools in ecological data analysis like the Self Organizing Map (SOM), which capable of the visualization of high-dimensional data. SOMs were used frequently in community patterning of benthic invertebrates in streams since 1990s. SOM could converts complex statistical relationships between high-dimensional data into a simple low-dimensional array by compressing information, but at the same time preserving the most important topological and metric relationships of the original data. Five distinct types could be formed based on these analyses: 1 - mountains small streams (altitude>350m, 10-1.000 km^2 catchment); 2 - colline (altitude>250m) small streams; 3 - colline large rivers (catchment > 1.000 km^2); 4 - plain (altitude 200-350m) small streams; and 5 - plain large rivers. The resulted indexes are typology specific, consist of composition, abundance, tolerance and diversity metrics such as ASPT, Shannon diversity, Ephemeroptera and Plecoptera taxon number or ratio of littoral zonation preference. The indexes were tested against various chemical and landscape variables and found to be stressor specific and fulfils all criteria of the WFD and recently used in the official assessment system in Hungary.

SS13

USING MECHANISTIC EFFECT MODELLING FOR CAPTURING INDIVIDUAL-LEVEL EFFECTS OF CHEMICAL STRESS AND ASSESSING THEIR RISK ON POPULATIONS IN *DAPHNIA MAGNA*

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With the increasing expansion of human activities, the welfare of freshwater ecosystem communities is directly threatened, due in particular to the extensive use of chemicals. Because it is impossible to eliminate all environmental effects of human activities, decisions were made to define protection goals which compromise between benefits of using the chemicals and costs in terms of acceptable effects. Protection goals vary among different biological levels of organization. In contrast to vertebrates where visible mortality of individuals has to be prevented, the target entity for aquatic invertebrates is the population rather than the individual, which implies that effects on individuals are accepted if they do not impair the functioning of populations. However, assessing the impact of chemicals on populations relies on simple standardized toxicity tests measured on individuals, which do not provide a clear understanding of the mechanism of action on individuals; neither do they yield realistic estimates of population-level effects.

In this study, we use an individual-based model (IBM) for *Daphnia magna* to implement the measured effects of a chemical on individual daphnids. Our main aim is to understand the chemical-induced effects on individual processes and determine how these effects translate into changes in population dynamics. The used IBM predicts the population dynamics of *D. magna* based on individual life cycles including feeding, growth, reproduction and survival processes. We address the degree of complexity needed for a successful extrapolation of the chemical's effects by contrasting different modelling assumptions about the individual-level effects and testing how well the resulting population model explains observations from laboratory population tests.

The results show that for the population dynamics to be fully captured, a combination of the IBM with a toxicodynamic model for survival was necessary. With such an integrative approach, we could select the key affected individual-level processes which are driving the dynamics of the exposed daphnid populations. Our study emphasizes the great potential of mechanistic effect modelling to provide realistic predictions of population-level effects of chemicals.

SS11

THE BENTHOS AND THE CHIRONOMID NOISE - GOOD AND BAD BIODIVERSITY OF A CITY CHANNEL

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The river Aa, a sandy lowland stream of North West Germany, passes through the City of Münster via two sequential man-made systems. The shallow artificial lake Aasee it fills, discharges into the channel of the City Aa, a sealed and straightened concrete bed and bordering traversing the city center. Productivity of the lake is high due to the amounts of nutrients originating from intensive agricultural land use within the headwater catchment. As a consequence, the City Aa transports a major load of seston along which is supposed to provide an abundant feeding basis for benthic invertebrates until far downstream beyond the city. As expected however, considerable numbers of benthic species were found only at transitory spots of gravel and detritus accumulations in the channel trench. Per site, average species numbers, were low in all taxonomic groups except in chironomids (benthos excl. chironomids: 19, total: 73, chironomids: 37, total: 69). Compared to near-natural streams of the rural vicinity, diversity ratios found in the City Aa were inverted: approx 1.5 times greater in chironomids and approx. 3 times less in the other benthic groups. This ratio remained approximately stable even in the near-natural reaches downstream of the city channel, within a stretch of approx. 2 km; only average species numbers were slightly increased in both groups (benthos excl. ch.: 21, ch.: 43). The findings circumscribe the specific ecological properties of this urban channel but as well a possible nuisance risk: an unbalanced succession potential of the benthos and hardly controllable secondary effects of the great seston load from the lake outflow - scenarios that shall be discussed critically in the light of the pending restoration measures on the City Aa.

SS13

ASSESSING THE IMPACT OF PARAMETER UNCERTAINTY ON LAKE MANAGEMENT SCENARIO RESULTS

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Complex ecosystem models are often used as a means for gaining insight into ecosystem processes and as a management tool for resource managers. Ecosystem models are especially useful for studying potential impacts of anthropogenic processes on the ecosystem in question. The uncertainty, however, associated with these models, particularly with their parameter values reduces the confidence in the results and predictions. Parameter uncertainty is therefore a major stumbling block in their acceptance as a main stream management tool. In addition, the difficulty in estimating model uncertainty and the resulting errors associated with them further limits model use. Various configurations of the lake ecosystem model DYRESM-CAEDYM (DYCD) have been extensively applied in recent years to Lake Kinneret, Israel, and have been used as a means for examining long term management strategies. It includes, however, hundreds of parameters and processes and inherently incorporates a large degree of uncertainty associated with them and with model outcomes. In this study, we test the reliability of the outcomes of a number of management scenarios, simulated with DYCD, given the large degree of parameter uncertainty. We do so by applying a single-model ensemble approach. We introduced parameter uncertainty into the model response to a series of management scenarios by using the Latin Hyper Cube sampling procedure to determine 1000 different parameter vectors which were then applied to 19 management scenarios. Based on the results, we tested the underlying assumption that the trends predicted by the model, in response to the scenarios, are consistent across the range of uncertainty. We tested the assumption by comparing concentrations of state variables and by applying the Lake Kinneret Water Quality Index (CWQI), an indicator of ecosystem sustainability. The results of the simulations for each scenario were combined to provide an ensemble of results for a series of state variables. As predicted, the scenario results exhibited large variations. Their trends, however, matched those observed with the base simulation. The outcome suggests that in spite of the large uncertainty associated with complex ecosystem models, they can nevertheless be used as a reliable management tool.

R01

GROWTH FEATURES OF BITTERLING, *RHODEUS AMARUS* FROM SMALL STREAMS, WHICH FLOW INTO A LARGE RESERVOIR (DARLIK RESERVOIR, NW TURKEY)

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Although it is one of the most dominant and ecologically important fish speciesin freshwater systems, biological features, mainly the growth of bitterling, *Rhodeus amarus* has received very little attention. In this study, growth properties of bitterling inhabiting in the streams of Darlık Reservoir, which is providing important part of water demand of city of Istanbul, Turkey were studied. During the study period between October 2008 and September 2010, 1669 bitterling individuals were collected by electrofishing. Length, weight, age, sex distribution rate, age-length and age-weight relationship, von Bertalannfy parameters and condition factor were calculated. Age varied between I and V ages. Total length values were between 1.5 cm and 8.6 cm while weight values were between 0.0323 g and 8.7011 g. Length-weight relationship was $W=0.0082*TL^{3.273}$ in all individuals. Calculated von Bertalanffy parameters, L_∞, W_∞, K and t_0 were 10.045 cm, 15.4107 g, 0.028 and -0.906, respectively in all individuals. To assess general status of the population, calculated condition values were maximum in 2010 August as 0.899 and minimum was in 2010 February as 0.662. Mean condition values of ages in all individuals was minimum in age V (0.782) and maximum was in age II (0.838).

R12

REMOTE SENSING AS A SUPPLEMENTARY TOOL FOR WFD MONITORING

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Remote sensing techniques and data have their potential and limits regarding applications for freshwater monitoring. While the Water Framework Directive (WFD) aims for a harmonised water monitoring and conservation across national borders, local stakeholders and national authorities point out regional characteristics of water types that need to be taken into account. Remote sensing meets both approaches in that sense that the spatial coverage allows a comparable dataset on European scale. On the other hand, the methods to process data, as well as product development, allows adjustments to regional requirements, like thresholds and statistics for water quality parameters. Due to limits of the technique, like e.g. cloud coverage and atmospheric correction, it is evidently a supplementary method, supporting monitoring activities in place.
Interest for remote sensing data began to rise in the Coastal Waters community in Germany. Activities for lakes and coastal waters are also known from Finland and Sweden. Within the GSE Projects MarCoast Brockmann Consult worked in close collaboration with German national authorities and institutions, like the Federal Maritime and Hydrographic Agency and the NLWKN in Lower Saxony. Maps of chlorophyll-a P90 per water bodies as well as chlorophyll-a time series products for optimizing the monitoring activities have been developed. Within the FRESHMON (EU FP-7) project the focus is on inland waters with the aim to develop user tailored products for the WFD. Special emphasize is on water quality parameters gained from high-resolution satellite data. FRESHMON is co-funded by the EU and coordinated by EOMAP with the partners Water Insight, SYKE, Brockmann Consult and EAWAG.

SS01

THE ALBERTA OIL SANDS IN CANADA: IMPACT ON BIODIVERSITY?

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The Athabasca oil sands in Northern Alberta, Canada, are one of the largest oil sands reserves in the world and mining operations are constantly growing. As a result, the release of toxic oil constituents with potential effects on water quality of the Athabasca River and its tributaries - all running through the oil sands deposit - is of growing concern. Current monitoring practices in the Athabasca watershed have not been able to provide a reliable risk assessment of the oil sands development due to confounding environmental factors and high natural variation. The aim of this study was to develop a bioindicator system focussing on macroinvertebrate communities which can improve environmental monitoring methods by enabling discrimination between toxicants' effects and confounding factors. The SPEAR index (SPeciesAtRisk) is a bioindicator that reflects the sensitivity of freshwater macroinvertebrate communities towards toxicants of concern, as it is based on each taxon's vulnerability towards these toxicants. SPEAR was applied to Canadian conditions and validated in three sampling campaigns. In September 2010, 2011, and 2012, main stem and tributaries of the Athabasca watershed were sampled for their macroinvertebrate communities - both up- and downstream of potential mining impacts. In parallel, water and sediment were collected and analyzed for PAHs (polycyclic aromatic hydrocarbons), metals, and naphthenic acids. The relationships between the contaminant loads and the community sensitivity were compared between sites and years. We found a close relationship between the organic contaminant load and the community sensitivity towards organic toxicants measured with the SPEAR index. This suggests that SPEAR can help to achieve a more holistic understanding of potential effects of oil sands development on the aquatic ecosystem and can be integrated into monitoring programs undertaken by environmental agencies and consultant companies.

SS10

FRESHWATER ECOLOGY MEETS ECOTOXICOLOGY

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Ecology and ecotoxicology have distinct roots, have evolved largely independently, and yet have many commonalities. Both disciplines are gaining momentum in the face of ubiquitous environmental change, including freshwater pollution by a suite of emerging contaminants. Therefore, a systematic exchange of concepts, methodologies, and specific insights into the ways in which organisms interact with each other and with their environment appears to be timely. As much as applied ecology could benefit from established ecotoxicological approaches to impact and risk assessment, as much ecotoxicology would profit from considering ecological concepts and methodologies applicable to levels of biological organisation beyond the individual and population. At the heart of this tenet is the recognition that indirect effects resulting from species interactions such as predation, competition and facilitation are important in determining outcomes when environmental conditions change. Applications of these concepts can build on a long tradition and rich data in freshwater community and ecosystems ecology. A complementary consideration is that species ranging in size from bacteria to fish can exert strong effects on their environment. This suggests that approaches targeting ecosystem processes mediated by organisms have great potential to understand impacts of environmental change at the ecosystem level.

SS12

CHARACTERISATION OF THE UPPER AND THE MIDDLE COURSE OF THE MÖHNE VALLEY

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The Möhne is with a total length of 65 km the one of the largest tributaries of the river Ruhr. It originates close to Brilon, runs mostly in a westerly direction along the northern margin of the south Westphalia low-mountain region and reaches its confluence with the River Ruhr near Arnsberg-Neheim. One of the best known touristic spots is the Möhne reservoir at the middle course of the river.

The project area has a high importance for the protection and preservation of endangered species such as bullhead (*Cottus gobius*), the lesser marbled fritillary (*Brenthis ino*) and buckbean (*Menyanthes trifoliata*). The Möhne River is a gravel-type watercourse with submerged or floating vegetation mainly containing the water crowfoots *Ranunculus fluitans* and *R. penicillatus*.

The Möhne valley is characterized by typical alluvial habitats; for example species-rich meadows and fragments of riparian forest prevalent with alder (*Alnus glutinosa*). Based on site properties there are some major differences between the upper and the middle part of the valley. Due to the permanent water supply from the adjacent Arnsberger Wald special types of marsh-marigold and related – communities (*Calthion, Magnocarition*) have been developed in the upper reach. In contrast the widened middle part is dominated by more or less drained mineral soils. Here the above mentioned damp grasslands are increasingly substituted by the species-rich meadows with the false oat – grass (*Arrhenatherion*).

SS13

LIMITATIONS IN TRANSFERRING MACROINVERTEBRATE DISTRIBUTION MODELS TO ADJACENT CATCHMENTS

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Species distribution models (SDMs) are increasingly used in conservation ecology to model the present and future occurrence of organisms under changing environmental conditions. A good model accuracy and predictive power is of importance for generalizing SDM outcomes to other, unobserved regions. Several criteria may influence the model precision and thus, the potential to generalize the outcome: the model species' natural distribution, its coverage by the data, the species prevalence and the quality and resolution of direct (ultimate) and indirect (proximate) environmental predictors. Based on 225 samples of eleven benthic macroinvertebrate species, we developed a SDM to predict the presence of absence of these species in the Ruhr catchment, North Rhine-Westphalia, Germany. Separate SDMs were run for smaller catchment units (upper Ruhr and Lenne sub-catchments). We expected the SDM outcome to reveal similar results for adjacent sub-catchments with regard to the environmental predictors in the model, the model's accuracy and its predictive performance (i.e. low rate of false predicted presences/absences). The distribution models showed considerable differences in model accuracy and predictive performance of SDMs at sub-catchment level, although the environmental differences between both observed catchments were marginal. For several species reliable models based on proximate predictors were achievable, but the species differed at sub-catchment level. For example, good SDMs were achieved for *Leuctra geniculata*, *Silo piceus* and *Siphlonurus lacustris* in the upper Ruhr catchment, while *Hydropsyche instabilis* showed the best model performance in the Lenne sub-catchment. Furthermore, the SDMs of rare species had the highest predictive power despite their weak model accuracy. Our results imply that SDMs may reveal varying results even in adjacent sub-catchments of the same river basin. Thus, a thorough interpretation of distribution models regarding environmental gradients and species prevalence is recommended.

SS12

ERCIP - EUROPEAN RIVER CORRIDOR IMPROVEMENT PLANS - A JOINT AGENCY APPROACH TO MANAGING RIVER CORRIDORS.

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The European River Corridor Improvement Plans project (ERCIP) is being developed as a transferable model of effective joint agency river management. ERCIP is part funded by the EU European Regional Development Fund through the INTERREG IVC programme from January 2012 to December 2014 and involves partners from the UK, Germany, Greece, Italy and Romania.
The aim of the ERCIP project is to promote the exchange and improvement of current experience regarding jointly produced River Corridor Improvement Plans (RCIP). The objective is to achieve by improving the integration between national and regional environment agencies or water boards with local government and planning authorities. This will improve the results when carrying out a range of river corridor management processes related both to the protection and future development along geographically sensitive river corridors.
ERCIP aims to provide best practice examples on how to jointly manage a range of activities along river corridors of different sizes in urban, semi-urban and rural environments by covering the following issues:

- How to establish, manage and maintain a co-ordinated approach and develop formal processes to river corridor management between the relevant authorities in order to work together on strategic issues.
- How to identify and agree short, medium and long term priorities by developing environmental risk prevention and planning and design policy with supporting guidance that is jointly owned and implemented by all parties.

This approach allows for three complementary levels of embedded policy results, each one an outcome in its own right but with the potential to be developed further:

1. A (formal) commitment to joint working
2. Preparation of, or improvement to, a local RCIP
3. Adoption or publication of a RCIP.

By implementing these objectives through a bottom up approach, the project aims to address issues arising from the EU Water Framework Directive and Floods Directive. This includes how local government and their communities can be motivated to actively participate in the processes involved in enjoying, owning and maintaining river corridors to deliver maximum environmental, social and economic outcomes.
ERCIP encourages participating organisations to develop a shared understanding of river corridor management issues (environmental pressures, climate change, the pressures of development) and how to address their impact on the environmental, economic and social sustainability of an area.

SS01

CO-OCCURRENCE OF FUNCTIONAL GROUPS IN PHYTOPLANKTON ASSEMBLAGES DOMINATED BY DIATOMS AND CHRYSOPHYTES

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Phytoplankton assemblages of four deep karstic lakes in Croatia and the ecological conditions correlating to those assemblages during succession period were investigated. Samples from lakes Prošće, Kozjak, Visovac and Vransko were taken monthly throughout 2009 and 2010 at 5 m intervals from the surface to the bottom in the deepest part of the lakes. Species with high affinity for nutrients or capability of mixotrophy dominated in all investigated habitats. Changes in the structure of the community reflecting dominant interannual succession in phytoplankton assemblages for each lake were caused by the same taxa: *Cyclotella*, *Dinobryon*, *Ceratium*/*Peridinium*, except for Lake Visovac where *Oocystis* was also well represented. Statistical analyses confirmed that these common taxa reflect conditions in the oligo-mesotrophic habitats. It is considered that the functional approach by Reynolds is a method that captures much of the species ecology, and therefore can be successfully used as a method of describing successions. Results of its application on the phytoplankton communities of deep karstic lakes confirmed association E, with *Dinobryon* species as descriptive representatives, as main functional group in lakes Prošće and Vransko. Group B, with *Cyclotella* as a descriptive genus, dominated in lakes Kozjak and Visovac. Functional groups B (A), E and L_0 co-occurred in 50-90% of samples for all investigated habitats. Those three functionally well-adapted groups interchange in dominance during seasonal cycle and, thus, likely tolerate the constraining conditions of nutrients deficiency more successfully as an aggregated group. The fact that three groups describe such high percentage of community variation additionally accentuates the importance and applicability of functional groups. Do we marginalize the role of species biodiversity by applying the functional groups and then aggregating multitudes of different groups? Aggregating species into groups can be largely subjective process and can provide only selective information about individual species observed in the field. Also, aggregation of functional groups in our systems puts conclusions at a greater distance from empirical results, so it seems reasonable to propose a hybrid approach that relies on simple model of the species taxonomical classes and functional classification, which can successfully describe a variety of species in deep karstic lakes.

R05

SELECTIVE FEEDING OF FISHES IN A DETRITUS-BASED SANDY LOWLAND BROOK?

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Sandy lowland brooks are the most common small streams in the northwestern German lowlands, but as they flow through strongly agriculturally used land they have been heavily impacted by human activities in various ways. In many cases, stream morphology is thoroughly affected by regulation and installation of non-natural riverside-structures. Very commonly artificial fish stocking has led to alteration of the communities due to release of large-growing fishes for fishing purposes. Despite the high anthropogenic pressure still relatively few is known about the ecology of these lowland brooks, particularly concerning functional interactions such as foodweb characteristics.
The goal of this study was to examine the feeding habits of the fish community in a small sandy brook (Ladberger Mühlenbach, Northrhine-Westphalia, Germany) representative for a widespread type of running waters in the Central European lowlands. To assess the trophic relationships of consumers the fish as well as the benthic communities were sampled monthly over half a year. Analysis of stomach contents of the fishes revealed two different feeding types: detritivores (including only Cyprinidae; foremost roach, *Rutilus rutilus* and Prussian carp, *Carassius auratus gibelio*) and benthivores (mostly stone loach, *Barbatula barbatula* and three-spined stickleback, *Gasterosteus aculeatus*). The detritivores mainly foraged on detritus, but also benthic invertebrates were found in their stomachs. This latter prey (especially some Trichoptera and Coleoptera, which were selected with a high preference) was strongly associated to hard substrates, only present in the brook as coarse detritus. Benthivore fishes only foraged on benthic invertebrates, mostly Gammaridae and Chironomidae, which were the most dominant elements of the macrozoobenthos. Niche overlap between these two foraging groups was very low, while the within-group overlap was rather high. The results revealed that food was not a limiting factor, which led to the conclusion that a direct competition for food between most of these species in this brook seems most unlikely.

R07

IMPACT OF TEMPERATURE, PH-VALUE AND PEAT QUALITY ON ANAEROBIC CARBON DIOXIDE PRODUCTION AND METHANOGENESIS IN PEAT FROM A CANADIAN BOG

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Peatlands are of great importance as carbon stores, but release carbon dioxide (CO_2) and methane (CH_4), too. With this incubation experiment of 73 days I tried to evaluate what influence temperature, pH-value and peat quality have on the CO_2 and CH_4 release in the water saturated, anoxic layer in a Canadian bog.
Initial production rates were lower for CH_4 with 0.018 to 0.180 µmol g_{DW}^{-1} d^{-1} than for CO_2 with 0.399 to 2.27 µmol g_{DW}^{-1} d^{-1}. They seem to depend on the experimental set-up in incubations. Higher temperature had an increasing effect on the initial production rate of both gases, but the effect was greatest for high temperatures on methanogenesis with Q_{10} values of 0.45 for a temperature range at low temperatures and 26 at high temperatures. Production rates increased with pH for CO_2. Production rates in pH treatments for CH_4 did not differ much between treatments. Rates were below those of the comparison-treatment at 20.1 °C and original pH.
A slow-down in production was detected within 32 to 39 days for CO_2 and later, within 39 to 52 days, in pH-value treatments for CH_4. The amount of gases released before a slow-down reached from 9.93 to 91.6 µmol g_{DW}^{-1} for CO_2 and 1.12 to 9.02 µmol g_{DW}^{-1} for CH_4 and was likely to depend on a limitation of easily decomposable substrate. Either higher temperatures and pH-values led to an activation of additional decomposable material for CO_2 production, production was suppressed by some toxic substance at low temperature or pH-value, or the produced substances were consumed by a process following production. Methanogenesis was probably suppressed by the availability of electron acceptors. Optimum pH-values for methanogens seemed to be at a pH between 5 and 6.
Peat from depth greater than 50 cm did presumably not produce any CO_2 or CH_4 due to missing decomposable material or a lack of microorganisms, making it unlikely, according to my incubation, that such peat contributes to CO_2 and CH_4 release from this Canadian bog.

R02

DEVELOPMENT OF MICROSATELLITES FOR POPULATION GENETIC STUDY OF *HETEROTRISSOCLADIUS MARCIDUS* (DIPTERA: CHIRONOMIDAE) IN ALPINE LAKES

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Lakes of glacial origin represent more than 90% of all natural lakes in Slovakia. Investigation of benthic fauna inhabiting the Tatra lakes (Slovakia, Central Europe) has relatively long tradition. However, we still know very little about genetic structure and variability of populations of alpine aquatic organisms, especially small macroinvertebrates such as chironomids. According to previous studies, a midge *Heterotrissocladius marcidus* (Walker 1856) is the most widely distributed chironomid species in the Tatra lake district, and its larvae.(easily determinated) are an important part of the littoral assemblanges. At the first phase of population-genetic study, we are developing microsatellite markers for this species using next generation sequencing (NGS) technology. Because of NGS requirements and very small size of larvae, the genomic DNA was isolated from pooled sample including several specimens (larvae were collected in Okrúhle pleso lake (Mlynická dolina valley). The DNA was subjected to 454 sequencing at the GS-FLX LAB of Macrogen (Seoul, Korea). Even the concentration of gDNA did not meet NGS requirements, 1/8 plate sequencing generated 104,299 reads (50.3 Mb) with an average length of 414.244 bp. The raw data were analyzed with MSATCOMMANDER software, and tri- , tetranucleotide repeats were set. 208 suitable loci were recovered. Subsequently primer pairs were designed for these loci using Primer3 software. The selected microsatellite loci are tested for their variability, using specimens from different subpopulations in the Tatra Mts. Using selected loci and analyzing *H. marcidus* population we expect to describe population-genetic structure of *H. marcidus* in highly fragmented (sub)alpine biotopes, imply whether the population of *H. marcidus* is stable or not, but also monitor gene flow in alpine area, distributional trends of threatened species and identify their possible refugia. Consequently, this research can help to preserve unique aquatic environments and their biodiversity. Beside population study, the data on intraspecific variability will serve for development of determination technology of animal species using DNA. This contribution/publication is the result of project implementation (ITMS: 26240220049) supported by the R&D OP funded by the ERDF.

SS02

PARASITES OF AQUATIC INSECT LARVAE: ARE THEY RELEVANT FOR WATER QUALITY ASSESSMENT?

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Insects with aquatic larval stages like mayflies, stoneflies and caddis flies are important parts of biocenoses due to their high abundance and diversity in freshwater habitats. Also, many species are important indicators for water quality assessment. Surprisingly, their role as hosts for parasites has not been investigated in detail so far. In an ecological context, parasites are of importance as they might influence host abundance due to decreased vitality or increased predation rate of infected individuals. This will have an effect on species composition in an ecosystem with parasites compared to one without. Additionally, parasites mostly have complex life cycles and thus indicate the presence of more than one host species in the habitat. For this reason, considering parasites will improve the validity of biological water quality assessments.

In our study, we focused on the occurrence and abundance of helminth parasites (cestodes, trematodes, nematodes and acanthocephalans). Brown trout (*S. trutta*) and invertebrate samples were taken at the Ruhr river close to Meschede in North Rhine-Westphalia. Fish were checked for parasites by routine methods and parasite species were identified morphologically. Insect larvae were identified and checked for parasites morphologically and by PCR with primers specific for relevant trematodes/cestodes and nematodes. PCR products were sequenced and compared to sequence information in the Genbank.

Various parasite species were found in brown trout (*S. trutta*), mostly the trematode *Crepidostomum* sp., the cestode *Cyathocephalus truncatus*, the nematodes *Raphidascaris acus*, *Cystidicoloides ephemeridarum*, and the acanthocephalan *Echinorhynchus truttae*. In insect larvae, cestodes and trematodes were detected in the mayflies *Seratella ignita* and *Ephemera danica*. According to the sequencing results, one of the trematodes belonged to the family Allocreadiidae, while no clear results were obtained yet for the trematode from *S. ignita* and the cestodes.

We will discuss possible links between fish parasites with unclear life cycles and parasite stages detected in aquatic insect larvae in order to assess the usefulness of parasite communities in biological water quality assessments and to gain further information on parasite biology.

SS08

INTER-BIOME COMPARISON OF DISSOLVED ORGANIC MATTER COMPOSITION AND CONCENTRATION IN STREAMS OF AGRICULTURAL CATCHMENTS

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Land use development from pristine to agricultural land use is a major global trend and may change the concentrations of dissolved organic carbon (DOC), nitrogen (DON) and phosphorus (DOP) in aquatic ecosystems. Until now it is unclear, if this effect is consistent across the globe, since no comparative studies across various biomes exist. Thus, a globally comparable data set on the effects of agriculture (arable land and pasture) on DOC, DON and DOP export would help elucidating the potential role of agriculture. To achieve this, we took five to ten samples from each pristine, arable or pasture catchments during the two main seasons in Denmark, Germany, Spain, Brazil, Uruguay and Chile. We used the same protocol for the choice of the catchments and sample treatment. Moreover, all samples were measured in the same laboratory and background information on all catchments was gathered (land use, soil types, climate). We measured absolute DOC, DON and DOP concentrations and used size-exclusion chromatography to measure DOC and DON composition, as well as spectroscopic measurements combined with parallel factor analysis to determine the composition of the chromophoric dissolved organic matter. Our dataset will provides first insight into the effects of agriculture on DOC, DON and DOP composition and concentrations in streams at a global scale. This information will enable to understand, if the results of agricultural land use on dissolved organic matter concentration and composition mainly gathered in the temperate biome are transferrable to other biomes and it will open new perspectives for future studies on dissolved organic matter in anthropogenic landscapes.

SS06

BIOLOGICAL QUALITY ELEMENTS AND TEMPORARY GREEK STREAMS AND RIVERS.

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In recent years various biotic indices began to be implemented in Greece for the assessment of the quality of surface running waters. These indices were based only on microinvertebrates but the most important thing is that the specific indices were also developed in other European countries as well, where obviously different environmental conditions and pressures apply. However, along with the development of certain Biotic Indices for macroinvertebrates, efforts are currently being made for the development of corresponding indices based on the rest of the Biological Quality Elements.
Among the first months of the implementation of Biotic Indices based on benthic macroinvertebrates and especially in temporary streams and rivers, great discrepancy was noted between results – findings which concerned the relationship of the Biotic Indices with the scores, the physicochemical and chemical results, as well as with the various pressures or not (reference sites) in the aquatic ecosystems.
The principal limiting factor for the genuine ecological finding was actually a number of factors, such as the duration of the aquatic period, the time that it commences, whether it occurs only once or more than once per year, as well as the sudden extreme flood events.
Also a dynamic relationship was noted between narrow riverbed and floodplain surface with the composition and abundance of biodiversity, but also with other elements such as riparian vegetation, slope, substrate etc. Similar results are being recorded concerning the biodiversity of macrophytes but most acutely. Regarding the fish fauna, the above relationship applies only in cases where there are certain pools annually or the river basin with the temporary stream or river consist a sub-basin of a river system of continues flow in which case the fish recolonize the ecosystem during the flood season. Particular interest exhibits the rivers batch due to human factors, as in the case of dams in ponds. In these ecosystems and especially in the estuaries the constant change between freshwater- saltwater, hot – cold, strong flow etc creates dramatic conditions for the entire aquatic biodiversity and generally for the Biological Quality Elements. In the present study important and specific issues will be developed and presented for the tackling of the subject of biotic indices in temporary streams and rivers throughout Greece and Europe.
Keywords: Greece; temporary rivers; drought; biological quality elements

SS02

*STENTOR AMETHYSTINU*S: ECOLOGICAL CONSEQUENCES OF MULTITROPHIC INTERACTIONS

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Studies on intra- and inter-specific interactions even with higher organisms demonstrate that bacteria can rapidly adapt to temporal and spatial changes in their environment. Aquatic bacteria have optimized and dramatically expanded their living space by efficient exploitation of organic matter point sources such as particles/aggregates and higher organisms. Higher organisms are “hotspots” for microbial growth and transformation processes, but they have not been taken into account for sampling strategies of aquatic microbial ecologists, who often focus solely on the free-living bacterial fractions and *a priori* exclude higher organisms by non-representative water sampling. Therefore, it is not surprising that aquatic microbial ecologists have largely overlooked the fact that many aquatic bacteria may possess a complex life style and frequently alternate between a free-living and an organism-associated stage. We have studied the freshwater ciliate *Stentor amethystinus* as a model system to evaluate ecological consequences of multitrophic interactions. Here, we propose that modern concepts in aquatic microbial ecology should take into account the presence of higher organisms as an important bacterial habitat and hotspot of microbial processes of biogeochemical relevance. Interactions of aquatic bacteria with living organisms are the key to understanding their physiological adaptations and population dynamics, as well as their contribution to global biogeochemical cycles.

R01

DRIFT EXPERIMENTS ON THE MIDDLE DAUGAVA RIVER AT THE FILLING PHASE OF THE SPRING FLOODS

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In order to assess the role of turbulence intensity and other environmental factors in downstream transformation of main physical, chemical and biological characteristics of the drifting river water masses in-situ, two real-time Lagrangian drift experiments were performed on the Middle Daugava at Daugavpils City (South-East Latvia) at April 8, 2010, and April 12, 2011, respectively. Both drift experiments were performed at the filling phases of the anual spring floods by applying a manned drifting research platform, which was equipped by two floating anchors, a HACH DS5 multiprobe, a GPS receiver, an echo sounding device, a Secchi disc and a zooplankton sampling net.
Both experiments lasted for about 11 hours, and a downstream distance of 60 km was covered. The in-situ research program included manual subsurface water and phyto- and zooplankton sampling, as well as simultaneous measurements of the water mass temperature, pH level, red-ox potential, conductivity, turbidity, dissolved oxygen concentration and saturation, and the chlorophyll a content at the depth of 0,5 and 5 meters at regular time intervals (30 min). At each sampling site, measurements of the water mass transparency, drift speed and river depth were also performed. Samples of zooplankton were obtained by filtering 100 l of water through the plankton net. From each zooplankton sample, 3 subsamples 6 ml in volume were selected and examined according to standard methods. Phytoplankton samples 0,5 l in volume were collected manually from the water surface, and a 10 ml subsample was analysed according to the inverted microscope method.
During the first drift experiment at April 2010, the planktonic loricate species (Keratella cohlearis) and benthic (Bdelloida) species dominated within the zooplankton communities of the Daugava River by biomass and abundance, whereas the soft-bodied species were least abundant. An impact of the turbulence and other enviromental factors was found in a positive correlation between the turbidity gradient and the Bdelloida biomass, as well as in its negative correlation to the drift speed. During the second drift experiment at April 2011, the role of the turbulence was found in a positive correlation between the drift speed and the biomass of large-sized benthic Bacillariophyta algae (Gyrosigma acuminatum, Pinnularia sp., Cymbella sp.), as well as in a negative correlation between the drift speed and the biomass of the planktonic Rotifera species Notholca squamula.

R14

EFFECTS OF FLUOXETINE ON LIFE HISTORY PARAMETERS OF *DAPHNIA MAGNA*

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All kinds of pharmaceuticals are being detected in surface waters. Drugs and their metabolites are present in freshwater ecosystems in concentrations that are potentially hazardous to aquatic organisms. Antidepressant pharmaceutical – fluoxetine (Prozac, Sarafem) was shown to be present in the discharge of waste waters and surface waters in concentrations up to 540 ng/l.
The effects of long exposure of three *Daphnia magna* clones to three concentrations (360 ng/l, 720 ng/l and 1440 ng/l) of fluoxetine on key parameters of life history were investigated. Effects of fluoxetine on age and size at first reproduction, and number and size of neonates were examined during five subsequent generations. The effect of flouxetine will be disused in the light of already published data.

R07

COMPARATIVE STUDY OF NUTRIENT RELEASE FROM SEDIMENT OF THE KÜÇÜKÇEKMECE LAGOON UNDER FIELD AND LABORATORY CONDITIONS

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In this study, nutrient release from sediment of the Küçükçekmece Lagoon, a B class wetland site within the Istanbul Metropolitan area, was measured in monthly intervals in four stations between the October 2006 to February 2008 using the Kajak core.
The data obtained under field conditions showed that the highest values of nitrate (NO_3-N) and ortophosphate (o-PO_4) were 3.39 mg l^{-1} and 6.62 mg l^{-1}, respectively. However, the highest value of NO_3-N was measured as 3.41 mg l^{-1}, while the highest value of o-PO_4 2.95 mg l^{-1} under laboratory conditions. From these results, the highest values of nitrate and orthophosphate fluxes were calculated as 3035 and 1487 mg m^{-2} day^{-1}, respectively. Significant differences in the measured nutrient values were found between the deepest and costal stations under field conditions, Laboratory studies was also performed, however the results obtained under laboratory conditions generally did not exhibit such a difference ($\rho<0.05$). In conclusion, our data indicate that nutrient load of the Küçükçekmece Lagoon is at a level that characterizes highly eutrophic lakes.
The flux measurements were used to estimate the share of internal nutrient loads over the total nutrient loads into the lagoon. The investigations have shown that sediment fluxes cover 45% of the nitrogen loads and 85% of the phosphorus loads into the lagoon on annual basis revealing the importance of sediment fluxes on the progress of eutrophication in the Küçükçekmece Lagoon.

R13

GROWTH OF *PSEUDORASBORA PARVA* (TEMMINCK & SCHLEGEL,1846) INVADING KOCADERE RESERVOIR IN THRACE REGION OF TURKEY.

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The topmouth gudgeon *Pseudorasbora parva* is an exotic and invasive freshwater species, has spread from East Asia from Europa during the last 50 years. *P. parva* was first recorded in 1982 from Thrace Region of Turkey. Despite its rapid invasion, there is very limited information on biological properties of *P. parva* living in Turkish freshwaters. This study aims to show the invasive characteristics of *P. parva* in the Kocadere Dam Lake. The growth characteristics were studied by the data obtained from the measurements of 123 species collected on monthly basis between March 2012 and December 2012.

SS13

HYDROLOGICAL MODELLING FOR RECENT AND FUTURE CONDITIONS TO PROVIDE DISCHARGES AS INPUT OF HYDRO- MORPHODYNAMIC AND HABITAT MODELS

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According to the European water framework directive, good ecological conditions have to be achieved in a catchment-based approach. To model the occurrence of the biological target species, a model chain from hydrological catchment models via hydraulic reach models to biotic habitat models has to be developed. This model chain for the current conditions can then be used in different model scenario runs to assess the effect of eco-hydrological changes on the abiotic and biotic conditions.

This study is focused on the hydrological modelling at the catchment scale as the first step of the IMPACT model chain. The spatially distributed eco-hydrological model SWAT is applied to the Treene catchment in Northern Germany and to the Célé catchment in Southwestern France. In a multi-site calibration, the SWAT model is adapted to the conditions of the study catchments. The model performance is assessed by calculating several performance measures for different hydrological stations at the outlet and within the study catchment. The modelled discharge of SWAT can be used as input for hydraulic modelling in the river reaches within the IMPACT model chain.

The effect of changing conditions is exemplarily shown for climate change scenarios in the Treene catchment. For this, two scenario runs with linear temperature increases of 0K and 3K until 2060 provided by the regional climate model STAR are compared.

The comparison of modelled and measured discharge time series shows that SWAT is able to reproduce the discharge conditions for all hydrological stations in the two study catchments for recent conditions. The comparison of the two climate change scenarios illustrates decreasing discharge in the 3K-scenario. The largest decrease can be observed in low flow periods in the autumn months.

The modelled discharges of both scenarios provide an input for the next models within the IMPACT model chain to assess the effect of climate change on the morphological and habitat conditions as presented in the following presentations.

R09

USING BENTHIC ALGAE (EXCL. DIATOMS AND CHAROPHYCEAE) FOR ASSESSING THE ECOLOGICAL STATUS OF RUNNING WATERS IN GERMANY

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A method, called 'PHYLIB' procedure, exists in Germany to assess the ecological status of running waters by means of the composition and abundance of the aquatic flora (Schaumburg et al., 2004, 2005). It considers three components, i.e., aquatic macrophytes, benthic diatoms, and benthic algae of other organismic classes. Focusing on the non-diatom algae called 'phytobenthos without diatoms' (PoD) the current status quo of application will be presented after a basic revision of the method was realized on behalf of the Federal Environment Agency (Umweltbundesamt) of Germany in 2010. Basic analyses made for this revision showed that the component reveals relevant data for monitoring. PoD occurs generally in all types of running waters in Germany. Many taxa were characteristic for special geomorphological types of running waters, like those of the alps, of the alpine foothills as well as of siliceous or calcareous rivers in the Central Highlands. The small siliceous rivers in the Central Highland with predominantly coarse substrates are especially rich in number of taxa and also exhibit high abundances of PoD. To specify the indication value of the taxa, tolerances and their preferential occurrence with regard to physical and chemical parameters were investigated and literature data were considered. In summary, a list of now 231 indicator taxa was established. Indicator taxa were classified into four categories (indication groups) for nine types of running waters. For the assessment of a sampling site, the abundances of these indicator species are used to calculate an index from which the ecological status can be inferred. All details of this routine and software for application are available at http://www.lfu.bayern.de/wasser/gewaesserqualitaet_seen/phylib_deutsch/index.htm including an English version.

SS08

LINKAGE BETWEEN THE TEMPORAL AND SPATIAL VARIABILITY OF DISSOLVED ORGANIC MATTER AND WHOLE STREAM METABOLISM

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Dissolved organic matter (DOM) is an important resource for microbes, thus affecting the whole stream metabolism. The factors influencing its chemical composition and thereby also its bio-availability are complex. We hypothesized that the whole stream metabolism itself can affect the DOM composition and that the coupling of both is influenced by seasonality and different land use forms. We tested this hypothesis in a comparative study on two pristine forestry streams and on two non-forestry streams. The investigated streams were located in the Harz Mountains (Central Europe, Germany). The whole stream metabolism was measured with a classical two station oxygen change technique and the variability of DOM with fluorescence spectroscopy.
All streams were clearly net heterotrophic, whereby the non-forestry streams showed a higher primary production in general, which was correlated with irradiance and with the total phosphorus concentration. The whole stream metabolism but also the chromophoric DOM (CDOM) showed distinct seasonal patterns. We detected three CDOM component groups (C1, C2, C3) by the use of the parallel-factor-analysis and found temporarily variable, typical component fingerprints (C1:C2, C1:C3, C3:C2) for CDOM originated from forestry streams and from non-forestry streams. Based on comparative literature studies and correlation analysis with different indices, we demonstrate that two of the components are clearly from terrigenous sources (C1, C3) and one is rather autochthonously (C2) derived. The whole CDOM matrix was dominated by humic like, high molecular-weight substances, followed by humic like, fulfic acids, low molecular-weight substances, and with minor amounts of amino-acids and proteins. We showed for the first time a correlation between the gross primary production (GPP) and the autochthonously derived, low molecular weight DOM. The amount of autochthonously produced DOM increased overall with increasing GPP, as indicated by a tight, positive correlation between the fluorescence index or C2 and the ratio of GPP and the daily community respiration (CR_{24}).
This study showed the linkage between whole stream metabolism and DOM composition, based on a new integrated approach. We demonstrated that this relationship is influenced by seasonality and different land use forms. These complex mechanisms lead to typical DOM fingerprints for streams pass through the different land use forms.

R03

A LONG TIME BETWEEN DRINKS: THE INFLUENCE OF INCREASED RIVER FLOWS ON UPPER MURRUMBIDGEE RIVER CONDITION

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The negative effect of dams on river condition is well documented. Tantangara Dam on the Upper Murrumbidgee River in south-east Australia has resulted in ecological communities adapted to invariant conditions. An environmental flow (EF) regime has been recommended for the river and as a part of this regime an EF of 1500 ML/day was released in October 2011. Following the EF, a natural flow (NF) of 6000 ML/day occurred in December 2011. This study determined the effect of the EF and NF on macroinvertebrate communities downstream of the dam. Macroinvertebrates were collected from the Murrumbidgee River and compared with those collected from the unregulated Goodradigbee River. Following high flow events macroinvertebrate assemblages in the Murrumbidgee River were more variable than those in the unregulated Goodradigbee River, which also experienced high flow events. This illustrates that macroinvertebrates in the Murrumbidgee River may not be as adapted to high flows. This result also has implications for how environmental flows are delivered to flow deprived rivers, by showing that one off pulses may be less favourable to river condition than longer term release programs.

R12

OPERATIONAL PAN EUROPEAN FRESHWATER MONITORING USING EARTH OBSERVATION TECHNOLOGIES

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Satellite based mapping of water quality has been developed and established in the past decades as a powerfully tool to monitor the ocean and coastal areas worldwide. With an increasing number of spatially high resolved satellite sensors and improved algorithms, it is nowadays capable to monitor also smaller inland waters and rivers at pan-continental levels. These capabilities will be signifcantly extended with the upcomming SENTINEL satellites of the European COPERNICUS program. In the frame of FRESHMON, a FP7 funded downstream project to foster space applications, significant efforts are done to create continuous and well accepted services for inland water monitoring at European level. Water quality products such as suspended matter, secchi depth, organic absorbers and chlorophyll of inland waters were generated and validated for a variety of temporal and spatial scales in various countries. The results underline that the method is now capable for harmonized monitoring on intercontinental levels, covering long-term measurements as well ongoing near-real-time deliveries from fully operational processors, on multiple scales from small lakes, river to whole river systems. The capabilities, validation examples and also the technical restrictions of the new technology are discussed on base of various freshwater systems and applications in various countries, over lakes and rivers.

SS08

DOC-TRENDS IN SAXONIAN RESERVOIR TRIBUTARIES

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The State Reservoir Administration of Saxony operates 23 drinking water dams with an overall storage capacity of 236 million cubic meters, which are situated in the low mountain ranges of the Erzgebirge along the border to the Czech Republic. The water quality of these reservoirs and their tributaries is regularly (as a rule once a month) monitored since 1993. Depending on structure and use of their drainage basins, the concentrations of many water quality criteria of 22 reservoir tributaries vary in wide ranges and mostly show significant and synchronous temporal trends. Special attention was paid to dissolved organic carbon (DOC), which tends to increase in many Saxon reservoirs and reached concentration levels that are problematic for raw water treatment and processing of drinking water. Correlation analysis results partly in corresponding and diverse interrelationships between chemical variables and with meteorological and atmospheric deposition data. Two common DOC-trends were detected by Dynamic Factor Analysis (DFA). Canonical correlation and DFA factor loadings were used to determine, which reservoir tributaries were related to a particular trend. The trend association in DFA was further used as grouping variable in a discriminant analysis of potential drivers for these common trends, including meteorological data, atmospheric deposition, chemical composition of stream waters as well as hydrographic properties of the watersheds and catchment sites. In conclusion of the study, a high proportion of the DOC-variance can be explained by key catchment and land use characteristics, air temperature, and precipitation.

R05

HOW IMPORTANT ARE INVERTEBRATE PREDATORS IN STREAMS? A FIELD STUDY TO COMPARE THE PREDATION IMPACT OF FISH AND INVERTEBRATES

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It has been suggested that invertebrate predation can be more important than vertebrate predation. This assumption is mostly based on small-scale experiments with these predator types while large-scale comparative studies of the consumption impact on a whole benthic prey community are rare.
We performed an ecosystem experiment following the Before-After-Control-Impact design in two mountain streams in Germany. After two years with similar density of benthic fish (*Gobio gobio, Barbatula barbatula*) in one reference and one experimental stream (phase 1), we manipulated the experimental stream by removing all fish (phase 2). We quantified the consumption of the benthic fish population and the most important predatory invertebrates including omnivores to compare the predation impact on the benthic community by these predator types. Although the biomass of fish was higher than that of all invertebrate predators together, their specific consumption rate was generally lower. This resulted in an invertebrate consumption and predation impact, which were similar to or even higher than consumption and predation impact by fish. Consequently, the absent fish consumption in the fish-free stream food web during phase 2 was compensated by a higher consumption of invertebrate predators due to biomass increases. This compensation was much more pronounced in riffle habitats, indicating that predator prey relationships might be more mesohabitats specific than previously assumed. We conclude that the predatory invertebrates' consumption compared to fish is mostly underestimated in natural streams and suggest to consider it more consequently in trophic experiments.

R11

REHABILITATION PLANNING FOR FRESHWATER ECOSYSTEMS: COPING WITH MULTIPLE OBJECTIVES IN COMPLEX DECISION MAKING SCENARIOS

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Freshwater ecosystems are among the most diverse environments on Earth but also one of the most degraded and threatened due mainly to the intense human modification and exploitation. The poor conservation status of freshwater biodiversity and the risk to the future maintenance of services that humans receive from freshwater ecosystems calls for rehabilitation projects as a global priority. Despite the increase in funds devoted to rehabilitation little success has been reported so far. Planning for rehabilitation entails complex decision making, since stakeholders have to decide what set of actions to implement from a vast number of combinations of action types, timing and their locations to maximize the benefits. These complexities demand the use of new tools to help overcome the poor performance of rehabilitation.
We apply the principles of systematic planning to rehabilitation to integrate ecological and socio-economic aspects in the planning process, and then enhance cost-effectiveness of rehabilitation plans. We apply a multiobjective optimisation Simulated Annealing algorithm (MOSA) to find a set of near-optimal solutions among the vast number of candidate combinations of rehabilitation actions and multiple competing objectives. We use a Pareto-front to demonstrate the trade-offs between the different objectives being addressed and help stakeholders understand the implications of different rehabilitation options.
As proof of concept, we use a rehabilitation project in South East Queensland (Australia) that aims to reduce sediment loads and improve the ecological health of rivers while minimizing the impact of project implementation in local economy.
We found that trade-offs between the different objectives were driven by two main rehabilitation strategies: concentrating the budget on reducing sediments or improving the ecological health at a higher socio-economic cost. These strategies resulted in rehabilitation plans shaped by different rehabilitation actions and areas of implementation.
There is an urgent need for improving rehabilitation success by making plans more cost-effective. This requires better informed decision-making. We suggest using optimization methods to process and organise the information offered to stakeholders, to facilitate the understanding of trade-offs between competing objectives and select the most appropriate rehabilitation plan according to their priorities.

R05

INFLUENCE OF RIPARIAN VEGETATION ON TEMPERATE STREAM FOOD WEB: SEASONAL VARIATIONS ALONG A SHADING GRADIENT

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Riparian vegetation is of paramount importance for stream ecology but the underlying mechanisms are still poorly understood. For instance, riparian vegetation plays a key role in determining the nature and amount of autochthonous and allochthonous organic matter entering the streams. In temperate regions, both aquatic primary production and terrestrial organic matter are strongly influenced by the seasonal patterns displayed by riparian vegetation: i.e. leaf emergence in spring and leaf fall in late autumn. Still it remains unclear, how these seasonal patterns affect the contributions of autochthonous and allochthonous organic matter to stream food webs. Here, we shed light on the seasonal variations of stream food webs in relation with the processes of leaf emergence and leaf fall.
Using stable isotope analysis of nitrogen, carbon and hydrogen, we studied stream food webs in four sites differing in their riparian vegetation (from meadow to forest) at four different dates (before leaf emergence, just after leaf emergence, before leaf fall and just after leaf fall). All sites were located maximum 50 km from each others, so that they display homogenous geological and climatic conditions. Following a quantitative sampling, we estimated the biomasses of macroinvertebrates and fish. Accordingly, we analysed the isotope ratios of the representative taxa (1531 values) from basal resources (algae, macrophytes, biofilm, suspended organic matter and leaf litter) to consumers (macroinvertebrates and fish).
In a first step, we described the food web trajectories across seasons, using circular statistics on different food web metrics. In a second step, we estimated the contributions of autochthonous and allochthonous organic matter to the food webs, running isotopic mixing models. Given the riparian vegetation differences between sites, we expected a sharp contrast in terms of food web functioning, with sites mainly influenced by aquatic primary production (meadow sites), and sites mainly influenced by allochthonous organic matters (forested sites). In addition to these differences between sites, we expected to observe a seasonal variation of food web at each site, in relation with light availability and terrestrial inputs of organic matter.

SS12

LIFE11 NAT/LU/857 "RESTORATION OF *UNIO CRASSUS* RIVERS IN THE LUXEMBURGISH ARDENNES" 2012-2018: A SUMMARY DESCRIPTION OF THE PROJECT.

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The thick shelled river mussel *Unio crassus* a formally abundant species of semi-lentic river habitats in Luxemburg has dramatically declined within the last fifty years. Small populations remain in the two rivers Our in the three country region of Belgium, Germany and Luxembourg and Sûre on the Luxemburgish Belgian border with about 9.000 individuals respectively 32.000 individuals. The two crucial problems of these catchments are the heavy load of fine sediments causing a clogging of the interstitial pore system, the key habitat used by juvenile mussels during the first years and the eutrophication. The aims of the present project are to improve the habitat quality of the two rivers Our and Sûre and to strengthen the existing populations by different actions.
An initial mapping phase in order to locate the siltation problems and the main entrances of nutrients, mainly from agriculture, will help to guide the further implementation of measures which consists in installing fences along the rivers to protect the banks against cattle erosion, in installing of water gutters on forestry and agricultural roads to prevent that the sediment loaded rain runoff runs directly in the rivers and in proposing to farmers agri-environmental measures in order to reduce in the catchment amounts of nutrients and fines.
In order to strengthen the existing populations of the two rivers the rearing facility at the Mill of Kalborn, will be used to develop rearing methods for *Unio crassus.* The propagated mussels will be released at well selected sites into the river Our and Sûre after they had been kept in captivity for 3 to 4 years.

R04

THE ROLE OF MACROPHYTE HERBIVORY AND PERIPHYTON SHADING IN AQUATIC VEGETATION COLLAPSE IN SHALLOW LAKES

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Submerged macrophytes play a structuring role in aquatic systems as they aid in stabilizing sediments, reduce nutrient resuspension, and provide refuge to zooplankton grazers. They can therefore promote a clear water state in lakes. Herbivory on aquatic macrophytes may hence critically compromise their functional roles. In shallow lakes, aquatic plants often appear less resistant to herbivory under eutrophic conditions than under nutrient-poor conditions. This runs contrary to established theory in plant ecology predicting that compensatory growth of plants is enhanced by nutrient richness. An important cause of the discrepancy may be the role of periphyton in aquatic systems, which has been hypothesized to be a major player in causing the decline and final collapse of submerged vegetation. The interactive effects of herbivory and periphyton on submerged macrophytes, however, have received little attention.
We propose the existence of feedback between the impact of the herbivores of macrophytes and periphyton shading on these submerged macrophytes. We predict that macrophyte herbivores negatively impact macrophyte biomass only when periphyton shading impedes macrophyte growth rates and 2) that periphyton shading is affected indirectly by vertebrate omnivores, which enhances negative effects on macrophyte biomass. Two mechanisms may be responsible for this effect: (1) consumption of aboveground macrophyte biomass remains largely uncompensated for due to competition for light with periphyton and (2) omnivorous fish and bird grazers cause trophic cascades by preferentially feeding on periphyton grazing macrofauna such as snails, amphipods and chironomids.
In this presentation we clarify concepts, review the literature and use a longterm dataset from Lake Müggelsee as a case-study to disentangle the impact of the two mechanisms.

R08

LONG-TERM AMELIORATION OF ACIDITY ACCELERATES DECOMPOSITION IN HEADWATER STREAMS

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The secondary production of culturally acidified streams is low, with a few species of generalist detritivores dominating invertebrate assemblages, while decomposition processes are impaired. In a series of lowland headwater streams in southern England, we measured the rate of cellulolytic decomposition and compared it with values measured three decades ago, when anthropogenic acidification was at its peak. We hypothesized that, if acidity has indeed ameliorated, the rate of decomposition will have accelerated, thus potentially supporting greater secondary production and the longer food chains that have been observed in some well-studied recovering freshwater systems. We used cellulose Shirley test cloth as a standardized bioassay to measure the rate of cellulolytic decomposition, via loss in tensile strength, for 31 streams in the Ashdown Forest over 7 days in summer 2011 and 49 days in winter 2012. We compared this with data from an otherwise identical study conducted in 1978 and 1979. In a secondary study, we determined whether decomposition followed a linear or logarithmic decay and, as Shirley cloth is no longer available, we tested an alternative in the form of readily available calico. Overall mean pH had increased markedly over the 32 years between the studies (from 6.0 to 6.7). In both the previous and contemporary studies, the relationship between decomposition and pH was strongest in winter, when pH reaches a seasonal minimum. As in the late 1970s, there was no relationship in 2011/2012 between pH and decay rate in summer. As postulated, decomposition in winter was significantly faster in 2011/2012 than in 1978/1979, with an average increase in decay rate of 18.1%. Recovery from acidification, due to decreased acidifying emissions and deposition, has led to an increase in the rate of cellulolytic decomposition. This response in a critical ecosystem process offers a potential explanation of one aspect of the limited biological recovery that has been observed so far, an increase in larger bodied predators including fish, which in turn leads to an increase in the length of food chains.

R04

INFLUENCE OF FLOW REGIME ON INVERTEBRATE COMMUNITY STRUCTURE IN MANAGED RIVERS

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The regulation of the world’s major river systems is threatening global biodiversity and generating the urgent need to manage river flows. One type of management is the delivery of restoration flows to regulated river systems. This is thought to help ecosystem recovery by mimicking a more natural flow regime and potentially restoring natural ecological processes and patterns. However, our understanding of the relationship between flow and ecological response is limited. Designing ecosystem-scale experiments and monitoring the delivery of restoration flows can help advance our knowledge of flow-ecology relationships. In this study, we carried out an ecosystem-scale experiment and manipulated flows in four managed rivers. One river received minimal flows (base flow), two rivers received natural flow pulses (natural flow) and one river received both natural flow pulses and the delivery of two restoration flows (restoration flow). We investigated whether changes in river flow regime can alter aquatic invertebrate biodiversity in the Edward-Wakool river system, located in south eastern Australia. The Edward-Wakool system is a major anabranch and floodplain of the Murray River and has a history of regulated flows for irrigation. We sampled aquatic invertebrate communities on small woody debris over a seven-month period. We measured invertebrate abundance, biomass, taxonomic richness and community structure. We showed that biological changes were most evident in the base flow river, which did not receive natural flows or restoration flows. In the base flow river benthic processes dominated with a greater biomass of consumers (“grazers”) that fed on benthic algae. Benthic processes were less important in rivers with natural flows or restoration flows. In contrast, there was a strong link between the abundances of filter feeding consumers and flow increases. The restoration flow river had greater abundances of filter feeders than the base flow and natural flow rivers. In general, for most invertebrate measures (biomass, taxonomic richness, abundance) the restoration flow river was similar to the natural flow rivers and therefore seemed to mimic natural flow regimes. In summary, shifts in river flow regime can drive changes in invertebrate communities which may have consequences for higher trophic groups such as fish.

SS10

MICROCOSMS TO ASSESS THE PROTECTIVENESS OF CHEMICAL QUALITY STANDARDS

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Quality standards to assess the chemical status of water bodies under the Water Framework Directive are often based on a few standardized laboratory tests and fixed assessment factors for extrapolation to the field situation. If larger data sets including tests with non-standard species are available, a statistical extrapolation approach, the Species Sensitivity Distribution approach (SSD) is applied. For assessing the remaining uncertainty on the SSD, the threshold concentration derived can be compared with data from field monitoring or model ecosystem studies. Taking the priority substance Ni as an example we present the use of microcosms to test the protectiveness of the quality standard derived from laboratory toxicity tests.
The study was conducted in 14 microcosms including a natural sediment layer and an overlaying water volume of 750 L located in a greenhouse. After a pre-treatment period for establishing a diverse aquatic community of phytoplankton, zooplankton, periphyton and snails, Ni solution was added to reach concentrations of 6, 12, 24, 48 and 96 µg Ni/L in two microcosms each. Four microcosms served as untreated controls. To achieve the intended constant exposure over the test period of four months, Ni concentrations were frequently determined in the microcosms and appropriate amounts of nickel solution were added mostly on a daily basis. Parameters known to affect Ni toxicity, i.e. water hardness, pH, and dissolved organic carbon, were also measured. Population abundance and community structure were analysed for difference to the dynamics in the controls.
In the microcosms with 48 and 96 µg Ni/L long-term effects on phytoplankton, rotifers, snails and, due to reduced grazing by snails, indirectly on the periphyton biomass were observed. Only minor, and/or temporary deviations from controls, i.e., for single sampling dates, were found for a few algae taxa at lower concentrations. Because these deviations showed no clear dose-response and were not found at the end of the study they were not seen as adverse effects. However, for the snail (*Lymnaea stagnalis*), effects on the trend of population development could not be excluded at 24 µg/L.
Thus, the overall No Observed Effect Concentration (NOEC) for a chronic exposure to nickel in this microcosm study was considered to be 12 µg Ni/L. This NOEC confirms the protectiveness of the quality standard derived from the laboratory single species tests.

R03

ECOLOGICAL CONTRAST OF SPRING FENS FOR CADDISFLIES: CHANGES IN SPECIALISTS/GENERALISTS RATIO ALONG THE MINERAL RICHNESS GRADIENT

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Spring fens, fed by mineral-rich groundwater, are mostly small and isolated habitat islands of specific environmental conditions. We can consider these habitat patches as „islands“, surrounded by a matrix of terrestrial habitats and other aquatic habitats. These island-like habitats can be colonized by specialists from other spring fens (interpatch dispersers) and by generalists from an adjacent matrix (matrix-derived species). The share of matrix-derived species is a measure of contrast between a matrix and an island.
The main environmental gradient, determining the richness and composition of species assemblages in spring fens, is the gradient of mineral richness (i.e. poor-rich gradient). It goes from acidic, mineral-poor bogs to extremely mineral-rich tufa forming fens. A change in ecological contrast for various aquatic invertebrates along this gradient can be expected, where the highest contrast should be at the ends of the gradient being the most ecologically different form the matrix habitats.
This study is conducted in the Western Carpathians, as all types of spring fens along the whole range of the poor-rich gradient are presented there. It this presentation we focused specifically on caddisflies (Trichoptera), which includes species with very good dispersal abilities (e.g. *Potamophylax nigricornis*) and also species that are supposed as rather poor dispersers (e.g. *Ernodes articularis*). We hypothesise that the ecological contrast become more important as species dispersal ability decreases.
This research is supported by the Czech Science Foundation (project no. P505/11/0779).

R09

PRELIMINARY ASSESSMENT OF CHIRONOMID PUPAL EXUVIAE (DIPTERA: NEMATOCERA) AS BIOINDICATORS IN THE RIVERS OF NORTHERN PORTUGAL

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This communication presents results on the evaluation of chironomid pupal exuviae as bioindicators as part of the FCT financed project “River biomonitoring: an integrative approach”, which aims to combine information from bioindicators, biomarkers and ecosystem function (leaf decomposition) to produce reliable metrics and indices from different levels of ecosystem organization to better identify cause-effect associations and are also ecologically relevant. Exuviae were collected seasonally over a two year period across a quality gradient in several rivers across northern Portugal using the European Approved Standard Method. The collected material was sorted and identified to genus in the laboratory. Over 6000 exuviae were collected from 61 genera. The most abundant sub family was the Orthocladiinae followed by the Tanytarsini, Chironomini, Tanypodinae, Diamesinae and the Prodiamesinae although seasonal shift in abundance of these subfamilies were observed. The most abundant genera were *Cricotopus* (Orthocladiinae) and *Paratrichocladius* (Orthocladinae). Data from all campaigns was agglomerated, transformed and analysed using nMDS and hierarchical clustering. Results showed distinct communities separating reference sites and degraded sites which were then tested using ANOSIM. Differences in physicochemical and habitat quality were tested using the Kruskall Wallis test and Dunn’s Test. The environmental and biological data were analysed using DCA and RDA to examine the relationship between the chironomid assemblages and the explanatory variables. A SIMPER analyses was then carried out to identify potential indicator genera which were then tested for optima and tolerance across the perceived quality gradient.

R14

TOWARDS ESTIMATING INVASION POTENTIAL: CSR (CELLULAR STRESS RESPONSE) IN TWO POPULATIONS OF THE KILLER SHRIMP, *DIKEROGAMMARUS VILLOSUS* (CRUSTACEA, AMPHIPODA) FROM DIFFERENT INVASION ROUTES

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Dikerogammarus villosus (Sowinski, 1894), a freshwater amphipod, originating from the Ponto-Caspian region, started to successfully colonize the large rivers of Central and Western Europe about two decades ago. Since that time, this species has revealed great invasion potential through its high euryoeciousness and competitive abilities as a predator. The goal of the present study was to compare the cellular stress response (CSR), and thereby, try to predict competitiveness between populations of *D. villosus* from two different invasion routes (rivers Rhine and Vistula) which advanced along ecoregions with significantly different environmental conditions. Both populations were proved to have different genetic structure, which may be associated with differences in cellular stress response reflecting levels of tolerance to environmental stressors, and thus indicate their invasion potential. To test this hypothesis, individuals were retrieved from the rivers Rhine (Germany) and Vistula (Poland) and kept under standardized conditions. Thermal stress response was measured during mid-term exposure to constantly elevated temperature. As a stress marker, 70 kDa HSP (HSP70) expression over time was analyzed. Entanglements within the results harbor an information potential, which allows for detailed interpretation and critical discussion of the link between physiology and invasiveness.

SS14

CAPACITY DEVELOPMENT IN INTEGRATED WATER RESOURCES MANAGEMENT (IWRM): LESSONS LEARNT FROM THE BMBF'S IWRM FUNDING INITIATIVE

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Integrated Water Resources Management (IWRM) is a highly complex issue and often perceived as being difficult to focus. Nonetheless it is a key process for achieving a more sustainable and equitable future. It has been recognized that Capacity Development for IWRM is one of the most urgent challenges, especially in developing countries. In order to support societies, science, administration and management worldwide, new and integrative approaches are needed for complementing classical ways of conveying knowledge.
The German Federal Ministry of Education and Research (BMBF) has launched a funding initiative for Integrated Water Resources Management (2006-2015). Within this initiative, German researchers, water managers and business-persons go abroad and apply their professional knowledge to the development of the water sector in the respective partner country. Capacity Development thus represents a core element in running R&D projects for the achievement of long-term solutions. During workshops and interactive meetings the experiences made in different countries were shared and new approaches for knowledge transfer in the light of strategic development of learning systems were discussed. The presentation will illustrate different Capacity Development strategies and summarize the main lessons learnt from a series of IWRM projects.

SS13

POPULATION MODELLING FOR AN ECOLOGICALLY MORE RELEVANT PESTICIDE RISK ASSESSMENT FOR FISH

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The vulnerability of an organism to chemical stress consists of a) its likelihood of exposure, b) its intrinsic sensitivity to the chemical and c) its ecological sensitivity considering its life cycle and recovery potential. The principle of vulnerability was adopted for this study in service of the ecological risk assessment (ERA) of pesticides for fish. Herein, we identify vulnerable representatives (focal species) of fish in edge-of-field water bodies and propose the use of population modelling for these species to improve the ecological relevance of ERA.
We first listed the European freshwater fish species which inhabit streams, ditches and ponds in agricultural landscapes and thus run a high risk of being exposed to pesticides. Then, ecological sensitivity of the listed species was compared by means of elasticity analysis on structured models which are built around the species' life histories. Interspecies comparison allowed the identification of species which were most sensitive to effects on fecundity, juvenile survival and adult survival. Based on this analysis focal species for a more detailed analysis of the different types of effects can be selected. For ERA of pesticides, only sub-lethal effects are relevant for extrapolation to the population level because fish should be protected against lethal effects on the level of individuals. Intrinsic sensitivity to pesticides was not used to define focal species because it is substance and context dependent. Thus, the sensitivity of surrogate species will be extrapolated to focal species by the use of established approaches in ERA.
To allow extrapolation of effects from the organism to population level while accounting for individual, spatial and temporal variability, an individual based model of fish was built. This model was parameterized for *Phoxinus phoxinus*, as one of the identified most sensitive species to effects on fertility. In the model, mobility, growth, survival and development, mating and reproduction and mechanisms of fish density dependence were considered.
We conclude that our stepwise approach is applicable to any type of stress, such as habitat change or competition by invasive species, following the steps of (1) identifying most susceptible species to the stressor of interest and then (2) identifying those species which are ecologically most vulnerable to the expected type of effect, followed by (3) an ERA based on a population model for the consequently identified focal species.

R11

HOW CAN WE CONSERVE THE THREATENED BOREO-ALPINE SPECIES IN ALPINE PONDS FACED WITH CLIMATE WARMING?

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Freshwater biodiversity has shown to be highly vulnerable to climate warming, with boreo-alpine species being especially at risk of becoming extinct. For ponds in the Swiss Alps, 42 freshwater species belonging to three different taxonomic groups (plants, beetles and dragonflies) were identified as potentially vulnerable to climate warming according to their thermal preferences. As a measure for mitigation of the effects of climate warming, increasing the connectivity between Alpine freshwater ecosystems should facilitate upward dispersal and colonisation. Therefore we developed an innovative approach which combines population genetics, landscape ecology and social analysis to assess the connectivity of alpine ponds with the objective to localize potential pond restoration (or creation) actions. Occurrence and gene flow of potentially vulnerable species were related to landscape structures and land use in order to identify migration corridors. This approach was developed and implemented in a test area in the Swiss Alps and allowed to propose new ponds creation areas for improving freshwater connectivity. The main boreo-alpine species identified here as useful tools for the connectivity mapping were the dragonfly *Aeshna juncea*, the beetle *Stictotarsus griseostriatus* and the plant *Carex nigra.* These species were therefore considered as umbrella species for the other boreo-alpine pond taxa. The outputs of this study can be used directly as pond management recommendations for the conservation of aquatic boreo-alpine biodiversity, also taking into account the local uses of these Alpine ecosystems.

R02

DISCRIMINATION OF FOUR *SIMOCEPHALUS* SPECIES FROM CENTRAL EUROPE USING PCR-RFLP TECHNIQUE

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Planktonic crustaceans are traditionally identified based on morphological and morphometrical characters. However, such characters may be hardly distinguishable and often overlap among species. A probability of misidentification is thus relatively high. Molecular techniques are more precise and can be very effective if appropriate markers are used. Aim of our work was to develop a simple molecular procedure discriminating four species of *Simocephalus* species group occurring in Central Europe. PCR-RFLP technique seemed to be suitable for such discrimination. Within the 709bp fragment of mitochondrial cytochrome oxidase I gene we found unique combinations of restriction sites of the *Bbs*I and *Sac*I enzymes for *S. vetulus, S. exspinosus, S. serrulatus* and *S. congener*, respectively. PCR products of samples from various locations were digested with the two enzymes and electrophoresed on an agarose gel. The restriction patterns were clearly visible and easily distinguishable. This method proved to be valuable for identifying the four species in any life-stage. Considering its simplicity and cost-effectiveness it can be widely used as a diagnostic tool discriminating *Simocephalus* species with overlapping morphologic characters.
This contribution is the result of the project implementation: Development and application of the innovative diagnostic approach for the molecular identification of animals (ITMS: 26240220049) supported by the Research & Development Operational Programme funded by the ERDF.

R01

MORPHOMETRIC CHARACTERISTICS AND LENGTH-WEIGHT RELATIONSHIP FOR *GOBIO SAKARYAENSIS* (TELEOSTEI: CYPRINIDAE) FROM ÇAMKORU POND (ANKARA-TURKEY)

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The present study reports the population density, length-weight relationship and morphometry of *Gobio sakaryaensis* caught from the Çamkoru Pond (Ankara-Turkey) during the period from August, 2002 to August, 2003. 6 fish species were determined in this study and the population density ratio of *Gobio gobio* was calculated as 3.34%. A total of 40 individuals, ranging in size between 4 and 13 cm total length, 0.9 and 30.1 g total weight, was examined. Slope value (b) estimated for combined sexes was 3.2027. The regression equation calculated Log W=-2.1135+3.2027Log L. Morphometric measurements of various body parts and meristic counts were recorded. Morphometric relationships between parameters (total length-standard length; total length-fork length; total length- head length; total length- body depth) were calculated using the linear regression equation. The standart deviation of morphometric characteristics on the head and body ranged from 1.09 to 4.18 and 0.57 to 1.53, respectively.
Key Words: Gobio sakaryaensis, Morphometry, Length-weight relationship, Çamkoru Pond

R01

PERENNIAL POPULATION DYNAMICS OF DANCE FLIES (DIPTERA, EMPIDIDAE) AT FRESHWATER KARST HABITATS

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Aquatic dance flies (Empididae; Clinocerinae & Hemerodromiinae) are important components of freshwater ecosystems, especially in running waters. Larvae and pupae live in water habitats, while adults live on land habitats close to water. They are predators as larvae and adults and thus essential for understanding aquatic food webs. The goals of this study were to analyse their preference for various microhabitats, main ecological factors that have influence on composition and abundance of specimens and emergence of species at different freshwater karst habitats. Also correlations between abundance of aquatic dance flies and amount of their prey were explored. Sampling was made monthly from 2007 until 2010 at Plitvice lakes, on 4 sites (Spring of Bijela Rijeka, Upper reach of Bijela Rijeka, Tufa barrier Labudovac and Tufa barrier Kozjak-Milanovac). Adult specimens were collected using a semi quantitative method of emergence with 6 traps placed on each location. A total of 2378 specimens comprising 16 species were caught during four years study, 10 species from subfamily Hemerodromiinae and 6 from subfamily Clinocerinae. The dominant genus was *Chelifera*, while the most abundant species was *Hemerodromia unilineata*. All species were univoltine except *Chelifera precabunda*, *Chelifera pyrenaica* and *Chelifera stigmatica* that were bivoltine. Water temperature and photoperiod are the main ecological factors influencing their emergence, while water discharge is the main factor influencing the assemblage composition of aquatic dance flies. The highest abundance of aquatic dance flies on spring site was recorded on moss. The highest emergence rates were recorded above microhabitats with highest prey densities and with highest current velocity. Highest abundance changes over four- year period was recorded for population of *Chelifera siveci*. It may be caused by differences in sex ratio during the years, and defined by population dynamics within years.

R04

TOWARDS A GLOBAL PICTURE OF AQUATIC BIODIVERSITY BY THE INTEGRATION OF META-ANALYSES OF BIODIVERSITY DATA INTO A LAND-USE AND CLIMATE MODEL

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The world's freshwater ecosystems (lakes, rivers and wetlands) are heavily affected by world-wide changes in the water cycle that involve both quantity and quality. Not only biodiversity values but also the ecosystem services they deliver are compromised. Biodiversity data are often scattered and difficult to relate to these global changes. In this study we describe a framework that links aquatic biodiversity to anthropogenic drivers via a chain of models of different methodology. It is meant for integrated policy analyses at global or national levels, and complements a comparable terrestrial model.

Biodiversity data were used in a 'compiled' way, by meta-analysis of studies of species composition related to drivers such as land use in the catchment, eutrophication, flow deviation and climate change. One of the biodiversity indicators used is the relative mean abundance of original species, relative to their corresponding natural abundance, abbreviated as 'MSA' (scaled 0-1); a measure of 'intactness' or 'naturalness'. This allows to scale and compare different ecosystem types. The data covered a wide range of taxonomic groups. The results show an overall negative relation between catchment land use intensity and nutrients, and the biodiversity in lakes, rivers and wetlands. Likewise, the biodiversity in rivers and riverine wetlands generally decreased with a deviation of the seasonal flow pattern from the natural one. Other drivers such as exploitation (fisheries) and exotic invasions were not yet included. The different drivers were (as yet) assumed to be independent (multiplied). The probability of harmful algal blooms was used as an additional indicator for lakes.

The model is embedded in the IMAGE model chain for global change, which includes modules for population, land use changes, climate change, carbon and nutrients as well as a global hydrological model. These drivers are modelled spatially explicit (resolution at present 30' lat/long, being translated into 5'). Water and nutrient (N, P, Si) fluxes are accumulated downstream according to a digital network model (catchment approach), and combined with the Global Lakes and Wetlands Database map.
Recent applications of the model show that aquatic biodiversity has declined considerably in many parts of the world in the last two centuries (about 35% worldwide averaged), and is expected to decline further in the future (PBL, 2010; OECD, 2012).

References
See: www.globio.info

SS13

MULTIPLE STATES IN LAKE TAIHU (CHINA): SPATIAL VARIABILITY IN THE SUBTROPICS

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In 2007, a drinking water crisis affected over 1 million people in Wuxi (China), 100km west of Shanghai. This water crisis is a catastrophic result of a large scale algal bloom in Lake Taihu. The chance on such algal blooms increased last decades due to an increased nutrient load from agriculture, domestic waste waters and industry. Highly polluted rivers discharge their water mainly in North and West Taihu. The high nutrient load favours blue-green-algae in their competition with vegetation. The emergence of algal blooms resulted in turbid water. The turbidity is increased even more in the centre of the lake by wind that easily can resuspend sediment particles due to the absence of vegetation, shallowness (~2.6m) and large size of the lake (2338km^2). Despite the environmental problems with eutrophication, the east of the lake has still clear water allowing vegetation to grow. The coexistence of both turbid and clear water can be explained by spatial heterogeneity. The east of the lake is shaded for wind and is shallower than other parts of the lake, both favoring vegetation. Additionally, East Taihu is exposed to lower nutrient levels. Therefore, the critical nutrient load at which a system shifts to a turbid state is not reached yet and algal blooms are (still) absent in East Taihu.
Different alternative states (turbid and clear) can thus be distinguished within one lake. The exact mechanisms behind the different alternative stable states in a subtropical monsoon climate are unclear yet. It is known that due to relative high temperatures, processes like reproduction, predation and growth may occur all year round. In addition, the food web structure of subtropical lakes differs from temperate lakes. Restoration of subtropical lakes like Taihu asks for knowledge on the steering processes that lead to alternative states. The aim of this research is to identify critical nutrient loads for Taihu in relation to spatial variability and the subtropical monsoon climate. The critical nutrient load will be spatially determined with the dynamic ecosystem model PCLake. Since this model is developed for temperate lakes, adjustments are needed to use the model for subtropical climates.

R11

PIONEER COLONIZATION AND SPATIO-TEMPORAL PROCESSES IN RESTORED RIVER SECTIONS

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Nowadays, an increasing number of studies deal with restoration effects on biota. Those studies mainly focus on single organism groups and often disregard the factor ‘time’. Often, morphological restoration measures include a complete restructuring of the riverbed and riparian areas by e.g. excavation of the upper soils, creation of secondary channels or substrate addition. There is little known about how aquatic and (semi-)terrestrial pioneer colonization of newly created habitats proceed directly after restoration and how colonization and successional processes develop in the first years after restoration. We recorded instream and floodplain habitats and investigated aquatic and (semi-)terrestrial organism groups (benthic invertebrates, fish, aquatic macrophytes, carabid beetles, floodplain vegetation) in a large restored section of the river Ruhr. The total length of 3.5 km was restored step-by-step in the years 2008-2010. Investigations started in the first year after restoration and continued 3-4 years. Our data analysis focused on the following questions:

- How do instream and floodplain habitats change directly after restoration and how do habitat compositions change in the first years after restoration?
- Which organism group is the fastest colonizer directly after restoration and how does colonization develop in the first years after restoration?

Our results shed light on morphological and biological processes initiated by restoration measures.

R08

HOW DO GERMAN DRINKING WATER RESERVOIRS RESPOND TO CLIMATE CHANGE?

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Many studies show trends of increasing air and water temperatures since the 1980s. General features are warmer winters, shorter or missing ice covering and changes in the seasonal mixing and stratification patterns. Consequently, there is growing evidence for alterations in the biotic and abiotic structures of aquatic ecosystems, like switches of species composition and biomass or time shifts in the life-cycle of phytoplankton, zooplankton, and fish populations. Because the supply of drinking water from reservoirs plays a major role in many regions of Germany, it is of interest to early recognize consequences of climate change for the management of reservoirs.

Based on long-term data from 37 German drinking water reservoirs (48,2-51,4°N, 6,1-14,3°E, 138-899 m), trends of monthly water temperature averages were analyzed. All reservoirs show regionally similar increasing trends of the temperature in the upper water layers, especially in winter, spring and summer. Additionally, we applied the CW-concept according to Wagner et al. (2012) to examine the coherence among the reservoirs. This generalized approach defines temperature thresholds that are used to classify four phases as warm (W) or cold (C). These phases proved to be sensitive both in terms of the physical and biological structure of lakes and reservoirs. Phase 1 characterizes the winter, phase 2 the time of spring overturn, phase 3 the early stable stratification, and phase 4 the mid-summer stagnation. The frequency of the appearance of warm phases increases. However, reservoirs located in the lower longitudes show higher winter and spring water temperatures, much shorter or missing ice cover and a considerably earlier spring overturn. These differences are mostly attributed to the various altitudes and exposition to continental climate. Generally, summer stratification tends to establish earlier and its duration is prolonged. Increasing water temperature and thermal stability in summer as well as changing stratification patterns may affect not only the physical characteristics but also the dominance within the phytoplankton and the raw water quality of the reservoirs. Therefore, management strategies of drinking water reservoirs need to be adapted.

Reference:

Wagner, A. et al. (2012): A phenomenological approach shows a high coherence of warming patterns in dimictic aquatic systems across latitude. Mar. Biol. 159: 2543-2559.

R05

IMPACTS OF PH AND TEMPERATURE CHANGE ON PREDATOR-PREY INTERACTIONS IN A WELL-CHARACTERISED FOOD WEB

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Increasing temperature and acidification are major climatic stressors on freshwater ecosystems, which can have potentially severe consequences for community structure and food web dynamics. Here we present work in which we experimentally tested functional response used multiple combinations of freshwater invertebrate species (3 predator species and 5 prey species) from across a pH gradient in a well-characterised aquatic food web in South England, under a variety of temperature regimes. These were used to characterise how predator-prey functional responses might respond to future warming and pH change.

SS12

LIGHT GAPS FOR DRAGONFLIES - MONITORING OF RESTORATION MEASURES IN THE LIFE-PROJECT "BACHTÄLER IM ARNSBERGER WALD", NORTH RHINE-WESTPHALIA, GERMANY

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The LIFE-Project „Bachtäler im Arnsberger Wald“ (Stream vallies in the Arnsberger Forest) started in 2009 with a duration up to 2014. The main aims of the project were the restoration of small brooks by channel modifications and removal of European Spruce (*Picea abies*) from the riparian vegetation. Dominant Spruce stands insulate streams from direct sunlight. By removal of theses conifers streams become more light-flooded. Natural riparian vegetation like European Black Alder (*Alnus glutinosa*) and stream insects bound to natural and unaltered streams profit by these measures.
In this investigation we focused on dragonflies living in running waters. The Beautiful Demoiselle (*Calopteryx virgo*) is bound to streams with natural vegetation and gaps of solar light. We investigated the abundance of dragonflies like *C. virgo* and *Cordulegaster boltonii* (Golden-ringed Dragonfly) influenced by the change of riparian vegetation in the course of the restoration measures. The results are presented in this poster.
Keywords: Restoration measures, natural riparian forests, light gaps, *Calopteryx virgo*, abundance

SS13

MODELLING THE EFFECTS OF CLIMATE AND LAND-USE CHANGES ON THE DYNAMICS AND ECOLOGICAL CONDITIONS OF TWO RIVER REACHES

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Changes in climate and land-use are pressures at the global and river catchment scale which influence discharges and sediment loads. The IWRM.NET project IMPACT assessed the effects of discharge changes on two contrasting river reaches: the freely meandering lowland sand-bed river Treene, in northern Germany, and the piedmont gravel-bed river Célé in south western France. After having inferred the future changes in discharge regime and sediment load for the two river reaches, the study focused on their effects on channel dynamics, morphology, hydraulics, and habitat conditions by a combination of different modelling techniques.
For the Treene River, two different approaches were used to assess the effects on channel geometry, focusing on bankfull width: an empirical regime equation and an adapted existing regime model. The results allowed studying the effects of the changes on channel dynamics and planform evolution with the meander migration model MIANDRAS. The results indicated that the expected small changes of discharge will have minor effects on channel geometry, dynamics, and planform changes, especially if compared to the much larger potential effects of riparian vegetation.
For both study reaches, flow velocity, water depth and shear stress were modelled for the present and future discharge conditions, calculating monthly values and hence, considering seasonality. The outcomes indicated that discharge changes will result in considerable changes in flow and habitat conditions in both river reaches, especially during summer and autumn low-flows. In contrast to the gravel-bed Célé River, flow conditions and possible future changes were more strongly influenced by aquatic vegetation in the sand-bed Treene River.

R05

FATTY ACID BIOMARKERS IN ZOOPLANKTON: INFLUENCE OF SEASONAL DIET AND TEMPERATURE CHANGES

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Fatty acids are increasingly used as dietary biomarkers in organisms of aquatic food webs. In this ongoing field study (since 2009), we examined effects of seasonal diet and temperature changes on retention patterns of fatty acids in freshwater zooplankton. Using a multiannual data set of fatty acids in edible seston (<30 um; potential diet) and zooplankton (cladocerans and copepods) we hypothesized that zooplankton track dietary supply of algal, bacterial, and terrestrial organic matter. Throughout the season, bacterial fatty acid proportions were positively and significantly correlated between seston and cladocerans ($r = 0.77$) and seston and copepods ($r = 0.67$). However, none of the algal (polyunsaturated fatty acids) or terrestrial fatty acids proportions were significantly correlated between seston and cladocerans or seston and copepods. The retention of algal-derived fatty acids was zooplankton taxa-specific throughout the seasons. Cladocerans had consistently significantly higher arachidonic (ARA) and eicosapentaenoic (EPA) acids, and significantly lower docosahexaenoic acid than copepods. Based on variation coefficients, zooplankton were less variable in ARA, EPA, terrestrial and bacterial fatty acids than seston. Seasonal changes in water temperature had no significant effect on algal or terrestrial fatty acids in seston, but bacterial fatty acid biomarkers in seston were significantly negatively correlated with temperature. Contrary to our hypothesis, we provide correlative evidence that bacterial, not algal or terrestrial fatty acids were the most predictive biomarkers in zooplankton throughout the seasons.

R04

DISTURBANCE OF SMALL-CELLED PHYTOPLANKTON IN LAKE KINNERET

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Ever-growing anthropogenic pressure and pronounced climatic changes may cause distinct changes in natural ecosystems. Some of these changes are undesirable and even dangerous. Such situations demand scientific tools for quantitative estimations, ecological forecast, and diagnostics of aquatic assemblage structural changes. The whole-assemblage species abundance distributions demonstrated a high level of similarity during a long-term (15 years) monitoring of Lake Kinneret (Israel) phytoplankton. The distribution pattern changes of cell abundances become evident only during periods of extreme changes of the phytoplankton annual succession. At the same time, the species-list variation and strong variability in dynamics of biomass and cell abundance are notable even during the stable period. In such a system, the phylum appears to be an intermediate level of optimal sensitivity, suitable for the aims of assemblage structural-similarity estimation. Some phyla (Cyanophyta, in our case) demonstrate especially high sensitivity at Lake Kinneret. The rank-abundance distributions of species exhibit a pronounced difference between the taxonomically rich central region, producing the reliable assemblage backbone and highly variable tails of a few species. Therefore, the distribution pattern comparison enhances the importance of ubiquitous small disturbances valuable for diagnostics. A simple disturbance index was constructed, based on opportunistic small-celled species. The fine-structure disturbances, which can provide early-warning information, are discussed.

SS08

DOC AND NUTRIENT PATTERNS IN A RIVER NETWORK ALONG A LAND USE GRADIENT

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The Bode catchment (Germany) shows strong land use gradients from forestry parts of the National Park (23% of total land cover) to agricultural (70%) and urbanized areas (7%). Sampling of surface water was performed nearly simultaneously at 21 headwater sites with low land use and 10 downstream sites with high land use before and during the vegetation period in early spring and late summer, respectively. Nutrients (ammonium, nitrate, phosphorus) showed lower concentrations in the headwaters than in downstream reaches, and chlorophyll *a* concentration and total phosphorus in surface waters were positively related. The concentration of dissolved organic carbon (DOC) was higher in summer than in spring whereas the molecular size of DOC was lower in summer. The specific UV absorption, indicating the content of humic substances, was higher in headwaters than in downstream reaches. CO_2 oversaturation of the water was higher downstream compared to headwaters and was higher in summer than in spring. It correlated negatively with oxygen saturation, positively with DOC concentration but negatively with DOC quality (molecular size and humic content). This is supported by results of bacterial production showing higher metabolic activities in agricultural streams than in forest streams. A principle component analysis clearly separated the effects of season and sites demonstrating the strong effect of land use on DOC and nutrients.

SS06

RESPONSE OF MACROINVERTEBRATE FAUNA TO PERTURBATION BY DROUGHT IN MEDITERRANEAN STREAM ECOSYSTEMS

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Drought in streams may be viewed as a disturbance in which river flow is interrupted or decreases to extremely low levels for extended periods of time. Knowledge of the ecology of droughts in running waters is rather limited and fragmentary. Here, the response of the macroinvertebrate fauna to drought in Greek running waters was examined using the Evrotas River as an example. Faunal responses to drought were assessed through comparisons of assemblages in perennial and intermittent reaches and pre-drought versus post-drought assemblages. In addition, faunal responses to drought were assessed in streams with different ecological status gradients. Results indicated there were no differences in assemblages between intermittent and perennial streams as well as between pre-drought and post-drought assemblages in the intermittent sites. Differences between perennial and intermittent streams were detected in the mean percentage of EPT taxa as showed by t-test. However, the mean percentage of EPT taxa did not vary considerably between seasons in perennial and intermittent sites. Furthermore, seasonal changes in the mean percentages of COH taxa were insignificant in both stream types. Regarding taxon richness, overall, no marked differences were found between perennial and intermittent streams (mean number of families was 21 and 22, respectively). Furthermore, in perennial and intermittent streams that were seasonally affected by organic pollution, intermittent ones required more time to recover. The results from the specific river ecosystem revealed that the macroinvertebrate fauna do not seem to be markedly affected by summer river-bed desiccations. The post-drought macroinvertebrate community was relatively similar to the pre-drought community (c. 70% similarity). This suggested that there were no significant changes in the structure and composition of the macroinvertebrate fauna after summer desiccation in intermittent sites. However, prolonged and severe droughts combined with increasing water abstraction may have greater effects on benthic fauna or on certain benthic groups, as documented in other arid and semi-arid regions. The assessment of direct or indirect effects of drought on macroinvertebrates requires long-term monitoring. It cannot be excluded that repeated and prolonged drought conditions in the past may have already altered the initial macroinvertebrate species and communities towards more drought-resistant depauperate assemblages.

R09

IT IS NOT NECESSARY TO KILL INVERTEBRATES FOR BIOASSESSMENT: NOMBSI – A NEW METHOD OF BENTHOS SAMPLING AND IDENTIFICATION

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Mass killing of benthic animals is typically undesired side effect of all modern methods of biological assessment widely used in EU countries (e.g., BMWP, STAR/AQEM). Main assumption of proposed method is to reduce mortality of invertebrates due to traditional sampling procedures.
NOMBSI (Non-lethal Method of Benthos Sampling and Identification) is based on analysis of 3D digital images of benthic samples collected live with using artificial substrates. Preliminary results of the first year of new method testing will be presented. In comparison with other methods NOMBSI gives satisfactory results. The mean accuracy of ecological quality assessment score is about 75% compared with BMWP method, while correctness of taxa identification from digital images is about 70%.

R01

SPATIAL AND GEOGENIC PATTERNS OF MICROBIAL METAGENOMICS IN LOWLAND GROUNDWATERS

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Groundwater is an essential renewable resource for industrial, agricultural and municipal purposes. Its importance is exemplified by the fact that nearly 70 % of the drinking water in Germany derives from groundwater. The German drinking water ordinance defines threshold values for concentrations of abiotic parameters in groundwater such that it is safe for public consumption. However, groundwater is not only an important resource but also an ecosystem that contains a variety of species that have adapted to the specific conditions in the groundwater and are restricted to these ecosystems. These organisms provide ecosystem services which are able to reduce cost intensive purification techniques for the production of drinking water. It is therefore important to maintain and protect the groundwater ecosystems from pollution or other disturbing factors, because alteration of environmental conditions can lead to a shift in the community composition and therefore also in the functional structure of these biocenoses. However, and importantly, assessment of groundwater ecosystems on the basis of abiotic parameters is insufficiant to detect these impacts on the biocenoses of groundwater ecosystems. The aim of our study was to analyse the spatial and temporal diversity of bacterial biocenoses to give insights into the mechanisms that alter the composition of bacterial communities. We took water samples from boreholes and simultaneously measured *in situ* parameters as well as the cation and anion concentrations. We used culture independent methods to analyse the bacterial community composition: total bacterial DNA was extracted from water samples and amplified via PCR. The resulting DNA fragments were digested with restriction enzymes to identify community patterns of each borehole and we tested whether the species correlate with the abiotic parameters.

R14

PHYTO- AND ZOOPLANKTON RESPONSE TO THE INVASION OF *GONYOSTOMUM SEMEN* IN LITHUANIAN LAKES

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Over recent decades raphidophyte *Gonyostomum semen* has become a nuisance algae forming dense blooms, which have occurred with increasing frequency in temperate regions and in non-humic lakes. Mass species development may modify the trophic interactions leading to an extinction of native species. In Lithuania, *G. semen* was found in 66 from 243 lakes studied in 2008–2012. *Gonyostomum* impacted lakes were characterized by low conductivity (58 ± 72 SD µS cm^{-1}), high water colour (275 ± 162 SD Pt-Co units.), organic carbon (up to 136 mg L^{-1}), total nitrogen (up to 2.39 mg L^{-1}) and total phosphorus (up to 0.346 mg L^{-1}). Species abundance varied from single cells to 822 thous. cells L^{-1} and biomass 0.03–32.7 mg L^{-1}. Most of the *Gonyostomum* lakes (51%) were little impacted by raphidophytes that comprised up to 1 mg L^{-1} biomass and 16% of these were strongly damaged (biomass > 10 mg L^{-1}). Small edible by zooplankton chrysophytes, cryptophytes and green algae dominated in the lakes with low (< 1 mg L^{-1}) *Gonyostomum* biomass, whereas large unedible raphidophytes and dinoflagellates prevailed in the moderate and strongly impacted lakes.

Phytoplankton vertical distribution peculiarities investigated in two selected lakes revealed the importance of S strategists such as *G. semen* and *Ceratium hirundinella* (comprising up to 98% and 52% of phytoplankton biomass, accordingly). Both invasive and native species occupying the same ecological niche and competing for the scarce nutritional resources showed similar diel/diurnal migration patterns. The largest biomass they formed in euphotic layer during emersion to the surface at noon, whereas at the sunset, the highest biomass was accumulated in the lower layers.

The presence of crustacean grazers may result due to the low biomass of edible algae and rotifers in the *Gonyostomum* lakes. Top-down influence on *G. semen* was limited because of low biomass of carnivorous zooplankton species capable to feed on and control raphidophytes. Thereby, the lakes were dominated by inedible phytoplankton, which is able to modify the trophic interactions among species. Energy transferring to the higher trophic levels is redirected from a classic trophic chain to the microbial loop components in those water basins.

SS07

SURFACE-GROUNDWATER INTERACTIONS AND ECOLOGICAL RESPONSES TO LOW FLOWS: RIFFLE INVERTEBRATES IN THE UPPER MURRUMBIDGEE OF SOUTH-EASTERN AUSTRALIA

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Surface and groundwater connections may play a large part in determining ecological responses to low flows, droughts and water extraction. For example, aquatic ecosystems with little or no connection to groundwater may be strongly influenced by low flows and droughts, while those connected to groundwater much less so. Despite the potential influence of surface and groundwater connections in determining ecological responses to low flows, assessing and quantifying its importance is often limited by a lack of data over a range of low and high flow conditions. In this study we used long term invertebrate data from 189 surveys in riffles, collected at 8 sites, from 1994 to 2011, in the Upper Murrumbidgee Catchment of south-eastern Australia. At each site indices of groundwater influence, based on hydrogeological mapping, were calculated. Multivariate metrics indicating the degree of change (e.g. average dissimilarity, dispersion) in invertebrate communities between high and low flows were then modelled as a function of groundwater influence indices (calculated using hydrogeological layers), using ordinary least squares and validated using bootstrapping procedures. Groundwater influence indices explained high amounts of variation in invertebrate community change (R^2 = 0.9 for measures of average dissimilarity). Sites in high groundwater influence areas showed small changes between high and low flows, while sites in areas of low groundwater influence showed greater differences. The results suggest that differences in surface-groundwater connections strongly influence the degree to which low flow periods, such as droughts, impact on in stream invertebrate communities. The findings have important implications, highlighting that the impacts of reduced water availability caused by drought, water extraction and / or climate change on ecological communities, may vary greatly as a consequence of differences in surface and groundwater connections. We are now expanding the approach by using data from invertebrate communities in edge habitats of streams and also to other catchments in Australia, which differ in hydrogeology and also have areas of poor groundwater quality (i.e. high salinity).

SS13

MODELLING MACROINVERTEBRATE COMMUNITIES UNDER TOXICANT STRESS

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Macroinvertebrates play an important role in assessing the ecological status of freshwater bodies as well as in pesticide registration procedures. In the latter, simple and complex experiments with macroinvertebrates are part of the risk characterization. However, the combined effects of biological interactions, contamination and other anthropogenic stressors are often not well enough understood for sound extrapolation to untested conditions. Hence, a protective assessment of the risk under field conditions is questionable. Ecological modelling can improve the understanding of the involved processes in order to support the risk assessment.
Therefore we developed a stochastic, individual-based model (IBM) of a macroinvertebrate community. It is based on the metabolic theory of ecology, incorporates food web interactions and makes use of available trait data bases. The model describes food uptake including predation, respiration, reproduction including emergence pattern, and mortality. In addition, the IBM represents individual variability, intrinsic stochasticity and different life-stages of the organisms. Here, we present the IBM and apply it to data of a stream mesocosm experiment with the aim of investigating the consequences of toxicant effects on life cycle functions for community dynamics. We discuss input and parameter uncertainties, which the model propagates to the results, and particularly analyze the role of individual variability.

R09

MONITORING FOR LOW LEVEL CONTAMINATION OF WATER WITH SHIGA-TOXIGENIC *E. COLI*

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Shiga-Toxigenic/Vero-Toxigenic *E. coli* (STEC/VTEC) is associated with major outbreaks and sporadic disease worldwide. The reported incidence of STEC infection in Ireland has increased in recent years, with 497 VTEC notifications occurring up to October 2012, compared with an average of 181 notifications in the same time period for 2009-2011. Human infection may arise from consumption of contaminated food and water and from person to person contact. Routine bacteriological monitoring of drinking water relies largely on culture-based enumeration of total *E. coli* in small volumes (100 ml). When evaluating sources implicated in human disease, 1 L samples are examined for STEC. These approaches may miss low level, intermittent contamination of potential public health significance. By contrast, examination of water for *Cryptosporidium* involves filtration of up to 1000 L with specialized systems. The objective was to develop a protocol for monitoring large volumes of water for STEC using filtration, combined with enrichment culture and molecular methods. Initially we evaluated commercial filters for capturing *Cryptosporidium*, alone and in-series with a 142 mm 0.45 μM filter (Millipore), using 10 L volumes of sterile tap water spiked with *E. coli* O157:H7 NCTC 12900. Filters were divided into portions, for direct nucleic acid extraction and broth enrichment at 37°C and 42°C. Enrichments broths were plated on CHROMagar™ STEC plates and examined for STEC colonies. STEC was detected in direct filter extracts and in overnight enrichments using real-time PCR targeting intimin (*eae* gene). Real-time PCR targeting *eae* and Shiga-Toxin (*stx* 1 & 2) genes was applied to river water samples. STEC was not captured to any significant degree by the *Cryptosporidium* filter but was captured by the 0.45 μm filter. The limit of detection of the system, determined by real-time PCR, was 10 colony-forming units (CFU)/L. Incubation of enrichments at 42 ºC led to earlier detection of STEC by real-time PCR and improved isolation of STEC on CHROMagar™. Pilot application of the method to 10L of untreated and un-spiked river water resulted in direct detection of *stx* and *eae* from filtrate and isolation of an *stx*1/2 positive *E. coli* O26. We conclude that this is a promising approach to monitor for low level or intermittent STEC contamination of water sources and field sampling using volumes of 20-100L is in progress. The system may also have applications in food processing quality control.

R09

WATER FRAMEWORK DIRECTIVE IMPLEMENTATION FOR ECOLOGICAL QUALITY OF YESILIRMAK RIVER

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Yeşilırmak River flows from Sivas province (in eastern Turkey) towards Samsun province (in western Black Sea Region) and ends in Black Sea. The drainage basin of Yeşilırmak River covers 36.144 km² area. Its length is 519 km. The main tributaries joining Yeşilırmak River are Kelkit (245.5 km in length), Çekerek (200 km in length), and Tersakan (100 km in length).
Important pollution sources of the river are industries, sewage from urban areas and agricultural runoff. There are dams, regulators and hydroelectric power plants in the river basin.
The use of macroinvertebrates to assess running water health is becoming mandatory in Turkey with the introduction of the Water Framework Directive (WFD). In Turkey, we are now in a stage of determination and harmonisation of appropriate metrics consistent with fauna and ecosystem types of Turkey.
Aim of this study is to asess the ecological quality of Yeşilırmak River by using various benthic macroinvertabrate based biotic indices and physicochemical variables for the first time. The 48 collecting sites were investigated in different ecoregions between 2008 and 2010. Water bodies were also classified according to System A and B.
The various metrics such as Biological Monitoring Working Party (BMWP), Average Score Per Taxon (ASPT), Ephemeroptera Plecoptera Trichoptera-Taxa (EPT-Taxa), proportion of feeding types were performed in order to evaluate the ecological quality of the stream by using ASTERICS (AQEM/STAR Ecological River Classification System) software and to identify reference sites for Yeşilırmak River. Ecological Quality Ratio (EQR) of collecting sites were also given to estimate water quality of a river for the first time in Turkey.
The results of all these metrics and physico-chemical data revealed that collecting sites were impacted by slight, moderate and heavy organic pollution. Physical disturbance due to dam affects hydrologic properties of the stream.

R13

RESPONSES OF EPIPHYTIC MACROINVERTEBRATES TO CHANGES IN SUBMERGED MACROPHYTE COMMUNITIES FOLLOWING THE INVASION OF AFRICAN OXYGEN WEED *LAGAROSIPHON MAJOR*

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Invasive species alter local ecosystems by changing species composition, population structures and trophic interactions. Macrophytes are important as habitat structure providers in littoral ecosystems as they can directly or indirectly alter resource availability, create complex habitats and effect productivity. This study focuses on the submerged African waterweed, *Lagarosiphon major* and assesses the impacts of dense infestations on the invertebrate communities of littoral habitats in Lough Corrib, Ireland. Macrophyte samples were collected per unit area in three bays using a modified sampler to assess the differences between the native charophyte beds and the dense stands of *L. major*. Samples were divided into sections to assess the vertical distribution of epiphytic macroinvertebrates, and sampling was repeated at three different times of the year. *L. major* had a distinct growth cycle, changing from a dominant canopy-heavy stand to a slouched bed close to the lake-floor, the timing of which varied between bays.

Macroinvertebrate abundance and biomass was significantly different between macrophyte species, with the highest occurring on *L. major*. Invertebrate abundance and biomass was greater near the water surface where canopies occurred, but when the canopy collapsed invertebrate abundances and biomass were greater at the lake floor. Invertebrate communities were distinct between bays, and irrespective of sample date the community close to the sediment were distinct from the water surface. The macroinvertebrate communities *on L. major* were less even, dominated by only a few species, including other non-native species like *Crangonyx pseudogracilis* and *Dreissena polymorpha*. Communities on charophytes were distinct between bays and were significantly different from those on *L. major*, which were more similar between bays. The results show that the structure of the macrophytes and associated colonisable surface area changed after the invasion of *L. major*. Macroinvertebrates increased in abundance and biomass, with changes occurring in their vertical distribution within the water column when canopies had formed. The communities were distinctly different from those on native macrophytes and *L. major* reduced the heterogeneity of communities within and between bays. The implications of these changes are discussed in relation to the trophic dynamics in littoral habitats and the need for weed control is discussed.

R05

DATA EVALUATION FROM LONG-TERM MONITORING OF A STRATIFIED LAKE

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Stratified Lake Buchtzig in the south-western part of Germany was sampled over thirteen years for phosphorus concentrations and zooplankton. Phosphorus measurements from water samples were used to compute the ratio of total dissolved phosphorus to total phosphorus (TDP/TP-ratio). Zooplankton was collected by a pump and pipe system enabling large samples and accurate measurements of the filtered water. A collection of the measurements is presented on the website www.phosph-frctns.de. A significant linear regression was established between the planktivore fish stocking to TDP/TP-ratio and a significant polynomial regression of degree six was found between TP to Cladocera biomass and a significant quadratic regression between TDP/TP-ratio and *Daphnia* length. The Bottom-up : Top-down model is corroborated. Moreover, there are indications for the existence of a hysteresis. A loop is visible in the plot TP against Cladocera biomass and after years without planktivore stocking, a retarded return to an earlier state of TDP/TP-ratio and TP concentration was observed.

R14

EVOLUTIONARY ASPECTS OF HOST-PARASITE INTERACTIONS BETWEEN ANGUILLICOLOID SWIM BLADDER NEMATODES AND THEIR EEL HOSTS

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Anguillicoloid swim bladder parasites (*Anguillicola crassus*, *A. novaezelandiae*) that have accidentally been introduced into the population of European eels (*Anguilla anguilla*) belong to the best known examples of invasive parasites that negatively affect recently acquired hosts. *A. crassus* was introduced to Europe via the import of infected Japanese eels (*Anguilla japonica*) in the 1980s, whereas *A. novaezelandiae*, the endemic parasite of the Short-finned eel (*Anguilla australis*), was transported from New Zealand to Lake Bracciano (Italy) in 1975.
These species differ in terms of their natural hosts and their pathogenic degrees towards other hosts on different co-evolutionary levels. Data on *A. novaezelandiae* both in the European and the Japanese eel were compared with data on *A. crassus* in *A. anguilla*. These host-parasite systems provided the possibility to examine reciprocal physiological adaptations on the one hand and potential hybridisation processes between two closely related parasite species on the other hand. Previous studies have mainly focused on biochemical processes in the respective host, while the impact on the parasites remained completely unknown. That is why the present study had a distinct focus on the reactions of the parasites. Since heat shock proteins (HSPs) are generally used as biomarkers to analyse the response of an organism to different forms of stress, the HSP70 levels in both parasite and host organisms were examined. The results gave new hints to the different levels of adaptation between the respective host-parasite systems. The analyses of the HSP70 levels proved to be a suitable biomarker for investigating stress responses from different perspectives.
Furthermore, the possibility of hybridisation between *A. crassus* and *A. novaezelandiae* was investigated by means of a microsatellite analysis of adults and offspring taken from a mixed laboratory infection in a single European eel. Allele patterns revealed that hybridisation is possible between *A. crassus* males and *A. novaezelandiae* females, but not vice versa.

SS10

THE INFLUENCE OF RIPARIAN FOREST PATCHES AND PESTICIDE RUNOFF ON THE MACROINVERTEBRATE COMMUNITY COMPOSITION

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One of the main stressors for aquatic invertebrates in agricultural streams is the exposure to pesticide-containing runoff from adjacent arable land. It is known that the extend of the impact can depend on non-chemical factors. For example, the presence of riparian forests upstream of contaminated sites can reduce the effects of pesticides on macroinvertebrate communities. Previous studies have shown that the percentage of species, sensitive to pesticides is higher at such sites, compared to the sites with a similar contamination level, but without the forest patches upstream. However, this phenomenon has not been studied in detail. In the present investigation we aimed to identify the relevant parameters of the forested patches, which contribute to this effect. We analysed the data on pesticide exposure and macroinvertrebrate communities collected from 25 streams in three different field studies. The physical dimensions of the forest patches, such as the surface area and location relative to the sampling sites were measured with ArcGIS software. We confirmed that the proportion of sensitive species decreased with increasing pesticide contamination. The number and the proportion of sensitive species was also significantly influenced by the surface area of the riparian forest patch and the length of the stream within the forest. However, at high contamination levels only the toxicity of the runoff had an influence on the community composition. The efficacy of upstream riparian forest patches on macroinvertebrate communities should be taken into account, when assessing pesticide risks and planning risk reduction measures. The relevant factors to consider are outlined in our study.

R13

NATURE LOCATOR: GEOSPATIAL SMARTPHONE APPS AND THE USE OF CROWD SOURCING FOR THE RECORDING OF INVASIVE SPECIES

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Obtaining accurate data about the distribution of invasive species is of paramount importance when it comes to assessing impact and formulating an appropriate response. But data provision is often patchy and records are usually unverifiable and lacking accurate geographic reference.

The University of Bristol's Nature Locator team has addressed these problems by combining the development of case specific smartphone applications with the power of crowd-sourcing data collection. The smartphone apps enable high quality data to be collected by both scientists and the public in the field. Critically, each record collected is verifiable since it is comprised of a photograph, along with other relevant metadata such as number or amount of each species seen. Records are also accurately geo-located since the apps utilise the phone's GPS capabilities.

Nature Locator, together with the Environment Agency, Scottish Natural Heritage and the Scottish Environment Protection Agency, has developed an app to monitor approximately 20 freshwater invasive species including many fish species, *Dikerogammarus villosus*, *Pacifastacus leniusculus* and *Eriocheir sinensis* among others. It is anticipated that data from the app will act to enhance our understanding of current species distributions and also function as an early warning system for those spreading to new areas. The app is due for release in May 2013.

Another Nature Locator project "PlantTracker" (http://planttracker.naturelocator.org/) was released in August 2012. This Environment Agency funded project is crowd sourcing the location of 14 priority, principally riparian and aquatic, non-native invasive plant species across the UK in order to facilitate treatment and monitoring. Since its launch this app has received 10,000 downloads and generated 3,000 records of invasive plants. It has already facilitated the eradication of many high priority outbreaks of invasive plant species with the Environment Agency focusing its efforts on floating pennywort (*Hydrocotyle ranunculoides*).

R01

IS CATASTROPHIC DRIFT THAT CATASTROPHIC FOR CHIRONOMIDAE (DIPTERA-INSECTA)?

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The movement of macroinvertebrates suspended in the water column is known as drift. Three classical drift patterns are described: 1) constant drift throughout the water column, characterized by a small number of individuals which are drifting passively and accidentally; 2) behavioral drift, influenced by endogenous and exogenous factors corresponding usually to a daily pattern with higher drifting abundances at night, and 3) passive catastrophic drift, caused by physical disturbances of the sediment by floods with a marked and accidental increase of dragged individuals in water column. Tropical and subtropical rivers show a distinct hydrological cycle with difined flood and dry periods. In the present study we tested the hypothesis that catastrophic drift has a behavioral component. That means that chironomids may use flood periods for downstream dispersal. If this would be true, the relative abundances of the drifting stages pupae and exuviae should be higher during the flood periods. The study was carried in the Sinos River (29º44'08" S, 51º05'86" W) in southern Brazil between January and December 2004 and March 2009 and February 2010 in monthly collections with sampling intervals of 3 hours during 24 hours cycles. The drift samples were taken for 15 minutes at the surface and at the bottom with a plankton net of 500 µm mesh size in the middle of the river. Current velocity was measured by a portable flowmeter. A total of 9,028 chironomids was collected, 6,048 in 2004 and 2,980 in 2009-2010. Of these 7,305 were exuviae and pupae. During 7 months of floods 4,271 pupae and exuviae were sampled, during 16 months of dry season 3,134. This difference is highly significant (chi-square=2,452.7; $p<0.0001$; d.f.=1). Chironomids produce more emergent stages during the flood periods, probably taking advantage of the higher dispersal potential of the river. Therefore, higher drift rates are not exclusively catastrophic but show a behavioral component. The timing of emergence during floods may increase survival because it occurs under turbid conditions which decreases the efficiency of visual predators. Additionally mass emergence is known to have a confusion effect on predators, which as well contributes to higher survival rates.

R11

ALTERNATIVE RIVER BANK PROTECTIONS – AN APPROPRIATE APPROACH TO IMPROVE RIVER BANKS ALONG WATERWAYS FROM AN ECOLOGICAL POINT OF VIEW?

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Engineered bank protection like rip-raps usually prevents the establishment of near-natural plant communities which leads to low levels of species diversity for both flora and fauna and a high proportion of invasive species (neophytes, neozoa). Since the EU Water Framework Directive (WFD, 2000) support and sustain ecosystem standards new concepts for bank protection are required which combine navigation issues as well as the improvement of habitat and species diversity.

To achieve this goal the Federal Waterways Engineering and Research Institute (BAW) and the Federal Institute of Hydrology (BfG) developed different approaches such as the structural improvement of rip-raps, with regard to their ecological value, technical-biological river-bank protection or groyne modifications. The different approaches were tested along different waterways to gain practical experience with these measures under technical as well as ecological aspects.

New groyne types were built along the River Elbe to induce higher hydro-morphological dynamics in the groyne fields and compared to the standard construction applying a monitoring over several years. Results revealed that e.g. groyne modifications with clefts can form scours and small sand banks, which lead to an extension of the shoreline thereby increasing the habitat availability for riparian species.

Along a test reach of the River Rhine with high traffic intensity and extreme water level fluctuations structural improvements of rip-raps and measures of technical-biological river-bank protection were evaluated. First findings show that even under these harsh conditions willow brush mattresses for example can prevent bank erosion due to the quick development of a dense root system. The observations on fish highlight the ecological importance of coarse woody debris along river banks and shallow still water zones that provide protection against wave impacts. While alien fish species dominated rip-raps native species were observed in large numbers at fascines, woody debris, and root stocks.

Concluding, habitat and species diversity along waterways can be improved by alternative bank protection measures on a local scale. A network of such approaches may enlarge the effect on the scale of the river.

SS12

IMPLEMENTATION OF LIFE+ IN GERMANY

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LIFE+ is the only financial instrument of the European Union directly addressing the environment. Since 1992, the LIFE program has co-financed nearly 4000 projects in all fields of nature conservation and environment protection with approximately 2.8 billion Euro.
The implementation in Germany of the current LIFE+ program, running from 2007-2013, is outlined with emphasis on the strand “Nature and Biodiversity”. Statistics on main user groups, duration, targeted ecosystems and amount of LIFE+-projects are presented. Results underline the important role o LIFE+ to support German public authorities in putting European law on nature conservation and environment protection into practise, especially the EU water framework directive and the Natura-2000-directives.
Main perspectives of the future LIFE program running from 2014-2020 are introduced.

SS12

LIFE+ PROJECT "LIPPEAUE" - A LANDSCAPE TO EXPERIENCE

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The Lippe is the most northerly tributary of the Rhine, it has its source in Bad Lippspringe and flows into the Rhine in Wesel after around 220 km. For a lot of organisms it provides a pathway between Münsterland in the north and the Ruhr area in the south-west, serving also as a Biotope Network. The Lippe and its floodplain have always been useful to the local population providing not only settlement possibilities but also providing a means of transport, a source of energy and last but not least, for agriculture. In the past, the Lippe has been re-coursed or straightened, its banks were strengthened and the floodplain was laid dry. This has led to a drastic reduction of animals and plants and a worsening of the flood situation.

Times have since changed. With the help of the EU-LIFE-Sponsorship and the County of North Rhine-Westphalia, the Municipality of Hamm and its project partners consisting of the Lippeverband, the District of Warendorf, the Arbeitsgemeinschaft Biologischer Umweltschutz in the district of Soest e.V. and since 2010, the District of Soest in conjunction with the Projects „Lippeaue“ (2005-2010 and 2010-2015) have all contributed to returning the Lippe and its surrounding plains, to its former natural state.

In addition to the optimisation of the floodplain as a habitat for endangered species and as a flood retention space for high water, the immediate population should be made aware of the need for ecological conservation. An observation tower, an observation hill, information boards and a theme trail, the „Lippeauenpfad“ are now offering an enrichment in terms of leisure and recreation for the city of Hamm. With over 200 excursions and other activities the people have been actively involved into the LIFE-Projects.

The intense early involvement of various user groups significantly contributes to the success of the projects. Also an agreement with the representatives of agriculture, in which the interaction is regulated during the project period and beyond, promoted the acceptance of the project. An impact analysis of the farms in the project area developed by the agricultural chamber ensures the socially responsible implementation. By accompanying Land Consolidation a balance of interest between conservation and agriculture could be created.
Especially because of the extensive publicity and intense user involvement the LIFE-Project „Lippeaue“ was assigned with the „Best of best“ award, as one of the six best LIFE-Projects in Europe.

R09

DETERMINATION OF TROPHIC STATE OF LAKE MANYAS (TURKEY)

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Lake Manyas (Bird Lake), is a lake in western Turkey, located in the Balıkesir province. Lake Manyas is an important site for breeding and wintering waterbirds and one of the Ramsar sites of Turkey. The lake has been declared a national park since 1959 and awarded with the A class diploma by UNESCO in 1976. However, in recent years the lake is under serious threat because of domestic, industrial and agricultural pollutants. From the various factories and poultry farms the industrial and organic wastes reaching the lake through the Sığırcık stream and plays an important role in the deterioration of water quality in the lake.
The aim of this study was to determine the trophic state of Lake Manyas. For this purpose, Total Phosphorus (TP), Chlorophyll-a (chl-a) and Secchi depth (SD) measurements were done from five sites, one pelagic and four litoral region, in monthly intervals. In order to find the trophic state of the lake the trophic state index (TSI) method developed by Carlson (1977) and OECD criterias were used. As a result, according to both indexes the lake is found hypereutrophic conditions.

SS12

LIFE+ "MURERLEBEN"

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Under the heading of "murerleben" runs already the second LIFE - project on the upper Mur in Austria. In the first LIFE III - project from 2003 to 2007 a total amount of EUR 2.2 Mio. was invested for measures to improve the aquatic habitat of the river Mur. Investments of about EUR 2.8 Mio. are planned in the present LIFE+ - project from 2010 to 2015, of which 50% is financed by the EU.
In accordance with the objectives of the Natural Habitats Directive and the requirements of the EU Water Framework Directive on 16 water segments of the river Mur (a total length of 90 km), relevant steps are planned and are implemented in a large part that regards the preserving of the biodiversity, the dynamic river development as well as the improvement of the passive flood protection.
The restoration, improvement and long-term protection of the alluvial forests and river landscapes are a condition for the preservation, especially of aquatic, rare and endangered species of animals and plants. In addition these measures serve as protective water management requirements in order to increase the retention capacity of the river Mur.
To strengthen the already taken measures and to create a related restructuring stretch of river, the new LIFE+ areas were selected consciously in the near of previous projects. In order to document and to protect the success of the projects, the measures, but also the synergy effects of the measures, are scientifically examined in a monitoring programme based on the total length. The programme is going to be continued until the year 2015.
The public relations are an integral part of the project. The population is informed about the project by regular press releases, folders and the project homepage. Additionally, school projects, events and the production of a film for the documentation of the results take place.
Until now great success could be achieved by the realized measures in order to ameliorate the variety structures on the river Mur. Buying more land and reactivating flood plains provide passive flood protection. By means of intensive public relations the project is present in the people’s minds and the awareness and appreciation for the habitat river Mur was increased.
„murerleben“ is an important step towards a close to nature and worth living future on the upper river Mur – many steps should follow in any cause.

R09

TAXONOMIC STRUCTURE AND DIVERSITY ARE DETERMINED MOSTLY BY THE GEOGRAPHICAL PARAMETERS NOT BY AN "ENVIRONMENTAL QUALITY" - SOMETHING IS WRONG WITH THE ASSUMPTIONS OF STAR/AQEM PROCEDURE

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A large data-base on the occurence of leeches (Euhirudinea: Clitellata) found in 1100 large samples of macrobethos collected from varied flowing waters in Poland was analysed. Benthic animals were sampled according to assumptions of STAR/AQEM procedure, which is implementing in numerous EU countries as an official biomonitoring method. Priorily to benthos sampling, environmental quality at sampling sites had been established by Voivodship Inspectorates of Environmental Protection on the basis of biological elements in accordance to requirements of Water Frame Directive. Each sampling site was determined as a one of 26 abiotic types of flowing waters listed in Poland. The main aim of the study was to determine the taxa of Euhirudinea, which have high value as bioindicators of environmental quality in particular abiotic types. Additionally, certain parameters as altitude, longitude, latitude and distance to the source were included to analysis. Procedure of sampling used in the study seems to be clearly inappropriate to study the leech asemblages, which resulted e.g. in high percentage of empty samples. Most important in explaining the variability between leech samples were geographical variables, especially distance to the source and altitude.
Contrary to expectations no significant differences in number, percentages and taxonomic diversity between leech species and assemblages sampled from sites differred in terms of environmental quality were observed. The lack of those differences were noted in all analysed abiotic types of running waters.

SS11

ARE SUCCESSFUL RESTORATION MEASURES OF URBAN WATER BODIES POSSIBLE?

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The water boards Emschergenossenschaft and Lippeverband carry out restoration measures at urban running waters for more than 20 years. Upon completion the development of the restored river stretches are monitored for many years, e.g. referring to the demands of the European Water Framework Directive (WFD). The monitoring program lasts for at least 10 years and it is/was applied to 40 different running waters until now. Within the monitoring program we focus predominately on aquatic invertebrates (macrozoobenthos), the chemical-physical conditions and river morphology.
The presentation will describe best practice examples of successful restoration measures, partly beyond the assessment of the WFD. The focus is on the following questions: How does the succession of the macrozoobenthos community proceed in the course of time? What seem to be key factors for successful river restoration?

R08

CH_4 EMISSIONS FROM SEDIMENTS IN SHALLOW LAKES: THE IMPORTANCE OF CARBON SOURCE (PHYTOPLANKTON, MACROPHYTE OR TERRESTRIAL) AND TEMPERATURE

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Although lakes play an important role in the global carbon cycle surprisingly little is known about the climate change effects on the CH_4 fluxes between lakes and the atmosphere. Besides an increase in temperature, climate change may strongly influence the source (phytoplankton, macrophytes, terrestrial) and quantity of organic matter in the lakes. We aimed to disentangle the effects of temperature and terrestrial input on CH_4 emissions in two shallow lakes with different stable states. We split a small, eutrophic macrophyte-dominated and a phytoplankton-dominated lake into two halves using a curtain and added particulate terrestrial organic matter (maize leaves) to one half. In summer and autumn we took sediment cores in the littoral and profundal area in both lakes on both sides. The intact cores were incubated under anoxic conditions at two temperatures differing 5°C and we measured CH_4 emissions. Additionally, we measured CH_4 concentrations at different water column depths in each lake. Summer sediment-water fluxes were, in both lakes, highest in the profundal area followed by the littoral areas where extra terrestrial matter had been added. By autumn this difference had disappeared and decreasing CH_4 concentrations in the cores suggested that anaerobic CH_4 oxidation occurred. The summer CH_4 fluxes were strongly related to organic matter quantity and quality (C:N ratio; a250:a365). Temperature clearly affected CH_4 emissions in the phytoplankton dominated lake in summer, but the effect in the macrophyte dominated lake was not clear. Although decreasing CH_4 concentrations towards the water surface confirmed that CH_4 oxidation plays an important role in both lakes, CH_4 concentrations remained supersaturated in both phytoplankton- and macrophyte-dominated lakes. Preliminary results thus suggest that an extra input of terrestrial matter had a detectable effect on CH_4 emissions, possibly more so than either temperature or stable state (phytoplankton versus macrophyte dominance) highlighting the importance of allochthonous carbon inputs on carbon cycling in shallow lakes.

R09

BENTHIC DIATOMS AS A TOOL FOR WATER QUALITY ASSESSMENT OF RIVERS AND STREAMS IN CROATIA - IMPLEMENTATION OF WATER FRAMEWORK DIRECTIVE

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The purpose of this paper is to make an inventory of the diatom assemblages in Croatian rivers and streams, to access the relationship between diatom species composition and environmental variables and to choose among existing metrics the one that is the most appropriate for Croatian rivers and streams. Investigations were performed during spring and summer in 2006, 2007 and 2009. Altogether, samples were collected on 141 sampling points on 92 different rivers and streams in Croatia. Samples for water chemistry analysis were taken at the most of the sampling points. Altogether 182 diatom species were noted and used for the analysis. Canonical analysis of principal coordinates (CAP) revealed that main environmental factors describing the dataset were waterbed type, total N, NO_3^-, oxygen saturation, type of waterbed and stream type. It seems that nutrients, especially phosphorus, have more important role concerning diatom assemblages when we look into the data at regional scale. SOM analysis distinguished 10 stream types which indicate that existing typology is too detailed for diatom assemblages. Using OMNIDIA software, numerous water quality indices were calculated and with combination of different multivariate analyses, correlations with environmental factors and expert opinion, trophic index was chosen as a metric for estimation of water quality in running waters in Croatia. For every species, indication and sensitivity values were adopted for Croatian geomorphology using simple linear regression between diatom species abundance and total phosphorus concentration. Boundaries were set for different groups of stream types, streams water quality map was drawn and reference sites were selected for further consideration.

SS08

GROUNDWATER CONTROLS ON HYPORHEIC EXCHANGE FLOW PATTERNS AND ASSOCIATED BIOGEOCHEMICAL ACTIVITY HOTSPOTS IN LOWLAND RIVERS

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Exchange fluxes across aquifer-river interfaces can have a major impact on the biogeochemical cycling in streambed environments. This paper presents integrated experimental and model-based investigations of physical drivers and chemical controls on streambed biogeochemical cycling. It combines in-stream geophysical surveys, multi-level mini-piezometer networks and active and passive heat tracing methods for identifying spatial patterns and temporal dynamics of aquifer-river exchange fluxes with multi-scale hyporheic pore-water sampling and applications of reactive “smart-tracers”.
Hyporheic pore water analysis from nested multi-level piezometers and passive gel probe samplers revealed significant spatial variability in streambed nitrogen cycling in dependence of redox-conditions, dissolved oxygen and bio-available organic carbon concentrations. Hot spots of increased nitrate attenuation and anaerobic respiration of carbon were associated with semi-confining streambed peat lenses. The intensity of concentration changes underneath the confining peat layers correlated with the state of anoxia in the pore water as well as the supply of organic carbon and hyporheic residence times. In contrast, at locations where flow inhibiting peat layers were absent or disrupted - fast exchange between aquifer and river caused a break-through of nitrate without significant concentration changes along the hyporheic flow path. Fibre-optic Distributed Temperature Sensing was applied for identifying groundwater - surface water exchange flow patterns in dependency of streambed structural heterogeneity and supported the identification of flow inhibiting structures as indicators of streambed reactivity hot spots.
Coupled groundwater-surface water model simulations supported the experimental results, indicating that hotspots of exchange fluxes and streambed biogeochemical activity were predominantly controlled by the spatially heterogeneous impact of hydraulic conductivity patterns on the regional groundwater up-welling. In comparison, bedform driven processes including the advective pumping of surface water had only marginal impact and were widely superimposed by spatial variability in groundwater up-welling, questioning the adequacy of current conceptual models that emphasize streambed topography as the main control of hyporheic exchange flow patterns and associated biogeochemical turnover.

R03

ALLOCHTONOUS DETRITUS SUPPORT DANISH FORESTED STREAM FOOD WEBS – A STABLE ISOTOPE STUDY

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Basal resources supporting Danish stream food webs were studied in forested and open reaches of four streams by analyzing natural abundance of carbon (C) and nitrogen (N) stable isotopes of the food web compartments. Stable isotope signatures ($\delta^{15}N$ and $\delta^{13}C$) of potential sources were analyzed to determine: 1) which sources of energy supports the food web, and 2) possible changes in food web structure between forested and open reaches. Streams were chosen where an open grassland or meadow reach was followed by a forested reach in the same stream or vice versa, with approximately 500 meters reach lengths of each type. Two streams had an open to forest flow direction and two streams had a forest to open flow direction. The two sites of a stream were similar in water chemistry and catchment properties, except for the nearby riparian areas.
In all streams there were differences in source as well as consumer $\delta^{13}C$ between open and forested reaches. While this was expected, the difference in all consumer taxa $\delta^{15}N$ signatures were more surprising with a higher $\delta^{15}N$ in consumers of the open reaches, when compared to the $\delta^{15}N$ in the same taxa of the forested reaches. As it is the same taxa analyzed, the trophic role must be the same; however a higher $\delta^{15}N$ in the open reaches indicates a higher trophic position for these consumers. Another suggestion however, is that there is less retention of nutrients from agricultural practices in the open reaches and as the N-pool from agriculture is usually highly enriched in ^{15}N due to fractionation in livestock, this will be reflected in the organisms when it is incorporated into the food web. Further, forest foliage generally has low $\delta^{15}N$ values compared to in-stream periphyton or macrophyte assemblages, as also found in our study. So although degradation of the more indigestible allochtonous supply in the forest reach potentially require more steps in degradation (greater bacterial and meiofaunal diversity) leading to enrichment of the heavy N isotope (more fractionated Nitrogen), the catchment usage in the nearby riparian settings, seems to have a greater impact on the isotope signatures; even within few hundred meters of the same stream.

SS13

SMALL-SCALE STREAM MACROINVERTEBRATE DISTRIBUTION MODELS: THE CATCHMENT PERSPECTIVE

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Species distribution models (SDMs) are applied in freshwater ecosystems to understand the environmental factors that determine species' ranges and to assess the effects of environmental change on these ranges (e.g. climate change). Most freshwater models are built for broad extents (e.g. whole continents), at large scales and with low resolutions (>1km), leaving out environmental predictors which are known to influence riverine species' distribution. Our aim is to build SDMs that include these important predictors describing the physical conditions and ecological processes at much smaller scales (<90m). Catchments are the research units of choice as they encompass many of these processes. Within them, models of stream macroinvertebrates are set up with predictors describing the bioclimate, topography, hydrology and land use. These are applied in the model for a reach or a subcatchment, depending on the scale at which each predictor influences the macroinvertebrate community. To avoid an important source of bias, in this study we use occurrence data collected explicitly for the development of SDMs. We present first results that indicate improved model performance and less patchy occurrence predictions. The importance of each environmental predictor is inferred for single species and for the community. Reaches with particularly high or low predicted richness and diversity are described and located in the catchment. The potential application of the results in watershed management is discussed.

R11

RIVER AND FLOODPLAIN RESTORATION ON THE UPPER DANUBE BY REESTABLISHING RIVER CONTINUUM AND ECOLOGICAL FLOODING

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The upper Danube and its floodplain lost natural dynamics and river continuum in the 19th and 20th century due to river regulations. Power dams inhibiting river continuum and stream straightening are avoiding flooding and groundwater fluctuations. Measures has been taken to improve river continuum, flood dynamics and groundwater fluctuations. Three major measures were conducted to improve ecological conditions in the largest (2.100 hectare) remaining alluvial forest between Neuburg and Ingolstadt on the German Danube. 1. Construction of an eight km river system bypassing Bergheim barrage, which creates new stream habitats and allows longitidunal and lateral connections. 2. Frequent controlled flooding of 100 hectare flood plain forest to enhance flood dynamics. 3. Artificial changes in groundwater table to stress flood plain vegetation.

The project with a total investment of 15 Mio. Euros is accompanied by a intense monitoring programme of a 1 Mio. Euro costing monitoring programme in the aquatic systems and in the floodplain forest to evaluate the efficiency of the taken measures

SS13

ENERGETIC ORGANIZATION, FOOD WEB STABILITY AND CRITICAL TRANSITIONS IN THE ECOSYSTEM MODEL PCLAKE

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The structure and stability of a food web is largely determined by the strength of interactions that occur among its populations, and particularly the prevalence of weak links seems critical for the persistence of complex communities. Theoretically, interaction strengths are often approached as the entries of the Jacobian matrix (partial derivatives), used for linear stability analysis of Lotka-Volterra type equations near equilibrium. Empirically, however, it is found difficult to measure interactions strengths and link up with theoretical work.
In a novel, and potentially unifying approach, De Ruiter et al. (Science,1995) expressed interaction strengths as functions of measurable parameters related to the energetic organization of the food web (i.e. biomass, feeding rates, efficiencies), and built Jacobian matrices for real soil food webs. Their analysis revealed that besides the prevalence of weak links, the patterning of interactions strengths is an important determinant for stability, characterized by relatively strong top-down effects at the lower trophic levels, and relatively strong bottom-up effects at the higher levels.
The focus on trophic interactions implicitly assumes that predation is the most important process regulating community dynamics. In many systems, however, non-trophic interactions may also be important factors controlling the stability landscape. In shallow lakes, for example, sudden catastrophic transitions are generally associated with (interference) competition for light between macrophytes and phytoplankton. Which does not imply that trophic interactions are trivial as their effects may cascade across adjacent trophic levels and too contribute to the emergence of alternative stable states.
With the use of the ecosystem model PCLake, which explicitly models the most important biotic groups and their interrelations within the general framework of (closed) nutrient cycles, we study how the configuration of biomass and feeding rates affects food web stability, and predicts the response of the system as a whole. Following the procedure of De Ruiter et al, we constructed Jacobian matrices for the food web in PCLake along an eutrophication gradient, knowing that a regime shift is imposed when a critical nutrient loading is exceeded. Such integrated approach may help to elucidate which processes are predominant in controlling critical transitions in shallow lakes, and bridge the gap between food web patterns and community dynamics.

R02

GENETIC POPULATION STRUCTURE, EVOLUTIONARY LOSS OF TOXIN SYNTHESIS GENES AND SECONDARY METABOLITE SYNTHESIS IN THE CYANOBACTERIUM PLANKTOTHRIX

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It is intriguing to note that toxins produced by cyanobacteria show a patchy distribution, i.e. within one species both strains that are able to produce a certain toxin as well as nontoxic strains exist. The genus *Planktothrix* is frequently involved in bloom formation in lakes and reservoirs worldwide. Its green or red pigmented strains may contain the toxic heptapeptide microcystin (MC), but also differ in numerous additional (non-)ribosomally produced bioactive peptides. The factors influencing this patchy distribution are not understood. In this study, in total 138 *Planktothrix* strains, isolated from Europe, Russia, North America and East Africa, were analyzed (i) for the genetic variation within seven housekeeping gene loci, (ii) for the presence of remnants of genes encoding MC synthesis in non-toxic strains, and for the presence of genes encoding additional bioactive peptides, and (iii) for the occurrence of bioactive peptides, such as putative aeruginosins (containing either SO_3^-, Cl^-, or both), MCs, anabaenopeptins, putative cyanopeptolins (with and without SO_3^-), and planktocyclins, as revealed by LC-MS/ESI.

The phylogenetic analysis revealed a trichotomy consisting of non-toxic lineage 1 (n = 55) and a toxic lineage 2 (n = 76) occurring in both continents (Europe and North-America) as well as one non-toxic tropical lineage (n = 7). All 56 strains that did not contain the full *mcy* gene cluster contained at least remnants of it. In general, anabaenopeptins (n = 100) occurred most frequently, the cyanopeptolins (n = 102), and MCs (n = 64) occurred in lineages 1 and 2. Planktocyclins were found the least abundant (n = 23). The dependence of peptide occurrence on phylogenetic, ecophysiological (e.g. pigmentation) and environmental (water depth, geographical distance) parameters was determined using direct gradient analysis. The two abundant groups MCs and anabaenopeptins showed little correlation with these parameters. In contrast, specific aeruginosins and cyanopeptolins had their optimum frequency within strains assigned to a specific phylogenetic lineage. Thus, comparing peptide occurrence quantitatively between lineages can provide an opportunity to elucidate correlations between particular peptides and the speciation of the respective lineages.

R12

FEEDBACKS ON DATA COLLECTION, DATA MODELING AND DATA INTEGRATION OF LARGE DATASETS: APPLICATION TO RHINE-MEUSE AND RHONE-MEDITERRANEAN DISTRICTS (FRANCE).

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To improve our understanding of hydrosystem functioning, we need to enhance our knowledge of hydrobiological processes and to identify and quantify the associated pressures. In this context, the ANR11-MONU14 Fresqueau project associates data miners with hydrobiologists to define a new knowledge discovery process from datasets provided by public databases, in order to fully meet the expert requirements. The required data are grouped into five major categories: (i) data on water quality, (ii) data characterizing sampling reaches, (iii) data describing the hydrographic network, (iv) data estimating human activities (land use and waste water treatment plant) and (v) climate and environmental forcing variables. All these data are spatial and complex to structure and to inter-connect because of their volume and their nature. The studied data are characterized by a high heterogeneity due to their origin (values from measurements or expertise), their value, which can be quantitative, semi-quantitative or qualitative, and their structure (point, line, surface polygon) as well as because of their temporal variability (sampling duration and frequency). The objective of this presentation is to introduce the first phase of our work for collecting, modeling and integrating data. The inventory is carried out in two French districts: Rhine Meuse (33 000 km2) and Rhone Mediterranean and Corsica (130 000 km2). We present the main operational learnings from the work performed on the 16 concerned public databases (access, rights of use, data format, etc.). As a result, we present the conceptual data model (data standardization and positioning linking).

SS12

THE RIVER CONTRACT: A CONSULTATION PLATFORM IN WALLONIA (BELGIUM) FOR INTEGRATED RIVER MANAGEMENT

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In Belgium, the management of rivers is split in several administrations: regional, province and municipalities. Moreover, other actors such as drinking water production, water treatment and other water or river users have an impact on surface and groundwater quality and quantity. The Water Framework Directive asks for an integrated surface and groundwater management, so, the Walloon region established the river contract. This is a partnership of, as wide as possible, organisations which can work together for river restoration, management and protection … Within a cycle of three years, the river contract make an inventory of the rivers of a defined catchment. It is used to define concerted actions to carry on solving the problems highlighted by the inventory. Then, the partners take on to realize these actions in order to improve water management, quality, in other words, to reach the obligation of the Water Framework Directive. The River Contract works as an intermediate between the different power level and the citizens.

R14

MODELLING THE COMBINED EFFECTS OF AGRICULTURAL STRESSORS ON STREAM BENTHIC INVERTEBRATES

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Agricultural land use is affecting ecosystems worldwide and, in most situations, multiple stressors are at work. A stressor is a variable that, as a result of human activity, exceeds its range of normal variation and adversely affects ecosystem structure and function. Ongoing farming intensification and increasing abstraction of water for irrigation will put further pressure on stream ecosystems, and managers need to understand how multiple stressors affect ecological responses, especially the interactions between these stressors. For example, the effects of elevated nutrient and fine sediment inputs to streams due to farming are likely to interact with the effects of stream flow alteration, but such combined effects on invertebrate communities are largely unknown.

In summer 2011, we collected benthic invertebrate, nutrient and fine sediment samples from 43 stream sites spread throughout the catchment area of the Manuherikia River, a dryland river in Central Otago, New Zealand. Stream flows and water temperatures for each site were modelled using a catchment-scale model (SWAT, Soil and Water Assessment Tool). We then used generalized linear models and an information-theoretic approach to examine the individual and combined effects of stream flow alteration, nutrient enrichment, fine sediment inputs and water temperature on benthic invertebrate communities (focusing on sensitive taxa, community metrics and functional traits).

Farming intensification and water abstraction strongly affected the invertebrate community, and particularly taxa in the orders Ephemenoptera, Trichoptera and Plecoptera (EPT) as well as functional species traits. Most invertebrate taxa and community metrics responded to more than one stressor. For example, the final model for ‘percentage of EPT taxa’ explained 79 % of the variation in the data and included the predictor variables deposited fine sediment, nutrients and stream flows. Overall, we found a variety of complex significant interactions among the stressors, both antagonistic and synergistic.

Our findings imply that abstracting more water from streams already subjected to high farming intensity will have stronger detrimental effects on stream organisms than abstracting water from more pristine streams. Managers need to consider these multiple stressor effects when setting environmental flow limits.

R11

IDENTIFYING OPTIMAL REHABILITATION AREAS IN RIVER SYSTEMS: AN APPROACH ADAPTED FROM CONSERVATION PLANNING

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River rehabilitation aims to restore the conservation status of freshwaters, reducing the risk of losing the services that they provide. But, the success rate is low. The increasing funds devoted to rehabilitation measures have failed to improve this rate because trade-offs between costs and ecological benefits of management actions are rarely incorporated in the planning, i.e. in the prioritization of rehabilitation activities. In this project, we link costs of three types of management actions (depiping, widening of one riverside, and widening of both sides) to the improvement in riparian zone quality. We then use Marxan, a widely applied conservation planning software to identify priority areas to implement these rehabilitation measures in Switzerland. We demonstrate our approach by calculating optimal rehabilitation plans for two neighboring Swiss cantons independently (Aargau, AG and Zürich, ZH), and compare them to a plan for both cantons together to show how the allocation of priority areas and related costs change with collaboration. Priority areas identified for individual cantons met all the targets (i.e. the lengths of different actions to implement) at a total cost of 106.1 Million CHF (AG), and 129.3 M CHF (ZH). The best collective rehabilitation plan identified similar key rehabilitation areas as in the individual plans, while overall a shift in priority areas from the canton of Aargau towards Zürich was revealed. Consequently, the collaboration of the two areas led to an increase in implementation cost (6%) and more rehabilitated riparian zone (9%) in the canton of Zürich. This was achieved at only little extra costs (2 M CHF), while also considering slightly more riparian zone to rehabilitate (8881 m) than in the single plans together. Considering costs of management actions coupled with their benefits for river quality, as we propose here, helps allocating rehabilitation funds for sets of management actions at optimal locations. Moreover, we show that the spatial allocation of priority areas and therewith the optimal investment of rehabilitation funds change, when rehabilitation activities are planned collectively. In the future, our approach will support river managers in planning rehabilitations cost-effectively and deciding on the optimal spatial scale. This will facilitate the collaboration among self-governed areas, which so far manage rivers independently and ultimately improve the success rate of river rehabilitation activities.

SS07

IN-SITU MEASUREMENTS OF NITROGEN TRANSFORMATIONS AT SURFACE-GROUNDWATER INTERFACES

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Anthropogenic activities have disturbed the global nitrogen (N) cycle such that natural attenuation processes are becoming overwhelmed. As a result, high loads of N enter aquatic environments where the potential for N removal exists, but is not realised, resulting in eutrophication of receiving waters. In rivers, the hyporheic zone is considered a ‘hot spot’ of N removal through denitrification (DEN), however processes that conserve N such as nitrification (NIT) or dissimilatory nitrate reduction to ammonium (DNRA) can also occur. At present it is unclear exactly what controls the prevalence of different N transformations within the hyporheic zone, perhaps due to few truly in-situ measurements of these processes.
Here, we present a synthesis of work conducted at the River Leith, a permeable, groundwater-fed river in Cumbria (UK) where we have measured N transformations in the river bed both in-situ and in the laboratory using 15N-techniques. At the cm-scale, rates of DEN and NIT potential were quantified within two riffles to a maximum depth of 40cm in the river bed. Maximum rates of DEN and NIT occurred at opposing ends of a biogeochemical gradient, with DEN promoted under reduced chemical conditions and by organic matter decomposition. Both processes were also affected by hydrological factors, such as strength of groundwater upwelling and porewater flow velocity. At the dm-scale we focussed on pathways of dissimilatory nitrate reduction within both riffles and pools, quantifying DEN, DNRA and testing for anaerobic ammonium oxidation (of which there was no evidence). DEN was the most important pathway of nitrate reduction, however at some sites >60% of nitrate removal occurred via DNRA. Rates of DNRA were spatially heterogeneous across the reach and related to biogeochemical rather than hydrological factors. Laboratory manipulations showed that DEN activity decayed with depth, and was enhanced within riffles, as observed through in-situ, dm-scale measurements. There were differences however, between the location of DEN ‘hot spots’ detected using the two methods and the importance of DNRA was underestimated in laboratory-based measurements. Our study highlights that N transformations within the hyporheic zone are the result of complex interplay between biogeochemical and hydrological processes. Removing sediment from the river bed prior to analysis destroys these complex interactions and could have serious implications for quantifying N transformations.

SS07

ECOLOGICAL DYNAMICS IN SHALLOW ALLUVIAL AQUIFERS AND THE EFFECTS OF GROUNDWATER AND RIVER FLOW FLUCTUATIONS

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Alluvial rivers that interact with heterogeneous aquifers are often characterized by longitudinal and temporal shifts between influent flow (groundwater recharge) and effluent flow (groundwater discharge). Variable river-groundwater exchange may, in turn, lead to variation in the effects of river flow and groundwater level fluctuations on groundwater chemistry and biodiversity. Understanding these effects is important for determining protective river flows and groundwater levels for healthy groundwater ecosystems. Variable exchange patterns make hydrologically complex rivers useful sites for groundwater ecology studies. We used a hydrologically complex river in an alluvial plain in southern New Zealand to study ecological responses in shallow aquifers to river flow and groundwater level fluctuations. Monitoring wells with level recorders were installed adjacent to losing, gaining and variable river reaches in 2004 and 2011, and groundwater and river chemistry, and groundwater macroinvertebrates and heterotrophic bacteria were sampled from 2005 to 2012. We used the resulting dataset to characterize aquifer zones, and to quantify relationships between river flows and groundwater levels; groundwater ecology and river chemistry; and between groundwater ecology and river flows and groundwater levels.

R02

PHYLOGENY OF SOUTH AMERICAN LARAINAE (COLEOPTERA: ELMIDAE) – SEARCHING FOR THE ORIGIN

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The world fauna of the subfamily Larainae includes 28 genera and about 130 species, with the greatest species diversity in the tropical regions of South America, Asia and Africa. Larainae represents distinct group of semiaquatic beetles within family Elmidae, distinguishing by many morphological and ecological features. The taxonomy and phylogeny of the group is however still very poorly known, and monophyly of the subfamily is often questioned. In our study, we have tested the hypothesis of a single origin of the South American genera and we also assessed the phylogenetic position of several genera with deviated morphological features. Based on morphological features, it is probable that there are two separate groups within South American Larainae. One group, looking more derived, including genera such as *Hypsilara*, *Phanocerus*, *Phanoceroides* or *Roraima*, and the second, (resambling larains from other regions) including *Disersus*, *Pseudodisersus* or *Hexanchorus*. Out of the World 28 genera, 13 are from Central and South America and the samples available for this analysis represented more than a half of them. For reconstruction of the phylogeny and taxonomy of South American Larainae, we used mitochondrial and nuclear DNA markers. Sequences were edited in Sequencher v5.0.1 and aligned in Mega software v.5 with Muscle and ClustalX algorithms. We have tested monophyly of the group and relationships with other Elmidae genera. Investigating the origin of South American Larainae, we aimed to compare the genera and define, whether the Larainae fauna is derived from a single predecessor, or the genera evoluted independently. We also tested relationships of the groups to the European and African genera (e.g. *Potamophilus*, *Potamodytes*) and also to the North American *Lara*. The data on the genetic variability will contribute to the development of determination technology of animal species using DNA. This contribution is the result of project implementation (ITMS: 26240220049) supported by the R&D OP funded by the ERDF.

SS13

DEALING WITH NOISY ABSENCES TO OPTIMIZE SPECIES DISTRIBUTION MODELS: AN ITERATIVE ENSEMBLE MODELLING APPROACH

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Species distribution models (SDMs) are widespread in ecology and conservation biology, but their accuracy can be lowered by non-environmental (noisy) absences that are common in species occurrence data. We propose an iterative ensemble modelling (IEM) method to deal with noisy absences and hence improve the predictive reliability of ensemble modelling of species distributions.
In the IEM approach, outputs of a classical ensemble model (EM) were used to update the raw occurrence data. The revised data was then used as input for a new EM run. This process was iterated until the predictions stabilized. The outputs of the iterative method were compared to those of the classical EM using virtual species. The IEM process tended to converge rapidly. It increased the consensus between predictions provided by the different methods as well as between those provided by different learning data sets.
Comparing IEM and EM showed that for high levels of nonenvironmental absences, iterations significantly increased prediction reliability measured by the Kappa and TSS indices, as well as the percentage of well-predicted sites. Compared to EM, IEM also reduced biases in estimates of species prevalence. Compared to the classical EM method, IEM improves the reliability of species predictions. It particularly deals with noisy absences that are replaced in the data matrices by simulated presences during the iterative modelling process.
IEM constitutes a promising way to increase the accuracy of EM predictions of difficult-to-detect species, as well as of species that are not in equilibrium with their environment.

SS01

DO FUNCTIONAL OR MORPHOLOGICAL CLASSIFICATIONS EXPLAIN STREAM PHYTOBENTHIC COMMUNITY ASSEMBLAGES?

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There are many useful metrics used to explain ecological variation within phytobenthic communities. However most metrics are difficult to use with precision and do not, in isolation, effectively describe complex changes in the state of communities responding to environmental pressures. Many metrics focus upon a subset of species within the phytobenthic community or only explain assemblage according to one stressor and most metrics require specialist knowledge to identify species within the community. This study explored the potential of functional and morphological classifications to explain phytobenthic community responses to nutrients, current velocity, simulated spates and invertebrate grazers. Three classifications previously used with phytobenthos and a new metric developed from a method used on phytoplankton were tested using two datasets from streams in the North West of England in 2010. A combination of the newly applied morphological classification (using surface area to volume ratio) and the functional classification (using life forms) showed potential for aiding understanding of the response of phytobenthic communities to environmental pressures. With further validation this new classification method would be easier for non specialists to use and could potentially give a better overall insight into the state of the entire phytobenthic community.

PS6

RAPID EVOLUTION DURING HABITAT INVASIONS

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A fundamental unresolved problem regards constraints on adaptation to novel environments. Invasive species are often striking in their capacity to overcome such constraints and extend their ranges into novel habitats. In particular, in recent years, invasions from saline to freshwater habitats have become increasingly common. For example, within the past century the copepod Eurytemora affinis has invaded freshwater habitats multiple times independently from saline sources. To dissect evolutionary responses during these independent habitat invasions, my laboratory has been integrating analyses of physiological function with comparative functional genomics. Several factors appear to critically affect successful invasions into freshwater habitats, namely, salinity, food concentration, and microbes. We found the evolution of increased freshwater tolerance following saline to freshwater invasions and evolutionary shifts in activity and expression of ion transport enzymes and other loci that affect ionic regulation. We found that high-food concentration could significantly increase low-salinity tolerance. This reliance on ample food for low-salinity tolerance was reduced in the freshwater population, indicating that the food x salinity response has evolved following freshwater invasions. In addition, we found dramatic shifts in the copepod microbiome and parallel shifts across independent invasions. However, a set of core microbial taxa appeared to persist in all copepod populations across all environments. These core taxa include species known to be mutualists in ants and other insects by producing antibiotics or providing nutritional benefits. Such microbial constituents might have important functions for host fitness during invasions. We are currently exploring interactions among the key factors that might constrain or facilitate freshwater invasions and are probing the transcriptional responses of the copepod to these factors, as well as shifts in its microbial metagenome as it invades.

R02

ASSESSING AND INTEGRATING THE LEVEL OF GENETIC BIODIVERSITY INTO ASSESSMENTS OF FRESHWATER ECOSYSTEM QUALITY: NEW TRENDS AND CHALLENGES

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Biodiversity encompasses the diversity at community, species and gene level. In particular the level of genetic diversity is essential as it defines the evolutionary potential of species' and communities to respond and adapt to ongoing and future environmental stress. A growing number of studies clearly demonstrate the importance of the genetic diversity for population fitness and long-term species persistence. However, information on genetic diversity has been largely neglected in freshwater ecosystem assessments. For successful conservation and restoration plans, considering genetic diversity is of utmost importance. With molecular markers, such information can be analysed and it is possible to distinguish genetically rich from depauperate source populations, reveal signatures of population isolation or stress and estimate the dispersal potential. In the past, the selection of molecular markers was mainly driven by the availability and costs of the markers rather than their suitability for analysing genetic diversity. For freshwater organisms this problem was particularly evident, since few genetic resources such as microsatellite, transcriptome or genome databases were available. Today, scientists benefit from an array of so-called "next-generation" sequencing technologies, which bring powerful genomic tools in reach even for small laboratories studying genetically little known organisms. Using examples from 14 aquatic invertebrate species I will highlight the potential and pitfalls of different next-generation sequencing platforms (SOLiD, 454, Illumina and Pacific Biosystems) for marker isolation as compared to traditional protocols. One recently emerged technique for assessing the intraspecific genetic diversity, the dispersal potential and patterns of selection is RADseq (Restriction site associated DNA sequencing). With RADseq, the genomic complexity is reduced by several orders of magnitude using restriction enzymes. With specific barcode-adapters and next-generation sequencing methods, thousands of loci can be screened and compared efficiently for individual specimens or population at reasonable costs. This allows for a much greater resolution when studying population level processes than with traditionally applied markers. Such information on the genetic diversity can and shall be incorporated into assessments to improve conservation and restoration efforts.

SS14

FOSTERING WATER MANAGEMENT THROUGH CAPACITY DEVELOPMENT - LESSONS FROM THE INTERNATIONAL WATER RESEARCH ALLIANCE SAXONY (IWAS)

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The global water community acknowledges more and more that the concept of integrated water resources management (IWRM) is only the starting point in the IWRM implementation process. It is increasingly recognized that inadequate governance structures and especially the gap between existing and required capacities in the water sector constrain an enhanced water resources management (cf. Alaerts 2009).
Therefore, a key objective of the International Water Research Alliance Saxony (IWAS) is to evaluate the influence of capacity development (CD) on the implementation process of IWRM. IWAS addresses pressing challenges in the water sector, esp. focusing on drinking water and sanitation, agricultural irrigation and surface water quality to develop innovative solutions in different model regions worldwide (Kalbus et al. 2012). Special attention is drawn to a context specifically adapted IWRM concept integrating CD and its measures on all relevant levels: the individual, the institutional as well as the enabling environment, i.e. harmonising processes of IWRM and capacity development (Leidel et al. 2012).
This approach is illustrated by successful case studies: on the individual level through an electronic learning module on IWRM jointly developed with the German IHP/HWRP Secretariat, as well as a pilot farm program in Oman; on the institutional level by setting up a water competence centre in Vietnam, an installed IWRM office in Oman and the strengthening of the Ukrainian water association; on the systemic level by strengthening the river basin management approach in the Ukraine.
Based on the selected CD measures we show the high relevance of harmonizing both concepts (IWRM and CD), its inherent links to modelling, technology and socio-economic aspects as well as lessons learnt from this complex process in an international context.

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SS06

FLOW CESSATION, WATERBODY ISOLATION AND RIPARIAN VEGETATION MODERATE THE POTENTIAL SUBSIDY OF AQUATIC FAUNA TO THE TERRESTRIAL ZONE

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Aquatic fauna provide important subsidy to terrestrial consumers but flooding and drying events affect the exchange of energy and material between aquatic and terrestrial ecosystems. In highly seasonal rivers, spatial variation in aquatic-terrestrial linkages may be high during dry periods when hydrological connectivity is low. We investigated relationships between dry-season hydrological connectivity and potential subsidy of aquatic fauna to consumers in riparian zones in two highly seasonal rivers in Australia’s wet-dry tropics. Stable carbon and nitrogen isotopes of invertebrate predators in riparian zones were closely aligned with aquatic invertebrates, including emergent adult insects, in both hydrologically-connected (flowing) and disconnected (isolated) waterbodies. Consumers of aquatic fauna, including fish, crustaceans, invertebrates and flying adult insects with aquatic larval stages, made up a considerable proportion (40-50 %) of the observed vertebrate fauna in riparian zones. In isolated waterbodies, estimates of potential insect emergence and the proportion of vertebrate species in riparian zones that consume these insects both increased as indicators of riparian plant regeneration and condition improved. Our findings suggest that aquatic fauna provide important subsidies to terrestrial-zone consumers (invertebrates and vertebrates) during the dry season, and that for isolated waterbodies, these transfers can be moderated by riparian vegetation condition. The wide home and foraging ranges of some consumers also suggests that the importance of these subsidies may extend far beyond the waterbody of origin. Human activities and climate-driven alteration of flow regimes and riparian zones that cause isolated waterbodies to dry out prematurely or the fragmentation of riparian vegetation are likely to have negative impacts on aquatic-terrestrial linkages in these systems.

R10

APPLYING PHYTOPLANKTON INDICES ALONG THE RIVER LOIRE (FRANCE)

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The river Loire’s phytoplankton has been extensively studied since the 1990s (Water Authority AELB), and the Bi-Eau Consultancy has also made a large contribution to this effort. This monitoring has been extended post-2000 (WFD), but there are currently no French tools to use these data in a systematic way. Over the last 10 years, the National Running Waters System (SEQ-Eau) used only total phytoplankton ‘units’, with no further details (cells, individuals or biomass). New assessment methods that meet the requirements of WFD (2000) have been developed recently for river phytoplankton, applying various metrics, covering both composition and abundance data (biomass, photosynthetic pigment content). We applied the Hungarian HRPI and the German Phyto-Fluss indices to our data from the river Loire phytoplankton community. The Hungarian HRPI is based on phytoplankton functional groups, while the German Phyto-Fluss uses species level data. These approaches were applied at the whole river scale, involving 19 stations along the Loire, from March to November 2009. Here we discuss merits and pitfalls of these indices, and specify when and why they perform better.

SS14

COMMUNITY ENGAGEMENT ON THE ENVIRONMENTAL USE OF THE RIVER CRANE, A TRIBUTARY OF THE RIVER THAMES FOLLOWING A MAJOR POLLUTION INCIDENT.

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At SEFS7, the implementation of EU legislation covering the Habitats, Birds and Habitats Directives was discussed in the context of community use of the River Crane, a tributary of the River Thames. The positive outcome of partnership working was emphasised where a previously heavily polluted river had become a haven for wildlife.

Unfortunately, in October 2011, a sluice gate jammed and sewage was discharged into the river. This resulted in extensive ecosystem damage including the death of many mature species of fish. The water company responsible for the pollution incident, will be fined for the incident but will also be working with local community representatives through the Crane Valley Partnership over the next 5 years. Over 500 000 euros has been pledged to improve the river to a condition “better than it was before the incident”. As a part of this work a River Officer will be employed with the hope that this post will eventually become full time.

Examples of the biological and water quality monitoring being undertaken before and after the pollution incident will be summarised, as well as the way that the local community and environmental organisations have responded to provide science-based evidence and improve awareness of this important resource.

R09

DELAYED FLUORESCENCE: A RAPID AND SENSITIVE TOOL TO INVESTIGATE ADVERSE EFFECTS ON ALGAE

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Algal tests have developed into routine tools for testing toxicity of pollutants in aquatic environments. Chlorophyll fluorescence based methods become more important for rapid and sensitive measuring of adverse effects on phytoplankton. We tested the applicability of Delayed fluorescence (DF), a recombination fluorescence of the photosystem II, for potential use in phytoplankton toxicity tests with special emphasis on the cyanobacterium Microcystis aeruginosa. Besides the effects of chemicals (3-(3,4-dichlorophenyl)-1,1-dimethylurea (DCMU), 3,5 Dichlorophenol (3,5 DCP) and copper) on the DF decay kinetics, we also investigated the influence of UV generated reactive oxygen species from humic substances (HS) on algae. Analyses of changes in the DF decay curve in response to the added chemicals indicated the feasibility of the DF decay approach as a rapid and sensitive testing tool. While direct UV irradiation had a negative impact on cyanobacteria and green algae, pre-irradiated HS solutions affected only the physiology of cyanobacteria adversely. Our results indicate DF as promising tool to investigate negative impacts of various pollutants on phytoplankton.

R12

REAL-TIME ACQUISATION OF LACUSTRINE GROUNDWATER DISCHARGE IN LAKE ARENDSEE

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Lacustrine groundwater discharge (LGD) has often been neglected due to difficulties to measure LGD and the intense spatial heterogeneity of LGD. Therefore, fast, easily applicable methods to detect LGD pattern are required. We applied an airborne measurement of thermal infrared radiation (TIR) at Lake Arendsee. As a result of previous long-term field investigations based on ground-based methods, the LGD pattern of the study site is well established. A TIR image taken in April 2012 agrees with our previous findings and shows that warm groundwater entering the lake in some near-shore areas is visible as plume floating on top of the lake. Prerequisites for the application of TIR to detect LGD pattern are identified based on the balance between positive buoyancy of the groundwater and intensity of vertical mixing produced by heat and momentum fluxes at the lake surface. Our first application of the method in a lake yielded promising results and demonstrated TIR to be a powerful tool for identifying LGD pattern in lake-related studies. An ecologically relevant aspect of LGD is the import of nutrients into the lake. Due to intense spatial heterogeneity of nutrient concentrations in groundwater it is necessary to combine the spatial information of the groundwater exfiltration pattern and the spatial information of ground-based measurements of groundwater nutrient concentrations to localize the most relevant sites for water quality deterioration.

R08

CLIMATE CHANGE IMPACTS ON BENTHIC MACROINVERTEBRATES IN CENTRAL EUROPE: A LONG-TERM ANALYSIS

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A major issue in biogeography is the contribution of climate change to the locations of species' distribution ranges. Twenty-three years (climatic variables: 1986-2008; biotic metrics: 1987-2009) of rapid warming provides a good opportunity to test the hypothesis that climate change acts as a major determinant on species' distribution ranges. We analyzed the relationships between climate change and zonation/temperature preference indices (ZPI/TPI) of benthic macroinvertebrates from national (6129 samples) to low mountain scales (3196 samples) in German river ecosystems. Our results indicated that the maximum and mean temperatures, significantly increased by 1.3°C and 1.1°C, respectively, while the changes of minimum temperature, precipitation and water balance were unremarkable. The responses of benthic macroinvertebrates to climate change emphasized that those species upwardly occupying habitats have been enhanced for both spatial scales over the 23 years. Zonation preferences indicated that benthic macroinvertebrates upwardly shift 0.46 longitudinal units along the river continuum at the national scale, while they were 0.42 longitudinal units at the low mountain scale. The temperatures changed 1.65°C at the national scale, and 1.54°C at the low mountain scale, respectively. Biotic metrics from national sites were more closely related to geographical variables (elevation, latitude, and longitude) than to temporal variables (sampling year and method), while those metrics from low mountain sites were associated with elevation, sampling year and method. Our findings indicate that the relative importance of climatic and spatial effects on river ecosystems should be determined by geographical size.

SS10

BRIDGING ECOTOXICOLOGY AND ECOLOGY

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Global change alters conditions for the development of ecological systems. Understanding and prediction of the consequences requires understanding of ecological processes. However, significant progress is still necessary to perform this task.
Ecotoxicologists recognized during the last years the need to progress from their laboratory based roots to better predict effects of toxicants in the wild - not only in the beaker. Relevant parameter considered include environmental context, species traits and interactions.
Ecologists in turn could benefit from ecotoxicological findings. That is:
(i) Toxicants are a relevant environmental parameter effecting a majority of communities for example in streams receiving input from treatment plants and agriculture. Neglecting this influence strongly reduces understanding of community alterations related to environmental parameter.
(ii) Ecotoxicological research is centered to reveal cause-effect propagation through levels of biological organization. Although the ecological context of a stressor is considered, the approach contrasts to the concept of "conditionalism" focusing on the totality of processes. By this, knowledge is gained in understanding the relevance of a single stressor for sublethal reduction in individual performance, delayed effects and recovery processes.

R11

OPERATIONALISING CONNECTIVITY FRAMEWORKS IN FRESHWATER CONSERVATION PLANNING

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While over 40 papers in peer reviewed literature have dealt with connectivity in riverine conservation planning for fish, invertebrates and waterbirds since the first two major publications in 2007 (by Linke et al and Moilanen et al), implementation was still difficult. Until now, construction of the river network topology still required high level GIS skills. In this presentation we will introduce two free software tools that facilitate freshwater planning by automatically constructing connectivity files for the conservation planning tool Marxan. The first method starts with a digital elevation model (DEM) and uses the GIS package ArcHydro to delineate subcatchments and watercourses which are then the input data layer to construct a connectivity file. For this second method, the only required input is the global hydrological framework HydroSHEDS, from which connectivity files can be constructed at all available scales. We demonstrate this method based on a real conservation planning exercise in the Congo River Basin in which fish, crabs, dragonflies, molluscs and aquatic plants were planned for.

SS13

ENHANCED INPUT OF ALLOCHTHONOUS MATTER REDUCES THE RESILIENCE OF THE CLEAR STATE OF SHALLOW LAKES - A MODEL STUDY

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The amount of allochthonous matter entering lake ecosystems is increasing in the context of climate change. Rising temperatures and CO_2 concentrations will elevate the terrestrial production which increases among others the flux of allochthonous organic matter into lakes. Especially the functioning of small lakes may be altered with rising allochthonous matter input because of their high shoreline to surface area ratio. Most small lakes are also shallow. This implies that they may be bistable and thus either in a clear, macrophyte-dominated or in a turbid, phytoplankton-dominated state. Increasing nutrient loading promotes eutrophication and a switch from the clear to the turbid state when a critical threshold is passed. Reversing this process requires to reduce the nutrient loading to considerably lower values due to the resilience of both states. To understand system dynamics and improve management decision it is of great interest to understand how increasing allochthonous matter input may alter the threshold values.
We used ODE-models which differed in their complexity. They reveal various pathways how input by allochthonous matter may affect the bistability: first, it is used as a resource in the pelagic and benthic food web and second, it modifies the light climate for the primary producers. The additional food for benthic and pelagic primary consumers is likely to cause a numerical or behavioral response depending on the strength of the top down control on the primary consumers. The reduction of available light hampers the macrophytes which are the most light-sensitive species in this system. In the complex ecosystem model PCLake these processes directly and indirectly reduce the resilience of the clear state and thus make the turbid state at a given nutrient loading more likely. We compare these results to a mechanistic minimal model.
Recent climate change scenarios predict that we have to reduce nutrient loadings to lakes in order to maintain the clear state against climate-warming effects. Our models suggest that rising allochthonous matter input will be additive to the effects of warming wherefore reductions in nutrient loadings become even more important. This study clearly emphasizes the importance of using models of different levels of complexity; minimal models to understand the behavior of specific mechanisms, and complex models to study these mechanisms at the ecosystem scale and make predictions.

R03

INFLUENCE OF MATHEMATICAL TRANSFORMATION ON ECOLOGICAL ANALYSIS AND INTERPRETATION OF LAKE MACROPHYTE DISTRIBUTION ALONG A DEPTH GRADIENT.

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Underwater light regime is widely considered the principal determinant of submerged aquatic plant distribution. The majority of previous studies have singled out Secchi disk transparency (SD) as a key empirical factor to explain the maximum depth of macrophyte colonization (Z_c). In fact, few studies have investigated the role of other factors such as lake morphometry, sediment features, and temperature in structuring macrophyte communities. Using two datasets (20 Italian lakes and 173 Norwegian lakes), we explored the relationships among Z_c, transparency and morphometric traits to investigate their possible effects on macrophyte depth distribution, also in relation to a possible latitudinal effect. Our results confirm i) a direct dependence of Z_c on SD values and demonstrate ii) a significant role of lake area in the descriptive linear model. However, the SD–Z_c relationship was best described by similar polynomial correlations in both Italian and Norwegian lakes, which also better reflected macrophyte ecological traits in relation to changes in environmental conditions along the depth gradient. Our results emphasize the importance of nonlinear analysis on nontransformed data in the description of ecological trends. On the other hand, linear relations on log-transformed data allow the construction of predictive models.

SS05

WHOLE LAKE-ASSESSMENT BASED ON BENTHIC INVERTEBRATES UNDER THE EU WATER FRAMEWORK DIRECTIVE

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The ecological integrity of lake shores is increasingly affected by physical modifications that result in a homogenization of the previously diverse littoral habitats. The ecological consequences may be assessed by recently developed ecological assessment tools based on littoral benthic invertebrate communities, which were established in compliance with the EU Water Framework Directive (WFD). However, the effects of lakeshore alterations on whole-lake assessment still remain unclear.
Thus, we developed an approach for a whole lake-assessment of the ecological status of a peri-urban lake (Lake Müggelsee, Berlin). The status of littoral benthic invertebrate communities was thereby assessed on 9 lakeshore sites using the LIMCO index (Littoral Invertebrate Multimetric based on Composite samples) developed within the framework of the EU WISER project (www.wiser.eu). A physical habitat survey was conducted for each 100-m section within the 12-km long shoreline in order to extrapolate the biological assessment to the whole shoreline length based on pressure-response regressions. The combination of site-specific biological assessment and physical survey of the whole lake shore enabled us to calculate a whole lake assessment score based on littoral benthic invertebrate communities. Furthermore, the detailed assessment resolution using 100-m transects along the 12-km long shoreline enabled us to specifically identify sections suffering from high anthropogenic pressures. Finally, we were able to derive a minimum shoreline length where restoration efforts are needed to reach a good ecological status of the whole lake. For that purpose, we developed several scenarios on possible restoration efforts at various shorelines to reach a good ecological status of the lake based on benthic invertebrate assessment. Those scenarios involve a more distinct spatial separation of shoreline sections with different management priorities such as urban areas, beaches and protection zones, a number of ‘greening’ measures on urban shoreline sections, and the establishment of protection zones at shoreline sections with high ecological value.

R01

DOES STOCKING OF PIKE (*ESOX LUCIUS* L.) FRY MAKE SENSE?

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Fish stocking is a frequently used action in fisheries management. The success of releasing pike fry to increase abundance was questioned in the past. Nevertheless, stocking of pike fry is still practiced by many fisheries managers to sustain or enhance wild pike populations. In a controlled pond experiment, we evaluated the potential additive or replacing effects of stocking hatchery-reared fry into self-sustaining pike populations. We compared fry growth, density, and diet between ponds with naturally emerging fry with and without additionally adding of hatchery-reared fry derived from genetically similar spawners. We also added a treatment with stocking only to simulate the impact of releasing fry in a fishless situation, with the consequently absence of natural recruitment. Our results after draining the ponds revealed no significant differences in mean numerical densities between the three treatment groups and therefore no additive effects of fry stocking into self-sustaining pike populations were found. However, in the competitive situation - hatchery fry on top of naturally emerged fry - the hatchery fry suffered from a significantly higher mortality. Furthermore, the total length of wild offspring appeared greater than the total lengths of hatchery fry in the same pond. Our study demonstrated the competitive disadvantage of hatchery fry when released into the wild, the partial replacement of wild offspring by hatchery fry (which indicated a potential risk of the establishment of non-local genotypes in naturally reproducing pike populations) and the lack of additive effects of stocking on top of natural recruitment. By contrast, in fishless situations pike fry stocking was found extremely successful. Therefore, stocking of pike fry makes sense only under very particular situations and should generally not be conducted because the natural carrying capacity can easily be achieved by natural recruitment alone.

SS12

TO ACCOMPLISH LIFE IN THE EUROPEAN CONTEXT

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Life projects are implementing Natura2000 in Europe. They have to be accomplished in the European Context.Working in the European Context means -to look beyond your own nose. The further you look the more new horizons will open up. NATURA 2000 is the biggest project of nature conservation in the world. After designation the success depends on “how to bring LIFE into the network“.
Networking to exchange knowledge should be an important part of each LIFE project. Joining international workshops or meetings can give an enormous input in benefit of measures, techniques and their impact in habitat requirements of different species. LIFE is a very valuable platform for establishing networking. Networking affords a lot of time and money. Applicants should calculate a larger time quota and higher budget for networking. If we had new LIFE COOP-Programmes in future, networking activities would be catalysed.
Implementing NATURA 2000 needs the experience of best practice on site. But without networking nobody would recognise this practice. Networking is not only a pleasant part of work, it is the key to implementing NATURA 2000. Networking as much as possible is essential for evaluating the conservation measures and sustainable conservation strategies in Europe.

R14

OXYGEN STRESS AND LOW FOOD QUALITY: DOES *DAPHNIA* CARE?

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The energy and nutrient transfer from autotrophs to herbivores is a key process in all ecosystems, but we know little about how herbivorous zooplankton such as *Daphnia* could adapt carbon (C) to nutrient stoichiometry to varying environmental stressors. During phytoplankton blooms high C to nutrient ratios, e.g. C:phosphorus, occur and lead to low food quality for herbivores. During certain time phases also the species composition of a phytoplankton community changes quickly which strongly affects food quality in terms of essential biochemicals such as phytosterols or fatty acids. *Daphnia* may deal with low food quality by the regulation of egestion, excretion and respiration. Furthermore, it is almost unknown how additional oxygen stress constrains oxygen consumptive regulation processes in *Daphnia*. In the present study we acclimatized *Daphnia magna* to different food qualities (phosphorus, fatty acids, sterols) and different oxygen concentrations. We measured short time assimilation, excretion and respiration rates by ^{14}C tracing. First results of regulation measurements indicate that *D. magna* is able to respond to changing food conditions by altering different mechanisms, also when oxygen concentration is low. Moreover our findings suggest variable importance of different nutrients by diverging strength of regulation. This delivers further insights in the primary producer – consumers interface at changing environmental conditions.

R08

CURRENT HYDROPOWER DEVELOPMENT: A GLOBAL SYNTHESIS

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The economic, social and environmental consequences of hydropower have been discussed extensively by researchers, yet there is a paucity of information about the spatial distribution of new projects and their pace of development. Here we present the first global analysis of hydropower schemes which are currently planned or under construction.
Data were collected on hydropower projects over 1MW capacity from the world's largest river systems from grey literature reports, direct correspondence with government departments and non-governmental organizations. Spatial analysis was adopted within ArcGIS to assess a shift in dam building locations and density of planned projects and those under construction within the next 20 years.
There are a number of implications drawn from the analysis: challenges to meet Rio+20 targets (*1*) preludes to a significant increase in dam building, which is confirmed by global data for dams planned within the next decades. Also, a spatial shift of dam building activities can be expected. Especially in developing countries, knowledge of the status of freshwater species remains very poor (*2, 3*). Thus, prioritising discrete areas for proactive conservation management is likely to become more problematic. The scale of the problem is intensified by a predicted three billion increase in world population by 2050 (*1*). We show that, concurrently, dams will be built in areas which were not previously considered for hydropower as a result of ecological or social concerns. For this reason, if planned hydropower schemes progress to construction, we will see an unprecedented reduction in the number of remaining unregulated river systems.

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SS08

PATTERNS OF DAILY VARIABILITY IN STREAM NITRATE CONCENTRATION DURING RIPARIAN CANOPY LEAF-OUT

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Patterns of stream nutrient concentration are commonly related to processes occurring in adjacent terrestrial ecosystems. However, nutrient transformation and retention within the stream and at the stream-riparian interface can also contribute to these patterns, especially in the case of nitrate. The influence of in- and near-stream processes on stream nitrate dynamics may be crucial for understanding the variability of nitrate concentration at short time scales (hourly and sub-hourly intervals), especially in spring, when stream metabolism and the activity of riparian biota is enhanced by favorable environments. We analyzed the temporal pattern of stream nitrate concentrations at 12-hour intervals throughout the water year 2010 in a Mediterranean stream flanked with a well-developed riparian forest. We found that the highest amplitude in daily nitrate concentration was measured in spring (on average nitrate concentration was 15.2% higher at night than during daytime), whereas the daily variability of nitrate was almost negligible during the rest of the year. We further investigated the controls of the spring daily cycles (i.e., occurring either within the stream or at the stream-riparian interface) from March to July 2012 based on the intensive examination of daily variation in oxygen concentration, recorded at 15-min intervals, at the stream and at the riparian groundwater nearby coupled with the measurement of nitrate concentration at both sites. Riparian groundwater showed no daily variation in either nitrate or oxygen concentration and there was no relationship between stream and near-stream nitrate concentrations. In contrast, during this period, the stream daily variation of nitrate concentration was especially remarkable from mid-April to mid-May (average day-night amplitude = 16.6%), before the complete leaf-out of riparian trees. The daily amplitude in nitrate concentration was strongly and positively correlated with the variation in whole-reach gross primary production (derived from daily variation in oxygen concentration), which despite being relatively low, it explained the 63% of the nitrate pattern. These results indicate the relevance of in-stream processes on the control of stream nitrate concentrations, at least during spring months in streams with forested riparian zones.

R02

A STRANGE CASE: PHYLOGEOGRAPHY AND POPULATION GENETICS OF *THREMMA GALLICUM* MCLACHLAN, 1880.

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The caddisfly *Thremma gallicum* McLACHLAN, 1880 has a patchy distribution range, occuring mainly in isolated headwater streams in mountain ranges of the Iberian Peninsula. Further known populations are found in the French Massif Central and, remarkably, in the Northern Black Forest, Germany. It is yet unknown whether geographically distinct populations exchange migrants over time or represent autochthonous refuge populations or even cryptic species. To address these questions, we analysed mitochondrial CO1 sequence data for 352 specimens from the Cantabrian Mountains. The Pyrenees, the Massif Central and the Black Forest. In addition, we analysed a subset of the individuals from the four different geographic regions for polymorphisms at nuclear markers applying Restriction-site associated DNA sequencing (RAD). A next-generation sequencing library for 19 individuals was analysed on a HiSeq 2000 sequencer and 40,006 SNPs were reliably identified. Based on a concatenated alignment of all RAD tags, we calculated genetic diversity and differentation for the different populations. Measures of intraspecific genetic distances based on the CO1 dataset were in the range of those known from other caddisfly species. Our results suggest closer affinities among the populations from the Cantabrian Mountains and the Pyrenees, and also among populations from the Massif Central and the Black Forest. However, high and significant differentiation values suggest that recent gene flow is absent between populations of the Iberian Peninsula and those from France and Germany. A phylogeographic analysis suggests that all populations including the one from the Black Forest survived the last glacial maximum in independent refugia. The presence of two distinct CO1 haplotype groups in the Cantabrian Mountains suggests a secondary contact zone in this region. Our approach highlights the enormous resolution of RAD sequencing that is based on many independent nuclear loci.

R03

UNDERSTANDING THE IMPLICATIONS OF SUB-SEASONAL VARIATIONS IN THE WEATHER FOR INTERNAL PHOSPHORUS LOADING IN A SMALL, EUTROPHIC LAKE

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In recent years there has been increasing research interest in alteration to weather patterns as a possible consequence of climate change. Of particular interest are increases in the occurrence of extreme events such as heat waves and storms. These weather related phenomena have been found to impact upon the thermal structure of lakes by either strengthening and lengthening the stratification period or causing weaker stratification and more intense mixing. Internal cycling of phosphorus to lake surface waters from the hypolimnion can be an important component of a lake’s phosphorus budget and one which is strongly influenced by the stability of its thermal structure. In this study, we examined sub-seasonal variability in the internal load of bioavailable phosphorus (SRP) and its impact on the total summer SRP budget over two years in a small, eutrophic lake. Despite average weather conditions for the summer in both years being similar, we found that internal hypolimnetic loading and the overall summer phosphorus budget differed considerably. In early summer, hypolimnetic fluxes of SRP were small and little influenced by the prevailing weather conditions, whilst the late summer was characterised by a release of the SRP pool built-up in the hypolimnion as the lake moved towards overturn. The size of the SRP pool, however was determined by the extent of lake mixing during the mid-summer, with calmer weather conditions leading to greater stability and a substantial increase in the build up of hypolimnetic SRP. In the year with less mixing during the mid-summer the internal hypolimnetic flux of SRP increased by nearly 70% and was the dominant source of SRP in the epilimnion that year. We conclude that a better understanding of the variability of internal hypolimnetic phosphorus loading is important in the context of future changes to weather patterns and how we manage the problem of lake eutrophication.

R14

SHORT TERM BEHAVIOURAL RESPONSES OF BENTHIC COMMUNITIES TO THERMOPEAKING WAVES

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Hydropower represents a primary and strategic renewable energy source in the Alps and, more in general, in mountain areas. Though hydropower is ecologically sustainable at a global scale, being gas-free, at the local scale it is frequently a major stressor for aquatic ecosystems. Among its advantages is the possibility to respond immediately to peak demands, but in the case of storage plants, the sudden releases of turbinated waters in receiving water bodies (hydropeaking) causes well-known severe consequences on the benthic community and on the whole ecosystem.
In particular, for hydropower plants fed by high elevation reservoirs with hypolimnetic release, hydropeaking is not only a repeated and sudden change in discharge and velocity but also in the thermal regime and in other physical-chemical properties of the water body.
Due to their different physical nature, the thermal waves associated to hydropeaking propagate downstream with different velocities in respect to the hydrodynamic ones. Thus downstream of storage plants, the biota experience a first disturbance caused by the hydropeaking wave (catastrophic drift), followed by a second one caused by sudden and repeated temperature changes (behavioural drift). The time lag between the two events increases with distance from the power station and the magnitude depends on the relative position of the reservoir and the receiving water body. In the Alpine streams studied by the Authors the thermal alterations on an annual scale range from plus 3-4 C° in winter to minus 5-6 C° in summer.
In order to separate the effects of the short-term effects of the hydro and thermal waves, a series of experiments were planned from 2008 to 2012 in a set of five artificial flumes (20 m long, section 0.30 x 0.30 m) fed by a near-to-pristine Alpine stream. Hydro and thermo peaking waves were imposed to the benthic community in different combinations and the drift caused by each event was measured. Results indicate that both cold and warm thermopeaking waves cause behavioural drift with differences among taxa.

SS12

DEVELOPMENT OF A MULTI-FACETED FRAMEWORK OF DIVERSITY FOR THE SELECTION OF PRIORITY AREAS FOR THE CONSERVATION OF STREAM FISH ASSEMBLAGES.

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Freshwater ecosystems and their biodiversity are increasingly threatened by human activities. However, resources to protect them are limited. Thus, methods aiming at identifying the most valuable areas for conservation with respect to their biodiversity are urgently needed. Focusing on stream fish assemblages, we propose an innovative method for the selection of priority areas according to a multi-faceted approach of the diversity of assemblages. This method requires four steps. (1) We used fish data collected homogeneously at the scale of the spatial extent considered (e.g. France). (2) These biological data were then related to several environmental factors known to influence the spatial distribution of the species considered using six species distribution models. This made it possible to predict the fish assemblages potentially present in the unsampled areas. (3) Nine diversity indices were then calculated based on the predicted assemblages. These indices described four main aspects of the diversity: taxonomic, functional, natural heritage and socio-economic diversity. (4) Finally several prioritization methods recently developed were used to combine the four aspects of the diversity into a single conservation value of fish assemblages. In addition to the presentation of the method, we also propose to compare the selected prioritization methods in order to reach the best consensus between them. This method and associated first results are promising as they could lead to the development of a management tool designed for environmental decision-makers that would allow them to select the priority areas for conservation in line with their capacity for action.

R06

A PREDATOR PROVIDES ITS PREYS WITH "WELL–BEING": CASE OF A FLATWORM FORAGING IN HEADWATER LEAF PACKS

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Species can influence community structure and ecosystem functions through multiple pathways. Disentangling the underlying mechanisms is a tricky task because it requires to elucidate the nature (trophic *vs* non–trophic) and strength of both direct and indirect interactions. Structural equation modelling (SEM) is a useful statistical framework to infer species effects on communities and ecosystems based on empirical or experimental data. In this study we experimentally examine whether and how the free–living aquatic flatworm *Polycelis felina* (Dalyell)—a widespread and voracious predator of small invertebrates—affects the structure and functions of leaf litter–associated biofilm and fauna in a forested headwater stream. We predicted that, if *P. felina* affects the density and/or behaviour of its prey, then litter decomposition rate could be altered. We manipulated the density of flatworm (0, 3, 9 individuals) enclosed in fine–mesh (500 µm) bags filled with conditioned oak leaves and incubated in the field for 24 days. We assessed leaf litter mass loss through time and the responses of micro, meio and macrobenthic communities. Each community type was specified as a latent variable (i.e., a linear combination of community descriptors) in SEM. *P. felina* had a positive effect on the rate of leaf decomposition and on the biomass/activity of microbial decomposers and meiofauna. The biomass of bacteria and bacterial–feeding nematodes were twofold greater in the high predator density treatment than in controls without flatworm. In contrast, no direct effect of flatworm on the biomass of chironomids, its major prey taxa, was detected. Moreover, *P. felina* was found to indirectly promote leaf litter colonization by macro and meiofauna communities through increased sedimentation on leaf surface biofilm. Greater sedimentation in the presence of flatworms may be due to 1) a reduced foraging activity of invertebrates, and thus a low bioturbation rate, in response to predation risk and 2) sediment trapping by the sticky mucus secreted in copious amounts by flatworms foraging on leaves. SEM results further revealed that the positive effect of *P. felina* on microbial decomposers was inconsistent with predictions of the traditional top–down trophic cascade model. Our findings suggest that, in leaf packs, the consumptive effect of *P. felina* on invertebrate prey was overridden by non-trophic interactions in determining community structure and litter decomposition rates.

R01

THE INVESTIGATION OF THE ROTIFERA SPECIES IN THE SALINE AND FRESHWATER LAKES IN CENTRAL ANATOLIA

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The objective of the study was to observe the Rotifera species and distribution together with the physical and chemical variables. The samples were collected monthly from each sampling station which were situated on the different locality of the Acı Lake, Kozanlı Saz and Meke Lakes between January 2010-December 2011. Totaly 22 species were identified belong to 12 genera. It was observed that species diversity and density were high in spring and Autumn than the other periods. Among Rotifers *Brachionus quadridentatus*, *B. Calyciflorus*; *Keratella quadrata, Euchlanis dilatata, Asplanchna priodonta* and *Hexarthra fennica* were the common species.

SS12

TOOLS FOR MONITORING, MODELLING AND THE CONTROL OF ALGAL BLOOMS IN LAKES (GISBLOOM)

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The monitoring, modelling and the control of algal blooms in lakes are often based on fragmented and incompatible monitoring networks, databases, analysis and modelling tools. The Web-based map service, *Vesinetti* (http://www.environment.fi/default.asp?contentid=427475&lan=EN), was developed to integrate information in river basin scale and to increase the knowledge of algal blooms and eutrophication. *Vesinetti* combines nationwide data and models on climate, hydrology, hydrobiology, land-use, management measures, nutrient loads and water quality responses (LLR model http://lakestate.vyh.fi/cgi-bin/frontpage.cgi?kieli=ENG). Real-time forecasts of algal blooms and knowledge on the cost-efficiency of management measures were produced. As a result, *Vesinetti* provides integrated, web-based tools for monitoring, ecological and cost-benefit analyses, forecasting and planning.

R02

THE LONG OVERLOOKED IMPACT OF PARATHETYS REGRESSION ON PRESENT-DAY DIVERSITY IN FRESHWATERS. CASE STUDY OF *GAMMARUS BALCANICUS* (CRUSTACEA AMPHIPODA).

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The regression of Parathetys sea in Paleogene and Neogene resulting in continentalization of Europe opened a possibility for colonization of newly emerging freshwater systems. *Gammarus balcanicus* is widely distributed in the area previously occupied by Parathetys. It occurs predominantly in montane/submontane streams and springs. The aim of the study was to test the hypothesis whether the wide range of *G. balcanicus* in Europe can be explained by the independent colonization events of freshwaters by its ancestor originating from Parathetys. The studied material included 800 individuals from over a 100 localities within the European range of the species. Two mitochondrial (16S, COI) and one nuclear (28S) marker were used for phylogenetic analysis. Both, mitochondrial and nuclear, markers resulted in congruent topologies of the obtained phylogenetic trees. More than 20 molecular operational taxonomic units (MOTU) could be distinguished. Genetic distances among the MOTUs was of the level observed in other studies among species well defined based on morphological traits. Application of the molecular clock enabled us to determine divergence time of the MOTUs. Most of them diverged in late Eocene/early Oligocen, what coincides with the regression of Parathetys. Subsequent differentiation within MOTUs in Neogene may be related to further terrestrialization of the area and to various phases of Alpine orogeny shaping the Balkan and Carpathian Mountains.

R03

CLIMATE VARIABILITY, PALAEOECOLOGY AND AUSTRALIAN WETLAND ECOSYSTEMS

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The climate of Australia is variable today, but has varied more dramatically in the past. The dominant trend over the past 15 Ma has been increasing aridity from a starting condition of wet Gondwanan rainforest. The ultimate dry spell was only 20-17 Ka, with the Last Glacial Maximum of the most recent ice age. In response to these trends and extremes, wetland biota have adapted, persisted in climate refuges, or been forced to extinction.

Human impacts including habitat degradation, fragmentation, and accelerated climate fluctuations, alter the parameters determining how wetland biota will respond to future climate variability. Where resistance and resilience to this variability are compromised by anthropogenic impacts, or where future climate variability is expected to be greater or faster than that observed in the past, we have much reduced capacity to predict wetland responses.

In this talk, recent palaeoecological studies of Australian wetlands illustrate how such techniques allow reconstruction of wetland responses to both past climate variability and recent human impacts. This informs predictions of their responses to future climate variability and identifies climate refuges such as dune lakes on North Stradbroke Island which have persisted in the landscape for long periods of time. From this it is apparent that in order to maintain the ability of wetland ecosystems to adapt to future climate variability we should:

- Identify, protect or restore climate refuge wetlands;
- protect or restore appropriate connectivity between wetlands to allow recolonisation processes to proceed following extreme climate events;
- protect or restore degraded wetlands to improve their resistance and resilience to disturbance from climate variability

Despite this, if climate variability extends beyond that experienced in the past, it is likely to precipitate changes such as: shifting wetlands to novel states, restricting the distributions of species and extinctions.

SS14

MULTI-LEVEL CAPACITY BUILDING IN IRRIGATION MANAGEMENT: A CASE STUDY FROM THE BLUE NILE BASIN, ETHIOPIA.

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Capacity building has been widely acknowledged as a central objective to address water-related problems on global, regional and local scale, not only since the launch of the International Decade of Action “Water for Life”: Water problems can only be addressed appropriately if water education is provided at all levels and for all stakeholders.
As the world’s largest water user, agriculture has long been identified as a focal area of capacity building needs in water. Water management in agriculture calls for strong individual and institutional capacities to cope with increasingly complex linkages, e.g. crop water needs, climate variability and uncertainties, competing users and uses. The case study of the Blue Nile, drawing on ethnographic research in Ethiopia, illustrates these complexities and the need for capacity building.
For the past years, Ethiopia tried to make better use of the Blue Nile waters by building large infrastructure for water storage. The Koga project is the first large-scale irrigation scheme in the basin since the 1970s. Field research was conducted to study the local process of adaptation, farmers’ capacities to manage the system and the means undertaken for capacity building at different levels. As a major development project, the Koga scheme is subject to certain principles agreed upon on the level of global environmental politics, such as the IWRM approach. These principles, including capacity development and participation of different stakeholders, reflect back onto different scales through the impact of IOs. This is also true for Koga, where “the most important positive impact of the project will be to build the capacities of farmers in practicing the demand-driven approach”, as stated by the donor AfDB.
At national level, new policies were designed to incorporate IWRM principles into Ethiopian legislation. As this altered existing roles and allocation of power, the policies were contested among the government agencies; an institutional confusion that was passed on to the farmers.
Incompatibility with local conditions led to a situation in which IWRM principles contribute to conflicts and a reproduction of power on the grounds. Marginalized groups with low capacities, including women and the poorest, were left out of decision making.

The case study is used as a basis to add to the research on capacity building in water-related development projects and to generate context-specific recommendations on adaptive learning in such projects.

R08

BACTERIAL COMMUNITY STRUCTURE AND FUNCTION DURING DESICCATION AND REWETTING OF TEMPERATE STREAMBED SEDIMENTS

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Drought events pose a disturbance for the stream ecosystem by changing the water course temporarily and affecting the stream biota. Drying events of streams are commonly known from the Mediterranean region. However during the last decade the fate of temporary streams became also more important in the temperate regions of central Europe. Increasing temperatures lead to longer lasting droughts and short but more severe flood events especially in the upper regions of small streams. In the current study desiccation and rewetting of streambed sediment from the upper region of the Breitenbach (Hesse, Germany) which dries out for almost 6 months per year has been investigated. For the study the wet streambed sediment was dried artificially over 13 weeks at 20°C simulating different drying scenarios (fast, medium, slow) and rewetted over 14 days with two types of stream water (with and without cells) using a perfused core technique. Bacterial community structure (via CARD-FISH and TGGE) and extracellular enzyme activity (by using artificial substrates) have been investigated. The community composition changed during the desiccation events to a lower proportion of *Betaproteobacteria* and increasing proportions of *Alphaproteobacteria* and *Actinobacteria* achieving together about 50% of affiliated cells with regard to the degree of desiccation. Thus the bacterial community composition had shifted to higher proportions of Gram-positive bacteria representing more terrestrial conditions. After 14 days of rewetting the original bacterial community composition was not attained with both water types. The activity of all investigated enzymes decreased during the desiccation process, but decelerated in the slow drought treatment. The decrease of activity was most pronounced for alpha-glucosidase and aminopeptidase (15% and 8% of the initial activity remained after 4 weeks, respectively). Both enzymes recovered immediately upon rewetting increasing to 20-fold of the activity in desiccated sediment after 2 weeks. The results indicate that bacterial community structure and function was highly affected by a few weeks of desiccation, whereas the time span of 14 days of rewetting was insufficient for a complete recovery.

R04

THE INFLUENCE OF TUFA DEPOSITION ON PERIPHYTON DEVELOPMENT

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Tufa, a secondary calcium-carbonate deposit in freshwaters, creates a unique habitat for periphyton. Although generating increased sedimentation stress, tufa enhances resistance to hydraulic stress by incrusting periphyton matrix. In this study we used artificial substrata (glass-slides) to test whether increased calcium-carbonate deposition inhibits or promotes development of periphytic community and to assess the influence of flow velocity on both tufa-deposition and periphyton development. Experiments were set on two tufa barriers within the Plitvice Lakes barrage lake system (Croatia). One barrier showed low (LTD), and the other high (HTD) tufa deposition rate. On each barrier, three different reotopes were chosen, representing slow (20 cm s^{-1}), medium (50 cm s^{-1}) and fast (90 cm s^{-1}) flow velocity sites. Glass-slides were exposed *in-situ* for two weeks between July and November 2002. Average tufa deposits on the slides were about sixfold higher in summer months (July, August, September; T_{H2O} = 19.4 ± 1.7°C) than in autumn (October, November; T_{H2O} = 10.1 ± 1.9°C). Increased flow velocity decreased the amount of tufa on glass slides, contrary to some previous investigations. Possible reason for such trend is increased sedimentation of lake-generated tufa in the medium and slow flow velocity sites. Algal biomass in periphyton, measured as chlorophyll *a*, was almost two times higher on the HTD barrier (1.02 mg m^{-2} on average) compared to the LTD barrier (0.60 mg m^{-2} on average), suggesting that tufa deposition created more suitable habitat for colonizing algae. Lower numbers of protozoan and micro-metazoan taxa were recorded on the HTD barrier (76 taxa), compared to the LTD barrier (88 taxa), indicating tufa deposition as a diversity-reducing factor. Periphyton abundance between the LTD and HTD barriers did not significantly differ, but the HTD barrier exhibited a strong dominance of few taxa, primarily stalked suctorians (Ciliophora). Number of taxa decreased with increasing flow velocity. The same trend was observed for abundance, but on the LTD sites only. At the HTD barrier all three rheotopes displayed almost the same abundance. The latter pattern might be caused by the effect of periphyton incrustation that implies thicker periphyton matrix, resistant to sloughing. The observed protozoa and micro-metazoa community structure reflected the considerable influence of the seasonal tufa deposition patterns on the tufa-dwelling communities.

SS09

IMPACT OF SALINISATION OF SURFACE WATERS CAUSED BY IRRIGATION AND DIVERSION OF DRAINAGE WATERS ON FISHERIES IN AMUDARYA AND SYRDARYA RIVERS BASINS, CENTRAL ASIA

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Salinisation of surface waters as a consequence of re-introduction of collector-drainage water (CDW) from irrigated fields is a common problem in Uzbekistan. For instance, average water salt content of Amudarya River in Nukus (lower reach 200 km to the delta) was in 1913 within 0.41-0.57 g/L (max. 0.67) and raised in 2001 to 1.05-1.30 g/L (max. 2.77). The total amount of salts brought with Amudarya River in 1960s to the delta was equal to about 21 Mill. ton, but at present it is about 50 Mill.tons. Total amount of the mineral salts introduced into the hydroecosystems through CDW is about 70-80 Mill. tons per year. In all upper reaches of all rivers the water mineralization usually does not exceed 500 mg/L. They belong to hydrocarbonate class calcium type of hydroecosystems. However, in middle and lower reaches of all rivers, water quality is totally on a low level.

In Muynak, Sarbas and Mejdurechye Reservoirs located not far from the Amudarya River delta and fed by river waters, the salt level varies between 1.5 and 2.5 g/L in years of normal water supply. The highest levels are characteristic for winter and spring and for periods of low water, when water evaporation and filtration losses resulted in a rise in concentrations of mineral salts up to 8-16 g/L Present level of water mineralization in lakes of Syrdarya river basin varies within the range of 0.8-10 g/L. In middle and lower reaches of rivers sulphates are the leading anions followed by chlorides. Sodium is most abundant cation.

Majority of fish farms have to use unconventional water sources, mostly collector-drainage waters. Damachi fish farm situated in Syrdarya River Basin supplied by three collectors: in which water mineralization changes during the year within 0.3-1.55 g/L. In Khorazm fish farm, situated on lower reach of Amudarya River, water mineralization in fingerlings ponds can reach 1.3-1.8 g/L and in fattening ponds 1.5-3 g/L due to high evaporation. In some low water years, the fish farm has to use drainage water having salt content from 1.7 to 2.7 g/L. While water with salinity over 1 g/L considered unsuitable for usual crops, less known about water salinity levels harmful to especially the reproduction of the native fishes of the Aral Sea basin Our studies revealed that human intervention on fish reproduction process makes possible to mitigate negative impacts of water pollution with mineral salts in higher concentrations.

R04

NICHE SEGREGATION AND BIOTIC INTERACTIONS BETWEEN TWO CLOSELY RELATED GAMMARIDS (CRUSTACEA: AMPHIPODA) – NATIVE VS. NATURALIZED INVADER

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Closely related species share greatly similar niches, but are often found separated by one or more traits when they occupy the same habitat. Among the gammarids, shifts in life-cycles, food specialization and changes in microhabitat preference could limit the niche overlap and competition between species. We sampled stream sections in South Transdanubia (SW Hungary) in 2009, while the most important local scale environmental variables were also measured at each site. In this study we examined (1) how two closely related gammarid species - the native *Gammarus fossarum* and the non-indigenous, but naturalized *G. roeseli* - responded to abiotic conditions depending on their sympatric or allopatric distribution, and (2) the variability in their biotic interactions if they are sympatric. To determine the effects of site, microhabitat and season on abundance patterns of *G. fossarum* and *G. roeseli*, three-way Analysis of Variance (ANOVA) was used. To identify the seasonal shifts in microhabitat preferences, additional Kruskal-Wallis tests were used within each season. We conducted linear models to test the effect of environmental variables on distribution patterns of the two gammarid species. To determine the biotic interactions between the gammarids, the co-existence index (CI_{ij}) was calculated. We revealed different microhabitat preference of the gammarid species at sites where they co-occurred, compared to the habitat choice of single occurrences. We also sought the abiotic environmental variables that could determine the occurrence of *G. fossarum* and *G. roeseli* at reach scale. Our results show that *G. roeseli* occurred at sites characterized by abiotic habitat features resembling downstream sections of streams and more degraded riparian vegetation, which indicates stronger anthropogenic impacts.

R11

MANAGING LAKES TO DELIVER MULTIPLE ECOSYSTEM SERVICES: A CASE STUDY FROM LOCH LEVEN, SCOTLAND, UK.

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Many shallow lakes provide multiple ecosystem services to mankind. In the past, we have often tried to enhance individual services with little or no consideration of how this might impact on the provision of other services. Long term data from Loch Leven, Scotland, UK, show how such focused intervention can lead to unforeseen consequences. Over the past 150 years, many attempts have been made to manage or improve the ecosystem services that are provided by this lake. It has been hydrologically modified to improve water supply, stocked with non-native fish to enhance the fishery, and used for the management and disposal of effluents from agricultural, sewage and industrial sources. Using historical records, we have explored conflicts of interest that have arisen as a result of this management activity. We found that, when the supply of water to downstream industry was improved by installing sluice gates on the outflow in 1830, the economic value of the fishery fell by about 30% and the likelihood of downstream flooding increased significantly. Also, stocking with rainbow trout in the 1990s to improve the fishery, seems to have increased chlorophyll *a* concentrations and reduced water quality, probably as a result of increased fish predation on zooplankton grazing communities. These results show that, when changes in management are being considered to enhance one particular ecosystem service, it is important for potentially damaging effects on other services to be taken into account. Avoiding such unintended consequences in the future requires a better understanding of the role of ecosystem function in delivering ecosystem services than is currently available. This is especially true in relation to the conservation, management and restoration of lakes that are affected by multiple stressors. Our study also highlights the value of long term datasets in providing knowledge and understanding through 'hindsight' that can be used to inform future decision making. We conclude that, in the longer term, successful management policies are likely to be those that incorporate lessons learned from previous decisions into future management actions.

R05

STRONG LANDUSE EFFECTS ON THE DISPERSAL OF EMERGING STREAM INSECTS: IMPLICATIONS FOR TRANSFERS OF AQUATIC SUBSIDIES TO TERRESTRIAL CONSUMERS

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There has been substantial progress in quantifying the magnitude and effects of aquatic resource subsidies, chiefly dispersing adult aquatic insects, on terrestrial consumers. However, fewer studies have addressed the influence of anthropogenic disturbances on these cross-habitat resource flows. We investigated variation in lateral dispersal of two groups of adult aquatic insects with contrasting flight abilities and life history traits (Diptera and Trichoptera) within generally flat landscapes. We sampled adult flying insects emerging from 8 streams in central Sweden, with each representing one of two land use categories. Four agricultural streams were affected by crop farming and had reduced riparian vegetation that generally bordered on open fields, while four forested streams were little affected by human activities and had fully intact riparian vegetation that merged into extensive forest. The insects were captured using sticky traps deployed perpendicular to each stream channel over 5 standard distances up to 100m. The traps were deployed for four days during spring (April), summer (July) and twice during autumn (September and October). The agricultural streams, reflecting their enriched nutrient status, were substantially more productive than the forested streams, producing up to four times more insect individuals during the summer. However, while there was no variation in the diversity or abundance of insects captured at each sampling point along the forested stream transects, there were strong declines in both abundance and diversity with increasing distance from the agricultural streams. The factors most strongly associated with reduced capture-rates included a lack of riparian vegetation, stronger wind speeds, and steeper topographies. Our results indicate that while agricultural streams produce abundant emerging aquatic insects, alterations to vegetation and landforms in agricultural landscapes can strongly affect adult insect dispersal, and hence spatial patterns in incorporation of this subsidy into terrestrial food webs.

R05

ALLOCHTHONOUS DISSOLVED ORGANIC MATTER PATHWAYS SUPPORT SOMATIC GROWTH OF *DAPHNIA MAGNA* WHEN ALGAE ARE LIMITING

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Allochthonous carbon is increasingly being debated as a dietary energy source supporting lake food webs. Although particulate terrestrial carbon was identified as a low quality food source for supporting zooplankton growth, no study to date has experimentally tested whether zooplankton can grow and reproduce by using dissolved terrestrial organic matter (t-DOM). The uptake of t-DOM by lake zooplankton has been proposed in earlier studies, and given the large amount of carbon contained within the DOM pool of lakes, t-DOM could be an important resource for growth when algal food is limiting or when metabolic demands are high. In the present study, we asked: 1) are *Daphnia magna*, when fed a limiting amount of alga, able to use t-DOM as an additional carbon source to support growth and reproduction, and, 2) does the use of t-DOM by *D. magna* change with temperature? Two t-DOM solutions were established by first leaching senescent leaves of two trees (DOM_{beech}: *Fagus sylvatica* and DOM_{hazel}: *Corylus maxima*) in lake water for 48 h and then filtering through 0.2 µm. A life table experiment was performed at 15°C, 20°C and 25°C by feeding *Daphnia*: 1) alga (*Scenedesmus obliquus*), 2) alga+DOM_{beech}, or, 3) alga+DOM_{hazel}. Alga were provided at a limiting concentration of 0.1 mg C L^{-1} in all treatments. Both t-DOM solutions were provided at 10 mg C L^{-1}. Preliminary results revealed that t-DOM-exposed Daphnia grew more and reached maturity faster than *Daphnia* exposed only to alga at all temperatures, although effects were most pronounced at 25°C. *Daphnia* growth rates at 20°C were 0.21 mg d^{-1} when fed alga+DOM_{hazel} and 0.05 mg d^{-1} when fed only alga. At 25°C, maturity was reached on day 10 for *Daphnia* exposed to DOM_{hazel}, whereas alga-only *Daphnia* did not reach maturity after several weeks. Importantly, bacterial cell counts were also higher in the t-DOM than in the alga-only treatments. Our results indicate that both t-DOM uptake and t-DOM-driven bacterial production could be important pathways that support lake zooplankton growth when algae are scarce. Although observed growth and reproduction in t-DOM-exposed daphnids was lower than would be expected on a sufficient algal diet, t-DOM could become an increasingly important resource for zooplankton under current scenarios of climate change, including decreased algal biomass or quality, increased t-DOM availability due to increased precipitation and increased temperature.

R03

PHOSPHORUS-LOADS TO SURFACE WATERS FROM AGRICULTURAL CATCHMENTS – DO WE NEED HIGH RESOLUTION MEASUREMENTS?

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Intense agricultural land use is commonly seen as a main risk for the eutrophication of surface waters. Important transport paths for nutrients are water and wind erosion. Drainage ditches capture erosional phosphorus (P)-loads as well as vadose water and finally serve as tributaries to natural freshwaters. Exact quantifications of P-loads originating from drainage ditches are labor-intensive because discharge and P-concentrations need to be determined in a temporal resolution that meets the special characteristics of catchment and land use activities. The goal of the present study was to test if it is possible to derive reliable P-loads from automated discharge measurements of high temporal resolution combined with low-frequency P-measurements. Since several studies found direct correlations between nutrient concentrations and discharge, we hypothesized that a continuous determination of P-loads during a one-year-period might show significant statistical correlations between discharge and P-concentrations for the whole period or at least sub-periods. By means of this correlation it was expected that within these periods, P-loads might be determinable by discharge measurements and just very few concentration measurements. The study site was the agricultural catchment of Lake Arendsee in northeastern Germany, where four ditches drain into the lake. P-loads were calculated from daily measurements of phosphorus concentrations and continuous measurements of discharge volumes. Results show a wide range of P-concentrations in the drainage ditches (max. 1.3 mg total P l^{-1}) which can be assigned to seasonal and weather conditions (e. g. vegetation growth, precipitation) as well as land use activities (e. g. harvest, fertilization) and specific site conditions (e. g. soil properties, microbial activity). Within the four drainage ditches discharge volumes varied over time and showed a general dependency on land use type. Variations in P-concentrations did not always occur simultaneously in the four ditches. Apart from our expectations and from findings of other studies no significant correlations between P-concentrations and discharge rates were found. Average P-losses from the four different catchments (P-loads into the lake) ranged broadly between 0.03 and 0.5 kg ha^{-1} yr^{-1}. We conclude that a variety of factors individually influence P-loads from agriculture that might not be distinguished if the temporal resolution of the investigations is reduced.

SS07

WHY AND HOW TO CONSIDER HYPORHEIC HYDROGEOMORPHOLOGY FOR SAND-GRAVEL STREAM METABOLIC FUNCTION

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The hyporheic zone (HZ) community can contribute to major part of the stream ecosystem metabolic function. The potential of hyporheic metabolism is known to depend on water exchange between the stream surface water and the HZ providing solutes and oxygen to the hyporheic community. The nested hydrogeomorphological controls on advective water exchange across the streambed are well known. While the modulation of the metabolic function by flow patterns within the hyporheic sediments remains unclear. Many ecological studies estimate metabolic processes from a blackbox approach by assuming homogeneous structural conditions within the streambed. However, heterogeneity in the HZ is recognized as enhancer of metabolic function. The existing data from other disciplines, such as geomorphology, show that hyporheic sediments have a complex and heterogeneous sediment architecture with intricate flow patterns, especially on small scales (micro- to mesoscale, mm-m). The lack of understanding and data on the responses of biological processes to hyporheic hydrogeomorphology limits our capacity to create a mechanistic model for the comprehension and prediction of both hyporheic and stream metabolism. In this talk we select hydrogeomorphological features of the hyporheic zone that are significant for its metabolic function at micro- and mesoscale in sand-gravel streams. We propose permeability as basic feature for HZ metabolism, it modulates the supply of solutes and oxygen, the surface for potential microbial colonization and the contact time. In the streambed, permeability is heterogeneously distributed in sediment bodies as a result of sediment transport processes. The spatial arrangement of sediment bodies creates interrelations and hierarchies in the movement of water and solutes, such as preferential flowpaths (a network of higher permeability bodies), that will potentially control the HZ and the stream metabolism. Then the consideration of HZ heterogeneity opens the potential for better understanding of its metabolic function.

SS06

FLOW INTERMITTENCY AND BIODIVERSITY PATCHES IN VASTLY DIFFERENT RUNNING WATERS – IMPLICATIONS FOR CONSERVATION AND MANAGEMENT

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Runoff discontinuity occurring in largely distinct riverine systems involves ecological constraints that may generate similar biocoenotic patterns, despite their taxonomic and hydrologic dissimilarities. Our goal was to (i) highlight these specific common and different features and (ii) based on the findings, draw conclusions with respect to conservation and management strategies.
The study was conducted on two rivers, equal in size but of different geographical setting. The first system is the River Töss, a 58 km long pre-alpine tributary of the River Rhine, subject to flow intermittency along its main stem due seepage loss to the alluvial aquifer at various intensities and frequencies. Structural degradation such as channelization, bank reinforcement, and cross barriers intensify the hydrologic extremes, especially during low flow situations. The second system is the River Alme in East-Westphalia/Germany, characterized by flow intermittency due to karst formation in limestone of the Upper Cretaceous. Here, water loss is caused by seepage and through sinkholes (ponors).
Both rivers are summer-dry over long stretches, yet small-scale spatial and temporal water flows contribute to a diverse hydraulic situation. We analyzed local and regional macrobenthos diversity, the significance of substrate heterogeneity as desiccation refugium, origin of source populations, and the impact of stream degradation on the benthic fauna. Despite the difference in running water type and geo-hydrological setting, similarities with respect to overall biodiversity were striking. One major finding was that the mosaic of topography, substrate variety, and hydraulic conditions characterizing intermittent running waters contributes significantly more to the regional biodiversity than the corresponding qualities of permanent systems would do. The findings lead to common conclusions with respect to conservation and management. For the main part, all measures that target restoration and stabilization of the biocenotic mosaic are considered the most suitable management strategy.

SS05

MULTIMETRIC ASSESSMENT OF HYDROMORPHOLOGICAL SHORELINE DEGRADATION BASED ON EULITTORAL MACROINVERTEBRATE COMMUNITIES

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Hydromorphological alterations can have substantial detrimental effects on the littoral zones of lakes. However, these impacts have been rarely assessed systematically using bioindicators with respect to the ecological status of lake shores. Based on data from 51 lakes varying in trophic state out of 7 European countries, we developed the first tools to assess the ecological impacts of such hydromorphological alterations that are applicable across European lakes, according to the standards of the EU Water Framework Directive. Multimetric assessment tools are based on pressure-specific response patterns of eulittoral macroinvertebrate community composition, diversity, abundances and functional traits. Macroinvertebrate sampling covered a range of morphological degradation levels, ranging from natural to heavily degraded sites, including recreational beaches, ripraps and retaining walls. Both habitat-specific samples and multi-habitat composite samples were collected. Biological data were supplemented by physical surveys of shoreline morphology performed with the Lake Habitat Survey (LHS) method. ANOSIM analyses of the spatial differences in macroinvertebrate community composition showed strong differences between four main biogeographical regions, i.e. Western, Northern, Central and Southern Europe. Based on habitat-specific and composite samples, two biotic multimetric indices, the 'Littoral Invertebrate Multimetric based on HAbitat samples' (LIMHA) and the 'Littoral Invertebrate Multimetric based on COmposite samples' (LIMCO), were developed for the 4 biogeographical regions separately, thereby optimizing correlations with the respective hydromorphological stressor index. Hence, existing protocols to assess the ecological status of lakes based on their eutrophication status can be complemented by this new tool assessing the ecological status of lake shores with respect to their hydromorphological degradation.

R09

THE PERFORMANCE OF BENTHIC INVERTEBRATE INDICES TO ASSESS ECOLOGICAL STATUS IN MEDITERRANEAN STREAMS

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With the publication of the Water Framework Directive in 2000, Portugal and all other Member States of the European Community, assumed the commitment to achieve a good ecological status of all water bodies by the year of 2015. The accomplishment of this major objective requires the assessment of the current status of all water bodies. Benthic macroinvertebrate communities of 13 locations of the Santo André and Melides river basins were assessed based on the methods proposed for the Portuguese Southern rivers. As in other Mediterranean streams, insects were the predominant group with a high density of generalist taxa. Dissolved oxygen concentration, sediment grain-size and organic matter concentration were the major environmental variables structuring these benthic macroinvertebrate communities.
The Portuguese multimetric index of the South ($IPtI_S$), proposed for the assessment of the ecological status of southern Portuguese rivers was determined for the studied locations. The obtained results suggest that only three of these thirteen sites are in an ecological status considered good or excellent. Riparian vegetation quality (QBR index) and the habitat diversity (IHF index) were also assessed for a broader and integrated ecological assessment. The recent proposal of the $IPtI_S$ index as an assessment method is relatively recent and for that reason a wider use in order to verify its responsiveness and, therefore, improve its accuracy was not possible. The responsiveness of this index to previously identified pressures in the Melides and Santo André river basins was a major objective of this study. Although this index showed a predictable response in lotic environments, it did not show a good performance when applied to lentic environments and groundwater/surface water interfaces, underestimating ecological quality.

R09

EFFICIENCY OF THE MONITORING INDICATORS IN ASSESSING THE ECOLOGICAL STATE OF WATER BODIES: RIVER BASINS ARGES AND VEDEA (ROMANIA)

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Degradation of rivers through multiple stressors continues to occur throughout Europe. Simultaneously, the Water Framework Directive (WFD) explicitly asks for better tools to assist managers to preserve, restore, and manage river systems in a sustainable way. If such tools are to be successful and cost-effective, evaluation of the set of indicators monitoring system currently operates, with respect to their power to capture the change in the ecological state of aquatic ecosystems and to assist decision makers in identifying priority actions at different spatiotemporal scales and define management strategies for water systems are essential.
This paper aims to discuss the existing water management indicators sets with respect to their applicability and efficiency to evaluate the status of water bodies in the Arges and Vedea river basins (Romania). For this purpose, the paper first highlights the achievements and limits of the conceptual framework for the monitoring and evaluation process of the ecological integrity of lotic systems and its implementation. The following section analyzes a selection of biotic, hydro-morphologic and multimetric indicator sets, calculated based on the monitoring data obtained in 2009 and 2010. Then principles for the identification of indicators and important areas to be addressed are defined.
The results highlight that there are still a number of shortcomings in terms of defining concepts (insufficient integration between biological, physico-chemical and hydromorphological components) as well as the development of tools (structural indicators are still dominant and functional indicators are almost lacking, there are still weaknesses in the identification of threshold values to separate different classes of quality) and the implementation of the Directive (participatory, integrative and iterative process, integration of the economic dimension in water management). These issues are priorities for both research and management. One of the main results is that indicator sets elaborated so far are not powerful enough to assess the ecological state and overall, the assessment has a low confidence level. Consequently, in the final section recommendations on how to design indicator sets able to better assist managers to assess ecological status and prioritise the pressures and stressors acting in basins are made.

SS12

THE RIVER RESTORATION OF THE "GEER", A RIVER OF THE BELGIAN LOESS BELT

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The river "Geer" flows throughout a cross bordering catchment of about 470 km². The river begins in Walloon region (Belgium) then cross twice the regional border with Flemish region (Belgium) and finally the international border with The Netherlands. From 1950 to 1990, a wide program of straightening and channelizing of the river and its tributaries took place. About the half of the water system lost its natural aspect. The international status of the river allows benefiting Interreg funds to implement a restoring program for the river. The last three years, the project AQUADRA financed three restoration projects as well in Flanders as in Wallonia. The focus will be on the restoration of the river in Wallonia. This project involves 1 km length of water course in the upper part of the catchment. The objectives are first of all the biodiversity, then the landscaping aspect and finally the communication and sensitization of the public of the interest of river restoration. This pilot project is spreading, other river restoration are in preparation along the "Geer" river. These projects are the first puzzle pieces to reach the criteria of the Water Framework Directive.

R05

THE SMELL OF HIGH QUALITY FOOD: VOLATILE SIGNAL SUBSTANCES FROM BENTHIC GREEN ALGAE SERVE AS FOOD-QUALITY-INDICATORS FOR A FRESHWATER GASTROPOD

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Algal biofilms are the major source of primary production in littoral zones and shallow lakes. The nutrient content of those biofilms varies strongly, both spatially and seasonally, in these heterogeneous habitats. To investigate how the nutrient content of benthic algae influences the fitness of benthic consumers, we conducted a five week growth experiment with the common pond snail *Lymnaea stagnalis.* Low availability of either phosphorus or nitrogen in the algae significantly constrained the growth rate of the herbivores, which demonstrates that these herbivores require high quality resources to maintain their growth and reproduction. Therefore, it would be highly adaptive for consumers to be able to identify and locate high-quality food over certain distances by perceiving food quality dependent signal substances. One important group of such signal substances is volatile organic compounds (VOCs), which are liberated by various aquatic primary producers upon cell wounding.
Using behavioural assays, we clearly demonstrate that damaged cells of the benthic green alga *Ulothrix fimbriata* release VOCs that serve as foraging kairomones for
L. stagnalis. In further assays, we tested whether these herbivores are able to differentiate between VOCs derived from high or low quality food sources based on reception of the released bouquet of signals. We show that the snails recognize and prefer VOCs extracted from nutrient-rich algae over signals from low nutrient algae. Gas chromatography and mass spectrometry were employed to investigate differences in the chemical composition of the VOC bouquet dependent on algal nutrient content. We found no composition differences, but nutrient depleted *U. fimbriata* release lower amounts of VOCs than nutrient saturated *U. fimbriata*. Hence, our results demonstrate that recognition of resource quality via signal substances is a successful and potentially adaptive strategy for benthic herbivores to avoid food quality limitations.

SS13

SERVING MANY AT ONCE: HOW A DATABASE OF COMPONENTS AND PROCESSES CAN CREATE GENERALITY IN ECOSYSTEM MODELING

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Dynamic ecosystem models are composed of sets of equations that represent selected processes between selected components in a certain spatial setting. To analyze the model and run scenario's, simulations are performed through numerical integration. This process is controlled through some form of a user-interface. The number of choices that can be made during selection of the processes and components, the spatial setting, the numerical integrator and the user-interface is seemingly endless. This resulted in a myriad of models that are incompatible because they differ along a number of axes. (e.g. from theoretical to applied, from 0D to 3D, from a few lumped compartments to a detailed food web, from focus on lower trophic levels to focus on higher trophic levels, etc.).

Here we propose a database approach towards model components and processes to create generality in ecosystem modeling. In this approach the ecological knowledge captured by the model is stored in a database irrespective of the language and platform in which the model will be run. Only mathematical and logical operators and functions are used. The stored ecological key information on component and processes is well documented with meta-information on units, values, references, etc. To create an instance of the model in a certain language and for a certain platform, the information in the database is translated and augmented with the language and platform specifics. This process is automated so that a new instance can be created each time the database is updated.

We exemplify our approach for the ecosystem model of shallow lakes PCLake and its twin model for linear waters, PCDitch. These models were originally implemented in ACSL, after which they were ported to DUFLOW, and from there to M, DELWAQ, OSIRIS and R. Each translation step involved stripping specifics of the old platform, translating language specifics and then adding new platform specifics. While going from platform to platform, a platform and language independent database formulation of the model emerged. Scientific and educational experience with this database approach for PCLake and PCDitch showed that it indeed facilitated the insight in the ecology in the model by developers and users, contributed to a more dynamic scientific development of the model and finally, allowed for a direct implementation of these developments in multiple platforms.

R09

WFD AND EUTROPHICATION ASSESSMENT: THE ROLE OF NITROGEN AS A DRIVING NUTRIENT IN SHAPING PHYTOPLANKTON ASSEMBLAGES IN 13 ITALIAN WATER BODIES.

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This research was carried out in the frame of the LIFE project INHABIT (Local hydro-morphology, habitat and RBMPs: new measures to improve ecological quality in South European rivers and lakes). A key action of the project was finalized to detect the relationship between nutrients on the ecological quality of water bodies and to identify management options to reduce their effects on aquatic ecosystems to be included in RBMPs, focusing, in particular, on nitrogen. The outcome of the project will serve as a basis for the implementation of Water Framework Directive river basis management plans in Italy and, possibly, in Europe. Analyses were carried out on data from 13 lakes, located in two Italian Regions, Piedmont (North-western Italy, 7 lakes; 5 natural and 2 reservoirs) and Sardinia Island (6 lakes; 1 natural, 5 reservoirs). Seasonal samples were collected in each lake, from 3 to 6, depending on environmental characteristics. The following variables were considered: water temperature, conductivity, alkalinity, pH, dissolved oxygen, SRP, TP, N-NH_4, N-NO_3, TN, RSi, Secchi depth and chlorophyll. Species/environment relationships were explored using multivariate statistical techniques (CCA, RDA and Generalised Additive Models). Analysis was carried out on 23 phytoplankton orders and 51 genera/species. The results pointed out an increase of cyanobacteria (Nostocales and Oscillatoriales) with the increasing nitrogen availability. Moreover, a positive response of some chlorophytes species was also observed. On the other side, diatoms declined when nitrogen concentration increased. Our findings, confirming some experimental results previously obtained, emphasize the need for a further attention towards the impact of increasing nitrogen, in particular from atmospheric inputs, when restoration plans against eutrophication are designed.

SS06

CAN SUMMER DROUGHT AFFECT LEAF DECOMPOSITION WHEN THE WATER FLOW RETURNS TO THE STREAM?

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Temporary streams in Mediterranean regions are characterized by summer drought periods, which might become longer and harder under climate change predictions. During this period, the flow is interrupted and fallen leaves are directly exposed to high solar radiation and high temperature. Leaves can be chemically and physically affected when are exposed to such extreme environmental conditions, but the effect on leaf decomposition, once the water flow returns, is still unclear. We used leaves of *Populus nigra* to assess the effects of a severe drought event on leaf decomposition and the associated benthic communities (bacteria, fungi and macroinvertebrates). Recently-fallen leaves from the same source were separated in two sets: control leaves and treated leaves. The treatment consisted in simulating extreme drought summer conditions by exposing leaves to high solar radiation and temperature for three months, while control leaves were kept dried in the dark during a similar period of time. Then, control and treated leaves were enclosed in coarse-mesh bags and immersed in a stream for 37 days. Drought treatment affected leaf quality by increasing the percentage of nitrogen content, but this did not result in a faster decomposition after leaf immersion in the stream. Enzymatic activity related to cellulose degradation was higher in treated than in control leaves probably due to changes in leaf quality. At later stages of decomposition, control leaves had higher nitrogen percentage and greater biomass of microbial and macroinvertebrate communities. Interestingly, the structure of microbial community on control leaves was clearly different from those on treated leaves. Also, a lower variability among replicates in treated leaves was observed in all the studied community parameters (biomass and species composition) for bacteria, fungi and macroinvertebrates, suggesting that decomposer communities were functionally and structurally homogenized when leaves were pre-exposed to drought. Our study showed a clear effect of long drought periods on leaf litter decomposition, highlighting the importance of evaluating effects at different trophic levels to better assess the impacts of drought in freshwater detritus food webs.

SS13

ANALYSIS OF LAKE RESPONSE TO REDUCTION OF NITROGEN LOADS ACCORDING TO TROPHIC STATE AND SEDIMENT STORAGE CAPACITY

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Reduction of P loads has been the main remedial action for restoration in lakes following the OECD study (1982). In some cases reduction of P loads has not been enough to reduce eutrophication and improve the water quality. Reduction of N loads is often considered as an additional measure. However, nitrogen reduction is expensive and difficult to perform in the case of diffuse sources, and, on the other hand, the internal cycle of nitrogen in lakes is complex including different forms of nitrogen (NH_4, NO_3, DON, N_2) that interact through different processes (e.g. nitrification, denitrification, ammonification). This complexity creates a set of compensating mechanisms. The two mechanisms which can have the main buffering effects in the nitrogen reduction are NH_4 release from sediments and fixation of N_2 by cyanobacteria.
The Nitrolimit project investigates whether or not a reduction of nitrogen is ecologically meaningful and economically feasible. For that purpose models can be useful tools to include the interactions between the nitrogen components and be used for systems understanding and prognosis. Combining existing nitrogen models (e.g. Chlot et al. 2011) with ecological models for lakes (Mieleitner et al. 2006, Benndorf et al. 1982) and the knowledge acquired in Nitrolimit project a new Open Source Model has been developed. The model includes DON, NH_4, NO_3 and N_2 as state variables regarding nitrogen. Biodegradable detritus coming from dead plankton is transformed by remineralisation into NH_4 and SRP and by simple degradation into DON. NH_4 turns into NO_3 by nitrification and, partially, it is released as N_2 by denitrification. This processes take place in the water column and in the sediment which has been divided in three layers where the processes occur with more intensity.
The model will evaluate the significance of the buffering effects to nitrogen reduction of theoretical lake systems in several scenarios considering different trophic levels and loads from sediments.
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R09

PRELIMINARY STUDY OF 15 CORSICAN LAKES (FRANCE) EVALUATION OF THE ECOLOGICAL STATE USING MULTIVARIATE ANALYSIS

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Fifteen corsican lakes between 1310 and 2321 m of altitude were selected. Twenty-nine physico-chemical parameters and bacteriological parameters are measured. On the whole 207 Surber sampler of benthic macroinvertebrates were carried in the lakes an in the additional hydrosystems (springs, tributaries, emissary, pozzines).

A ranking of the lakes according to the degree of eutrophication is carried out by using the Principal Components Analysis (PCA) on the physicochemical and bacteriological parameters.

Specific richness and relative abundance of the benthic communities are studied according to the depth and to the altitude.

78 taxa were found (including 28 endemic species); Trichoptera group are diversified, come then Diptera ones, Coleoptera, Plecoptera, Ephemeroptera…
The diversity and of the macroinvertebrate communities is inversely proportional to the altitude of the lake considered. More diversified fauna is found in the additional hydrosystems (springs, tributaries, emissary, pozzines) where the Diptera ones, Oligocheta, Trichoptera and Plecoptera represente account for 90 to 100% of the inventoried species.
One notes a domination of Diptera and Oligocheta which account for 70 to 97% of the invertebrates sampled in the lakes.

The Diptera order is important in these benthic communities. It is particularly studied with the depth.
The bathymetric zonation of the benthos results by an impoverishment of the benthic community with the depth and in a dipterologic domination of the aquatic fauna beyond 5 meters where the larvae of Chironomidae Tanytarsini and Tanypodinae dominate.

A typology of the lakes is carried out by using a Canonical Correspondence Analysis (CCA) combining the topographic characteristics of lakes, physico-chemical concentrations and macroinvertebrates community. A ranking of the ecological state of the studied lakes is proposed.

Within the framework of a plan of management of these lakes (and additional hydrosystems) with high patrimonial value, a follow-up of the physico-chemical quality of water is essential. The benthic invertebrates are very good integrators of the changes of the water quality. Thus this integrating fauna must be studied within the framework of the climatic changes. The faunistic composition of the benthic communities and the follow-up of the bioindicator taxa (ie: Diptera Chironomini and Tanytarsini, Mollusca *Pisidium casertanum*, Trichoptera *Allogamus corsicus* and *Leptodrusus budtzi*) must be particularly studied.

SS07

MICROCRUSTACEAN (COPEPODA, OSTRACODA) ASSEMBLAGES IN THE ALPINE KARSTIC AQUIFER AND THE ORIGIN OF CARBON ESTIMATED BY STABLE ISOTOPES

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Microcrustacean assemblages, the origin of carbon and sources of groundwater recharge were investigated in the karstic alpine aquifer at the interface of vadose and phreatic zone. Drift from temporal and perennial karstic outlets was sampled monthly in 2011. Concurrently, the physical parameters (T, pH, conductivity, dissolved oxygen), major ion geochemistry of the water (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, HCO_3^{-}, SO_4^{2-}, NO_3^{-}) and stable isotopes of dissolved inorganic carbon ($\delta^{13}C_{DIC}$), particulate organic carbon ($\delta^{13}C_{POC}$) and oxygen ($\delta^{18}O$) were investigated. The investigated Alpine springs represented waters strongly influenced by chemical weathering of Mesozoic limestone and dolomite. Spring water solute chemistry was dominated by HCO_3^{-}, Ca^{2+} and Mg^{2+}. The water temperature in temporal and perennial outlets was from 6.3 °C to 7.1 °C and from 6.4 to 7 °C respectively and was not significantly different. The conductivity did not differ between the outlets and was from 235 to 303 µS cm^{-1}. Values of $\delta^{13}C_{DIC}$ and $\delta^{13}C_{POC}$ in investigated springs ranged from -12.7 to -9.1‰ and from -28.9 to -23.6‰, respectively. Isotopic composition of oxygen ($\delta^{18}O$) ranged from -10.7 to -8.1‰. $\delta^{18}O$ of precipitation were enriched with heavier ^{18}O in comparison to groundwater, especially in summer months. Temporal spring had more positive $\delta^{13}C_{POC}$ values in comparison with perennial one. 12 microcrustacean species were collected in permanent and 8 in temporal spring. Mao-Tau species accumulation curves did not reach asymptote in temporal but did in permanent outlet. The most abundant species occurring in both outlets were *Elaphoidella phreatica, Diacyclops zschokkei, Bryocamptus dacicus* and *Mixtacandona sp. B.* Some species occurred only in permanent outlet indicating highly heterogeneous distribution of species within aquifer. Despite similar geochemistry of the water, the fauna collected from the two outlet was significantly different. The study demonstrated that filtering of spring water in aquifers with karst-fissured porosity and without accessible caves can be an efficient method for the estimation of groundwater species richness.

R03

ENVIRONMENTAL FACTORS INFLUENCE PHYTOPLANKTON COMMUNITIES IN MEDITERRANEAN RESERVOIRS (CATALONIA, SPAIN)

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During the last decade, the phytoplankton assemblage approach, based on the physiological, morphological and ecological traits of the species, has proved to be an efficient tool to recognize environmental gradients. We analyzed the phytoplankton assemblage according to the specie descriptors, classes and functional groups (FG, sensu Reynolds) into Mediterranean reservoirs (S. Ponç - R1, La Llosa - R2, La Baells - R3, Santa Fe - R4, Susqueda - R5, Sau – R6, Foix - R7) with different trophic state, located in Catalonia (NE Spain). Samples were collected in the reservoirs in the summer of 2011, when they were thermally stratified. We identify 86 phytoplankton species in the reservoirs and 31 species were considered descriptors and grouped into 17 functional groups (Lo, A, B, E, Y, R, W1, W2, C, H1, X1, X2, X3, N, MP, J and S1). The reservoirs with oligo-mesotrophic state (R1, R2 and R3) showed low algal biomass ranging from: 0.5 to 1.4 $mg.L^{-1}$. The reservoirs with eu-hipereutrophic states (R5, R6 and R7) showed the highest biomass of algae (2.6 $mg.L^{-1}$, 6.6 $mg.L^{-1}$ and 34.5 $mg.L^{-1}$, respectively) except R4 (distrophic) showed a high algal biomass (6.4 $mg.L^{-1}$). According to the CCA analysis the most important variables to explain the variability data were euphotic zone, ratio Zeuf/Zmix, nutrients (P-TP and N-TN) and chlorophyll-a, indicating that environmental differences between the reservoirs are influencing the species descriptors, classes and FG composition in each reservoir.

Acknowledgments
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SS14

LIMNOLOGY, LIBERATION ECOLOGY, AND OUR FUTURE

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We live in unpredictable times. A number of powerful threats face us: climate change; the risk of collapse of the western and emerging economies because of potential shortages of oil, energy, liquid funds; difficulties due to increasing longevity, dementia and diseases of consumption-imposed lifestyles such as obesity; increasing population, lack of human rights, civil unrest and poverty in the developing world; and increasing inability of the remaining biomes to continue to regulate atmospheric composition and thus maintain equable climatic conditions and to continue provide goods and services. Our future may look bleak, but the ecological theory of alternative stable states, manifested perhaps most clearly in the behaviour of shallow lakes, and the ways in which diverse plant-dominated states can be restored from algal-dominated states can help us to understand alternatives in the way that human societies might be organised and the ways in which sustainability might be reached. It is likely that we will do little to avoid some major catastrophe but when it comes, it will be necessary to have in place a general public that is well enough informed to wish to change the ways that our societies are organised. A major block to this is the laager mentality of scientists, their general unwillingness to become politically involved, and a near complete inability to write and communicate in appropriate ways.

R09

DEVELOPMENT OF A PRELIMINARY FISH-BASED INDEX OF BIOTIC INTEGRITY (IBI) FOR COLDWATER STREAMS OF SELECTED ECOREGIONS IN IRAN

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A main issue for water resource management is the assessment of environmental degradation of lotic ecosystems. We developed two preliminary IBI for coldwater streams in Kura-South Caspian Drainages and Caspian Highlands ecoregions by using fish-assemblages data from 36 stream sites. An IBI was developed for each of two different sub-ecoregions (forest and grassland), which were identified within two specified ecoregions, according to significant differences between altitude, mean air temperature and precipitation parameters as well as the abundance of brown trout. In addition, we used 25 criteria describing major anthropogenic degradation and combined these into a global pressure index (GPI) that accounted for potential additive effects of multiple pressures. Twelve candidate fish metrics were selected and evaluated for sensitivity to human impacts. Finally two metrics (density of brown trout and ratio of non-type specific species) were included in the forest sub-ecoregion IBI and one (density of brown trout) for the grassland sub-ecoregion IBI. The Spearman rank correlation analysis showed a strong correlation between IBI and GPI (r=0.90 for both sub-ecoregions). We validated the model with an independent data set (40 sites), which showed that the model is applicable for the selected ecoregions.

R11

THE CONSERVATION VALUE OF STREAM RESTORATION MEASURES: AN EVALUATION FOR TARGET SPECIES AND ON ECOYSTEM SCALE

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Stream restoration is a widely applied management strategy for the conservation of freshwater ecosystems. In this study we evaluated two types of gravel introduction (8-16 mm and 16-32 mm), substratum raking and the placement of boulders applying a multi-scale approach simultaneously assessing effects on target species, different taxonomic groups and on ecosystem scale. For the gravel introductions and substratum raking, aquatic community composition changed significantly after restoration and was still different from the pre-restoration status after one year. The placement of boulders had no significant long-term effects on aquatic communities. The main factors driving the change of aquatic community composition were an increase in macroinvertebrate species density and numbers of individuals, periphyton abundance and a decrease in macrophyte coverage, species numbers and biomass. Fish community compostion only changed significantly in single study rivers depending on the river specific species composition and the occurrence of species sensible to the structures introduced by the restoration measures. These species were lithophilic, rheophilic and invertivoric fish species, comprising several species listed on the red list of endangered species, which particularly accepted the gravel introduction 16-32 mm as juvenile habitat. The gravel introductions were also most frequently used for spawning by brown trout, European grayling and European minnow. In contrast, the results of active bioindication with brown trout eggs indicate that investigated restoration measures were not sustainable enough to enhance habitat conditions in deeper substratum layers throughout the incubation period of salmonid eggs. The results of this study indicate that instream restoration measures can contribute to biodiversity conservation as well for target species as on ecosystem level. However, the effects were restricted to the species inventory being already present at a minimum viable population size prior to the restoration. Reproductive success of species depending on long-term improvement of interstitial water quality could not be enhanced, indicating that catchment effects and natural substratum dynamics should also be considered for a long-term and self-sustainable improvement.

R09

APPLYING THE RIVER HABITAT SURVEY METHOD FOR EVALUATING ECOLOGICAL STATUS OF SMALL RIVERS

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In order to test the applicability of the River Habitat Survey method (RHS) to assess human impact on small watercourses, two rivers were chosen in the vicinity of Kraków, southern Poland. They differ in habitat complexity within the channel, and the character and degree of human activity in their valleys. The Drwinka river flows across the floodplain of the Vistula river, its catchment area is covered partly by meadows, and partly by fallows. Its channel has undergone regulation in the 1960s and 1980s. The Bedkowka river in its upper stretch flows along the bottom of karstic Bedkowka Valley, part of Polish Jura. The lowest part of the channel crosses the floodplain of the Rudawa river, and it has been regulated. On each river a standard 500m site was chosen, and in summer 2012 data were collected according to the RHS manual. On that basis two indices: Habitat Modification Score (HMS) and Habitat Quality Assessment (HQA) were calculated for each river. Values of the indices clearly differentiated the rivers. The Drwinka scored 13 out of 136 (HQA) and 25 out of 100 (HMS), whereas the Bedkowka 65 and 2 respectively. This underscores the accuracy of the RHS method in describing and quantifying the extent of human-induced changes in natural river systems.

SS11

OPTIMIZING CHANNEL REHABILITATION FOR HEAVILY MODIFIED URBAN STREAMS

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Heavily modified urban streams are often restricted to unnatural hydromorphology due to inalterable through constraints such as zero sinuosity, low width, steep and fixed banks, immobile bed sediments, and a flushing flow regime. Thus stream channel rehabilitation measures can hardly follow the natural reference. In this work a procedure to find the best possible solution for channel rehabilitation is developed and applied in a pilot study in the Panke stream, Berlin, Germany. The procedure combines expert knowledge from hydromorphology, ecology, and river engineering in an iterative manner together with 2D hydraulic modeling (HYDRO_AS-2D), expert based design of channel structures, and habitat simulation (CASiMiR). Hydraulic modeling generates spatially high resolution information on the present flow conditions in the channel. This information then serves as the basis for an initial design of rehabilitation structures. The overall design is aimed at increasing the habitat heterogeneity and the achievement of sustainable bed morphology, while acknowledging invariable channel structures, such as shallow armed bed areas at bridges as future sites for riffles. Riffle-pool morphology and alternate bars are key elements of the design that is further supplemented by woody structures. The spatial realization of the design is oriented on the optimization of a set of targets which widen the bottle necks of ecological factors for fish and invertebrates at various discharges in the investigation reach. Main factors herein are water depth (at low flow), current velocity (at low flow, most frequent flow, and annual flood), bed shear (at most frequent flow, annual and hundred year flood), bed substrates (at most frequent flow), and fish coverage (at all flows). For each factor a number of requirements are established, e. g. bed shear stress. During annual floods the critical shear stress for fines at gravel-bed patches and pools should be exceeded, and stay well below critical shear for the riffle bed substrates. Iterative hydraulic modeling and adaptation of the design, mainly size, distance, and relative orientation of individual structures, allow for the optimization according to the given set of targets. At a later stage of the iteration, habitat simulation is used for fine tuning of the channel structures according to key species of fish and invertebrates in the stream. The such optimized design will be constructed in 2013 in four test reaches in a pilot study.

SS02

TROPHIC INTERACTIONS BETWEEN DIFFERENT FISH HOSTS AND THEIR ASSOCIATE PARASITES WITH A SPECIAL REFERENCE TO HEAVY METAL ACCUMULATION

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Little is known about the trophic relationship between parasites and their fish hosts. Due to the fact that heteroxenous parasites usually exhibit complicate life cycles and can either feed on host tissues or nutrients ingested by the host, their exact position in food webs is hard to be determined. Investigations of stable isotopes of carbon and nitrogen have shown that consumers enrich $\delta^{15}N$ with average 3.4 ‰ and $\delta^{13}C$ with 0-1 ‰ per trophic transfer, which might be helpful for understanding the trophic relationship between the fish host and its associated parasites.
We determined the trophic levels of different fish parasites with respect to their fish host using isotope-ratio mass spectrometry (IRMS). Therefore, the ratios of isotopes $\delta^{13}C$ and $\delta^{15}N$ in barbels (*Barbus barbus*) infected with either one parasite species (intestinal acanthocephalan *Pomphorhynchus laevis*) or simultaneously with two (acanthocephalan *P. laevis* and larval nematodes of genus *Eustrongylides* sp.) as well as in three spine sticklebacks (*Gasterosteus aculeatus*) infected with the larval tape worm *Schistocephalus solidus* were investigated.
In order to understand the role of the parasite's trophic level in the metal uptake process, the concentrations of 11 elements (As, Cd, Co, Cu, Fe, Mn, Pb, Se, Sn, V and Zn) were analysed in fish and parasite samples using inductively coupled plasma mass spectrometry (ICP-MS). Subsequently, the metal accumulation potential of parasites was linked to data obtained from IRMS analyses.
The results from stable isotope analyses revealed differences in trophic levels between selected parasites with respect to their host, which on the other hand corresponded to element composition in the selected host-parasite systems.

R07

PELAGIC REDOXCLINES AND THE TRANSPORT OF PARTICULATE ORGANIC PHOSPHORUS

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The physical conditions in lakes are strongly influenced by changing climate factors like temperature, wind velocity and solar radiation. Climate impacts on the physical structure of lakes range from increasing water temperatures, longer duration of thermal stratification to shorter periods of ice-cover. In eutrophic lakes the bottom waters can reveal excessive oxygen consumption due to the high biomass production in the upper water layers. An extended thermal stratification would thus lead to declined oxygen concentrations in the hypolimnion due to limited vertical mixing. Impacts on the phosphorus supply in the water and thereby on the lake’s productivity are contradictory discussed.

In the eutrophic Lake Arendsee in northeastern Germany an oxygen minimum is developing in the metalimnion during summer. Up to 50% of total oxygen consumption during the stratification period can occur in this water layer. To investigate the influence of redoxclines on the transport of particulate phosphorus, we measured the flux of material through the metalimnetic oxygen minimum in Lake Arendsee. By exposition of sedimentation traps above and below this layer, settling material was collected and the content of phosphorus, carbon and metals was analysed.

During the summer stratification 40% of total settling material was lost in the metalimnion mainly due to degradation of organic material. Due to vertical density gradients the retention time of material in the metalimnion is prolonged and intensive bacterial degradation can take place. The phosphorus sedimentation is significantly correlated to the sedimentation of organic material above and below the redoxcline. Thus, on average 26% of the particulate phosphorus was released during sedimentation across the metalimnion. The increase of the specific phosphorus content during sedimentation is explained by the uptake of algal phosphorus by heterotrophic bacteria throughout mineralisation. In summary, these findings suggest that a rapid mineralisation of organic matter and an enhanced phosphorus release are taking place at pelagic redoxclines.

SS04

SPATIAL AND TEMPORAL VARIATIONS IN CHIRONOMID ASSEMBLAGES IN GLACIATED CATCHMENTS (NP HOHE TAUERN, AUSTRIA)

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Within the pilot activities for the 'River- Monitoring Program NP Hohe Tauern' (2009 – 2012) selected river reaches (non-glacial, glacial) in four glaciated catchments were investigated in order to i) characterize the abiotic conditions and biotic patterns of the individual systems, ii) elucidate important variables being responsible for species occurrence, richness, diversity and abundance, and iii) to define appropriate indicators for showing environmental conditions and change. For this paper the chironomid assemblages were used as these organisms are ubiquitous in alpine river systems and are known to react sensitively to environmental gradients. Chironomid assemblages showed different temporal and spatial patterns when non-glacial and glacial rivers as well as reaches above and below the tree line were compared, both in terms of structure and functional organization respectively. In general, water temperature and current velocity were the main factors influencing the chironomid distribution pattern. However, several other parameters (conductivity, specific anions, kations, and nutrients) were found significant to explain species or species-group occurrence. Our results showed that the presence of certain chironomid species can be unequivocally associated with specific environmental factors. Fundamental premises are however, a robust taxonomy and a comprehensive set of physico-chemical data to characterize specific ecological demands, including optima and tolerances. This knowledge is essential to define appropriate species to be used as indicators for climate-change effects in alpine river ecosystems.

R13

WHAT REGULATES DIFFERENT SUCCESSES OF THE ASIAN FRESHWATER CLAM *CORBICULA FLUMINEA* IN CENTRAL EUROPEAN RIVERS? A CASE STUDY FROM THE RIVERS RHINE AND ELBE.

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During the past decades, the Asian freshwater clam *Corbicula fluminea* has become one of the world´s most successful aquatic invertebrates outside its native range. Once the clam had invaded Southern Europe in the early 1980s, it rapidly dispersed over the entire continent. Despite the generally high invasive success of *C. fluminea*, the clam did not uniformly establish in European inland waters: While several thousands individuals m^{-2} can occur in some large rivers such as the Rhine, Germany, only very low quantities of less than 10 clams m^{-2} were reported for other rivers such as the River Elbe, Germany. It was previously hypothesized that either the availability of food and/or water temperature may be important in regulating the invasive success of the clam. Here, we present results from a case study in which specimens from a single cohort of *C. fluminea* were cultured in bypass systems to original field water bypasses from the Rivers Rhine and Elbe over a period of ten months. Both water quality (e.g., seston and chlorophyll *a* contents, water temperature) and clam growth (shell length, soft body dry mass) and fitness estimates (motality and reproduction rates) were monitored throughout the experiment. The consistently higher food availability in the River Elbe significantly enhanced growth of *C. fluminea*, whereas a pronounced loss in biomass during times of food limitation was observed in the River Rhine. In contrast, extended periods of low water temperatures during winter significantly increased mortality and tended to decrease reproduction of the clams in the River Elbe. Our results highlight a prominent role of low water temperatures during winter in decreasing the fitness of *C. fluminea*. Nevertheless, it has to be discussed critically, in how far water temperature suffices to explain differences in the invasion success of *C. fluminea* throughout Europe.

R04

FUNCTIONAL DIVERSITY OF ROTIFERS, NEW INSIGHTS INTO COMMUNITY ASSEMBLY

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While the trait-based approach is widely used in plant research, it is in its infancy and limited to a few studies in aquatic ecology. We focused on how water residence time (WRT) influences functional diversity (FD) of rotifers as inferred from morphological traits. The wide variety of rotifer morphology is surprising and essentially reflects species adaptation to the environment. Specifically rotifers, due to their short generation time and important role in the aquatic food web, can serve as a model system to investigate how the environment shapes FD. We used Rao`s quadratic entropy (FD_Q) and community-level weighted mean trait (CWM) values to investigate FD of rotifers from Lake Tovel (Italy) during the ice-free period (May to November) for the years 2002-2006. We analysed the factors and processes driving rotifer FD_Q by generalized linear squares regression, logistic regression, and non-metric multidimensional scaling. Furthermore, we compared FD_Q to FD generated by null-models varying species richness and abundance to investigate trait convergence and divergence. Among the six traits used, FD_Q based on trophi type and body size of rotifers was best related to WRT, biovolume of large algae (> 30 µm) and the months August and September. Survival, feeding, and predator avoidance of rotifers are related to trophi type and body size, and this explained their general importance for rotifer FD. Biovolume of large algae decreased FD_Q, and we attributed this to the more difficult handling of large algae during feeding. The months August and September increased FD_Q, and we attributed this to reduced development time due to higher water temperatures. Remarkably, WRT decreased FD_Q; rotifers with a malleate or malleoramate trophi were positively related to large WRT values, while rotifers with virgate or incudate trophi were negatively related to WRT but positively to algal biovolume. We attribute the alternating pattern of these rotifer guilds to competition on overlapping food sources. Comparison of FD_Q to null-matrices indicated both trait convergence and divergence. A threshold value of $FD_Q = 0.39$ discriminated trait convergence from divergence. In cases where null-models led to the same indication of trait patterns, competitive exclusion could be identified as the driving factor of community assembly. Our study is the first to apply the FD approach on rotifers, and we could outline general principles of rotifer community assembly.

SS11

DO WATER SENSITIVE URBAN DESIGN STRUCTURES DELIVER WHAT THEY PROMISE?

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It is becoming widely accepted that stormwater runoff emanating from impervious surfaces is a primary driver degrading stream health. In an effort to mitigate stormwater impacts there has been an increasing emphasis on retrofitting urban catchments with water sensitive urban design (WSUD) structures, which seek to ensure that water management within urban settings is sensitive to both pre-development hydrological and ecological processes. Relatively limited evidence-based data exists demonstrating the efficacy of WSUD to achieve its ultimate goal: improving stream health in receiving environments.

This study examines the efficacy of several WSUD stormwater wetland systems retrofitted to one of Australia's most urbanised catchments – the Cooks River. Evaluation of the treatment systems included multiple environmental indicators: water and sediment quality assessments; invertebrate monitoring; decomposition studies; and aquatic ecotoxicology.

The data shows that water quality improvements were not universally achieved between or within systems, with some indicators showing conflicting outcomes. Structural design of the wetland systems was a fundamental determinant of water quality and associated ecosystem health outcomes. In terms of human health, one aspect that has been not been considered is the accidental generation of mosquito habitat. Our studies show that the inlet ponds provide a habitat and an effective breeding ground for mosquito larvae of pest/disease potential, which is a matter that needs to be addressed in any future designs.

R04

BIODIVERSITY OF SOUTH AMERICAN LOWLAND STREAMS - NATURAL SCENERY AND ANTHROPOGENIC FACTS

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The lowland streams and rivers of the Neotropics are a massive reservoir of biological diversity, though vastly unexplored. The reasons of this failure have been exhaustively discussed on various occasions in the past. The present study gives an interim overview of the biodiversity and organismal ecology of lowland streams and rivers belonging to 34 hydrographical regions and 12 limnological provinces of Colombia. All in all, 608 riverine sites (> 95 % below 1000 m a.s.l) have been investigated so far, including three replicate samples per site on an average. Additionally, 21 to 26 (max. 44) physico-chemical parameters and 30 structural parameters were analyzed at each site. The total number of taxa determined amounted to 448. Biodiversity, taxonomic distinctness, and community structures were determined at different spatial resolutions. On the alpha level, habitat structure was found to be as the strongest predictor of diversity but not of taxonomic distinctness, which showed the highest variance between the biogeographic zones. On the community level, organic contamination originating from land use and human settlements turned out as the strongest determinant. Nevertheless, coenostructural similarities allowed for clear distinction of 4 river types common to all zones with structural bank degradation by land use being a significant modifier. On the the biome scale, however, the most eminent environmental factors that determined the structure of the aquatic biocoenoses, were the organic contamination and the geologic conditions, obscuring biogeographic settings and ruling beta-diversity patterns to a great extent. As a straight consequence and as suspected, untreated wastewaters, soil lixiviation, and morphological degradation of river banks must be outlined as the most imminent threats to the aquatic biodiversity. Additionally, since these alterations frequently co-occur with microbiological contamination originating from animal farming, they actually mutate into a sanitation problem for the resident population. Despite the positive water balance, i.e. relative abundance of surface water, in far most of the ecosystems studied here, water resources increasingly run the risk of degradation and biological impoverishment.

SS06

INDICATION OF STREAM INTERMITTENCY USING MACROINVERTEBRATE COMMUNITIES – SEARCHING FOR AN APPLICABLE APPROACH IN THE CZECH REPUBLIC

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Climate change has brought remarkable alterations in hydrological regime over the last decades and the lack of summer precipitation causes consequent periodical drying of 1st to 4th Strahler order streams. The lack of data from regularly dried up streams in the Czech Republic led us to start a project focused on such streams. The extent of changes in macroinvertebrate community is related to various abiotic parameters (hydromorphology in relation to refugia availability, frequency and regularity of desiccation etc.), as well as to biotic factors (presence of fish, competition, predation etc.). Regardless the specific conditions of each locality, the impact of drought is considered to be one of the crucial ecological filters leaving its footprint in the assemblage composition for a specific time corresponding with the extent of impairment.

Based on these assumptions we are testing three approaches to bioindication of streams affected by annual or irregular drying. Firstly it is the usability of potential intermittency/permanency indicators selected using published data from intermittent streams. The second approach involves the use of preselected species traits enabling a long time survival of taxa in regularly dried up streams. And finally we are going to test suitable (multimetric) indices to distinguish between intermittent and permanent stream communities.

Preliminary results show a remarkable shift in the composition of intermittent stream assemblages to species with higher resistance (e.g. drought-resistant stages, ability to survive in hyporheal) or resilience (e.g. high recolonization capacity). Many specific species traits such as life cycle duration or timing and synchronisation of emergence are also important for species survival especially in case of temporary fauna, which abundance and number of taxa often decrease in the after-drought period. The “drought filter” eliminates a certain part of the community, namely taxa with specific ecological requirements (e.g. oxyphilic or rheophilic species – permanency indicators), while resistant taxa - unspecific indicators (e.g. with lower oxygen demands surviving in residual pools), can colonize rewetted habitats faster. However, gradual turnover in taxonomic composition and species traits representation exists along the intermittency-permanency gradient and the partial overlap of the communities complicates undoubted differentiation between both stream types.

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PS4

FROM SPECIES LEVEL INDICATION TO FUNCTIONAL GROUP LEVEL

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Use of biota to indicate “something” that is important for human life is probably as old as our culture and it covers intuitively much more than simple species level indication. The first scientific approach to describe consequent co-occurrence of species can be traced in terrestrial plant ecology (formations, associations, sub-associations) and resulted in the development of the Braun-Blanquet systematics. This approach has been still used in modern biology and practice. Due to their mobility, no similar approach was developed for animals and other aquatic biota. Water use and the consequent pollution have dramatically increased by urbanization and industrial development leading to deterioration of water quality especially by increased organic pollution. However, need for biotic indicators arose only in the early 20th century when species-based saprobic indicator system was developed. The developed index successfully integrates dominance level and indicator values. Eutrophication became evident in the middle of the 20th century and, subsequently, a number of trophic scales were developed mostly using bulk-variables like total P, chlorophyll-a or Secchi-tranparency. The need and practice of use of functional groups as indicators of habitat properties developed only in the late 20th century and has been recently the most successful approach both in basic and applied science. So far, feeding groups of aquatic macroinvertebrates has been most widely used approach.
Importance of phytoplankton in energy and matter transport of aquatic ecosystems has never been questioned and nearly all the above historical steps can be traced in back in early literature (Braun-Blanquet description, saprobic indicator species, eutrophic indicator species, indices based on occurrence or proportion of different taxonomic groups, trophic state indication on chlorophyll- or Secchi-level).
Since general indicator criteria that are widely used in conservation biology can hardly handle phytoplankton, functional groups are of distinguished importance. Not surprisingly: three different types of grouping have been developed quite recently. The lecture will provide a general overview on these three approaches discussing their potential strengths and weaknesses.

R11

ECOLOGICAL FUNCTIONS OF FISH BYPASS CHANNELS IN STREAMS: MIGRATION CORRIDOR AND HABITAT FOR RHEOPHILIC SPECIES

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The introduction of weirs into stream ecosystems resulted in modifications of serial continuity and in the decline of riverine fish species. Successful river restoration requires information on the ecological functionality of fish bypass channels which are considered an ecological improvement according to the EU Water Framework Directive. To assess ecological effects of fish bypass channels in streams a multi methods approach was applied to detect the seasonal trends in fish migration and habitat function. Therefore a combination of active and passive bioindication was used to investigate three nature-oriented bypass channels and their adjacent upstream and downstream sites each comprising a standardised length. Active bioindication with stocked fish was used in a mark and recapture experiment to assess the suitability of the fishpasses as habitat and migration corridor for the target species *Salmo trutta*. Passive bioindication was applied using the fish community as ecological indicator to determine the conservation value on ecosystem level. Fish passes differed significantly from upstream and downstream sites of the weirs, revealing higher current speed, lower water depth, smaller channel width and greater habitat variability. Following these structural differences, they provided key habitats for juvenile, small and rheophilic fishes which are typically underrepresented in highly modified water bodies. All fish passes were used as migration corridors, with increased fish movements during high discharge and at spawning periods. The observed limitations in species inventory and adult fishes indicate deficits on ecosystem scale which cannot be fully compensated with the construction of fish bypass channels. However, river stretches with high variability of current speed and water depth are scarce in highly modified water bodies. Consequently, fish passes can play an important role as compensatory habitats and should thus be considered more intensively in habitat assessments and river restoration. Ideally, fish bypasses should mirror the natural discharge dynamics and consider all occurring fish species and sizes.

R09

BENTHIC ALGAE IN POLISH SYSTEM OF WATER QUALITY ASSESSMENT

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Poland has a long tradition both of water protection and hydrobiology, but biological factors were not applied in state monitoring and assessment system until early 1960s. At first biological criteria were limited to organic, including fecal, pollution and meant saprobic and E. coli indices and parasite detection, as well as toxicity indication with the use of fish. Eutrophication indicators as chlorophyll a concentration were implemented later. System of water monitoring was developing continuously and major changes appeared in 1991. Becoming the EU member in 2004, Poland joined intercalibration exercises, but as Polish system of indicators was still not fully coherent with WFD requirements, it had to use ad hoc modifications. One of them referred to phytobenthos, since several algae species were the elements of a saprobic index previously. Simultaneously Polish scientists started a research project to establish phytobenthic indices meeting WFD criteria. The project resulted with two diatom indices: IO for rivers and IOJ for lakes. Both of them has been included in Polish Ministry of Environment Regulations since 2008. Polish phytobenthic indices are similar to German and Austrian ones, as these EU-15 countries have most similar natural conditions. IO is a mean of trophic index, saprobic index and reference taxa index while IOJ is a mean of trophic and reference taxa indices. Since then only slight changes were applied to better fit intercalibration decision.

R01

IS FACILITATION BETWEEN SHREDDERS AND COLLECTORS CONTROLLED BY NUTRIENT AVAILABILITY?

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The stress-gradient hypothesis (SGH) predicts that environmental stress modulates species interactions causing a shift from negative interactions to net positive interactions with increasing stress. Stressful environments here defined as those in which producers are limited by the environment in their ability to convert energy to biomass. Considering that growth of aquatic shredders may be limited under natural nutrient levels, moderate nutrient levels will represent less stressful conditions to their growth. We tested experimentally the interaction between shredders and collectors (*Limnephilus lunatus* and *Gammarus pulex)*) under moderate and low nutrient conditions occurring in streams. We hypothesized that moderate nutrient levels in water will enhance shredders biomass by increasing nutrient content in leaves, leading to increased feeding and FPOM production, thus promoting facilitation of growth and biomass of collectors. In a factorial design we used moderate and low nutrient levels in water (moderate: 7.3 mg/L NO_3^-N; 193 µg/L SRP; low: 0.2 mg/L NO_3^-N; 33 µg/L SRP), and four levels for invertebrate interaction: 1 individual of *L. lunatus* and 10 individuals of *G. pulex* alone, same numbers together, and controls, all with quantified amounts of alder leaves. We regularly recorded leaf weight, FPOM production and individual invertebrtae biomass for a total duration of 20 days. Our results demonstrated that moderate enrichment increased the shredder *L. lunatus* biomass, reaching even higher values when growing together with the collector *G. pulex*. Meanwhile, *G. pulex* reached higher biomass when growing together with *L. lunatus* than alone, independent of the nutrient level. To quantify the observed relationship we applied the facilitation index (I*pm,* Seifan et al. 2010), confirming positive relationships for both species under moderate nutrient levels. For *G. pulex,* the positive relationship with *L. lunatus* weakened with nutrient reduction (increasing stress), whereas for *L. lunatus* there was a shift towards a negative relationship with *G. pulex* with nutrient stress, a result supported by observed higher *L. lunatus* biomass at moderate nutrient levels, evidencing nutrient limitation. Hence, our results do not agree with the SGH predictions for the nutrient levels tested, but give evidence of the role of abiotic stress, caused by nutrient availability, in altering the balance of competition and facilitation between shredders and collectors in streams.

R02

NEW DNA BARCODES FOR 8 AQUATIC HYPHOMYCETE SPECIES

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DNA barcoding is a diagnostic approach in which short DNA sequences (DNA barcodes) can be used for species identification, in a rapid and inexpensive manner. Ideally, barcodes are short sequences flanked by conserved regions to allow the use of universal primers, and with enough variability to distinguish closely related species. Fungi play pivotal roles in ecosystems and the adoption of culture-independent methods based on nucleic acids extracted directly from environmental samples has been increasingly used to examine their diversity. Aquatic hyphomycetes are a polyphyletic group of fungi that play a key role in organic matter processing in freshwaters. The internal transcribed spacer (ITS) region from rDNA was recently designated as the most suitable barcode for fungal identification. To date, over 300 aquatic hyphomycete species have been described based on conidium morphology and conidiogenesis, but less than 50 species have published ITS sequences in the International Nucleotide Sequence Databases (http://www.ncbi.nlm.nih.gov/). In the current study, we generated new barcodes based on ITS region for 8 aquatic hyphomycete species, namely *Alatospora pulchella*, *Dendrospora tenella*, *Fontanospora eccentrica*, *Lemonniera aquatica*, *Lemonniera* cf. *alabamensis*, *Lunulospora cymbiformis*, *Triscelophorus* cf. *acuminatus* and *Triscelophorus monosporus*. DNA barcodes for *Alatospora acuminata*, *Tricladium angulatum* and *Varicosporium delicatum* were also generated, and compared with those already existing in the NCBI. These new barcodes and all ITS sequences for aquatic hyphomycetes published so far were used to construct a neighbour-joining tree to establish phylogenetic relationships among aquatic hyphomycetes. The enlargement of DNA datasets provides an opportunity to accurately assess biodiversity, and further examine phylogeny and evolution of aquatic hyphomycetes.

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SS08

TEMPORAL VARIATION IN ^{15}N NATURAL ABUNDANCE OF PRIMARY UPTAKE COMPARTMENTS IN FOUR STREAMS SUBJECTED TO DIFFERENT HUMAN IMPACTS

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Understanding variability in ^{15}N natural abundance of primary uptake compartments (PUCs; e.g. algae, bryophytes, epilithon, macrophytes) is important due to their multiple applications in freshwater research, especially for food web studies. Previous research has shown how this variability is linked to the isotopic signatures of their N sources, specifically to dissolved inorganic nitrogen forms in the water (DIN, ammonium and nitrate), which vary depending on human influence. However, less information is available about how these isotopic linkages vary over time. In this study, we examined monthly variation of ^{15}N natural abundance (expressed as $\delta^{15}N$ in ‰) of the stream PUCs in relation to the $\delta^{15}N$ of DIN forms over a one-year period. We selected four stream reaches across a fluvial network that differed in their dominant adjacent land use type (forested, agriculture, urban) and consequently spanned a wide range of nitrogen concentrations (DIN from 125 to 4712 µg N/L). We hypothesized that the temporal variation of the $\delta^{15}N$ of DIN forms would be altered by the influence of human activities and would be related to the variation of $\delta^{15}N$ of PUCs. Within a stream, we predicted that PUCs with high N turnover rates (e.g., algae) would be more responsive to $\delta^{15}N$-DIN variations than PUCs with low N turnover rates (e.g., macrophytes), because the latter are expected to integrate the variability in $\delta^{15}N$-DIN through a longer temporal span. Results show that isotopic variability was lowest at the forested stream for both nitrate (from -1.7 ‰ to 1.2‰) and ammonium (from 1.9‰ to 9.9‰) forms, and highest at the stream located downstream of an urban wastewater treatment plant (nitrate from 7.4 ‰ to 17.3‰ and ammonium from 9.5 ‰ to 50.0‰). These patterns held for $\delta^{15}N$ variation for the majority of PUCs studied, being the lowest at the forested stream and highest at the stream influenced by urban wastewater treatment plant outfall. Comparing within streams, $\delta^{15}N$ values of epilithon and filamentous algae were the most variable, in contrast to the lowest variation for macrophytes and alder leaves found in most of the streams. Our study shows that ^{15}N variability of in-stream basal resources can be high, probably influenced by the variation of ^{15}N in DIN sources, although this varies depending on the PUC considered, something that should be taken into account when interpreting stable isotopes data for inferring trophic interactions in stream communities.

SS05

SPATIOTEMPORAL RELATIONSHIPS BETWEEN MACROPHYTES AND MACROINVERTEBRATES AT HUMAN MODIFIED LAKESHORES

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Lakeshores are subject to a continuous increase of human utilization and degradation. The quantification of these effects and the development of effective assessment tools are currently an important issue in limnological research. Macroinvertebrates are well known to be sensitive to hydromorphological changes. Furthermore, the relation between macroinvertebrates and macrophytes, providing food and habitat to the animals, is well documented, and the seasonality of macroinvertebrates depends on the growing pattern of macrophytes. So far, there are neither seasonally resolved studies on the impact of different modified lakeshores on macroinvertebrates in relation to macrophyte growth patterns nor on the effect of lakeshore modification considering different depth zones.
In this study, we quantified the macroinvertebrate assemblage and the species specific biomass of macrophytes at Lake Scharmützelsee on four different shoreline types (natural shoreline, marinas with sheet piling, private shore stabilization with wooden piles and recreational beaches), in three depth zones (infralittoral, sublittoral and profundal) between April and November 2011.
A 2-way crossed ANOSIM showed significant differences in the infralittoral macroinvertebrate community composition between natural and modified shorelines throughout the year, with seasonal trends being less distinct. Effects on macroinvertebrate communities were not detectable in the sublittoral or profundal zone. Macrophyte biomass explained a large part of the variability in the macroinvertebrate assemblage between the different modified lakeshores. Thus, structural improvements of the infralittoral by the protection or planting of macrophytes appears to be a promising measure for lakeshore management.

R01

PHYSIOLOGY MEETS ECOLOGY: WATER TEMPERATURE AFFECTS POPULATION GENETIC STRUCTURE AND HEMOGLOBIN CONTENT OF *DAPHNIA*

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A field-and-laboratory study was carried out over three years to determine relationships between seasonal and interannual changes in temperature (year-specific temperature courses, presence or absence of ice in winter) and the genetic structure (composition of MultiLocus Genotypes, MLGs) of a *D. longispina* assemblage. Field studies on temperature and genetic structures were linked with laboratory analyses to evaluate the thermal tolerance of long-term 12°C-, 18°C-, and 24°C-acclimated clonal lineages (CL) derived from abundant MLGs sampled in the field (surface water and thermocline). The thermal tolerance of CLs correlated with water temperature in the field and with the point in time, when the corresponding MLGs reached maximal abundancy. The differences in thermal tolerance were related to different genotypes of the phosphoglucomutase (*PGM*) locus. Together with other results, it turned out that seasonal and interannual changes in temperature affect *Daphnia* genetic structure through genetic differences in thermal responses, thermal tolerance, and physiological plasticity. In another study over two years, the function of hemoglobin (Hb), which is a key protein of many species, was analyzed in *Daphnia* from the field. This study included measurements of temperature and oxygen content, abundance and composition of phytoplankton, and abundance, body, and clutch sizes of the *Daphnia* assemblage in the epilimnion and around the thermocline. In addition, carbohydrate, lactate, and hemoglobin concentrations were determined in whole *Daphnia*. In *Daphnia* from the thermocline, hypoxia-induced Hb expression was responsible for an increase in Hb concentration in parallel with a decrease in oxygen content. In *Daphnia* from oxygen-rich water (epilimnion), however, Hb and other hemolymph proteins were shown to function as protein store or buffer between food (protein) availability and protein demand. Accordingly, the size of the hemolymph protein store can indicate the state of nutrition of *Daphnia* from oxygen-rich water.

R02

DISENTANGLING THE EFFECTS OF DISPERSAL ASYMMETRY, DIFFERENCES IN POPULATION SIZES AND COLONIZATION HISTORY ON GENETIC DIVERSITY PATTERNS IN DENDRITIC RIVER SYSTEMS

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It is widely recognized that the spatial structure of a landscape deeply influences patterns of biological diversity. Accordingly, several studies indicated that connectivity, landscape geometry or dispersal constraints influence spatial diversity patterns of populations, species or communities. The investigation of diversity patterns in dendritic river systems has gained attention during the last few years and theoretical studies have demonstrated the effects of dendritic connectivity on biodiversity patterns. In parallel, several empirical studies have highlighted spatial patterns whereby neutral genetic diversity increases from upstream to downstream sections of riverine ecosystems. Such a pattern is generally interpreted as the by-product of asymmetric gene flow generated by the downstream-biased dispersal inherent to river flow in these ecosystems. Nevertheless, this pattern may also reflect historical processes such as colonisations, or other particularities of dendritic populations such as the scaling up of effective population sizes (*Ne*) along the upstream-downstream gradient.
Here, we aimed at determining the effects of (i) downstream-biased asymmetric dispersal (ii) upstream-to-downstream *Ne* scaling up, and (iii) colonization processes on spatial patterns of neutral genetic diversity in dendritic river systems. Specifically, we pipelined several programs to simulate and analyse neutral genetic data under three dendritic metapopulation models. We found that spatial patterns of increased genetic diversity in downstream sections are mainly generated by downstream-biased dispersal, and by the *Ne* scaling up. We also demonstrate that few dispersal asymmetry generate strong and significant increases of genetic diversity downstream, thus erasing the effect of dendritic connectivity. Furthermore, we identified, through the analysis of multiple summary statistics, genetic footprints that are specific to each process. For instance, the scaling-up of *Ne* in downstream sections led to an increase of private alleles downstream, whereas asymmetric dispersal do not led to such a pattern. This last result may open the door to the development of tests aiming at identifying the leading process shaping genetic diversity in empirical dendritic metapopulations. This work is part of the IMPACT project.

R13

SIMPLE AND COST-EFFECTIVE MOLECULAR TECHNIQUE FOR PREY SPECIES IDENTIFICATION IN PREDATOR'S STOMACH CONTENT

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Prey species identification in a predator's stomach content is often particularly difficult due to a certain degradation of prey. We tested the recently developed polymerase chain reaction – restriction fragment length polymorphism (PCR-RFLP) procedure for the identification of prey species in a burbot (*Lota lota*) stomach content. Fish remains were picked from formaldehyde fixed samples of burbot during ten days after sampling. Six burbot individuals contain putative fish remains in their stomach. After a DNA extraction of prey specimens, a 708bp fragment of mitochondrial cytochrome oxidase I gene was amplified. Products of PCR were digested with *Bfa*I enzyme. Three of six specimens possessed pattern characteristic for round goby (*Neogobius melanostomu*) and one specimen showed pattern of burbot. The remaining two specimens had clearly visible bands of both, round goby and burbot. On the contrary, previously analysed sequences of these specimens had ambiguous peaks disabling the species identification. Our work evidenced that along with the patterns characteristic for the particular goby species, a common pattern determining both the goby species and burbot can be identified in one reaction. The results also demonstrated that the PCR-RFLP method may be in some cases more reliable for species identification than a standard DNA sequencing.
This contribution is the result of the project implementation: Development and application of the innovative diagnostic approach for the molecular identification of animals (ITMS: 26240220049) supported by the Research & Development Operational Programme funded by the ERDF.

R10

A PRELIMINARY ASSESSMENT OF FISH GUILDS AS INDICATORS OF ECOLOGICAL QUALITY IN NORTHERN PORTUGUESE RIVERS

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This poster presents results from the FCT financed project “River biomonitoring: an integrative approach”, which aims to combine information from bioindicators (in this case fish), biomarkers and ecosystem function (leaf decomposition) to produce reliable metrics and indices from different levels of ecosystem organization to better identify cause-effect associations and are also ecologically relevant. Using fish community data, we aimed to evaluate the different degrees of disturbance of the study sites based on metrics relating to the composition and species richness, habitat, migration, reproduction, trophic / feeding tolerance. Fish were sampled using electric fishing equipment and a WFD compliant methodology at nine sites from rivers covering a quality gradient in northern Portugal in the summer of 2011 and winter of 2012. A total of 15 fish species were observed and 26 metrics were calculated. Multivariate analyses allowed discrimination of the locations according to the degree of perturbation. NMDS ordination and hierarchical classification identified 3 groups of sites ranging from minimally disturbed sites with well developed riparian gallery and good water quality to the highly eutrophic sites. Successive statistical refinement procedures yielded a small group of variables responsive to impairment. In order to develop a fully integrated approach, these selected bioindicators metrics will be integrated with appropriate biomarkers and functional indicators into a global index that will be used to evaluate the aquatic ecosystems.

R11

FISH COMMUNITY SUCCESSION IN THREE POST-MINING LAKES IN CZECH REPUBLIC

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Lignite opencast mining has a catastrophic impact on the landscape in Western and North-western part of the Czech Republic. After the mining is over, the ecological and aesthetical value of the landscape needs to be reestablished. The hydric way of reclamation is considered to be the most perspective way of the revitalization of lignite post mining sites in Czech Republic and consequently creation of eight pit lakes of the area of up to more than thousand hectares and the volume of up to hundreds millions of cubic meters is planned or already being realized. On the other hand, creation of a new lake in an abandoned mining site represents large ecological experiment, within its course many specific factors can have a negative influence on single organisms, whole food chains and finally on water quality, which in turn will be the main indicator of successful reclamation towards the most significant future use of the lake – the recreation. For water ecosystems of the area and volume mentioned fish community is their integral and essential component, which will evolve either naturally or with the (advised or inadvertent) help of man and which finally will be of crucial importance both ecologically, having positive or negative effect i.e. decelerating or accelerating the process of natural eutrophication, and socio-economically, being the most attractive component of the ecosystem from peoples perspective, as angling is very popular leisure activity in Czech Republic. Recently three post mining lakes are realized – Milada Lake (248 ha, 25 m max. depth), Most Lake (311 ha, 75 m max. depth) and Medard Lake (493 ha, 50 m max. depth) and all are under expert control to assure their high quality potential. Fish community succession is monitored annually using complex surveys consisting of hydroacoustics and gillnetting in all in lake habitats, supplemented by manipulative measures aimed towards enhancement of fish community based upon the lake typology i.e. perch-pike system in relatively shallow Milada Lake and coregonid system in deep Most and Medard Lake. With these measures unique ecosystems are realized with fish community highly valued both from biological and socio-economical point of view, being a guard of long-term maintenance of high water quality by decelerating the eventual negatives connected with possible eutrophication and all that by achievement of the EU water framework directive requirements.

R12

MONITORING THE ECOLOGICAL STATUS OF LAKE IJSSEL USING CLOSE RANGE SPECTROMETER (WISP-3) AND REMOTE SENSING (MERIS)

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The Dutch Lake IJssel is subject to many influences. It is a highly eutrophic lake with regular toxic cyanobacteria blooms. As a result, recreative and consumptive use of the Lake water is restricted. Because of the size of the Lake and the dynamics of wind and temperature induced stratification and mixing, monitoring the lake ecological status using traditional in-situ sampling is rather impossible. Not only is it cumbersome to get a synoptic spatial picture of lake water quality, it is also not easy to measure the water quality of today from traditional in-situ sampling. Therefore methods have been developed to use close range spectral measurements for cheap (but accurate) assessments in real time of the concentrations of Chlorohpyll-a, Phycocyanin, suspended matter and coloured dissolved organic matter, and additionally the water transparency. The same techniques are used to calculate these parameters from satellite images (MERIS, Sentinel). Lake IJssel results will be discussed.

SS11

LAKE PHOENIX - MANAGEMENT AND MONITORING OF AN ARTIFICAL URBAN SHALLOW LAKE

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The restoration of the River Emscher and the construction of the artificial Lake PHOENIX in Dortmund, Germany are a part of the largest restoration project in Europe, the construction of the New Emscher Valley. The project has a total volume of 4.4 Billion Euros and is carried out by the Emschergenossenschaft. The restoration of the River Emscher and the building of Lake PHOENIX were carried out at the same time. Lake PHOENIX is about 1.2 km in length and up to 320 meters in width and was designed as a shallow lake. The lake also serves as a flood retention basin for the upper catchment of the River Emscher, which flows next to the northern shore of Lake PHOENIX. The numerous functions of Lake Phoenix and its design as a shallow lake were addressed in the planning process. In addition to extensive precautions in terms of the input of nutrients a phosphorous removal plant was build. Also an extensive monitoring program was set-up to closely monitor the development and, if necessary, take measures. At five monitoring sites the physico-chemical status and the biological components are sampled. Also an online-sensor measures temperature, oxygen concentration, pH-value, conductivity, turbidity, chlorophyll a and blue green algae. The results of the monitoring of the first two years show a positive development of the water quality and the biocoenosis. Already more than100 species of macroinvertebrates, plankton and water plants were determined. The current trophic classification of Lake PHOENIX is mesotrophic. The paper presents the principles of the planning process as well as the detailed results of the first two years of monitoring after the flooding of Lake PHOENIX.

SS13

HYDROPHYSICS, PLANKTON, MACROPHYTES: COUPLING OF MODELS HELPS TO UNDERSTAND REGIME SHIFTS IN LAKES

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The success of eutrophication management and the fate of climate change will result in regime shifts in lake ecosystems, i.e. between macrophyte or plankton dominated states. Scientific understanding of the complex processes involved is difficult, and numerous theoretical concepts and management models have emerged. Each model has its own purpose, philosophy, and technical implementation and describes only a part of the story. This is correct from a scientific viewpoint, because super-models become overly complex and are of less theoretical value. However, tunnel-vision and wheel re-invention are hindering scientific exchange (Mooij, 2010) and in response, lake modellers have started to develop platforms and interfaces to support scientific and technical exchange.
We will present the open source package "simlake" for coupling ecological lake models. It is implemented in the R language for statistical computing, with the core models in C/C++ or Fortran. Ordinary and partial differential equations can be solved with package deSolve and matter transport with ReacTran (Soetaert et al., 2010, 2012). This enables the separation of process equations from numerical techniques and simplifies simulation of complex models.
The feasibility of the approach is shown by coupling the eutrophication model SALMO-1D (Benndorf et al., 1982), the GOTM model for hydrophysical forcings (Burchardt et al., 2006) and a macrophyte sub-model of PC Lake (Janse, 1997) to investigate the neglected impact of submerged macrophytes on stabilizing clear water conditions in deep lakes. The coupled model was validated with data from Lake Scharmützelsee (zmax = 29 m) and showed good agreement with temporal patterns. Long term simulations of water quality with gradually increasing or decreasing phosphorus loads were performed for deep and shallow lake scenarios with and without macrophytes. The presence of submerged macrophytes resulted in significant reductions of phytoplankton abundance, even in deep lake scenarios, underlining their potential importance for managing these lakes.
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R12

SATELLITE BASED MONITORING OF SWEDISH LAKES

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Major international and national agreements, directives and management plans aim to protect and monitor aquatic habitats in order to assure sustainable management. A fundamental part of this work is to monitor *temporal* variation in order to assure a satisfactory status of water bodies and to assess the *spatial* distribution of the most sensitive and essential habitats requiring long-term protection. In Sweden, these mandatory assessments are hampered by the size and enormous number of lakes. Conventional ecological monitoring methods require excessive efforts to achieve adequate *temporal* and *spatial* coverage. However, satellite sensors like ENVISAT/MERIS (or Sentinel-3/OLCI in the future), cover large areas swiftly and frequently and prime ecological indicators such as chlorophyll a and Secchi depth can be measured with remote sensing technique. Remote sensing can thus provide the key to the implementation of many of the directives and management plans and enables a fast and cost-effective method to map prime characteristics of aquatic habitats.

Brockmann Geomatics has during several years provided the end user community with satellite based water quality information for the Swedish great lakes Vänern, Vättern and Mälaren. The data has been used internally at different end user organisations and increased the knowledge regarding the present water quality status, how changes in the quality occur, what the dynamics of these processes are, seasonal changes and annual changes. It has also been used as a synoptic visual tool during discussion with regional companies and private stakeholders. Presently, Brockmann Geomatics together with several Swedish County Boards in southern Sweden and Sydvatten AB, a drinking water producer, is investigating the use of MERIS data for environmental monitoring of Lake Bolmen and surrounding smaller lakes, and also, to support the water treatment processes at Sydvatten AB. Bolmen is the most important freshwater resource in the water supply system of Sydvatten and the water quality of Bolmen directly affects the preparation processes, distribution and customer satisfaction. Investigations regarding the possibility to assess the status of the lakes and how changes in the quality occurs have been investigated, as well as if the spatial resolution in the satellite data is good enough to produce a sufficient representation of these lakes. An overview of the developments and results achieved during the last years will be presented.

R03

SMALL-SCALE EFFECTS OF LARGE WOOD IN A EUROPEAN LOWLAND RIVER: LINKING HYDROGEOMORPHOLOGY AND INVERTEBRATE DIVERSITY

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The presence of large wood (LW) may substantially modify riverine hydromorphological processes, leading to increased spatial heterogeneity in flow velocities and sediment composition. In lowland sand-bed rivers LW represents moreover the unique hard and stable substrate for invertebrate colonization. Thus, we aimed to establish quantitative relationships between small-scale hydromorphological features induced by LW and invertebrate diversity in a lowland sand-bed river in central Europe. Benthic invertebrate and sediment samples were collected systematically from four pieces of LW in the River Pliszka (North-western Poland). At each sampling point, detailed vertical profiles of flow velocity in three dimensions were measured at high frequency using an Acoustic Doppler Velocimeter, in order to compute turbulence parameters. Our results show that LW significantly changes the diversity of flow parameters (including near-bed mean velocity and turbulence), and sediment composition along a distance gradient from the LW. The flow and sediment characteristics strongly influenced the invertebrate community, as shown by changes in diversity and functional-traits metrics. Thus, we could demonstrate that, in lowland rivers with low degree of anthropogenic pressures, small-scale hydromorphological processes induced by large wood increases habitat heterogeneity and leads to an increase in the diversity of benthic invertebrates.

R05

TRANSFER OF POLLUTANTS IN LACUSTRINE FOOD WEBS: CRUSTACEAN ZOOPLANKTON AS SOLELY PRIMARY CONSUMER?

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Crustacean zooplankton have an important role in transfer of matter, energy, and pollutants through lacustrine food webs. In the open-water, crustacean zooplankters are a major link between phytoplankton primary producers and zooplanktivorous fish. The latter selectively feed on them, at least at the young stage. Despite being well-known as a non-homogeneous functional compartment, including both, primary and secondary consumers, zooplankters are often regarded, at least in ecotoxicological studies, as solely primary consumers. Regarding them as a single step in transfer of pollutants, however, may lead to temporary anomalies in estimates of concentration of pollutants. Such anomalies are often overlooked when annual means are applied resulting evident when seasonal changes in concentration of pollutants are measured. We provide results of a study on a deep subalpine lake, Lake Maggiore, in which distinction between zooplankton primary and secondary consumers was obtained by applying carbon and nitrogen stable isotopes analysis. In this lake, as in most deep, temperate, thermally stratified lakes, two phases in open water zooplankton seasonal succession can be identified: a first phase during which primary consumers prevail; a second phase in which secondary consumers prevail. Including the two steps of seasonal succession into conceptual ecotoxicological models is of crucial importance for reliable estimates of paths and mechanisms responsible in transferring persistent organic pollutants along the pelagic food web.

SS11

USING BIOLOGICAL INDICATORS TO ASSESS THE IMPACT OF DISCHARGES FROM COMBINED AND SEPARATE SEWER SYSTEMS

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In urban area, rivers and streams are often influenced by discharges from combined and separate sewer systems. These outlets may cause hydraulic stress and chemical pollution for a short time during rainfall. The biological response can be acute, e.g. with catastrophic drift or increased mortality, or with a time lag of days up to several years. Long-term response can be explained by chronic effects of chemical pollution or by the change in habitat conditions (e.g. food web composition or modification of physical habitat structure). Depending on frequency and intensity of discharge events the biological community may be altered permanently, leading to the failure of good ecological status.
Aquatic invertebrates are highly suitable indicators to assess the acute and long-term impact of discharges from combined and separate sewer systems. Comparing the invertebrate community upstream and downstream the outlet, data on taxonomic and ecological trait composition can be used to separate hydraulic stress from the effects of oxygen depletion, deposition of organic or inorganic fine sediments, modification in substrate composition, and the frequency of discharges. Combining these metrics, the results can be used as threshold values to distinguish critical discharges from outlets with low ecological impact.

SS09

DESALINIZATION OF THE RIVER WIPPER (THURINGIA, GERMANY): RESULTS FROM LONG-TERM MONITORING OF THE ALGAE

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Potassium mining has a centennial tradition in Germany affecting the ecosystem**s** of many rivers and streams. Salty production residues which had been piled up to huge heaps enter the streams both controlledly and uncontrolledly, especially after rain events. In the current study we present data of the algae and macrophyte community from the Wipper (Thuringia, Germany), a small stream in a finished potassium mining area which has been investigated since 1992. The concentration of chloride at this time was high (about 2.800 mg L^{-1}) and decreased (2008: 1.240 mg L^{-1}, annual means). Samples were taken at an unaffected sampling site and four saline sites along the stream. The results were compared to the algal community of a stream situated in the same area but with a geogenic salinization aspect. The algal community at the unaffected site represented a typical fresh water community whereas the community of the salinized stream sites in 2008 was still dominated by *Potamogeton pectinatus*, an indicator organism for pollution and high saline concentration. The diatom community indicated a halobion index between 12 and 33. But also fresh water diatoms up to 65% of the community were detected. In contrast, the geogenic salinized stream was not dominated by saline tolerant algae species. Twenty years after the closure of the potassium mines in these region the stream ecosystem was still affected by the residues but the high proportion of freshwater algae indicate a slow recovery.

R02

POLYPHASIC TAXONOMY OF THE GENUS *ELECTROGENA* (EPHEMEROPTERA: HEPTAGENIIDAE) IN CENTRAL EUROPE

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Mayflies (Ephemeroptera) are a significant component of freshwater invertebrate fauna having a considerable importance for the water quality assessment. Therefore, a good knowledge of Ephemeroptera taxonomy is necessary. Despite a relatively long-time tradition of taxonomical research on Central European mayflies, there still remain several groups with problematic taxonomy, including the genus *Electrogena*.

Five species of the genus *Electrogena* occur in Central Europe: *Electrogena affinis* (EATON, 1887), *Electrogena lateralis* (CURTIS, 1834), *Electrogena quadrilineata* (LANDA, 1969), *Electrogena ujhelyii* (SOWA, 1981) and *Electrogena samalorum* (LANDA, 1982). The latter species is recently considered as a junior synonym of *E. ujhelyii* (BAUERNFEIND & SOLDÁN, 2012). However, the type material of these two species has never been compared and detailed study supporting synonymy has never been published.

There are also ambiguities in the intraspecific variability of nearly all Central European *Electrogena* species. In some particular cases the accurate species identification is very difficult or almost impossible. In addition, there is no comparative study for all Central European *Electrogena* species. It is obvious that Central European species of the genus *Electrogena* need detailed taxonomical study.

To solve this taxonomical problem, we used the polyphasic approach involving both morphological and molecular analyses. This study brings (1) the comparison of available literature and the type material of Central European *Electrogena* species, (2) morphological and morphometric investigation using modern statistical and numerical methods such as Artificial Neural Network, and (3) detailed comparison of *Electrogena* species based on results of molecular analysis of cytochrome-oxidase subunit I mitochondrial gene acquired from available material from Central Europe. To determine individual species based on genetic variability, we used General Mixed Yule Coalescent as a modern analytic tool.

The results show some morphological and genetic differences between *E. ujhelyii* and *E. samalorum*, but the level of these differences is probably not high enough for unambiguous species delimitation. On the other hand, the results confirmed the validity of the other studied *Electrogena* species.

R06

FLOW REGULATION BY DAMS IN MEDITERRANEAN STREAMS: BIOFILM RESPONSES

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The presence of dams and reservoirs in rivers are common over the world. Historically humans alter river systems to provide economic services like drinking water supply, irrigation, hydroelectric power or flood control. Mediterranean rivers are subject to multiples human stressors; for their naturally, they are regions with a deficit on water resources and becomes one of the largest regions in the world impacted by dams. Damming alters hydrology and the river connectivity as well as downstream physical, chemical and biological characteristics. Epilithic biofilms are these biological layers growing in cobbles and pebbles in streams and represents the dominant mode of microbial life where from; the community composition and indeed their functioning could be modified with the presence of dams and reservoirs. We studied the effects of damming in epilithic biofilms in Mediterranean streams (Cinca, Siurana and Montsant) located in the Ebro river basin (NE, Spain). The hypothesis was that biofilms upstream the dam were subject to natural disturbances and, as a consequence, their structure and function would present higher variability than downstream communities. Related to Mediterranean climate, physical and chemical characteristics and biofilms measurements will have a major variability during hot seasons (summer and autumn). We conducted the study in five transects across river reaches located upstream (control) and downstream (impact) of dams and sampling was repeated three times to account for the temporal variability related with the hydrological variation (summer, autumn and winter). Samples for chlorophyll-a, photosynthetic capacity and efficiency and extracellular enzymatic activities (β-D-glucosidase, alkaline phosphatase and leucine-amino-peptidase) were measured.Our results show that the presence of dams had a significant effect on biofilm structure. The studied rivers had an increase of chlorophyll-a, photosynthetic efficiency and respiration capacity in impact reaches over the three sampling time. Extracellular enzymatic activities vary throughout the year depending on inorganic nutrient availability and organic matter present in the system. Higher Alkaline phosphatase activity suggests a P limitation in control reaches. In contrast, biofilms in impact reaches present more Glucosidase and Leucine amino peptidase activities than biofilms in control reaches, these results suggest organic matter decomposition prevails and N limitation downstream dams.

R03

LITTORAL INVERTEBRATE FAUNA OF EUROPEAN LAKES: BIOGEOGRAPHIC DISTRIBUTION AND COMMUNITY COMPOSITION PATTERNS

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Littoral zones of lakes are characterized by a high biotic diversity and productivity, as they represent transition zones between aquatic and terrestrial ecosystems. Littoral benthic invertebrates form a major component of lake ecosystems and their functioning. However, multiple human pressures on lake shores result in substantial degradation of littoral habitat complexity and biotic diversity. In order to identify the actual effects of human induced alterations to lake littorals on its faunal communities, we studied littoral invertebrates in 51 lakes. These included both natural and morphologically altered littoral zones and spanned a gradient across Europe comprising 7 European countries and 4 ecoregions. Benthic communities differed significantly among ecoregions, shore zone types and habitats. We identified characteristic invertebrate species for different habitats to vary among ecoregions, and were able to relate changes in invertebrate community structures to morphological alterations of littoral zones. Our pan-European dataset enables the first analyses of littoral invertebrate biogeographic distributions, community composition, habitat preferences, human degradation effects, and occurrence of invasive species at European level.

SS12

PROJECTE ESTANY, A LIFE+ PROJECT FOR THE RECOVERY OF NATIVE BIODIVERSITY IN LAKE BANYOLES: AIMS AND FIRST RESULTS

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Lake Banyoles is the second largest natural lake in the Iberian Peninsula. It is one of the first places in the Iberian Peninsula where planned massive fish introductions. Along the last 100 years, 20 exotic species have been released, although only 13 were established. Formerly, only 5 native fish species were present. In 2010, the fish community was extremely deteriorated, with more than 99% of the lake's fish biomass corresponding to non native species. The proliferation of alien fish directly explains a dramatic reduction of other species, from odonates to native fish, and indirectly also native unionoids. Moreover, cascading effects have been observed in the ecosystem, such as a large increase of algae.
Other invasive species of aquatic fauna also present, e.g. decapods or turtles, constitute a high threat for native herpetofauna. In the case of plants, the main problem with alien species is focused in garden species, which are now extending massively through riparian habitats.
Over the past decades, an ecological improvement of this natural site has occurred, thanks to a management geared towards the preservation of natural heritage. However, nowadays the main challenge for the management of the lake and its surroundings is to be found in the invasive alien species.
"Projecte Estany" (LIFE 08/NAT/E/000078) is a four year project, from 2010 to 2013. The main objective is to design and implement a large scale intervention to combat, slow down and revert the decline in species and habitats of Community interest in the Natura 2000 Network space "Lake Banyoles", through the control of invasive alien species, the population strengthening of seriously threatened native species, and restoration of key patches of riparian habitats.
The control of invasive water fauna is carried out by population culling campaigns of invasive fishes and turtles. Elimination of invasive plants is done through a combined use of mechanical actions with a restrictive use of herbicides. On the other hand, both captive breeding programs of native unionids and European pond turtle have been implemented.
A selection of main actions executed and first results of this LIFE+ project are shown. At the end of 2012, a significant reduction of the adult fraction of the dominant exotic fish (*Micropterus salmoides*) has been achieved. On the other hand, several indicators show also a significant response, e.g. the increase of density of the endangered freshwater blenny (*Salaria fluviatilis*).

SS06

THE MIRAGE TOOLBOX: AN INTEGRATED ASSESSMENT TOOL FOR TEMPORARY STREAMS

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The assessment of the ecological status of water bodies, as requested by the European Water Framework Directive, is a cumbersome issue when it has to be applied to temporary streams. This is due to the particular physical, chemical and biological conditions brought about by the recurrent cessation of flow or even the complete drying of the stream beds. In such non-permanent water bodies, the reference quality standards developed for permanent streams can only be applicable under some restrictions or cannot be applicable at all. Work conducted within the collaborative EU-funded project MIRAGE has addressed most of these difficulties, and used diverse approaches to solve them, which are brought together in the so-called MIRAGE TOOLBOX. This box consists of a general scheme based on the concept that qualitative hydrological states of the stream (such as the presence or absence of flowing water) are more relevant than the quantitative measures of water flow,. The tools included in this box deal with several issues, to know: i) the determination of the hydrological regime of the stream in terms of the relevance for aquatic life, ii) the design of adequate schedules for biological and chemical sampling, iii) the fulfillment of criteria for reference conditions, iv) the analysis of hydrological modifications of the stream regime, v) the representativeness of samples taken at different moments, and vi) the development of new methods to measure the ecological status (including structural and functional methods) when stream hydrological conditions are far from those in permanent streams.
(Presentation in name of MIRAGE team, a group of more than 50 researchers from 29 diferent institutions)

R03

NITROGEN AND CARBON CONTENT AND NITROGEN UPTAKE OF ATTACHED ALGAE AT DIFFERENT DEPTH OF LAKE BALATON

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Nitrogen and carbon content and nitrogen uptake of attached algae on reed (epiphyton) on stones (epilithon) in the littoral zone and in the uppermost 1mm layer of sediment (phytobenthos) by 5 transects of Lake Balaton were determined. The uptake velocity of algae on reed and stones was close to 1 µg N µg chlorophyll-1 day-1 and the amount of uptaken nitrogen at different water level was determined by the underwater surface. Their daily maximal uptake (120 and 200 kg) was with orders of magnitude less, than that of the phytoplankton of the lake (60 t), consequently they are not competitors of phytoplankton for nitrogen. Uptake velocity of nitrogen by phytobenthos (4-5 µg N µg chlorophyll-1 day-1) was close to that of phytoplankton and did not change significantly with depth of water (light intensity) and with the quality of sediment. The uptake velocity and the amount of uptaken nitrogen at the shallow sandy southern shore of the lake will change with the depth of water. At the deeper northern parts the penetration of light to the water column (affected by decreasing of depth vs. stronger stirring up) will affect the primary production of phytobenthos, but in less extent the uptake of nitrogen. On one hand the attached algal community especially the phytobentos are supplied with surplus nitrogen which is mainly due to ammonium regeneration, on the other hand the light dependence of ammonium uptake is small.
Keywords: attached algal community, N and C content, nitrogen uptake, 15N method

R02

MICRO-SCALE VICARIANCE AND DIVERSIFICATION OF WESTERN BALKAN CADDISFLIES LINKED TO KARSTIFICATION

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The karst areas in the Dinaric region of the Western Balkan Peninsula are a hotspot of freshwater biodiversity. Many studies have examined the diversification of the subterranean freshwater fauna in these karst systems. However, the diversification of surface water fauna remains largely unexplored. We assess local and regional scale diversification of surface water species in karst systems and explicitly examine if patterns of population differentiation can be explained by dispersal-diversification processes or allopatric diversification following karst-related micro-scale vicariance. We analysed mtCOI sequence data of four caddisfly species (genus *Drusus,* Limnephilidae, Trichoptera) in a phylogeographic framework to assess local and regional population genetic structure and Pliocene/Pleistocene history. Using BEAST we assessed the timing of intraspecific diversification of the target species. We compared climate envelopes of the study species and projected climatically suitable areas during the last glacial maximum (LGM) to assess differences in the species climatic niches and infer potential LGM refugia. The haplotype distribution of the four species is characterized by strong genetic differentiation with few haplotypes shared among populations and deep divergence among populations of the three endemic species, even at local scales. Divergence among local populations of the endemics often exceeds the divergence among regional and continental clades of the widespread *D. discolor*. Main divergences among regional populations date to 2.0-0.5 Mya. SDM projections and genetic structure suggest that the endemic species persisted in situ and diversified locally throughout multiple Pleistocene climate cycles. These results suggest that the population histories of the endemic species differ from those of the more widespread species: the patterns of population genetic structure and diversification are similar for the three regional endemics and consistent with micro-scale vicariance after the onset of intensified karstification in the study area; whereas the pattern for *D. discolor* is different and coherent with multiple invasions into the region. Our study shows that karstification may induce micro-scale vicariance of running surface water habitats and likely promotes allopatric fragmentation of stream insects at small spatial scales.

R08

LONG-TERM TRENDS OF INVERTEBRATE COMMUNITIES UNDER CHANGING ENVIRONMENTAL CONDITIONS

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Macroinvetebrate communities are one of the longest applied biotic indicator groups for running waters. Since the approval of the Water Framework Directive, in 2000, survey networks have been widely implemented in most Member States. Yet, for their evaluation they are dependent on reference conditions; for which both knowledge on former states as comprehension of temporal variance are crucial. To guarantee this knowledge the exploitation/querying of longer time series is indispensible. Still, very little knowledge sharing is based on long time series.

In France, national biological networks have been routinely sampled since 1992. Furthermore, many watercourses are surveyed since the 1970s-1980s. This data is of great importance for several reasons: 1) It contributes to the identification of temporal patterns of stability and persistence to calibrate assessment methods and 2) It allows the analysis of long time invertebrate community trends.
One of the main issues for the assessment of stream biotic condition is the understanding of invertebrate community functioning in the context of changing environmental conditions. There's a good knowledge of benthic invertebrate sensitivity to organic pollution. Nonetheless, the impact of modified hydrological regimes and climate change has yet to be clarified. The consequences of all these parameters in the long-term and at a broad scale have been scarcely studied.
The aim of this study is to asses and explain long-term trends from a series of watercourses belonging to different hydro-ecoregions. The period covers 22 years of biological and chemical monitoring; from 1988 to 2010. The sites cover a gradient of anthropogenic stressors.
We use this long-term dataset to test three hypotheses: 1) in general, reference and least impacted river reaches are more stable in time, 2) there is a general trend pattern in invertebrate community composition with water chemistry as main driving factor, and 3) geographic and climatic aspects only play a minor role in the observed trends.

SS12

LIFE+ FLUSSLANDSCHAFT ENNS

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The renaturation of the river Enns in the Gesäuse National Park was started from 2005 – 2011 with the LIFE **-** project „Conservation strategies for forest and wild river in the Gesäuse“. Typical river structures, like bank sections, gravel- or sandbanks, potholes and fords are emerging by a stream cutoff of the rivers Palten and Enns. This renaturation of the river Enns will be continued in the new LIFE+ - project under the heading of „River landscape Enns“ from 2011 to 2015 by investments of Euro 2.9 Mio. in total - 50 % of the project is financed by the EU**.**
Eight measures are taking an important step to improve the river habitat of the river Enns and the passive flood protection. The objective is to recover close to nature and rich in structure river habitats, the reconnection of cut-off meanders, the protection of existing and development of new alluvial forests by the reconnection of existing forests to the dynamics of running water and the consciousness of the population for the river habitat Enns.
By the LIFE+ - project „river landscape Enns“ remaining and newly created habitats can be protected from further succession, silting-up and water lowering in the long term. Until now five measures were implemented having a rapid development. The monitoring of particular measures as well as the effects on the total system is going to be examined to ensure the success of the project.
The connected localization of the measures achieves an impact on the river habitat reaching far beyond the result of the single measures and can be used for future projects as a reference.

SS13

MODELLING THE RE-COLONIZATION POTENTIAL OF FISH IN A LOWLAND SAND-BED RIVER

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The dispersal of fish is a key process that governs the exchange between subpopulations, the emi- and immigration, the spatio-temporal distribution and abundance of species, how fast they re-establish after defaunation events or (re-)colonize restored or new habitats. Therefore, modelling the dispersal of fish is a central question in restoration ecology. The dispersal or movement of fish and hence the re-colonization potential within a catchment depends on (1) the occurrence and spatial distribution of source populations, (2) the species-specific dispersal ability considering exogenic factors like movement barriers and the river network shape.

Source populations are typically used as starting points for modelling fish dispersal. However, at the catchment or river network scale empirical data on the presence of fish species are commonly missing, in contrast to the very detailed and completely mapped habitat characteristics. Hence, statistical modelling techniques such as species distribution models (SDM) were used to relate species occurrences to decisive local habitat conditions. Since fish are mobile and might also be influenced by the habitat conditions (substrate, flow velocity, morphological features) at larger spatial scales we also considered adjacent river reaches in the habitat-occurrence relationship.

Subsequently, these predetermined source populations were used in the fish dispersal model FIDIMO to predict the spread of species in the catchment after a modelling time step. FIDIMO considers biotic factors such as fish length and swimming performance as well as exogenic factors like the dendritic structure of river networks and potential movement barriers to estimate dispersal distances for stationary and mobile components of a population.

In this study, which is part of the IWRM-NET project IMPACT, SDMs have been exemplarily developed and the novel GIS-based fish dispersal model FIDIMO is applied for 13 fish species in the River Treene catchment, a meandering lowland sand-bed river in Northern Germany. The main results showed (1) that the SDM performances improved by including the adjacent river reaches besides the local habitat conditions and (2) that the recolonization potential differed greatly between species due to differences in number of source populations and species specific dispersal abilities.

R04

SMALL-SCALE DIVERSITY PATTERNS OF AQUATIC MACROINVERTEBRATES IN SPRING FENS: THE IMPORTANCE OF SPECIES REPLACEMENT AND RICHNESS DIFFERENCES IN VARIOUS TAXONOMIC GROUPS

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The presence of numerous spring fens of different ecological types is characteristic for the Western Carpathian Mts. These habitats are usually highly isolated from each other and exhibit relatively stable environmental conditions. On the among-site scale, mineral richness of water plays the leading role in structuring assemblages of various taxonomic groups (well documented for vascular plants and bryophytes, Testacea, Mollusca, Clitellata or Chironomidae from the study area), but little is known about small-scale, within-site patterns of diversity and distribution of these organisms.
Studied spring fens are small in size and, within site, relatively homogeneous in hydrochemistry and vegetation composition. However, a considerable variation may be found in flow conditions, represented by two extreme mesohabitats: mesohabitat A – the flowing water and mesohabitat B –the standing water.
Within this study we used data from 34 sites and compared within-site alpha-diversity and two components of beta-diversity (the rate of species replacement and richness differences) among three taxocenoses with different ecological demands and dispersal abilities: Clitellata, Plecoptera and Chironomidae.
We found that both mesohabitats provided favourable conditions for Clitellata and Chironomidae (there were no significant differences in alpha-diversity between mesohabitats), alpha-diversity of Plecoptera was significantly higher at the flowing water. However, mechanisms of which studied taxocenoses responded to abiotic differences between mesohabitats were different. Compositional differences in species richness were caused mainly by species replacement in Chironomidae, while differences in species richness played the major role in Plecoptera. Both mechanisms contributed in Clitellata. This might result from evolutionary adaptation for both flowing- and standing-water environments by various chironomid species, while Plecoptera are almost exclusive inhabitants of the flowing environment.
The study is financially supported by P505/11/0779.

R14

PESTICIDE IMPACTS ON PREDATOR-PREY INTERACTIONS ACROSS TWO LEVELS OF ORGANISATION

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Previous studies have documented changes in predator-prey interactions for freshwater macroinvertebrates during sublethal insecticide exposure, but most of these only consider long-term exposure. In reality, however, hydrophobic insecticides, such as pyrethroids, only occur in short pulses (few hours) during heavy rain episodes. In this study we aimed to evaluate the effects of a short pulse exposure of the pyrethroid lambda-cyhalothrin (LC) on the predator and anti-predator behaviour of the same species; *Gammarus pulex* L. Anti-predator behaviour (drift suppression in response to the presence of brown trout) was studied in outdoor stream channels during a 90 min pulse exposure to LC (10 or 100 ng L^{-1}) and/or the presence of brown trout. Predator behaviour was studied in indoor microcosms using video tracking equipment during simultaneous exposure of the predator (*G. pulex*) and its prey (*Leuctra nigra*) for 90 min exposure of 1, 10 or 100 ng L^{-1} LC. During the initial 30 min of exposure, the predator and prey organisms were maintained physically separated, and the actual interaction was studied through the subsequent 60 min of exposure. We found that the exposure of *G. pulex* to 10 and 100 ng L^{-1} LC significantly increased drift (from ~ 0 to ~ 100% in both treatments; $P<0.001$) independent of the presence of brown trout ($P<0.05$). In other words, the natural anti-predator behaviour of *G. pulex* was overruled by the stress response to LC exposure increasing the risk of *G. pulex* being eaten by drift feeding brown trouts. Based on survival curves for *L. nigra* we found that the mortality rate for *L. nigra* significantly decreased during exposure to 10 and 100 ng L^{-1} LC from 100% in the control and the 1 ng L^{-1} LC treatment to 50% and 0%, respectively ($P<0.05$ and $P<0.001$, respectively). We found no significant evidence for repelling effects of contaminated prey items ($P>0.05$) and conclude that *G. pulex* deviated from its natural foraging behaviour in response to even very low LC concentrations. Our results show that the anti-predator and predator behaviour of *G. pulex* were significantly changed during exposure to very low and environmentally realistic LC concentrations and exposure duration. Our study highlights the potential cascading effects of pesticide exposure through the food chain, but also underlines the need for research using long-term endpoints to elucidate the persistence of the effects observed in this study.

R07

NITRATE OR AMMONIUM? PERIPHYTON RESPONSES TO DIFFERENT N SPECIES

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In aquatic ecosystems, availability of dissolved inorganic nitrogen (DIN) is particularly critical because this element can control the rates of primary production. Human activity has significantly increased DIN availability and has modified the relative proportion of nitrate (NO_3^-) and ammonium (NH_4^+) species in many streams, which may affect the biogeodynamics of these ecosystems. The goal of this study was to understand how growth and N uptake of stream periphyton respond to increases in the concentration of either NO_3^- or NH_4^+ across 5 streams differing in ambient DIN availability within la Tordera catchment (Catalonia, NE Spain). We used nutrient diffusing substrata (NDS) with 3 different treatments (not amended and amended with either NO_3^- or NH_4^+) to test the response of periphyton chlorophyll a accrual rates to each DIN species. We then transferred all NDS to the stream with highest DIN concentration, to maximize periphyton responses, and measured N uptake rates of the resulting periphyton assemblages using separated field additions of ^{15}N-labeled NO_3^- and NH_4^+. We predicted that periphyton growth and N uptake rates would vary among streams due to the effect of ambient DIN availability as well as between added DIN species because of differences in energetic costs associated with the assimilation of each DIN species. Results showed minor differences in chlorophyll a accrual rates among streams and NDS treatments. In contrast, periphyton NO_3^- uptake rates were higher in streams with intermediate DIN concentrations, and lower in NH_4^+-amended NDS. Periphyton NH_4^+ uptake rates did not differ among streams or among NDS treatments. Overall, our results showed that the DIN species (NO_3^- or NH_4^+) did not affect periphyton growth, but had effects on N uptake capacity of stream periphyton. Nevertheless, other factors such as light or stoichiometric imbalances may be central to periphyton responses to DIN changes.

R04

EFFECTS OF RIPARIAN FOREST HARVEST ON STREAMS: A META-ANALYSIS

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Forest harvesting in the riparian area impacts streams in many ways, from altering temperature regimes, shifting geomorphic structure, increasing sediment fluxes, and affecting fish populations. Here we use meta-analysis to address the effects of logging on biological and chemical components of streams in contrast to control sites. We found that the overall effect sizes of the response variables in replicated studies differed significantly from zero for a number of variables, especially benthic invertebrates, but that there was a very large amount of variation in the effect sizes. In fact, for many measures the individual effect sizes from different studies were positive or negative, indicating site-specific responses. In general, Nitrogen and Potassium concentrations increased significantly following logging, as did the density and biomass of invertebrates. We then explored whether covariates, including stream size, stream gradient, and potential evapotranspiration for the region could explain some of the large amount of variation between studies in the effects of forest harvest on streams. We found that in many instances there were significant relations between these covariates and the effect size of responses to forest harvesting along streamsides. Despite relatively low sample sizes for the number of replicated studies, we found significant overall effects of riparian forest harvesting, but the magnitude and direction of responses within individual studies were often site-specific.

SS08

MACROPHYTE HABITATS ARE HOT-SPOTS FOR ORGANIC CARBON AND NITROGEN RETENTION IN LOWLAND STREAMS

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The abundance of submersed macrophytes and emergent riparian macrophytes in small lowland streams is likely to increase due to higher temperatures and changed summer hydrology with climate changes. The presence of submerse and emergent macrophytes can have a profound influence on the physical and biological structure of streams, increasing habitat heterogeneity and overall species diversity. However, much less research has focused on the role of macrophytes in the ecological function of stream ecosystems, such as primary production and nutrient removal and retention. To determine the effect of macrophytes on organic carbon production and nitrogen dynamic in streams, we quantified metabolism, nitrogen retention, and denitrification in submersed macrophyte and non-macrophyte habitats as well as emergent macrophyte habitats in lowland streams. We found that gross primary production and community respiration was 6-11 and 10-20 times higher, respectively, in submersed macrophyte habitats compared to non-macrophyte habitats. Also, we found that ammonium uptake was four times higher in submersed macrophyte habitats compared to bare sediment, which was due to the direct effect of macrophytes as well as the indirect effect of macrophytes increasing substrate surface for autotrophic and heterotrophic microorganisms. Quantification of organic carbon production and nitrogen removal in emergent macrophyte living in the transition zone between water and land will also be presented. Together, our habitat-specific studies document the role of submersed and emergent macrophytes in contributing to organic carbon production and nitrogen retention in lowland stream ecosystems.

R03

SPATIAL AND TEMPORAL DISTRIBUTION PATTERNS OF WEED BED FAUNA COMMUNITIES IN SHALLOW LAKES IN THE SMALL ISLAND OF BRAILA (ROMANIA)

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The weed-bed fauna is a constant component of the aquatic systems representing important link in aquatic or transition systems food-chains, thus sustaining the ecosystem function and resilience. Changes in weed-bed fauna composition impacts on the local and regional aquatic diversity and productivity of integrative systems, dynamics of other biotic compartments and aquatic systems self-regulation function.

In the Small Island of Braila (SIB) - the largest area remained under the natural hydrological regime of flooding from the former Inner Delta of the Danube - significant changes in the structure and function of the aquatic food webs during the last several decades occurred under the impact of different pressures acting at the Danube Basin scale, mainly changes in floodplain longitudinal and transversal connectivity with the river and eutrophication process. Nevertheless, the successions of the state transition over the time and the role of disturbance and dispersal in community structure and composition of weed-bed fauna as well as the present structure and functions of this compartment within the integrative systems received only a marginal attention. Our present study focussed on the development of data and knowledge base concerning taxa richness and identity, comunities diversity as well as space and time patterns in the distribution of taxa.

Eight lentic and lotic systems interconnected along a longitudinal hydrological gradient were sampled monthly during the summer of 2009 and spring - autumn of 2010 except for periods with low water level, extreme coverage with aquatic vegetation or absence of macrophyte stands. Classical field and laboratory methods were used as well as distributional techniques, univariate and multivariate methods of data analysis.

Among the 27 taxa of macroinvertebrates identified Chironomida and Oligochaeta are almost always predominant and recorded the highest densities. Taxa richness is generaly higher in lakes as compared to channels and equitability of different groups is higher in channels. Statistically significant differences between the structure of weed-bed fauna communities in lakes as compared to channels were noticed. Relative grouped communities patterns recorded for each month and habitat type are altered by the hydrological regime and by some managerial practices related to prolonging of water retention in the area.

R13

WHO BUDGES LOSES – THE LAZY INVADER AMPHIPOD *ECHINOGAMMARUS BERILLONI*

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Invaders are frequently assumed to be rapid, aggressive, or all-consuming and thus outcompeting vicariant species of the regions they intrude into. But invasion success can also be connected with less conspicuous features - as in the case of the SW-European gammarid *Echinogammarus berilloni*, which we used as an invader model organism. The amphipod started to make its way to Central European streams and rivers presumably some hundred years ago, and in its new territory nowadays competes with the native species *Gammarus pulex* and – to a lesser extent – with *G. fossarum*. To examine the invaders abilities in comparison to those of the natives, we performed a series of strictly standardized and reproducible field and laboratory experiments. Thereby, the focused behavioral, autecological, and physiological traits clearly depicted the species specific ranges of tolerance towards environmental stressors, in which the invader gained only marginal head start, though. At this point, a conservative and straightforward approach may lead to overinterpretation of the findings, independently of asserted statistical significances. Differences between trait modes of the species were (i) marginal relative to the amplitude of environmental conditions and/or (ii) highly subject to phenological and individual variation. We hypothesize that an invader's success, as in *E. berilloni*, can be explained not obligatorily nor exclusively through the combination and coaction of marginal trait advantages on the ground of average environmental conditions but contrarily thereto, by relative deficiencies in some traits that, specifically under greater environmental pressure, may inevitably yield a positive energy and survival balance, and thus a higher reproduction rate on the long run.

R07

NITROGEN TURNOVER IN A LARGE, NITROGEN RICH RIVER – ASSIMILATION VS. DENITRIFICATION

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Nitrogen delivered by rivers causes eutrophication in many coastal waters. Its turnover and retention in the rivers is therefore of major interest. Here, we present evidence for high nitrate turnover in the large, plankton-rich river Elbe by both, assimilation by phytoplankton and denitrification. Our assessments are based on data from two Lagrangian sampling campaigns along a 585 km river section. While water quality data were taken for calculations of a nitrogen budget and the quantification of phytoplankton growth, stable isotope analyses and measurements of N_2 concentration by membrane inlet mass spectrometry were applied to estimate denitrification. These “open water methods” allow direct measurements of the respective metabolic rates in the river channel and thus prevent laboratory artefacts. Although the N-budget shows intense phytoplankton assimilation along the river stretch, up to 60% of the total nitrate loss can be attributed to denitrification. Denitrification rates calculated from the N_2 concentrations are high and range between 0.5 and 2.5 mmol N m^{-2} h^{-1}. Nonetheless, particulate N concentrations remain high in the lower river sections and will subsequently be transported to the estuary where they add to the eutrophication problem in estuarine and coastal waters.

SS07

CHALK RIVER HYPORHEIC COMMUNITIES RESPOND TO VARIATIONS IN SURFACE-SUBSURFACE EXCHANGE AT THE REACH SCALE.

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Chalk rivers are some of the most biologically productive and iconic fluvial systems in the UK; they are predominantly groundwater fed. Although hyporheic invertebrate community structure is known to vary with groundwater- surface water exchange at the riffle scale, our knowledge of this interaction at larger scales is quite limited. Here we investigated whether hyporheic communities differed between three gaining and three losing reaches of a chalk river. We identified suitable reaches using a groundwater model constructed by Entec Ltd. pH and dissolved oxygen were significantly higher, and organic matter was significantly lower, in gaining than in losing reaches. Upwelling and downwelling patterns within reaches were weak, as is common in chalk rivers. We found that total hyporheic invertebrate abundance was significantly higher (t test $p<0.05$) in the gaining compared to the losing reaches of the river, a pattern largely driven by the Chironomidae. Taxon richness was also significantly higher (t test $p<0.05$) in the gaining reaches where stygobitic taxa such as *Niphargus* spp., *Proasellus* sp. and *Antrobathynella* sp. were mostly found. Thus, this chalk river supported distinctively different hyporheic communities in losing and gaining reaches.

SS04

LOTIC BACTERIAL ASSEMBLAGES IN ALPINE STREAMS

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Glaciated alpine floodplains are responding rapidly to climate change. We seasonally examined microbial assemblages in glacial- and groundwater-fed streams in three alpine catchments. We also studied bacterial communities along hydrologic flow paths of two alpine streams differing in adjacent landscape structure using spatial models. Assemblage structure was assessed using ARISA and CARD-FISH and function by potential enzyme activities. Each catchment had a distinct bacterial assemblage structure and different separation strengths in structure, functioning, and seasonality. The magnitude of separation between stream types was dependent on water physico-chemistry within each catchment. Seasonality in structure and function was mainly apparent in kryal systems, whereas krenal systems were more temporally stable. The flow path study indicated a strong influence (up to 40% explained variation) of hydrological connectivity on bacterial functioning corresponding with successional changes along each flow path. The distinction of hyporheic and riparian zone bacterial assemblages appeared dependent on the landscape structuring along each stream. The catchment results suggest that microbial structure and functioning is likely to change substantially in alpine floodplains in the future, whereas the flow path results demonstrate the importance of hydrologic conditions within alpine floodplains driving bacterial (ecosystem) functioning and community dynamics.

R11

THE PENRITH LAKES SCHEME - NATURAL HERITAGE & BIODIVERSITY CONSERVATION MASTERPLAN - RE-ESTABLISHING ENDANGERED RIPARIAN ECOLOGICAL COMMUNITIES AND IN-LAKE BIOLOGY.

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The Penrith Lakes Scheme occupies 1935 hectares adjoining the major fresh water way the *Hawkesbury / Nepean River*, just north of *Penrith, Sydney, Australia*. The Lakes development was conceived out of the rehabilitation of the largest open cut sand and gravel extraction site in the Southern Hemisphere. The project is a Joint venture between Boral Australia, Hanson (Heidleberg) and Holicm, the State Government, managed by PLDC and administered through a Deed of Agreement to deliver a Major Conservation based Parkland. The completed Lakes Scheme will encompass some 770 Ha of created lakes, and 1200 Ha of re-establishing ecological communities on newly formed landforms. The Lakes will also act a major treatment and detention train, accepting stormwater from a peri urban catchment of some 2065 ha and act as a flood mitigation facility for events in the H/N River alleviating pressure on downstream and local residential and rural properties in a 100yr ARI. A Biodiversity Conservation Master Plan is being developed to guide the longterm establishment of the Scheme. It draws upon science, best practice, a leading experts in relevant fields to re-establish and sustain Endangered ecological communities and in Lake Ecosystems cost effectively.
Under the Master Plan, these former riparian, and terrestrial vegetation communities with their representative plant and animal populations will be re-instated. In line with State Government policy some of the significant species from Western Sydney that largely disappeared from the area will be re-introduced or encouraged to re-establish. The Master Plan distils new benchmarks and incorporates an integrated monitoring programme, including the assessment of rehabilitation progress, against analogue sites of remaining riparian and in lake vegetation communities. Rarely does an opportunity present itself at this scale to re-instate Endangered Ecological Communities, support unique local wildlife, and make a considerable contribution to both local and regional biodiversity conservation and broader-based Catchment Action Plans. In seeking to sustain natural heritage and minimise long term maintenance costs, when adaptively implemented, the Master Plan should provide continuing useful data and direction. In future years and decades, this should help to address habitat degradation and the loss of Endangered Ecological Communities across Western Sydney.

SS08

RECENT TRENDS IN ORGANIC CARBON CONCENTRATIONS IN SWISS LAKES

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It is generally accepted that organic carbon (OC) concentrations have increased in rivers and lakes of Northern Europe and North America over the last 20-30 years but numerous exceptions to this trend exist. As part of our ongoing study on long-term OC dynamics in freshwaters (Rodríguez-Murillo & Filella 2013), we have studied OC concentration trends in 38 lakes in Switzerland using data from the Swiss Federal Office for the Environment (FOEN). The set of lakes studied includes large lakes (Lakes Geneva, Neuchâtel, Constance, Lucerne and Zurich) as well as medium-sized and small lakes and wetlands. All OC concentration time series (40 in total) are longer than 10 years and include at least one value per year (sampling frequency from 1 to 26 per year), at several depths, from surface to lake bottom. Time trends have been studied with LOWESS (LOcally, WEighted Scatterplot Smoothing) regression, and long term trends have been obtained with the non-parametric Mann-Kendall and Seasonal Kendall methods. All the above mentioned large lakes show a small (<1% mean OC concentration per year), but significant, increase in OC concentrations whereas small and medium-sized lakes display different trends and levels of significance. In this communication, these results will be presented together with their relationship with other lake physicochemical parameters (i.e., water temperature, chlorophyll, conductivity, pH, oxygen, and orthophosphate concentrations) and with OC concentration trends in Swiss rivers.
Reference:

J. C. Rodríguez-Murillo and M. Filella, Temporal trends in organic carbon content in the main Swiss rivers, 1974-2010, submitted for publication.

SS01

OVERLAP OF BIODIVERSITY AND FUNCTIONAL GROUPS OF ALGAE: A CASE STUDY FOR MANAGING WATER QUALITY (WATER FRAMEWORK DIRECTIVE, EU) IN SPANISH RESERVOIRS.

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There are many recent issues of community ecology addressing the causes of biodiversity. Regarding phytoplankton assemblages, there is a need to balance between details (reductionist approach) and more general models (holistic view). And this wide range of approaches also appears in the applied areas of our knowledge, such as for example in water quality assessment. To help deciding what feature of algal community structure is more relevant to this purpose, be it the abundance of species or that of functional groups (classified according to various criteria), we have carried out a comparative study based on phytoplankton biovolume in 20 reservoirs of the same Mediterranean catchment (Júcar watershed) sampled twice (summer and winter) for three years.
We built a matrix with 3 environmental variables related to trophic state (TP, TN and the Z_m:Z_{eu} ratio) and phytoplankton descriptors. These were considered as: i)species biomass (>10% total biomass); ii)microalgal biomass in associations by Reynolds et al. (2002); iii)percentage of Cyanobacterial biomass; iv)a quality index used in the Spanish WFD based on the ratio between biomasses of different taxonomical groups (Index Group of Algae, IGA; Catalán 2003); v)functional groups based on morphological traits linked to the environment such as MFG (Salmaso & Padisák 2007) and MBFG (Kruk et al. 2010), which were viewed from a mechanistic point of view. Since community composition data contained many zeros, biovolumes were Hellinger-transformed for a RDA analysis. Environmental factors were also standardized.
RDA showed the following values of AdjR2cumulative: 1st) species biomass explained 2% of variance of TN (p=0.001); 2nd) biomass distributed in Reynolds's associations explained 3% of cumulative variance of TN (p=0.001) plus TP (p=0.038); 3rd) percentage of Cyanobacterial biomass and IGAs did not covariate with studied environmental variables; and 4th) MFG and MBFG explained until 4% of TN plus TP variability (p<0.005). In addition to the fact that explained variance is scarce and that TN was the main stressing factor shaping phytoplankton structure, we conclude that morphologically-based functional groups were best indicators of reservoir water quality. There were overlap between populations and functional groups information; for instance, *C. erosa* and Reynolds'association Y explained 3% of ZZ variance; *G. mitratum* and MFG-2b explained 2% of TN variation; then complementarity information was not demonstrated.

R07

SULFATE IN THE BAUMBERGE SPRINGS, CENTRAL MÜNSTERLAND, NW GERMANY: A STABLE ISOTOPE INVESTIGATION

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Upper Cretaceous marlstones form a shallow syncline that is exposed by relief inversion as the small mountain ridge Baumberge in the central Münsterland, NW Germany. The internal structure resembles a trough with an aquifer consisting of jointed, sandy marlstone on top and an aquitard of lesser permeable, clayey marls at the bottom. Numerous overflow springs are lined up at the boundary of aquifer and aquitard. During rainfall, the trough is filled until overflow and the Baumberge spring system can thus be considered as a “natural lysimeter”. The Baumberge area is highly influenced by agriculture. Previous research on the Baumberge springs (Göbel, 2010) forms the basis for the present investigation. Hydrochemical data clearly reveal that the spring water and groundwater is rich in dissolved inorganic carbon (DIC), sulfate, and nitrate, and poor in total organic carbon. In order to identify the source(s) of sulfate and the processes of sulfate turnover in this area, we performed an isotopic investigation of sulfate and DIC. Stable sulfur and oxygen isotopes of sulfate are a valid tracer for identifying its natural and anthropogenic inputs. Potential sulfate sources, also for the Baumberge region, include atmospheric deposition with $\delta^{34}S_{sulfate}$ around 0 ‰ and positive $\delta^{18}O_{sulfate}$ values, fertilizer with positive $\delta^{34}S_{sulfate}$ and slightly negative $\delta^{18}O_{sulfate}$ values and natural sources like pyrite oxidation with characteristically negative $\delta^{34}S_{sulfate}$ values (Schwientek et al., 2008).

Preliminary $\delta^{34}S_{sulfate}$ values of spring water and groundwater are consistently negative within a range of -8.5 ‰ and -0.5 ‰, whereas $\delta^{18}O_{sulfate}$ values vary between 2.3 ‰ and 9.2 ‰. This suggests that pyrite oxidation is a significant source of sulfate in springs and groundwater in the Baumberge area. However, alternative contributions cannot be excluded.

Due to the high nitrate concentrations in spring water and groundwater, the coupling between denitrification and pyrite oxidation could be a suitable process for explaining the sulfate sulfur isotopic composition (Böttcher et al., 1990), especially when the availability of organic carbon as an electron donor is limited. Respective information can be derived from nitrate nitrogen and oxygen isotopes.

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R03

IS EUTROPHICATION REALLY A MAJOR IMPAIRMENT FOR SMALL WATERBODIES' BIODIVERSITY?

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Eutrophication is and will stay a major stress for freshwater biodiversity. Moreover, climate warming, land-use changes and other human pressures are increasing the eutrophication. The deleterious consequences of eutrophication on biodiversity were often evidenced for large waterbodies. For smaller waterbodies, like ponds and small lakes, which can support naturally high levels of nutrients, the response to eutrophication is not necessarily identical. Furthermore, the impact of eutrophication on biodiversity could depend on the scale considered, from local (the waterbody) to regional (the network of waterbodies). It is also unclear if the richness of threatened species responds in the same way than the total species richness.

The present study investigated, at the local and regional scale, the consequences of eutrophication on taxonomic richness (all taxa) and conservation value (threatened taxa) from temperate lowland ponds and small lakes. Six taxonomic groups were investigated: macrophytes, aquatic macroinvertebrates as a whole and with a particular focus on gastropods and water beetles, adult dragonflies and amphibians, in two data sets covering a large nutrient gradient from mesotrophic to hypertrophic conditions.

At both local and regional scales, biodiversity responses to eutrophication could not be described by a general pattern, because the responses varied highly according to the taxonomic group. For macrophytes, local richness and conservation value decreased with eutrophication and a slight contribution of waterbodies of high nutrient status to the regional diversity was revealed by beta and gamma diversities as well taxon accumulation curves according to increasing or decreasing nutrient status. In contrast, for amphibians, an absence of impairment by eutrophication was revealed at both local and regional scales. Dragonflies, gastropods and water beetles showed intermediate situations.

No surrogate taxonomic group describes the impact of eutrophication on small waterbody biodiversity, reinforcing the need to consider different taxonomic groups in conservation action plans. Moreover, eutrophication is not a major impairment for all groups, especially if it does not alter all waterbodies of a regional network. However, as nutrient-rich small waterbodies are expected to be dominant in our future landscape, conservation efforts should favor waterbodies with lower nutrient status in order to favor beta and gamma diversities.

SS04

ARE DIVERSITY GRADIENTS AND NICHE FEATURES OF ALGAL COMMUNITIES IN HIGH ALPINE STREAMS REGULATED BY SPECIFIC STRESSORS?

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Lotic aquatic environments above the timber line in Alpine areas are frequently characterized by extreme climatic and hydraulic conditions as a consequence of the lack of higher vegetation as well as variable influence by catchment glaciation. In contrast to benthic animals in alpine habitats (insects in particular), until now no exclusive high altitude taxa of benthic algae have been recorded although a high portion of oligo- and ultra-oligotraphentic taxa is common. It is still disputable however, if specific stressors favour the dominance of particular lotic algae such as the cold adapted golden alga *Hydrurus foetidus* or not. In the massive spring bloom of *Hydrurus* in a glacier stream we found an enrichment of a specific associated heterotrophic community comprising rarely recorded bacteria, ciliates and insect larvae irrespective from nutrient limitation. Beside this detailed study of a specific micro-habitat we will investigate stressor variability and effects on algal communities (diatoms and soft-bodied algae) within specific hydrographical catchments with variable glacial influence, comprising streams characterized by krenal, kryal to glacial, glacio-rhithral and permafrost (rock-glacier) type hydrologies. Beside a majority of examples from the Central Eastern and Southern Eastern European Alps, we will draw attention on diatom communities from one catchment in British Columbia and spot-light samples from large glacial rivers in British Columbia and Alberta, Canada respectively.

SS12

LIFE + IN NRW - NORTH RHINE-WESTPHALIA

Rudolph I.

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The Natura 2000 network is the main instrument for implementing the biodiversity targets in Europe. In North Rhine-Westphalia this European network includes 518 Natura 2000 sites and 28 Special Protection Areas under the Birds Directive, in total covering about 8.4% of the territory.
The conservation of species and habitat types occurring in these areas is essential for the conservation policy in North Rhine-Westphalia.
The EU provides for the financing of Natura 2000 sites an integrated approach.
In addition to the large EU funds such as European Agricultural Fund for Rural Development (EAFRD) and European Regional Development Fund (ERDF), LIFE + is in this context of particular importance as it is the only EU funding program supporting only environmental concerns.
Starting in 1996, North Rhine-Westphalia uses LIFE for the implementation of Natura 2000 sites.
Since then, in North Rhine-Westphalia 27 LIFE projects were approved with a budget of EUR 78.3 million, co financed by the EU with 50%.
The state of NRW supports the projects and takes part in the project costs.
Many LIFE projects in North Rhine-Westphalia aimed at the water and wetland habitats restoration.
LIFE + in North Rhine-Westphalia is used for the implementation of Natura 2000 as well as for the Water Framework Directive.
This lecture gives an overview of the implemented projects in North Rhine-Westphalia and the experience gained.

R05

HOW DOES HYDROLOGICAL STABILITY AFFECT FOOD CHAIN LENGTH IN MEDITERRANEAN STREAMS?

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One of the few agreements existing on food web theory is that food chains tend to be short and wide, and their length (i.e., the number of trophic levels or energy transfers from the base to the top of a food web) is a key attribute affecting food web stability. Besides, hydromorphological impacts (i.e., physical structures decreasing the hydrological and morphological dynamism of a stream) have long been described to provoke crucial constraints to aquatic biota. However, studies to date have mainly focused on particular faunal groups (e.g., invertebrates, fish) rather than considering all trophic compartments at the same time.

This study aims at exploring the effects of hydrological stability at the food web level in a “natural experiment” of regulated- and unregulated-flow reaches in Montsant and Siurana streams (Ebro basin). To this end, 100-m reaches upstream (i.e., controls) and downstream (i.e., impacts) of the two major dams were selected, as well as 5 reaches located along ca. 25 km downstream from the dam (i.e., recoveries). First, we implemented a distributed hydrological model in order to obtain discharge series of the last 15 years for each reach (100x100m and daily spatial and temporal resolution respectively; Nash and Sutcliffe efficiency index in calibration = 0.59). Grain-size distribution, river channel topography and microhabitat availability were also measured. Combining these data, we confirmed that both flow regime and the river channel become more stable downstream from the dams (i.e. 30% decrease in magnitude of floods and a threefold increase in bed armouring, respectively). Besides, food webs (including algae and macrophytes, invertebrates, and fish) were constructed at each reach, combining quantitative and qualitative samplings and the use of stable isotope analyses. Food chain length ranged from <2.8 to >5.1, lengthening drastically due the increased hydrological stability at impact reaches. However, from the respective impact reaches to the most downstream recovery reach it continued to lengthen progressively, suggesting that it also responded to the increasing habitat heterogeneity. Overall, our results suggest that both hydrological stability and habitat heterogeneity may determine food web structure in Mediterranean streams.

R03

ORGANIC CARBON DYNAMICS IN THE HYPORHEIC ZONE OF A SMALL LOWLAND STREAM

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An organic carbon dynamics was assayed in a gravel-sand bar situated within a small lowland stream Sitka, in the Czech Republic. We estimate that about 58 % of the dissolved organic carbon (DOC), which discharge through sediments, is immobilized. Decomposition of sediment particulate organic matter (POM) accounts for about 84 % of carbon need for bacterial production in sediments, revealing that POM content is important factor for bacterial metabolism. Mean bacterial carbon production was estimated at about 2.55 g $C.dm^{3}.y^{-1}$. Hyporheic community respiration (HCR) was found to be negatively correlated with grain size and positively with sediment organic carbon content. Turnover time of POC was 332 days. Anaerobic metabolism is an important pathway in organic carbon cycling in hyporheic sediments. Nitrate respiration seems to be a dominant respiration process, participant on overall organic carbon respiration 46 %. Sulfate respiration and methanogenesis participate on overall organic carbon respiration 30 % and 6 %, respectively. The aerobic respiration rate was 5 fold lower than anaerobic, probably due to relatively low oxygen concetration within hyporheic zone. The imbalance between changes in DOC concentrations and organic carbon reduced via declining electron acceptors observed in our study strongly suggests that carbon sources other than infiltrating DOC contributed substantially to microbial demand. We propose that POM is the predominant carbon source for microbial metabolism

R02

COMPLEX COLONIZATION OF OCEANIC ISLANDS BY MAYFLIES (EPHEMEROPTERA: BAETIDAE)

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Oceanic islands provide ideal settings to understand how speciation and dispersal shape present-day biodiversity. Here, we examined the evolutionary history of mayflies (Ephemeroptera) on three Macaronesian archipelagos (Azores, Madeira, Canary Islands) using a molecular phylogeny that included species from Corsica, North Africa, and several areas in mainland Europe. The Macaronesian mayfly fauna is largely restricted to *Cloeon* and members of the *Baetis rhodani* group, which is thought to contain undescribed (cryptic) species both in Europe and on the islands. We first delimited putative species with a gmyc model analysis of *cox1* (mtDNA) and then used a concatenated mtDNA dataset (*cox1*, cyt *b, rrnL*) for phylogenetic reconstruction using Bayesian inference. Island endemism was higher than expected, with ten gmyc species in total and endemic species on several islands. Only Madeira shared a species with the European mainland (*Baetis rhodani*). A second *Baetis* on Madeira was most closely related to those from Canary Islands (*B. pseudorhodani* s.l.). Two lineages (*B. canariensis* s.l. and *B. pseudorhodani* s.l.) appear to have diversified in parallel throughout the Canary Islands. The closest relative of *B. canariensis* s.l. from Gran Canaria was found in Tunisia, indicating a complex colonization history and perhaps dispersal from the islands to the North African mainland. Our results, while intriguing, also show the limitations of standard phylogenetic markers. We are currently developing nuclear phylogenetic markers using *de novo* assembled draft genomes of two species.

SS03

DISTRIBUTION AND CONSERVATION STATUS OF ENDANGERED *PHOXINUS STRANDJAE* DRENSKY, 1926

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Phoxinus strandjae Drensky, 1926 was only known from the Veleka and Rezve (Resowska) drainages, draining from Strandzha to Black Sea in Bulgaria and Turkey (Kottelat and Freyhof, 2008). The species is in the Endangered (EN) category of The IUCN Red List because of its distribution area was around 2,000 km^2. We have found this fish from seven different localities outside known distribution area. With this study, the distribution area of this species in Turkey was extended 70 km southeast to Istranca Stream which is draining to Durusu Lake in İstanbul City and its conversation should be transferred to Vulnerable (VU) from Endangered (EN).

R14

MULTI-STRESSOR EFFECTS OF NUTRIENTS AND SEDIMENT ON STREAM COMMUNITIES: CHANGES IN STRESSOR IMPORTANCE WITH TIME

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Agricultural intensification has caused nutrient enrichment and increased fine sediment inputs to streams worldwide, leading to a decline in water quality and changes to stream communities in many areas. In 2008, Wagenhoff et al. (2011) conducted a survey of 43 streams and rivers spanning a wide range of land use intensities in Southland, New Zealand. This survey was repeated in April 2012 with the aim of investigating changes in stream health in Southland between 2008 and 2012. Both surveys focused on two known agricultural stressors for streams: elevated levels of deposited fine sediment and dissolved nutrients. To study the relationships of these stressors with stream health, invertebrate and algal community metrics were examined. Patterns in the 2012 data were analysed using generalised linear models with AIC-based model selection and key stressors compared to those for the 2008 data, which had been analysed with the same approach. Overall, the concentration of dissolved inorganic nitrogen (DIN) increased from 2008 to 2012, especially in streams with intensive catchment land use, whereas overall levels of deposited fine sediment decreased somewhat. These observed changes in stressor levels led to the hypothesis that DIN might have become a more important stressor for aquatic biota in 2012. In both sampling years, the community-level invertebrate metrics ‘EPT taxon richness’ (number of taxa in the pollution-sensitive orders Ephemeroptera, Plecoptera and Trichoptera) showed a simple multiple stressor response, with a negative response to both increasing sediment and nutrient levels, and ‘% EPT density’ (contribution of EPT taxa to the total number of individuals per sample) was negatively correlated with increasing sediment levels. In 2012 the majority of observed invertebrate responses were negative, indicating a generally detrimental effect of excess sediment and nutrients on stream health. Furthermore, mean stressor effect sizes indicated that, while in 2008 sediment was the more pervasive stressor, by 2012 nutrients (DIN) had become relatively more important, in agreement with our above hypothesis. These results indicate the importance of understanding how in-stream physicochemistry changes with time due to agricultural activities in the catchment and how stream biota are impacted by these changes, particularly as agricultural intensification is likely to continue in New Zealand and globally.

SS01

FUNCTIONAL CLASSIFICATIONS IN PHYTOPLANKTON ECOLOGY: A COMPARATIVE REVIEW OF APPROACHES AND EXPERIENCES

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Empirical models of phytoplankton groups and their recurrence in water bodies have traditionally made use of taxonomic classifications, implicitly or explicitly assuming that species classified together could share similar ecological properties. Nevertheless, the use of taxonomy in ecology has many drawbacks. From one side, many broader groups include species with very different ecological properties. From the other side, convergent evolution, the independent evolution of similar characters in different lineages, can explain why distantly phylogenetically related species can be linked together by close analogous ecological affinities. With the aim to obtain a better understanding of the functioning of the freshwater ecosystems, complementary approaches based on ecological criteria have been therefore proposed. The aim of this contribution is to critically review the rationale of the different classifications that have been proposed during the last three decades, highlighting the strengths and weaknesses of the different approaches. Besides the first classifications, which considered broad functional categories based on reproductive (*r-K* selection) and life strategies (*C-S-R*), successive formulations included the functional groups (*FG*), firstly established by C.S. Reynolds, the Morpho-Functional Groups (*MFG*- Salmaso & Padisák, 2007), and the Morphology-Based Functional Groups (*MBFG* - Kruk et al., 2010). In the original formulation of *FG*, species were put together if they showed similar dynamics and ecological requirements, implicitly assuming a similar response to a set of environmental and seasonal changing conditions. With successive refinements, morphological properties have been used to fit hitherto functionally unclassified taxa into existing *FG*. This classification has been widely used in many aquatic ecosystems, with applications in ecological status assessment. At the opposite, *MBFG* (totalling 7 groups) are exclusively based on morphological characters, irrespective of the temporal dynamics of the species. The *MFG* concept use a hybrid approach, integrating morphological, functional and, when ecologically relevant, taxonomic characters in the definition of groups. The comparative evaluation of the above classifications was attempted only very recently, and will be critically examined in this review. Finally, this work will provide an updating of the original *MFG* classification based on the application of the concept to real case phytoplankton studies.

SS12

RESTORATION OF BACCHIGLIONE SPRINGS AND HABITAT OF SPA IT3220013 AND SCI IT3220040 SOR.BA-LIFE09 NAT/IT/000213

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The project area is located within the SPA IT322013 «Bosco Dueville» and the SCI IT322040 «Bosco Dueville and nearby springs». Therein lies an area (19 ha) in the past used as a fish farm, that was been purchased by the Public Administration of Provincia di Vicenza (PVI) by the year 2009. The project SOR.BA is realised in partnership with Provincia di Vicenza (Coordinating beneficiary), Consorzio di Bonifica Alta Pianura Veneta, Regional Forestry Service of Vicenza, Veneto Agricoltura (Associated beneficiaries) and such as Co-financiers Municipalities of Dueville, Villaverla and Caldogno. Total project budget is € 1.224.000,00 and EC financial contribution is € 612.000,00; the project realization period is 2011-2013. SOR.BA project is built to restore and protect an unhealthy environment, also by deepening the scientific knowledge about the flora and fauna living in the SPA. The overarching objective of the project, protection and habitat restoration and monitoring of EU habitats and species, is consistent with the objectives and priorities listed in Annex II of the Life+ Regulation. The project actions for the conservation are:
- conversion of a part of the area occupied by the tanks, recovering the original springs, environment and habitat 3260. This action is implemented through a morphologic rebuilding of the surface and a plantation of the most important habitat's species, able to ease the colonization of *Cottus Gobio* (fish), *Rana latastei* (anphibian)*, Alcedo atthis, Nycticorax nictycorax, Egretta garzetta and Circus aeruginosus* (birds)*;*
- some forest restoration interventions will be carried out, to thin the infestant weeds out and to reconstruct the plant associations typical of the Habitat 91E0*, considered as a "priority habitat", and included in the intervention area with some neighbouring strips;
- acquisition of an area (about 6 ha) by the PVI to carry out an ecological corridor in order to connect the restored area and the biotope "Bosco del Centro idrico di Novoledo". Inside the ecological corridor the habitat 91E0*, 3260, 6510 and 6410 will be reconstituted;
- the outcomes of the researches and the scientific monitoring will be collected and implemented in order to build an updatable database;
- some actions for the dissemination of the outcomes and the environmental priorities are carried out. The targets will be citizens, stakeholders and local Authorities with a special attention for the students.

R05

A NEW CARBON SOURCE WITHIN RIVERINE FOOD WEBS?

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Recent evidence suggests that methane provides an energy subsidy to freshwater food webs. Cased caddis (Trichoptera) larvae such as *Agapetus fuscipes* and *Silo nigricornis* show consistently depleted carbon isotope ratios associated with a reliance on methane-derived carbon, rather than the abundant photosynthetic resources they are normally thought to consume. These two species can achieve high biomass and production, showing the potential for significant trophic transfer of methane-derived carbon through the food web. So far, the evidence for this phenomenon has been restricted to rivers on permeable chalk geology in southern Britain – but if it also occurs more widely on catchments of different geology, the importance of methane in stream food webs in general could be considerable. Twenty-nine sites of differing geology across Britain were sampled in the summer of 2011. The results suggest that the use of methane-derived carbon by primary consumers is indeed far more widespread than we first thought.

To assess the role of methane-derived carbon in the secondary production of *Agapetus fuscipes* and *Silo nigricornis*, we used the size-frequency method at a subset of eight sites from November 2011-October 2012, and combined production estimates with analysis of the stable carbon isotope in the tissues of the larvae. We discuss how our findings require a reassessment of the role of different carbon sources within stream food webs.

R06

INTERACTIONS BETWEEN WARMING, NUTRIENT ENRICHMENT AND DETRITIVORES ON LITTER DECOMPOSITION AND ASSOCIATED MICROBIAL DECOMPOSERS

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Leaf litter decomposition in aquatic environments constitutes a fundamental ecosystem process that is controlled by the joint action of microbial decomposers and animal detritivores. The structure and function of decomposer communities may be impaired by warming and eutrophication of the water body. We conducted a microcosm experiment to investigate how warming, nutrient-addition (N and P) and detritivores, interact to affect multiple parameters associated with leaf decomposition. These parameters included microbial (bacteria and fungi) biomass and community structure, decomposition rate and detritivore growth. Our analyses demonstrated increased bacterial and fungal biomass and changed community structure upon warming and nutrient addition. The presence of detritivores showed positive effect on fungi but negative effect on bacteria. Litter decomposition rates significantly increased with warming, nutrient addition and the presence of detritivores. Growth of detritivores significantly increased with warming and nutrient addition. The results of this study emphasize a general, pivotal role of microbial decomposers. However, their impact on leaf decomposition may be regulated by the interplay of detritivores.

R11

DOES BOULDER DENSITY AND FLOW DISCHARGE INFLUENCE CYPRINID FISH PERFORMANCE IN POOL-TYPE FISHWAYS?

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Pool-type fishways are the most common types of fishways built at small weirs; yet, their performance for restoring connectivity for fish species with limited swimming ability has not been fully explored. To address this concern and ease upstream fish passage, increasing interest has been expressed in the placement of artificial substrata in the bottom of these facilities. Nevertheless, no study has so far considered the effect of boulder spacing (i.e. density) and flow discharge on the success and timing of upstream movements of migrating cyprinids. The aim of this study was to assess the performance of two boulder density designs with increasing flows. Passage success was tested for a potamodromous cyprinid, the Iberian barbel (*Luciobarbus bocagei*), in an experimental but full-scale pool-type fishway. Although no significant differences in passage success were detected between boulder spacing (high density: 35%; low density: 40%), increased flows induced a higher proportion ($P < 0.05$) of successful negotiations (50%), relative to low flow discharges (25%). Both factors did not interact. Furthermore, under higher flow discharge, fish took significantly less time ($P < 0.05$) to ascend the fishway with the higher (mean ± standard deviation (SD): 5.3 ± 4.2 min.) versus the lower boulder density (mean ± SD: 12.1 ± 6.5 min.). Results showed that although fish passage success was independent of boulder density, a tighter configuration combined with higher flow discharge can be beneficial, as it was found to reduce transit time. However, if flow volume is a constraint, a low density design should be employed instead.

R01

SEASONAL COMPOSITION AND POPULATION DENSITY OF ZOOPLANKTON IN KARABOGAZ LAKE FROM KIZILIRMAK DELTA (SAMSUN,TUKEY)

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Karaboğaz Lake is located in 10 km west of Kızılırmak Delta where northern side of Turkey on the Black Sea coast. The Kızılırmak Delta is one of the most important Ramsar sites in Turkey. The lake, a part of the delta, comprises a significant aquatic ecosystem with indigenous species and, in addition, supports the local economy (agriculture and fisheries). The lake covers an area of 1500 hectare; with a mean depth of 2.5 m. The lake watershed has undergone substantial agricultural development over the past 50 years. The agricultural area is located in the southern and southern-west part of the lake. The results of recent biota-monitoring studies indicate that portions of the lake ecosystem are degraded significantly, primarily due to eutrophication and chemical pollution. In addition to this, studies on the zooplankton communities of Karaboğaz Lake are completely unavailable compared with other lagoon lakes of Kızılırmak Delta. Therefore, it is important to identify ecosystem components of the lake. The aim of the present investigation is to explain the composition, abundance and species diversity of the zooplankton community in Karaboğaz Lake.
Zooplankton composition and abundance were investigated seasonally at six sites in Karaboğaz Lake in relation to the some physicochemical conditions from October 2008 to September 2009. A total of 65 taxa were identified, among them 52 species of rotifers, 8 cladocerans, 5 copepods. Rotifera represented the predominant component (79% of the total community), followed by nauplii, cladocerans and copepods (15, 5 and 1% respectively). The average total zooplankton abundance ranged from 9603 and 22,968 ind/m^3. The maximum and the minimum densities were measured in June and August of 2003, respectively. 39 taxa identified in the zooplankton were composed of species to have low frequency in the lake. Among the species with the highest frequency of encounter were found to be *Alona rectangula, Chydorus sphaericus, Colurella adriatica, Keratella quadrata, Lecane closterocerca, Lecane bulla* and *Polyathra vulgaris.* The findings indicated that the quantitatively dominant groups in the lake were small-sized organisms with low filtration rates. Zooplankton diversity showed positive correlation with temperature and chlorophyll a. However significant negative correlation was detected between diversity and salinity.
Key Words: Karaboğaz Lake, zooplankton, species composition, abundance, diversity.

SS07

HYPORHEIC DEFICITS CALL FOR RIVER BANK CONSERVATION IN THE KHARAA CATCHMENT (MONGOLIA)

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Recent developments in land-use practices prove to threaten Mongolia’s ecosystems affecting both the terrestrial but also the aquatic compartments. This emerged for the Kharaa catchment in Northern Mongolia as well. Here, livestock husbandry in the floodplains was restructured and intensified over the past years. We want to present an interdisciplinary assessment on the status of and pressures on hyporheic functions in order to find adapted protection measures. Investigations included sediment source fingerprinting, erosion susceptibility calculations, hydromorphological mapping, river bed sediment composition, hyporheic connectivity, whole system metabolism, macroinvertebrate biodiversity, and functional composition analysis. It revealed that sediment input underlied strong seasonal and annual variability with river bank erosion beeing the main source for suspended sediment in the river. Especially within the floodplains of the middle reach degradation of the river banks and riparian vegetation was observed. Further, fine sediment infiltration into the river bed was shown to be high in the lower middle reach. Here, severe implications for hyporheic functioning occurred: hydrologic disconnection from the surface water and decreased habitat suitability with effects on macroinvertebrate biodiversity and functional composition. We concluded that in order to protect the aquatic ecosystem river bank conservation is indispensable.

SS10

ARE ORGANIC TOXICANTS A MAJOR THREAT FOR THE ECOLOGICAL INTEGRITY OF FRESHWATER ECOSYSTEMS?

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Several field studies in streams and rivers ranging from a local to the regional scale have demonstrated that organic toxicants may affect freshwater ecosystem structure and functions. However, it is unclear whether the observed effects represent worst-case scenarios and are limited to individual streams in agricultural or urban areas. In this talk, we will present a synthesis of studies on the effects of organic toxicants in freshwater ecosystems that focus on the following research questions:

Which organic toxicants are the most important?
How widespread are effects of organic toxicants in freshwater ecosystems?
Are current regulatory approaches sufficient to protect ecosystem structure and functions?

Results from field studies and data analyses of governmental data encompassing different regions of the world and ranging from the regional to the continental scale will be presented to answer these questions. We will demonstrate that pesticides are the most important group of organic toxicants and that their ecological relevance exceeds that of many priority substances and emerging pollutants (e.g. brominated flame retardants) under discussion. Moreover, depending on the assumed no effect thresholds and the trophic level under consideration between 5 and 60% of streams and rivers in Europe are at risk of acute toxic effects to invertebrates, plants and fish. Finally, we suggest that current regulatory approaches are not protective for freshwater ecosystems structure and functions.

SS09

SALINITY PARADOX: MISMATCH BETWEEN LABORATORY-BASED RISK ASSESSMENT AND FIELD STUDIES ON THE EFFECT OF SALINITY ON STREAM MACROINVERTEBRATES.

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Salinisation, the process of increasing salinity, originates both from natural processes and human activities. Anthropogenic or secondary salinisation has a number of causes including dryland agriculture, irrigation agriculture, road de-icing and discharges from mining and industry. There has been increasing interest in effects of salinity on freshwater biodiversity in general and stream macroinvertebrates in particular. Risk assessments based on laboratory toxicity tests suggest that salinity (in electrical conductivity) in the range of 1.1-1.5 mS/cm should protect approximately 95-99% of species of stream macroinvertebrates. However, in the Australian states of Victoria and South Australia about 50% of Ephemeroptera, Plecoptera and Trichoptera (EPT) species are lost when salinity rises to 1 mS/cm. Likewise in the Appalachian Mountains in the USA there is a significant decline in ephemeropteran abundance by 0.175 mS/cm and a 5% loss of all macroinvertebrate genera by 0.295 mS/cm. We consider several theories to explain this discrepancy between what the laboratory-based risk assessment points to as an environmentally safe salinity and observed changes in the field. We discuss the implications for management of salinisation in freshwater and for risk assessment more generally.

SS10

A MODEL ECOSYSTEM APPROACH TO ASSESS THE EFFECTS OF COPPER SLAG ARMOURSTONES ON A FRESHWATER COMMUNITY

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Slag material from copper production (copper slag) is used since several decades as armour stones in channels, rivers and harbours in Germany. It consists mainly of iron silicate and silicates of aluminium and c silicates. However, because also metals like Cu, Zn, Pb, Ni and As are present in small amounts the potential hazard of metals leaching in to the water is discussed. Usually, the hazard of substances leaching into water is assessed in laboratory elution experiments with material broken into small pieces. However, these worst case conditions are not suitable for realistic assessments of the risks to populations in the field. Field monitoring suffers from the problem of many factors affecting environmental concentrations and their effects on populations and communities.
We present an outdoor model ecosystem approach as an alternative which allows combining a controlled experimental approach with the opportunity to measure the effects of a stressor on the dynamics of population of many populations of different trophic levels under realistic exposure conditions. In order to analyse the heavy metal load of water, sediment and biota resulting from armourstones and its effects on algae, macrophytes, zooplankton and macroinvertebrates, different doses of armourstones were tested in 2 000 L enclosures placed in a large pond. Basanite armourstones were used to achieve the same total amount of stones in all enclosures. Metal concentrations and effects on the biocoenosis were followed over 1 year after introduction of the slag. Effects were statistically analysed on the population and community level.
Cu, Ni, Zn, Mn and Fe concentration in the water increased, related to the amount of the introduced copper slag; e.g. the maximum Cu concentrations found at the highest treatment level (100 g stones / L) were 14 µg Cu/L. In biota Cu concentration increased up to a factor of 5 compared to the controls while other metals showed usually no or a smaller increase in biota. No indication of biomagnification was found. At 100 g stones / L, effects on algae, macrophytes and insects over more than 8 weeks or at the end of the study could not be excluded. Up to 50 g stones / L no long-term or pronounced effects on the biocoenosis were observed.
Thus, 50 g armour stones / L (1:20) are considered as the No Adverse Effect Concentration in this study.

SS05

FACTORS AFFECTING THE LITTORAL FISH COMMUNITY IN SMALL ARTIFICIAL LAKES IN NORTH-WEST GERMANY

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We analyzed effects of morphology and productivity on fish communities in 19 small (<12 ha), shallow (<13 m), and mostly artificial water bodies, managed by recreational fishing clubs in Lower Saxony. Electrofishing and gillnetting was used in 2011 and 2012 to sample fish communities. Fish faunistic indices of the littoral fish community were tested for relationships with habitat structure, morphological and biological factors. Biomass and abundance of littoral fish were positively correlated with lake productivity and indicators of trophic status (i.e., chlorophyll *a*, total phosphorus and water turbidity), while the abundance of predatory fish declined alongside eutrophication. Furthermore, the average size of the fish in the community declined with increasing trophic state. Mean lake depth also turned out to be a relevant factor affecting the biomass and abundance of the littoral fish community negatively. By contrast, the degree of underwater area overgrown by aquatic macrophytes in the lakes did not exert any clear signal on the littoral fish community. Similar to natural water bodies, lake productivity and lake morphology primarily structure fish communities in small artificial lakes.

R07

SILICON AVAILABILITY CONTROLS MICROBIAL DECAY AND NUTRIENT RELEASE OF GRASS LITTER DURING AQUATIC DECOMPOSITION

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The decomposition rate of plant litter is an very important part of the carbon cycle. Element stoichiometry and content of hardly degradable carbon compounds are main factors controlling this decomposition process. Recent research has linked these factors to silicon availability during plant growth, but less is known about the effect of silicon on litter decay. Hence, we conducted a batch experiment to assess the effect of silicon availability to plants on litter degradation, nutrient release and multi elemental stoichiometry. Experiments were conducted in the presence or absence of invertebrate shredders (*Gammarus pulex*). It could be shown that nutrient content (affected by silicon availability during plant growth) has a strong impact on nutrient turnover, while DOC, N and Mn were mainly controlled by invertebrate feeding.
The litter decay by heterotrophic microbes (as a main part of litter decay) was strongly influenced by the silicon availability during plant growth, with faster decay of litter with higher silicon content. This may be explained by the dissolution of the extensive amounts of silicon near the epidermis of the leaves which in turn enhances the surface area for microbial penetration of the litter and maybe the possible positive effect of silicon on microbial growth. These effects may be reversed or neutralized by including higher trophic levels (shredders), which has to be elucidated in more detail by future experiments. Since this process of aquatic litter decomposition is described to be controlled in the tropics mainly by microbes and in higher latitudes by invertebrate shredders, we show that the silicon availability in wetlands is a very important factor to estimate the potential of carbon turnover/sequestration as well as remobilization of nutrients in these ecosystems.

SS12

THE LIFE+ PROJECT “ALOSA ALOSA”: MEASURES FOR THE CONSERVATION AND THE RESTORATION OF POPULATIONS OF THE ALLIS SHAD IN EUROPE PART 1: MEASURES TO RE-ESTABLISH AN ALLIS SHAD POPULATION IN THE RHINE SYSTEM*

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The Allis shad formerly colonized large parts of the eastern Atlantic Ocean, the North Sea and the western Mediterranean Sea and rivers draining therein, has become extinct from nearly the entire historical distributional range during the first half of the 21st century. The main reasons were over-fishing, habitat losses due to river engineering measures and water quality deterioration and affected also one of the formerly biggest populations in the river Rhine system. Although single Allis shads have been caught by professional fishermen after that time and also some specimen have been observed at monitoring stations at the Iffezheim and Gambsheim dam on the upper Rhine, no proofs for natural or even sustaining reproduction have been found so far. The species is thus considered as extirpated from the Rhine system. Specimen found to cross the fish passes at the upper Rhine have been found to be strayers from the biggest remaining, the Gironde-Garonne-Dorgdoge-(GGD)-Population in Southwest France. After comprehensive feasibility studies and by means of the EU support program Life mass breeding and marking techniques have been developed, established and implemented. With regard to the viability and size of the GGD-Population with some hundred thousand adult Allis shad returning to the rivers for spawning each year, it was decided to recruit a small part of shads on their spawning run for artificial reproduction in order to produce YOY shads for stocking the Rhine and by that way to found the basis for a future Rhine’s Allis shad population. A total number of 4.8 Mio larvae were successfully transported to Germany and released within the Rhine system. The measures on the re-introduction of the Allis shad to the Rhine system are continued in a following-up Life+ Project (2011-2015). Post-release monitoring studies have revealed that the shad larvae disperse rapidly with the current and apparently settle downstream, however and according to studies in France, no further traces were found by the emigration of the juvenile shads to the estuary. Closing the gap of knowledge of habitat utilization, further optimize the stocking strategy and monitoring of returners from the sea and documentation of spawning activities are the main tasks of the running project. The foundation and maintenance of facilities for ex situ stocks aims to substitute the exploitation of wild stocks for the purpose of breeding YOY for stocking measures.

SS02

SOME PARASITES LIKE IT HOT, BUT NOT TOO HOT!

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Environmental variation has a strong impact on host-parasite interactions and coevolution, but information on specific effects of environmental variables on such systems is sparse. In this study, three-spined sticklebacks (*Gasterosteus aculeatus*) infected with the tapeworm *Schistocephalus solidus* were experimentally exposed to different temperatures. Hosts and parasites were laboratory offspring of populations from Norway, Spain and Germany. Infections were performed at 18°C and temperatures were changed thereafter to 13° and 24°C or kept at 18°C. Parasite infections and immune parameters of the sticklebacks were monitored after 36, 50 and 64 days of infection. At 13°C *S. solidus* were growing much slower compared to 18° and 24°C, which might partially be explained by lower metabolic rates, but also by the activity of the stickleback's immune system which was higher at 13° compared to 18°and 24°C, in infected and control sticklebacks. Parasite growth rates did not simply increase with temperature and were lower at 24° compared to 18°C. This indicates that both, host and parasites have different temperature optima. While immunity of sticklebacks seems to be optimal around 13°C, *S. solidus* grows optimally at 18°C. The reduced growth of *S. solidus* at 24°C might be an adaptation to the physiology of the stickleback host in order to avoid overexploitation of the host under stressfully high temperature conditions (critical thermal maximum of sticklebacks: 26°-30°C). Contrary to our expectations, different origins of sticklebacks and *S. solidus* (Norway, Germany and Spain), or the specific (sympatric/allopatric) combinations of host and parasite origins, did not differ prominently in their response to temperature treatments. Norwegian *S. solidus* were more virulent than the other origins and Norwegian sticklebacks were more resistant to the infection, independent of the temperature treatment. The present study illustrates that temperature has prominent effects on host-parasite interactions in an ectothermic system. Increasing temperatures seem to favour growth of the parasite, whose egg output in the final avian host is positively correlated to its body mass. Consequently, reproductive rates of *S. solidus* will increase with temperature. However, this advantage of the parasite seems to be confined by physiological limitations of the host at high temperatures, which puts selective pressure on the parasite not to overexploit the host at stressfully high temperatures.

SS12

LIFE+ PROJECT „LIPPEAUE" – IMPROVEMENT OF THE CONNECTION BETWEEN THE RIVER AND THE FLOODPLAIN

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Floodplains are unique landscapes. The power of the river water creates a complex mosaic of natural habitats, and constantly recarves the contours of the floodplain, creating an ever new combination. The water meadows between the town of Hamm and the districts of Warendorf and Soest are an excellent example. Since 2005, various measures are being implemented as a part of the LIFE and LIFE+ Projects "Lippeaue", for the near-natural development of the Lippe and its floodplain (see abstract 1).

The aim of the projects is to protect and to improve the Lippe floodplain as a habitat for threatened species and as a retention area for floods. It is particularly important to re-integrate the river with its floodplain. However a final state; a "completed" man-made floodplain; will not be created. By the measures a near-natural development of the landscape will be initialized. This allows constant alteration and development of the river's landscape, which is one of the projects explicit aims.

Not all of the Lippe floodplain was available for the LIFE-Projects. During the planning of optimization measures, it was important not to affect any neighbouring private land. For this reason, a total of nine action zones were defined, whose terrain was such that the implemented measures could not affect the property of third parties. It was thus permissible to re-waterlog these areas and allow their occasional flooding.

To enable this natural development of the Lippe floodplain, bank reinforcements will be removed, new water areas will be formed and alluvial woodland will be developed. One effect of the reinforcing of the riverbanks, was that the river-bed had been eroded to several metres depth. It is intended to raise the riverbed to its natural depth over a stretch of around 1,1 km. Simultaneously, by forming two new Lippe loops, the flow rate and consequently the resulting erosion, will be reduced.

The success of both LIFE-Projects is already clearly visible: now there are sections of natural banks without rock reinforcement, flood channel systems, various-sized standing bodies of water, extensively managed wet grassland and young alluvial woodlands. Obstacles preventing water creatures from moving freely up and downriver and between river and water meadows have been removed or made passable. These measures have provided the preconditions for a natural development. Some species that were previously rare have again become more numerous.

SS12

THE RENATURATION OF THE RIVER EMS: CONCEPT AND IMPLEMENTATION

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Among Germany's large rivers, River Ems is the smallest one. The catchment area amounts to approximately 18,106 square kilometers and a total length of 371 kilometers. A share of 4,100 square kilometers and a length of 156 kilometers are located within North-Rhine Westfalia.

Expansive wet floodplains were seriously affected by river regulation measures that took place between 1934 and the 1970's. The respective areas came into intense agricultural use. The straightening of the formerly meandering river bed resulted firstly in a considerable degradation which subsequently had to be stopped by the construction of large numbers of embankments and other transverse structures. Secondly the ground-water level decreased and thus caused drought damages for all kinds of landscapes, the nature protection areas and the agricultural areas. After all the results of river regulation caused more damages than advantages to the landscape. Nowadays the impact of climate change exacerbates the respective effects.
Already in the end of the 1980s it became visible that the ecology was negatively influenced which in turn led to a new concept regarding the protection of rivers and floodplains. This Emsauenschutzkonzept (EASK) was estabished in 1990. It aims at a reduction of damages caused by erosion and degradation. Ever since, the District Government of Münster, responsible authority for River Ems maintenance, reconstructs the River Ems aiming at a near-natural state.

As regards the Water Framework Directive (WFD) the River Ems was classified into poor or unsatisfactory environmental condition. In order to improve the ecological functions of river and landscape the EASK was further developed towards the concept of Trittsteine (stepping stones) and Strahlursprünge (jet origins). Apart from technical requirements the involvement of farmers, local residents, local politicians, nature protectionists and nature users in a common process is of high relevance. This in turn causes discussions and requires compromises.
Within the framework of the LIFE+ Project "Ems - Dynamik + Habitate", the course of the river was lengthened and widened along a section of about 4 kilometres nearby Einen (Warendorf). The lecture will show the gradual progresses since 1990.

SS05

PRIMARY SUCCESSION OF PIONEER VEGETATION ON NEWLY FORMED FRESH-WATER ISLANDS IN LAKE WOHLEN (SWITZERLAND)

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In 1920 a hydroelectric dam was built in the river Aare creating Lake Wohlen. Due to silt deposition four islands were formed 2003-2010. Little is known about the succession of pioneer vegetation on such islands. Therefore, their vegetation was studied 2010-2012. Based on indicator plants three zones were defined. The surf zone (area of transition between water and land) was characterized by *Hippuris vulgaris, Veronica beccabunga,* and *Nasturtium officinale*; the intermediate zone (occasionally flooded) by *Bidens cernua*, as well as *Mentha* and *Rumex* species; and the central zone (rarely flooded) by *Phragmites australis* and *Typha latifolia.* All plants of each zone were identified and their percentage of coverage was estimated in spring, summer, and autumn. I observed the largest diversity of plant species in the transition zone (6-13), the smallest in the surf zone (2-5), and an intermediate in the central zone (4-10). Due to short periods of vegetation the number of species decreased from spring to autumn. The central zones were growing faster than the islands. The transition and surf zones were not only moved to new outer island areas, but also squeezed. I observed a succession starting with the species of the surf zone, continuing with the ones of the transition zone, and ending as relative stable vegetation of the central zone. However, the next step of succession started already with the appearance of *Salix* species. I hypothesize that the cove studied (Inselrainbucht) will convert into a floodplain, dominated by *Salix* species and reed beds.

R04

FUNCTIONAL RICHNESS IS MORE SENSITIVE TO HUMAN IMPACT THAN FUNCTIONAL REDUNDANCY OF STREAM INVERTEBRATES

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Human-induced reductions in species richness might alter the quality of ecosystem services when the remaining species are not able to substitute the functions provided by extirpated species. We examined how human disturbances (nutrient enrichment, land-use intensification, instream habitat degradation and the presence of alien species) influence the species richness of stream invertebrates. Stream invertebrates (425 native species) were collected by kick and sweep sampling technique at 274 sites covering the entire area of Hungary. We measured species richness, functional richness (i.e. number of unique functional roles provided by community members) and functional redundancy (i.e. the functional insurance of the community) using information on the feeding habits of each species. Our results showed that species richness was negatively influenced by instream habitat degradation and nutrient enrichment. We found that functional richness is more sensitive to human impact than functional redundancy of stream invertebrates. The finding that a reduction of species richness is associated with a loss of unique functional roles (i.e. functional richness) is important for conservation issues, because the number of unique functional roles is usually regarded as driver of ecosystem functioning.

SS02

IMPACT OF ELEVATED TEMPERATURE ON THE GENE EXPRESSION OF THREE-SPINED STICKLEBACKS (*GASTEROSTEUS ACULEATUS*) PARASITIZED BY THE CESTODE *SCHISTOCEPHALUS SOLIDUS*

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In aquatic environments, poikilotherm species and their interaction are expected to be significantly affected by global warming, as vital functions are determined by ambient temperature. To explore how a tapeworm parasite influences metabolism and immune activity of a teleost host in a scenario of elevated temperature, whole transcriptome sequencing was performed with RNA isolated from livers of three-spined sticklebacks infected with *S. solidus*, sticklebacks that had defended the infection, and naïve sticklebacks. Livers were collected after 50 days of exposure to 13°C and 24°C.
In all treatment groups the higher temperature resulted in higher metabolic rates and energy generation. The naïve sticklebacks were less afflicted by temperature increase than the sticklebacks that had been exposed to *S. solidus*. Compared to naïve sticklebacks, both, *S. solidus* exposed and infected and not infected fish showed strong differences in gene expression profiles, with amongst others, up- regulated heat shock protein expression as cellular stress reaction to elevated temperature. Exclusively in infected sticklebacks the immune activity, in particular of MHC class-II, was differentially regulated across temperatures with a down-regulation at the higher temperature of 24°C. Further it was observed that sticklebacks parasitized by *S. solidus* had a significantly lower expression of intracellular superoxide dismutase (SOD1 and SOD2) and higher extracellular expression of superoxide dismutase (SOD3) compared to naïve and exposed but not infected sticklebacks at both temperatures. This might result in a higher intracellular and lower extracellular concentration of toxic superoxide and suggests a possible parasite manipulation on its host's superoxide metabolism.
Over all the combination of the factors temperature and parasitation most likely elevates the selective pressure on the host, by which alterations of genotype frequencies in stickleback populations and consequently properties of aquatic ecosystems might be affected.

SS12

LIFE IN A SPECIAL SESSION – BACKGROUND, INTRODUCTION AND WELCOME

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Four LIFE+ projects, aiming at connecting scientific knowledge with applications to the resto-ration of running waters initiated a special session at SEFS. LIFE is an EU funding instrument that supports nature conservation and other environmental projects throughout the European Union.
The special session will include examples illustrating the challenge to achieve the highest possible benefit for nature and stakeholders, and to maintain or even improve, ecosystem services for humans. Achievements of projects will be highlighted especially in relation to monitoring programmes and assessments of the effectiveness of restoration, yet reports of case studies addressing other current topics are also presented.
Here we give an introduction of aims achieved, information regarding our chairmen and send a warm welcome to all participants.

R13

LIMITING FACTORS FOR THE DISTRIBUTION OF THE INVASIVE *ECHINOGAMMARUS BERILLONI* (AMPHIPODA) CATTA, 1878 IN A CENTRAL EUROPEAN CATCHMENT

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The amphipod *Echinogammarus berilloni* is a successful invader in Central European running waters. It originates from the Atlantic region of Spain and France. First records in the River Lippe catchment (central Germany, North Rhine-Westphalia) date from 1924. Sympatric occurrence of the invader with the natives *Gammarus pulex* and *G. roeselii* has been repeatedly documented.
Our study aimed at answering the following questions:
1. To which physicochemical properties or other habitat characteristics is the distribution of *E. berilloni* linked?
2. How great is the niche overlap evidencing possible competition among the gammarid species?
We concentrated our study to a tributary, the River Ahse, where *E. berilloni* has been observed since 1997 and compiled existing records from 1986-2009 of the gammarid fauna. Additionally, the most recent distribution was assessed by semi-quantitative substrate-specific sampling at 69 sampling sites. Besides sampling in near-natural and non-natural sites, we measured temperature, pH, oxygen concentration, chemical oxygen demand (COD), spec. conductivity, ammonium, nitrate, SRP, chloride, carbonate and total hardness.
The occurrence of *E. berilloni* shows a typical pattern. The species is present in the main river with high abundances and is absent in the (mostly temporary) tributaries of the lower catchment, which are partially colonized by native gammarids, though. Sites where *E. berilloni* was present are characterized by higher mean temperatures and daily amplitudes, pH, chloride, oxygen concentration, and higher conductivity. By contrast they showed lower phosphate concentration, COD, carbonate and total hardness. With regard to habitat quality, *E. berilloni* obviously preferred the settlement on or in between bryophytes, vascular plants, stones or boulders, as well as gravel. *G. pulex* by contrast concentrated on particular organic materials, whereas stones were settled in high abundances by *G. roeselii*. A presence of *G. pulex* and *G. roeselii* was often ascertained on large woody debris.
Although there were differences regarding the structural habitat preferences of the species, the niche overlap calculated on the basis of proportional abundances indicates interspecific competition. As *E. berilloni* shows high abundances especially at sites where structural degradation has been caused by past engineering measures, we conversely conclude that the native amphipods would benefit from habitat restoration activities in the future.

SS03

A EUROPEAN DATABASE ON CADDISFLIES (TRICHOPTERA)

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Freshwaters cover only a small amount of the world’s surface, but they harbour a large fraction of the global species richness. During the past years freshwater ecosystems have experienced alarming rates of biodiversity decline. While some freshwater organism groups as e.g. fishes, molluscs, odonats and crayfish, are already investigated and analysed by big organisations concerned with conservation like the IUCN, for most of the aquatic insects living in freshwaters almost nothing is known regarding their European-wide distribution or their threats.

With the help of the EU funded project BioFresh (www.freshwaterbiodiversity.eu) occurrence data (point-data) of European caddisflies (Trichoptera) were collected from about 45 experts and institutions. During this process about 550,000 records with about 390,000 records of adult Trichoptera related to ca. 1,400 species and subspecies from all over Europe were compiled.

Here we present an overview on the challenges of the data mobilisation process, the data compilation and harmonisation as well as the quality control. Further, we present the first analysis of these data regarding contemporary and future distribution patterns of caddisflies in Europe, including the identification of biodiversity hotspots and centres of endemism.

SS10

HOW DO DRAINAGES CONTRIBUTE TO ESTROGENIC ACTIVITY IN FRESHWATER SYSTEMS? A FIELD STUDY IN EASTERN SWITZERLAND

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Dairy cow manure applied to pastures is a potential source of estrogenic activity in drainage pipe water and the receiving water bodies. We hypothesize that washout of estrogenic activity should be highest during or right after heavy rainfall events, that occur shortly after manure spreading. In a 2 ½ month period in spring 2010, a pipe draining a small catchment in an intensively managed cattle pasture was closely monitored. During three rainfall events, water samples from two sampling locations were taken for 24 hours in consecutive sampling intervals. 17 ß-estradiol equivalents (EEQ) were determined with the Yeast Estrogen Screen (YES) and the ER-CALUX assay. Peak values of > 10 ng/l EEQ were found in several samples, indicating that the predicted washout takes place. Estrogenic compounds also seem to be much more stable in natural soils than laboratory studies suggest.

SS13

THE “HABITAT EVALUATION TOOL” – A NEW HABITAT MODEL TO ASSESS THE PRESENCE AND ABUNDANCE OF BENTHIC INVERTEBRATES IN RIVERS AND ITS APPLICATION IN TWO CONTRASTING RIVER REACHES

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Many benthic invertebrate species are associated with particular substrate types and and bottom substratum composition has been widely identified as one of the most significant variables for explaining their spatial distribution, besides the hydraulic conditions. In most habitat models, the weighted usable area (WUA) is calculated to describe the suitability of habitat conditions for a species. WUA can be used to assess the probability of occurrence, which increases with WUA, but it does not allow to model the abundance of a species.

In the IWRM-NET project IMPACT, a new Habitat Evaluation Tool (HET) was developed in order to quantitatively assess the effects of altered habitat conditions on invertebrate species presence and abundance. An integrated ‘Multi-Habitat-Sampling’ which is frequently applied to implement the water framework directive (2000/60/EG) is carried out to assess the changes in community composition and the associated ecological status for a river reach.

The HET was applied in a lowland sand-bed river in Northern Germany (Treene) and a lower-mountain gravel bed river in south western France (Célé). After the discharge and habitat conditions have been modeled for a baseline and climate change scenario, this study focused on the shifts in community composition based on the availability of mineral substratum types and their associated macroinvertetrate community. Since substrate diversity was low in the sand-bed Treene river (moving and stable sand and frequent patches of organic matter), hydraulic parameters like flow velocity were taken into account in addition to reflect changes in community composition more accurately. In contrast, the gravel-bed Célé river showed a greater variety of mineral grain sizes and enables to link alterations in substratum availability more effectively to benthic invertebrate composition. The results showed that the HET can be applied in the two study reaches to assess invertebrate presence and abundance but model accuracy strongly depends on the availability of appropriate data on habitat conditions.

SS09

THE PUZZLE OF SALINISATION: GEOGENIC AND ANTHROPOGENIC SALT INPUTS OF RIVERS OF THE SOUTH HARZ REGION (GERMANY)

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Several rivers of the South Harz region (Germany) are characterized by elevated salt concentrations. The following sources are a possibility: (i) inputs from geogenic pathways (ii) discharges from potassium heaps having been piled up during the former period of active mining (1893 to 1994). The issue of this contribution was which proportions of total salinization of the river Wipper (Thuringia, Germany) are to be assigned to geogenic and anthropogenic soures, respectively. Evaluation of the salt concentrations (Na^+, K^+, Mg^{++}, Ca^{++}, Cl^-, SO_4^{--}) from 1992 to 2010 showed that salinities decreased from 1992 to 2006 and increased slightly from then on. Mean geogenic percentages (2002-2010) of the salt ions ranged from 33 (Cl^-) to 99 % (Ca^{++}), the rest originating from heap effluents. Mean concentrations of K^+ (92 mg l^{-1}) and Mg^{++} (170 mg l^{-1}) were above the biologically critical thresholds as discussed currently (80 and 150 mg l^{-1}, resp.). Rainfall and discharge were identified to be prominent factors shaping the annual development of salinities. Compared to running waters which are influenced only by geogenic salt inputs river Wipper with its mixed load exhibits more adverse living conditions for aquatic organisms.

R11

STREAM WALK SURVEYS BY VOLUNTEERS IN RIVER BASIN MANAGEMENT: AN EXAMPLE FROM BRAZIL

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The Sinos River, located in Brazil`s southernmost state Rio Grande do Sul, is among the most polluted watercourses of the country. The river basin covers 2% of the states surface, but produces 20% of its GDP. Municipal sewage and industrial discharges, particularly from tanneries and metallurgical factories cause water quality class four, which is the worst of the Brazilian ranking system. Brazilian legislation does not consider this class appropriate for human consumption. Even so the Sinos River is the source of drinking water for 1.2 million people. In an attempt to quantify the extent of anthropogenic interventions we adapted the methods of "Stream-Walk-Surveys" to Brazilian conditions. The local water committee and UNISINOS trained more than 200 volunteers of 22 municipalities to categorize impacts on the stream network and attribute scores of severity. Eight impacts classes were recorded: Sewage discharge, structural modifications of the stream bed, loss of riparian vegetation, erosion, barriers for fish migration, garbage deposits, water diversion and exposed pipes. The volunteers screened an extension of 2,300 stream kilometers and produced 8,095 geo-referenced field protocols. Organic sewage discharges (n=2,104) and loss of riparian vegetation (n=1,539) were the most frequent impact categories. All impacts and severity scores produced an environmental quality index which was calculated for 5km-stream segments. The index displayed highest impact densities in urban areas. In a second step we compared the fish communities at 34 sampling sites with the occurring impacts. An Index of Biotic Integrity (IBI) based on the fish community and the environmental quality index showed a significant negative relation. Stepwise multiple regression revealed, that structural modifications of the stream bed explained 52% of IBI variance. At present the results of the Stream-Walk-Survey are the technical basis for the implementation of remediation projects in most municipalities of the Sinos River basin. The inclusion of the volunteers caused long lasting environmental education effects, because the participants got to know the environmental reality of their municipal stream network, which increased their motivation to engage themselves for local changes.

SS11

FISH AND THE CITY

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In the German Federal State of Northrhine-Westphalia a great number of streams and rivers run through heavily urbanized areas. These waters are usually not only characterized by channelization, but the riparian zone and the adjacent area consist mainly of build-up area which influences the discharge and increases input of supended solids. The aim of this study was to investigate what kind of fish fauna is found in these rivers and streams.
A gradient of "urbanization" has been created for the Northrhine-Westphalian stream network, using the proportion of settlement and traffic area in a two kilometer corridor along the streams. Based on this gradient, data from the Northrhine-Westphalian fishdatabase "FischInfo NRW" (fish inventories by electric fishing) were analyzed to find out, whether similar conditions and pressures in heavily urbanized streams lead to a similar composition of fish species - irrespective of the natural stream types. In a next step additional parameters like stream and catchment size, temperature and substrate compostion were included into the analysis. Furthermore, pressures - especially data about stream morphology and information about longitudinal connectivity - were added to find the main parameters influencing the fish fauna.
Findings vary from fish-free streams to mono species stocks (e.g. Three Spined Stickleback *Gasterosteus aculeatus*) and to more diverse fish inventories. Eurytopic fish species are most dominant, but also more demanding species, like Bullhead (*Cottus gobio*) are common in urbanized streams. Also species that are subject to stocking (Trout *Salmo trutta*, Pike *Esox lucius*) have been found.
Although analyses are still ongoing, first results show that connectivity may be a crucial factor for the fish composition in urbanized streams, together with donor populations within reaches that may act as source for colonization. Further analyses will address the question if there are (realistic) means to support a diverse fish fauna within large settlement areas and if there are limits for fish diversity.

SS13

STREAMBUGS: A MECHANISTIC MODEL FOR THE COMMUNITY COMPOSITION OF MACROINVERTEBRATES IN STREAMS

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Mechanistic models facilitate the synthesis of existing quantitative knowledge about ecological processes that are relevant for ecosystem management. They provide the possibility to integrate different sources of information and to propagate their uncertainty to model predictions.

We developed the mechanistic model Streambugs for the community composition of macroinvertebrates in streams. Macroinvertebrates are susceptible to different kinds of stressors like hydromorphological impairments, input of organic matter, pesticides from point and non-point sources, and temperature changes. The exposure to these stressors varies over space and time. Therefore, it is a challenge to assess the relative importance of stressors and propose effective mitigation options. For river management it is important to anticipate potential effects of different management actions on ecological endpoints. This is much more difficult than assessing potential effects on physico-chemical properties of the ecosystem.

To contribute to the solution of this problem, we combine knowledge from theoretical food web modeling, the metabolic theory of ecology, and ecological stoichiometry with the use of functional trait and ecotox databases in the model Streambugs. The model describes the coexistence of macroinvertebrate taxa in streams dependent on different environmental conditions. We can assess functional as well as structural aspects of river ecosystems and test our current understanding about the association of patterns and processes. The model is intended to be used for theoretical studies (e.g. the influence of environmental stochasticity on the coexistence of taxa, meta-community dynamics) as well as for applied issues regarding the prediction of ecological effects of river management actions based on existing monitoring data.

SS14

WHAT DO LAKES AFFORD? A PHILOSOPHICAL PERSPECTIVE ON THE CONCEPT OF ECOSYSTEM SERVICES

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Lakes can be looked at as interesting scientific objects to scrutinize limnological theories on the correlation between nutrition factors and the growth of algae or geochemical theories on the dynamics of acidification and the impact of organic material. But lakes are also considered as ressources for drinking water, as fish production sites, as touristic attractions, or as a means for transport of goods and persons. Lakes afford a couple of possible scientific, economic and cultural properties and this is precisely what is expressed when conceptualizing these properties as ecosystem services. In the last years, this discourse on ecosystem services has permeated almost every field in the ecosciences and ecotechnologies be it biological conservation or industrial ecology. Talking about ecosystem services implies a (mostly) beneficial relationship between the objects in question and human societies. Accordingly, the term ecosystem services is one of these ambiguous boundary concepts that involve both descriptive and normative aspects that are justified by social, political, economic or ethical values. Ecosystem services are not primarily a matter of fact but a matter of concern that needs to be explicitly addressed and deliberated. This will be discussed by presenting case studies.

R02

MICROEVOLUTION IN DAPHNIA: SEASONAL OR LOCAL ADAPTATION TO CYANOBACTERIAL PROTEASE INHIBITORS?

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Pronounced seasonal environmental variability in lakes leads to seasonal succession of different taxa of phytoplankton, namely blooming cyanobacteria in summer in nutrient rich lakes. Within the genus *Daphnia* phytoplankton succession results in a succession of different genotypes (clones). In nutrient rich lakes one reason for this observed succession of *Daphnia* clones might be the production of digestive protease inhibitors by cyanobacteria. Here, seasonal changes in the frequency and the abundance of *Daphnia magna* haplotypes were observed in a eutrophic lake, which developed a chymotrypsin-inhibitor-producing cyanobacterial bloom in May. However, no difference in tolerance to inhibition by the natural lake seston from May was found between the clones from before and after the bloom. Thus, the hypothesis that a seasonal adaptation of *D. magna* subpopulations to inhibitors might have occurred could not be proven. However, this lake is known to frequently develop cyanobacterial blooms in summer. This suggests that the *Daphnia* population is locally adapted to cyanobacterial protease inhibitors due to microevolution. To test this hypothesis we compared this putatively locally adapted population with *Daphnia* from an oligotrophic lake without cyanobacteria. For this we determined the tolerance of the two populations in growth experiments, as IC50 values of digestive chymotrypsins and in protease gene expression assays. In order to reveal the genetic basis of differences in tolerance, we sequenced the digestive protease genes from both populations and calculated $\pi N/\pi S$ ratios.

SS14

WATER-RELATED RESEARCH AND CAPACITY DEVELOPMENT IN THE MEKONG DELTA, VIETNAM

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The United Nations University (UNU) has a mandate to “promote exchange of scholars, scientific and technical ideas and information within the world academic community, particularly in developing countries” (UNU Charter, 1973). It’s Institute for Environment and Human Security (UNU-EHS) in Bonn is involved in various capacity development activities in developing and transition countries on water related issues. One of the most prominent water related projects is WISDOM (Water-related Information System for the sustainable Development of the Mekong Delta in Vietnam), funded by the German and Vietnamese governments.
UNU-EHS is involved in this project by i) conducting comparative vulnerability assessments to gain insights on the evolution and dynamic progress of vulnerabilities to water related hazards such as floods and salinity intrusion, ii) developing mitigation measures, and raise awareness of Vietnamese authority’s in the field of water pollution management (pesticides, antibiotics, nutrients, heavy metals, microbial contaminants) for drinking water resources, and iii) host the PhD programme of the project with 29 PhD students on board over a period of 6 years. The involvement of a large number or Vietnamese PhD students (14 out of 29) had the aim to enhance the sustainability of the project through the academic education of young researcher.
In addition, UNU-EHS organized, facilitated or hosted various meetings and workshops for stakeholder in Vietnam such as the Expert Meeting on Vulnerability, Climate Change Risk and Adaptation held in October 2010, two workshops on Water quality and Agriculture in the Mekong Delta held in 2009 and 2012 as well as two Scientific Seminars. Stakeholder addressed were mainly from different levels of governmental agencies (district, province) responsible for agriculture and rural development as well as for environment and natural resources.
Our experience in the region with working in a coupled research-capacity development mode has been very positive in terms of research outcome, outreach and sustainability of the efforts.

R09

NO-EXTREME CONCENTRATIONS OF MICROCYSTIN-LR AFFECT CHAROPHYTES INHABITING MEDITERRANEAN LITTORAL WETLANDS (L'ALBUFERA DE VALENCIA NATURAL PARK, SPAIN)

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It is known that elevated concentrations of microcystins (MC) are harmful to a wide range of organisms. However, our proposal is to study MC allelopathic effects on charophytes testing MC concentrations reached in the field as a result of development of toxic cyanobacteria, but no-extreme. In this study we analysed the MC-LR (the most common MC) effect on five charophyte species (*Chara hispida*-CH, *C. aspera*-CA, *C.baltica*-CB, *C. vulgaris*-CV and *Nitella hyaline*-Ni) collected from shallow water bodies located in L'Albufera de València Natural Park, Spain. The hypotheses about MC-effects were: i) charophytes are vulnerable to low MC-LR concentrations, ii) sensitivity is species-specific and iii) depends on the evolutionary relationship with cyanobacteria. For that we analysed changes in growth (length based) and metabolic functions (photosynthesis and respiration rates) of those charophytes cultivated in water with 1 (Treatment1), 8 (T8) and 16 µgMC-LR/L (T16, maximum concentration occasionally observed in these ecosystems). Concentrations of MC in water and charophyte tissues were analysed by ELISE method; chlorophyll *a* and nutrients concentration, pH, T and photosynthetically active radiation were measured by standard methods. Metabolic rates were determined by changes in water oxygen concentrations (Winkler method). CB, CV and Ni grew somewhat less in T8 and T16 than in T1, being this difference statistically significant only for CH. CA hardly grew even under T1. Photosynthesis rates were reduced to half in all charophytes species whose specimens had grown in cultures with MC for two weeks compared to those grown under absence of MC (control). CA respiration rate was higher in T1 and T16 than in control and Ni respiration rate was not affected by MC. The charophyte chlorophyll *a* concentrations after treatments were lower than in the control, with the exception of Ni. The results indicate that Ni seems less vulnerable to MC within the tested charophytes, and CA was the most affected within populations of genus *Chara.* To summarize, no extreme concentrations of MC-LR in wetlands might produce severe damage on macrophytes beds. The effect is species-specific and a phylogenetically based relationship may be discerned. At a community level, MC-LR effects can change the structure of macrophyte's assemblages. As a result of this, natural concentrations of MC-LR could be a part of the explanation for the existence of alternative steady-states in wetlands.

SS02

BIRD SCHISTOSOMES AND OTHER TREMATODES IN FRESHWATER SNAILS FROM THE RUHR AREA IN GERMANY: TROUBLEMAKERS AND ECOSYSTEM PLAYERS

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Digenean trematodes represent a species-rich, cosmopolitan group of parasitic flatworms that utilize molluscs as first intermediate hosts and a wide variety of invertebrates and vertebrates in their life cycle, which are mutually connected through various trophic relations, making them important and integral parts of aquatic ecosystems. However, some trematode species constitute important human pathogens. In Europe, bird schistosomes that parasitize snails and waterfowl, most notably *Trichobilharzia* spp., are the most important agents of swimmer's itch, an intensely itching skin infection caused by the parasites' free-swimming larval stages, the cercariae. Global warming and increasing eutrophication of water bodies are important factors for an increased occurrence of the parasites and a raised awareness of the disease, recently labelled as a re-emerging disease in Europe and North America.
The aim of this study was to assess the trematode communities in lymnaeid snails in reservoirs along the Ruhr River in Germany, with a special focus on the occurrence of bird schistosomes in this region. Snails were hand-collected at selected sampling sites in five reservoirs (Baldeneysee, Hengsteysee, Sorpe-, Verse- and Hennetalsperre) between May and September 2012. All snails were examined for patent and pre-patent trematode infections in the laboratory; trematode species were identified morphologically and, in cases of morphological homogeneity, based on molecular markers.
A total of 2,351 lymnaied snails were examined: 1,339 *Radix auricularia*, 310 *Radix peregra*, 574 *Stagnicola palustris* and 128 *Lymnaea stagnalis*. In these four snail species, 19 trematode species were identified to species level and a further 7 were identified to genus level. Overall prevalence in these hosts ranged from 4,2 % to 26,6 %. Infections of *T. franki* in *R. auricularia* were found in three reservoirs with an overall prevalence of 0,9 % (12 snails out of 1,339).
However, despite the generally low prevalence of bird schistosomes, there still is a considerable risk of acquiring swimmer's itch, amongst others, due to the high number of cercariae that can be emitted from an infected snail. Yet, one should be aware that agents of swimmer's itch only present a fraction of the digenean fauna in the studied ecosystem. More than mere troublemakers, trematodes are important and integral parts of ecosystems.

R03

NETWORK AND HABITAT CONNECTIVITY DRIVE PATTERNS OF SPECIES DIVERSITY OF INVERTEBRATE COMMUNITIES : A METACOMMUNITY-PHYLOGENETIC APPROACH

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Understanding how environment and spatial structure of landscapes affects population dynamics and diversity is of high current interest in ecology. Until recently, studies on biodiversity and dispersal have minimally considered the specific spatial structure of landscapes, or were done using simplified linear or lattice networks. However, the spatial structures of many natural systems are complex. This is especially true for river ecosystems, which are bifurcating in a hierarchical way, creating well-defined dendritic networks. Relative to their area, freshwater rivers are among the most diverse habitats on earth. However, diversity and species composition in many river systems is rapidly declining, often due to species invasions and habitat changes. Therefore, understanding diversity patterns at several fundamental levels (genetic, functional, spatial and environmental diversity) and how river-network structure affects community composition is a high priority. Metacommunity phylogenetic is a new field, combining metacommunity ecology and community phylogenetic, which assesses the relationship between trait and phylogenetic relatedness, spatial structure and environmental heterogeneity to assess the importance of regional and local process on species diversity patterns. A recently initiated large-scale (>40,000 km^2), randomized monitoring program in Central Europe, has been collecting data on diversity of all macroinvertebrates across several river systems. Using a metacommunity phylogenetic approach, we found network structure and environmental heterogeneity had strong and consistent effects on diversity patterns, both on the species and genetic level. Dispersal-limitation along the river network resulted in a distance-dependent decay in community similarity, which didn't match the decay when using Euclidian distance as a Null model. We analysed how phylogenetic similarity resembled trait similarity, suggesting both to be important causal modelling factors for explaining species diversity patterns with regards to spatial and environmental heterogeneity. Our findings confirm the key role of dispersal directionality in dendritic metacommunities and help to direct conservation actions in alpine river systems.

R06

EXPERIMENTAL MODELS OF MICROCYSTIN ACCUMULATION IN *DAPHNIA MAGNA* GRAZING ON *PLANKTOTHRIX RUBESCENS:* POTENTIAL FOR MICROCYSTIN TRANSFER THROUGH THE FOOD WEB

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The occurrence of toxic cyanobacteria blooms have been recognized as a world-wide phenomenon due to the eutrophication of the aquatic environment. Several cyanobacteria species have the ability to produce a wide variety of potent toxins (cyanotoxins): hepatotoxins (microcystins, nodularins), neurotoxins (saxitoxins, anatoxins, and BMAA), and specific protein synthesis inhibitors (cylindrospermopsins). Cyanotoxins have the potential to accumulate in aquatic organisms at different trophic levels. In Lake Garda, the filamentous cyanoabacterium *Planktothrix rubescens* is present. This species is potentially toxic because it is endowed with production of cyanotoxins, in particular of microcystins (MCs). In order to elucidate the potential transfer of MCs produced by *P. rubescens* through the food web, a set of laboratory experiments was carried out using *Daphnia magna* as model of the zooplankton population. *Daphnia magna* was chosen because large cladocerans have a key role in aquatic food chains feeding on primary producers. A set of experiments was conducted aiming at i) demonstrating the effective grazing of *D. magna* over *P. rubescens*, and ii) modelling the accumulation of MCs in *Daphnia*. We set up a series of *P. rubescens* cultures with different densities; *Daphnia* was added only in half of the cultures. We measured at fixed times the *P.rubescens* density, the microcystin concentrations in the water and in the Daphnids This way we could clearly detect the effect of the grazer on the *P. rubescens* populations and follow the accumulation of MCs in the Daphnids. In the experiments with the grazer, the density of *P. rubescens* decreased faster*,* confirming that *D.* magna is very active in grazing *P. rubescens*. As a consequence of the grazing, cyanobacteria filaments were accumulated and ingested by *D. magna*, with a significant increase of MCs inside the grazers. Models of toxin accumulation showed that, at low doses of MCs, the toxin accumulation was linear, while, at high doses, the toxin accumulation was exponential. Implications for the aquatic food webs and resource management in lakes of different trophic status will be discussed during the presentation.

R08

STRUCTURE OF PLANKTON AND BENTHIC COMMUNITIES IN LARGE LAKE ONEGA (NORTHERN RUSSIA) UNDER CLIMATIC CHANGES

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The spatial and temporal heterogeneity of distribution, structure and functioning of lake plankton and benthos are formed depending on a number of global factors primarily such as climate change and anthropogenic impact. Aim of this study to analyze main tendency of changes in structure of biotic communities in Lake Onega, the second largest lake of Europe, associated with climatic changes during last 40 years. Climatic changes recorded during this period include an decrease in period of ice cover in Lake Onega and increases in air temperature over water surface and duration of solar light during joint supervision. The duration of the ice-free period on Lake Onega has increased from an average of 215 days/year late in the 19th century to an average of 227 days/year early in the 21st century. The important factor behind the extension of the ice-free period has been air temperature which increases in March significantly, resulting in 8-10 days earlier ice-breaking. The long-term investigations of species composition, seasonal and annual fluctuations in abundance and biomass of phytoplankton communities in Lake Onega, showed the general tendency as an increase in their average quantity in spite of high seasonal and spatial variability of local communities. Biomass of phytoplankton varied also seasonally from 0.1 up to 5 g/m^3 with the maximum in the early summer. Changes in profundal benthic communities were not found over observed period; they were recorded as monotony invertebrate complex with low species richness consisting mainly of Oligochaetes and relict crustaceans. Average macrozoobenthic abundance in the lake nowadays in general reached 4.5±0.8 thousand ind./m^2 and 6.7±1.1 g/m^2. Native oligochaetes contribute almost 50% to the total abundance and biomass and relict crustaceans 17% and 42%, respectively. The main changes were recorded in macrozoobenthos of coastal areas, where invasive amphipod species *Gmelinoides fasciatus* has been established successfully above ten years ago. It resulted in an increase in the total benthic biomass and in important shifts in community structure. Significant correlations found between climatic variables (index NAO, air temperature, durations of ice-cover and solar light) and studied biological components testify on notable influence of climatic fluctuations on Lake Onega ecosystem.

R03

SACRIFICING THE "BOOM" AND PROLONGING THE "BUST": WATER RESOURCE DEVELOPMENT AND HYDROLOGICAL VARIABILITY IN AUSTRALIA'S INLAND RIVERS

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Australia is home to large and iconic dryland rivers, such as those of the Murray-Darling and Lake Eyre river basins. Dryland rivers are renowned for their episodic floods that extend over vast floodplains but much of the time they exist as a network of ephemeral channels and turbid waterholes. The larger waterholes represent the only permanent aquatic habitat for much of the aquatic biota during extended periods of low or no flow. While these waterholes represent potentially important refugia for aquatic organisms during dry times, the long-term 'survival' of waterholes is dependent on the episodic flood events. These floods may cover thousands of square kilometres and last for weeks to months, they fuel incredible production on the floodplain which transfers back into the waterholes as the floods recede. While many of the rivers in the Lake Eyre Basin remain unregulated, across Australia many other dryland rivers have been controlled through dams and weirs, allowing a more predictable supply of water for irrigated agriculture. In these regulated rivers the waterholes that once characterised the dry times have been consumed by extensive weir pools, and the iconic episodic floods have been harvested to fuel agricultural production. Consequently, in these regulated rivers production is now low with estimates of less than 10% the original (pre-European) fish biomass. This paper outlines the important roles played by waterholes as aquatic refugia in arid landscapes and explores the changes river regulation has had on the ecology of dryland rivers, both at the scale of the waterhole, but also at the scale of the river basin.

R03

SEASONAL METHANE OXIDATION AS A CHEMOSYNTHETIC CARBON SOURCE IN RIVERS

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The role of inland waters in carbon cycling is poorly quantified. Most rivers are supersaturated with methane and carbon dioxide relative to the atmosphere and we have measured methane oxidation in the riverbeds of over 20 rivers. We measured the methane concentration and potential for methane oxidation in the top 15cm of a riverbed over an annual cycle, in order to estimate the amount of organic carbon fixed by methane oxidation relative to that fixed via photosynthesis. We quantified the photosynthetic potential of the gravel bed epilithon and modelled the riverbed light regime.

We found high potential for methane oxidation in the subsurface gravels where darkness completely prevents photosynthetic production. The methane concentration (100nM) and potential for methane oxidation peaked in mid-summer when the shading was greatest. Beneath the uppermost layer of sediment methane oxidation is responsible for all new carbon fixation. Considering the high photosynthetic production at the surface, 8% of organic carbon across the riverbed is fixed by methane oxidation. Our results indicate that a significant portion of river food webs could be supported by chemosynthetic carbon.

R01

CATASTROPHIC SHIFT REGIME OF PHYTOPLANKTON TO *PSEUDANABAENA LIMNOTHRIX PLANKTOTHRIX* DOMINATED STATE IN THE SHALLOW EUTROPHIC LAKE NERO (RUSSIA)

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Long-term phytoplankton succession (1902, 1920s, 1963, 1985-1991, 1999-2008) in the shallow eutrophic Lake Nero (Russia) with special focus on the process of mass appearance in the plankton of filamentous non-heterocytous cyanobacteria *Limnothrix redekei*, *Pseudanabaena limnetica* and *Planktothrix agardhii* have been studied. Dramatic proliferation of these species occurred abruptly at least twice – in 1987 and 2003. It followed closely the raise of water level caused by the dam. These field observations corroborate well with a simple graphical model of a catastrophic transition of algal communities to the dominance of *Oscillatoriales* as proposed by Scheffer *et al*. (1997). The functional groups theory was used for the analysis of the phytoplankton succession in Lake Nero and other shallow eutrophic lakes. The most common feature of phytoplankton succession in such lakes is a competitive displacement of microalgae of the associations **J**, $\mathbf{Í_1}$, $\mathbf{Í_2}$, **Ì** by the $\mathbf{S_1}$-type species according to the Reynolds *et al*. (2002) functional classification. Using RFLP-analysis we discovered the presence of toxigenic (microcystin-producing) *Planktothrix agardhii* populations among S1 type cyanobacteria in Lake Nero. The nitrogen, light, hydrological and climatic hypotheses on the mechanisms of the transition of lake ecosystems to the S_1-cyanobacteria dominated state are discussed. Increasing water level in the shallow Lake Nero has led to the reducing of the water turnover rate. This could have a direct impact on the increasing biomass of the S_1 type cyanobacteria by decreasing of the washout losses of cells from the lake. The increase of nitrogen concentration and water turbidity on the next year after abrupt development of S_1 type could have stabilized the domination of these species thus making the shift permanent.
This study was supported by the President Grant of the Russian Federation, project MK-1284.2013.5.

R08

INFLUENCE OF THE FILAMENTOUS CYANOBACTERIA AND WATER TEMPERATURE ON BODY-SIZE DEPENDENT COMPETITIVE ABILITY AMONG *DAPHNIA* SPECIES

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Large-sized cladoceran species are competitive superior, because they are more efficient filter feeders than small species. However, when filamentous cyanobacteria are present in the food suspension, the small-bodied species may prevail, since they are less susceptible to the interference of the filaments with food-collection mechanisms. Susceptibility to the interference should rise with increasing temperature, decreasing viscosity of water and consequent increase in flow through the filter screens. To test the prediction that the presence of filamentous cyanobacteria lessen the relationship between body size and competitive ability and competitive advantage in Cladocera, especially at elevated temperature, I conducted a factorial competition experiment involving large-bodied *Daphnia pulicaria* and small-bodied *D. longispina* mutually exposed in 50-liter tanks, with either green algae *Scenedesmus obliquus* or cyanobacteria *Cylindrospermopsis raciborskii* as food and with at thermal regimes – 18 and 25°C. Contrary to the expectation, *D. pulicaria* outcompeted *D. longispina* despite the presence of *C. raciborskii*, even at the elevated temperature. Additionally, analysis of filtration and respiration rate in both food treatments has been done. The results of this research are discussed in the context of the impact of the climate change on zooplankton communities in temperate lakes.

R09

EVALUATION OF LIMNOLOGICAL CHARACTERISTICS OF LAGOON TYPE BIRDLAKE ENGURE, LATVIA

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Lake Engure Ramsar site is situated in the western part of Latvia. It is the reminant of Litorina sea, divided from the nowday Baltic sea by a 1.5 - 2.5 km wide sand bar with pine forests. Its outflow is the artificial Mersrags channel, dug in 1842. The whole lake and its vicinity have been included in the Lake Engure Nature Park since 1998. During Soviet period lake was hardly affected by inflow of biogenic substances from agriculture and household. In past ten years a lot of restouration work has been done. The aim of research is to determine year cycle of limnological caracteristics of the lake ecosystem. Investigations of phytoplancton and zoobenthos comunities were performed in ten sampling sites. Development of phytoplankton succesion is caracteristic for macrophyte type clear water lakes situated in boreal zone. Two small peaks of phytoplankon development were observed in spring and in late summer. Spring maxima was formed by Diatoms, Chrysophytes, and Cryptophytes. Summer maxima was dominated by Cyanobacteria, Diatoms ,Chlorophytes and Dinophytes. It is significant that both maximas are characterised by low phytoplankton biomasses. It is characteristic for waterbodies with good ecological status. Zoobenthos communities mainly are formed by Crustaceans, Chironomidae, Mollusca and Oligochaeta. Highest biomasses and number of individuals were observed in late summer period. Zoobenhos community is dominated by *Asellus aquaticus*, *Caenis* sp. juv., *Cloeon dipterum*, *Oligochaeta*, *Chironomidae*, *Valvata piscinalis*, *Valvata cristata*, *Valvata naticina*, *Bithynia tentaculata*, *Viviparus contectus*, *Physa fontinalis*, *Planorbis planorbis*, *Gyraulus albus*, *Galba palustris*, *Acroloxus lacustris*, *Pisidium amnicum*, *Sphaerium corneum*, *Glossiphonia complanata*, *Piscicola geometra*, *Coenagrion vernale*, *Ischnura elegans*, *Lestes virens*, *Helipus* sp., *Mystacides azurea*, *Cyrnus flavidus*, *Athripsodes aterrimus*, *Notonecta glauca*, *Sigara* sp.juv., *Acari* sp. and other species in small numbers. It is possible to evaluate available food resources for birds and fish as rich and diverse in all invesigated seasons. Dominated groupes of zoobenthos such as Chironomidae, Malacostraca and Ephemeroptera are evaluated as most valuable part in bird and fish ration food. All the year presence of Ephemeroptera shows good oxygen conditions and good water quality. Phytoplankton succession, low biomasses allow to evaluate lake ecological statuss as good.

SS04

CONSEQUENCES OF ALPINE GLACIER RETREAT ON THE BIOGEOCHEMISTRY AND MICROBIAL BIODIVERSITY OF GLACIER STREAMS

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In high-alpine landscapes glaciers not only constitute the source of water for the downstream fluvial ecosystem, but are themselves ecologically active; they receive, store and transform organic carbon, and harbour a diverse microbial community. Organic carbon released with melt water is an important energy source for glacier-fed streams, whose ecohydrology is under strong control of the melting dynamics of glaciers.
Using ultrahigh-resolution mass spectrometry in concert with radiocarbon dating, fluorometry and bioavailability assays we describe the high biogeochemical diversity – in terms of origin as well as composition – of ice-locked dissolved organic carbon (DOC) in 26 Austrian glaciers. Besides phenolic compounds of vascular plant and soil origin, we found predominantly microbially derived peptides and lipids, but only little combustion products dominating glacier DOC elsewhere. This DOC was highly bioavailable and may readily support downstream microbial metabolism upon its release. The responsible microbial communities in the glacier-fed streams, however, do not remain unaffected by the ongoing glacier retreat and changing hydrology. Applying 454-pyrosequencing of the 16S rRNA, we describe microbial biodiversity and community composition in ice and glacier streams. Microorganisms from ice had the lowest diversity and contributed little to downstream community composition. Instead, streamwater collected microorganisms from various glacier and non-glacier sources, and the composition of stream biofilms is shaped by species sorting by local environmental conditions. Microbial biodiversity in the glacier-fed streams decreased with elevation, possibly reflecting less diverse sources of microorganisms upstream in the catchment. In contrast, compositional divergence of microbial communities (i.e., beta diversity) decreased with stream temperature, suggesting glacier retreat to cause homogenisation of microbial communities among glacier-fed streams.
Our findings highlight the relevance of mountain glaciers for carbon cycling in glacier-fed streams. The underlying ecosystem functions are driven by microbial communities, whose composition and diversity are controlled by glacier dynamics. Glacier retreat due to climate change will have profound influences not only on the hydrology, but also on the downstream biogeochemistry and microbial biodiversity.

SS06

TEMPORARY STREAMS IN MEDITERRANEAN EUROPE: ASSESSING RESEARCH, MANAGEMENT AND CONSERVATION NEEDS

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We will review policy-relevant research, management, and conservation issues regarding temporary lotic systems in Mediterranean climate regions of six European member states (Spain, Portugal, France, Italy, Greece and Cyprus). Temporary streams are broadly defined as systems that flow only when they receive water from springs and surface runoff, while during dry periods they may cease to flow entirely or are reduced to stream pools. Seasonal desiccation in lotic systems can be attributed to natural climate variability, to anthropogenic pressures, or, more commonly, to a combination of both. Although temporary rivers and streams are the dominant freshwater ecosystem type in the European Mediterranean, very limited research has been done to record, classify, manage and restore them where necessary. During the last decades, increased water demands, especially for irrigation, and mismanagement have created water stress conditions and significant pressures on the natural integrity of these sensitive ecosystems. Natural flow regimes have been widely impacted and temporary streams, especially small ones, have suffered drastic changes.The alteration of flow regimes widely threaten the ecological integrity of natural river ecosystems, whereas the transformation of perennial water courses to “artificially intermittent” ones, or the reverse due to municipal wastewater inputs during drought conditions, induce relevant transformations in the structure and functioning of river ecosystems both at a reach and at a basin scale. In view of increasing water demands and potential climate change effects, temporary running waters are increasingly attracting research and conservation interest. However, baseline data on the inventory of these streams is relatively limited. Furthermore, policy-relevant research initiatives are severely lacking especially since the EU Water Framework Directive does not specifically address intermittent rivers and its particular problems and needs. Through an inter-country review we identify main knowledge gaps and policy-relevant research needs, and promote research that is required to support and safeguard these valuable and threatened ecosystems.

R12

ASSESSING THE CONTRIBUTION OF IN-SITU FLUOROMETRY TO UNDERSTANDING HEADWATER PERIPHYTON STRUCTURE AND FUNCTION.

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Freshwater ecosystems of headwaters streams are dominated by benthic biofilms comprised largely of diatoms. These universally distributed one-celled algae found at the base of aquatic food webs play a critical role in river ecosystems, particularly through the fixing, cycling and retention of nutrients. Diatoms are excellent organisms for biological monitoring due to their short life cycle which allows rapid response to physical-chemical pressures. Current biological assessments, including those conducted under the European Water Framework Directive rely heavily on the relative abundance of diatoms, neglecting productivity which needs to be considered as part of ecological status assessment.

Assessing the development, abundance and productivity of headwater benthic communities, and evaluating their spatial-temporal habitat variability is important. This study is based in the highly – instrumented River Eden catchment, Cumbria, UK, one of three research platforms established under the Demonstration Test Catchment project. In this paper we assess the potential of a novel technique, the BenthoTorch, for characterising the productivity of benthic biofilms, based on red-light fluorescence emitted from algae following illumination at different excitation wavelengths. This handheld fluorometer allows for an immediate and cost-effective in-field assessment of the quantity and composition of three different algal groups. The effectiveness and sensitivity of this method is compared against more traditional measures of chlorophyll *a* and the relationship between fluorometric estimates of chlorophyll *a* and assemblage composition and physical-chemical drivers are investigated.

We present preliminary data critiquing methods of assessment and exploring the structural and functional attributes of benthic diatom communities, including community composition and benthic chlorophyll *a*. Our results suggest headwaters demonstrate a seasonally-dependent productivity-diversity relationship, which may depend on physical habitat conditions. This would be consistent with the intermediate disturbance hypothesis as in these spatially and temporally dynamic headwater streams near-bed scouring can re-set benthic communities. Understanding the relation of fine scale spatial-temporal distribution of diatom composition and productivity to environmental factors is critical to design appropriate diatom-based biological assessment strategies for headwater and wider catchment monitoring.

SS11

URBAN WATER BODIES – AN OVERVIEW

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In urban areas surface waters and the water cycle are often severely modified by human activities, influencing the abiotic and biotic conditions of the aquatic ecosystems. On the other hand, surface waters provide an important economic and social benefit for the citizens. Moreover, they may contribute to biodiversity and nature experience as well as to climate protection.
The presentation will give an overview on waters in urban areas using examples from mega-cities down to small villages. The examples will show typical urban modifications in river bed morphology, as well as modifications in hydrology, flood dynamics, scarceness, and water quality, mainly caused by pavement of the urban area and discharges from combined and separate sewer systems and WWTP.
Best practice strategies are able to reduce these multi stressor impacts. What can be achieved (e.g. for biota, citizens, the infrastructural development of the cities)? And what will be the situation of urban water bodies in future? Where do we go? What will be the main targets, the main challenges? And which important questions still need further discussion?

SS13

LANDSCAPE FILTERS INFLUENCE THE DISPERSAL OF AQUATIC MACROINVERTEBRATES: IMPLICATIONS FOR RIVER RESTORATION MANAGEMENT.

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To achieve rivers with a “good ecological status” (EU-WFD), river restorations are planned to enhance the ecological conditions at a site or stretch. However, especially in degraded catchments the sources of sensitive species for the recolonisation of restorations are limited. The likelihood of recolonization depends on the distance between remnant source populations and the restored river section, but also on the species-specific dispersal capability of larval (aquatic) and imaginal (terrestrial) life stages. Using a GIS-based method, the known locations of selected aquatic macroinvertebrates were merged with potential landscape filters (e.g. dispersal barriers) and species-specific dispersal capabilities. This method allowed to quantify the likelihood with which a restored section is accessable by individuals of the nearest source populations. The method will be exemplary shown for three aquatic insects: *Calopteryx virgo* (Odonata); *Hydropsyche dinarica* (Trichoptera); *Dinocras cephalotes* (Plecoptera) and allows to estimate the ecological success of – but also limitation for river restorations.

R09

MACROPHYTES: LIMITATIONS OF USING THEM TO ASSESS RESERVOIR STATUS ACCORDING TO THE WATER FRAMEWORK DIRECTIVE

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Macrophytes are among the major groups of organisms that the Water Framework Directive (WFD) recommends should be used in assessing the status of reservoirs. The use of macrophytes in reservoir monitoring is still fairly limited and studies are needed on their inter-calibration and sources of variation. Many status assessment methods based on macrophyte communities have been defined for lakes, Nevertheless few of them have been tested for reservoirs. The purpose of the study is to highlight the limitations of using macrophytes to assess reservoir status according to the Water Framework Directive. An assessment of macrophyte composition and abundance and of water quality was carried out in seven Walloon reservoirs between 2010 and 2012. The main limitations of the macrophyte approach for assessing these reservoirs were: i) geographical features, ii) physical variables, iii) water chemistry and iiii) lack of ecological information on the various macrophytic groups, such as helophytes, algae and mosses. Few of the taxa occurring in the Walloon reservoirs have an indicator score for status assessment based on macrophyte communities. We used two assessment methods to test the relevance of using macrophyte communities to assess reservoir status: the Flanders (Belgium) method (BE-FL method**)** and the United Kingdom method (UK-method). The relationships between macrophyte metrics for both methods and nutrient enrichment were examined. Highly significant correlations were found between the chemical variables (O-P [mg P/l]); P tot (µg P/l); total hardness (°F), conductivity (µS/cm) and the trophic UK-metric (LMNI); and between it and the abundance of 'Bl-FL disturbance indicators' metric (V). The 'UK group of macrophyte species' metric does not provide direct information on the quality or degree of degradation of the environment from which the sample was taken.

Key words: Aquatic vegetation, reservoirs, ecological indices, ecological potential, WFD.

R08

DAPHNIA POPULATIONS IN (ULTRA) OLIGOTROPHIC LAKES?

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In several peri-alpine lakes in Switzerland fishermen organisations complain about declining catches. As major reason they identify the reoligotrophication of these lakes. As possible solution they propose to stop (partially) the cleaning of waste water.
The successful reoligotrophication of peri alpine lakes has led to situations where phosphorus concentrations in lakes declined to values below 2 or 3 microgram per litre. This has led to decreased primary production, less zooplankton which is the primary food source of whitefish in these lakes.
In lake Brienz, Switzerland, *Daphnia* disappeared during several years and also in other lakes there are indications that the *Daphnia* population decreases. In this presentation I present data about the historic *Daphnia* densities in lake Brienz as well as life history data about the two main *Daphnia* species in large Swiss lakes. With this data I try to answer the question: “is there a threshold for phosphorus in a lake for the support of a *Daphnia* population?”

R14

METABOLOMICS AS A TOOL IN ECOTOXICOLOGY: SIZE-DEPENDENT EFFECTS OF CADMIUM AND ZINC ON THE ASIAN CLAM (*CORBICULA FLUMINEA*)

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Metabolomics as the study of all naturally occurring small molecules within an organism is rapidly gaining acceptance in ecotoxicological research. The simultaneous measurement of hundreds of metabolites such as sugars, nucleotides, amino acids and many more can provide a detailed picture about an organism's health status and how it changes in response to a stressor such as a chemical.
The Asian clam, *Corbicula fluminea*, is a freshwater bivalve species that is widely used in biomonitoring programs for environmental chemical pollution. We exposed *C. fluminea* specimens of two different size classes to environmentally relevant levels of the metals cadmium, zinc, and both elements via the sediment. No effects of the zinc-spiked sediment were seen for clams in both size classes, whereas cadmium only affected the smaller clams. The mixture of both zinc and cadmium in the sediment led to metabolic changes in both size classes of clams, however in opposite directions. Even without the metal stress, small and large clams were clearly differentiated by their metabolic composition. When subjected to both zinc and cadmium, small *Corbicula* reacted with a decrease in amino acids, potentially to use them as an energy resource. On the other hand the large clams were able to draw on their reserves of carbohydrates for increased energy requirements. These results show that metabolomics is a very sensitive tool to discover toxic effects even at low levels of pollution. However, the results also imply that it is important to consider potentially confounding factors such as age, size or sex within the design of biological tests that are to be used for metabolome analysis. It might also be beneficial to specifically test for example differently sized individuals to have a better representation of the natural environment.

R03

ASSESSING IMPLICATIONS OF LAND COVER AND LAND USE CHANGES ON THE ECOLOGY OF TWO LAKES IN NW GREECE IN RELATION TO LONG TERM WATER LEVEL FLUCTUATION.

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Land use and land cover changes are widely recognized as a significant factor of water bodies degradation. Specifically in Greece, the freshwater ecosystems have been heavily affected by the increasing agricultural and urban land use within their watersheds during the last six decades. In this study we investigated how the changes of the land cover/use and the landscape of two lakes in NW Greece (Vegoritis and Petron) have affected the hydrological regime and ecological functions during the last forty years. Four series of LANDSAT images (1972, 1984, 2002, 2011) were assembled for classification of land cover/use in a buffer zone defined by the Natura 2000 boundaries. Land cover/use and landscape changes were evaluated using ArcGIS 9.3 and Fragstat 3.3 respectively. Patches of land cover were used to calculate landscape indices and thus to quantify the landscape changes. Long term data series of water level, conductivity and chloride concentration were obtained in order to investigate for relationships between the hydrological disturbance and the trophic status in the context of the landscape alterations. Additionally, we assessed historical data on fisheries and aquatic vegetation for two time periods with different water level in order to highlight any significant changes in the biological communities.

The results revealed several changes in both water chemistry and aquatic communities that may linked to the long term water level decline. A strong correlation between water level, conductivity and chloride concentration was identified that suggests some kind of effect of the water loss on the water chemistry. A decline on aquatic macrophyte composition was also noted while during the last few decades the fisheries seem to have shifted towards a zoobenthivorous composition. The land cover changes include those of a spectacular replacement of lake surface area mostly by cultivations that are likely to have contributed further to the eutrophication and water level reduction processes. Between 1972 and 2011 almost 30% of the lake Vegoritis and 23% of lake Petron have been replaced by agricultures and reed beds respectively. At the landscape level an increase of land cover classes fragmentation was recorded from 1972 to 2006. The landscape indices revealed a significant increase in the number of patches indicating degradation and further habitat fragmentation within the proximal buffer zone of the studied lakes.

SS07

GROUNDWATER-SURFACE WATER-INTERACTIONS SHAPE STYGOFAUNA ON DIFFERENT SPATIAL SCALES - FINDINGS FROM A KARSTIC AREA IN SOUTHERN GERMANY

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In a recent investigation on a karstic aquifer in the Swabian Alb (along a stretch of 20 km) faunal abundance and diversity largely decreased with distance from the mountaineous recharge area. In parallel, a decrease in nutrient concentrations was observed as well. This was probably due to the respective resources having decreased with time and distance from the recharge area. This pattern was interrupted at spots, where a local influence of surface or soil water on the groundwater was supposed. Where surfaces water intrusion was low or moderate, faunal abundance and diversity increased. At those sites, where a moderate surface water intrusion was supposed, abundances and species richness increased, while fauna was nearly absent from soil water influenced groundwaters.
The soil water influenced sites were characterized by higher DOC-concentrations r and hypoxic conditions, resulting to ochreous precipitations. Ochre clogs pores, and very often results to depleted faunal communities with faunal community diversity being lowest at these local inputs of high organic loads in combination with low redox potentials.
As general results, faunal abundance and taxonomic richness decreased with distance from the recharge area, but was also influenced by local, vertical surface or soil water intrusion.

R12

APPLICATIONS OF REMOTE SENSING FOR FRESHWATER – AN OVERVIEW

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The increasing interest in the use of remote sensing applications for water monitoring activities is driven by national and European policies such as the Water Framework Directory (WFD), by intergovernmental organisations like HELCOM and OSPAR or by research. Common to all of them is the proposition to use remote sensing data, especially ocean colour, as a valuable supplementary source of information for water quality parameters such as chlorophyll a, coloured dissolved organic matter, total suspended matter and transparency. These can be derived in a high spatial and temporal resolution and thus providing supplementary information to ground truth data. Additionally, remote sensing is relevant in research activities on water ecology and is a useful tool for supporting monitoring activities in the field.
An introduction into the technique will provide an overview on the principle of water remote sensing including the processing steps that are needed in order to retrieve information on water constituents from raw satellite data. The potential and limits of remote sensing application for coast and inland water will be shown. Advantages are the spatial coverage of information which enables the detection of structures as well as a high temporal coverage, enabling the extraction of time series over seasons or several years, depending on questions to be answered. Limits are given by cloud coverage and algorithmic challenges of complex coastal and inland waters, atmospheric influences, near shoreline influences or influence of bottom reflection. Techniques for validation have been developed and are as important as challenging due to a dynamic environment, match of measurement techniques and uncertainties in both, in situ and remote sensing data. Remote sensing data are available from different sensors which have a large range of characteristics in terms of different spatial resolution, temporal coverage or spectral suitability of water applications. This enables dedicated investigations for specific questions as well as operational monitoring over larger areas and longer periods.
Finally, examples will illustrate value added water quality products and services. Water Quality Services are developed among others within the GMES Projects MarCoast (GSE), Aquamar and FRESHMON (EU FP-7). FRESHMON focusses on the water quality of inland waters and is co-funded by the EU and coordinated by EOMAP with the partners Water Insight, SYKE, Brockmann Consult and EAWAG.

SS11

THE RESTORATION OF THE EMSCHER - EUROPE'S LARGEST PROJECT FOR THE ECOLOGICAL IMPROVEMENT OF A WHOLE RIVER SYSTEM

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The restoration of the Emscher system in the densely populated area of the Ruhrgebiet is probably the largest European project on ecological improvement of surface waters, at least in terms of time and investment. A system of open waste water channels with a total length of more than 400 kilometers will be restored in order to develop a near-natural lowland river system again. The project with a total investment of 4,5 billion Euros (4,5 Mrd. Euro) includes the construction of four large waste-water treatment plants, a modern subterranean combined and separate sewer system, and 340 kilometers of new rivers and streams with an adjacent floodplain wherever possible. It is more than a river renaturation project: The Emscher restoration provides the base for a structural change of the whole conurbation Ruhrgebiet, including new spaces of leisure and recreation, an improvement of the value of the real estate and also the quality of life in general. The so-called generation project “Emscher-Umbau” will be finished in 2020 after 30 years of investment and construction.
The presentation will give a short overview about the whole project and present selected results of the limnological monitoring of already restored rivers in the Emscher catchment.

PS2

ECOLOGICAL STOICHIOMETRY: SPATIAL ASPECTS AT SMALL AND LARGE SCALE

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Ecological stoichiometry (ES) is concerned with the balance of multiple chemical elements in ecological interactions. It has grown into a robust field of research with strong theoretical underpinnings. Many of what one may call the core principles of ES (e.g. element limitation of growth, the Growth Rate Hypothesis, balancing of N and P at the ecosystem scale) were developed in aquatic systems but have been extended and modified to fit other environments. ES has been used to address a wide variety of research questions across many levels of organization in biology from the gene to the globe. To date, however, most of these core principles are essentially zero-dimensional theories in that spatial variance has not been explicit. As is true elsewhere in ecology, spatial and temporal variability in element ratios exists and it can play a major role in ES. How do we incorporate spatial and temporal variability into ES? What traits do we use to scale organismal activities across patches? How does variation among patches scale to affect the elemental balance of ecosystems?

This talk will explore stoichiometric approaches to understanding spatial and temporal variation in biogeochemistry and in consumer-resource interactions, two very different spatial scales. At the small scale, we ask how organismal level patterns in homeostasis (maintaining relatively constant chemical content in the face of environmental variation) affects production dynamics of zooplankton consumers that inhabit a stoichiometrically variable world. For example, vertically migrating animals may encounter stoichiometrically distinct layers of water. Patterns of growth relative to nutrient acquisition are key in understanding these dynamics. It is a story of how environmental variability is integrated at the scale of the individual, combining information about movement with information about homeostasis. This work seems to offer fresh insight into the spatial ecology of organism growth generally. At the larger scale, we ask how patterns of variability in biogeochemical properties of interconnected lakes affects large-scale nutrient balancing in the sense of Redfield. Over the long term, does the N cycle come into balance with the P cycle by way of fixation and denitrification? This work emphasizes the fundamental importance of spatial structure and the patterns of connections across patches. It is a story of how environmental variability is integrated at the scale of ecosystems and offers insight into the questions about N vs. P limitation in aquatic environments.

SS01

ECOLOGICAL CLASSIFICATIONS *VS.* TAXONOMIC APPROACH IN THE EVALUATION OF FLOOD-INDUCED PHYTOPLANKTON CHANGES IN A RIVER-FLOODPLAIN ECOSYSTEM

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Floodplains are extremely dynamic environments in which the flood pulse is the most important environmental parameter, causing rapid change in phytoplankton composition. The aim of study was to investigate the effectiveness of different ecological classifications versus taxonomic approach in description of phytoplankton changes in a river-floodplain system. The study was conducted at Kopački Rit Nature Park (Croatia), one of the largest conserved floodplain areas of the Danube River. During eight years of investigation (2003 to 2010), extreme hydrological events significantly influenced the environmental variables of the floodplain as well as phytoplankton abundance and successional pattern. A high number of phytoplankton species (271 taxa) was found and assigned to 23 functional, 26 morpho-functional and 7 morphology-based functional groups. Redundancy analysis revealed that using ecological classifications yields a higher percentage of variance explained (axes 1 and 2 from 78.5 % to 91.3 %) than that by the taxonomic approach (69.4 % of the variance). Furthermore, the redundancy analysis showed a clear distinction between river and lake samples. The intensity and duration of flooding was the primary cause for the separation of samples during the years. Results indicate that ecological classifications constitute a comprehensive approach to assess the flood-induced changes of phytoplankton assemblages, although the lack of sensitivity for different functional properties of dominant small centric diatoms in the river phytoplankton seems to present certain disadvantages. Altogether, it seems that there is need for certain minor integrations and arrangements of species in current ecological classifications. Flexibility in species grouping according to the specific characteristics of each individual freshwater system, along with the simultaneous application of a taxonomic approach, would aid the development of morpho-functional schemes.

SS06

A NEW FRONTIER: RESPONSES OF TERRESTRIAL INVERTEBRATES IN DRY RIVER BEDS TO LANDSCAPE DISTURBANCE

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Temporary rivers that naturally cease to flow and dry up can be found on every continent. Many others that were once perennial now also have temporary flow regimes, due to the effects of water extraction or changes in land-use and climate. River health monitoring and assessment programs have traditionally used aquatic biological indicators, such as macroinvertebrates, to define river health. Dry sites have been excluded from such programs, even though they could be naturally dry and 'healthy'. A novel solution to this problem is the development of biological indicators of dry river health. Aquatic and terrestrial indicators could then be integrated to make an assessment of an entire river network.

Invertebrates, such as ants, have been used as indicators of human disturbance in terrestrial ecosystems. Do terrestrial invertebrates in dry river beds respond to human pressures? Pressure from grazing, for example, would result in a stressor of reduced land cover. Are there ecological responses to this stressor in dry river bed invertebrates? The suitability of using terrestrial invertebrates as indicators of dry river health was tested at 5 sites in the Cooper Creek catchment, Queensland, Australia. Sites were selected along a gradient of disturbance based on land cover. Terrestrial invertebrates were sampled using pitfall traps.

Terrestrial invertebrates were found to respond to the disturbance gradient. Taxa richness and abundance was lowest at sites with low land cover. This trend was also evident in individual taxonomic groups, particularly ants and beetles. These results suggest that terrestrial invertebrates could be investigated further as biological indicators of dry river health, and incorporated into river health monitoring and assessment programs.

SS02

DENSITY-DEPENDENT RELATIONSHIP BETWEEN *CHAETOGASTER LIMNAEI LIMNAEI* (OLIGOCHAETA) AND THE FRESHWATER SNAIL *PHYSA ACUTA* (PULMONATA)

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The relationship between the widespread and common oligochaete *Chaetogaster limnaei limnaei* (*CLL*) and its snail hosts is usually considered commensal or mutualistic. We used laboratory experiments to examine fitness-relevant behavior, growth, and reproduction parameters of host snails relative to different degrees of *CLL* infestation. As the host snails, the pulmonate freshwater snail *Physa acuta* was used. At high infestation rates, snails used a smaller proportion of their time for foraging and a larger proportion for resting. Consequently, the infested snails had lower growth rates. Moreover, their overall reproductive output was reduced and their reproductive strategy was shifted toward producing a larger number of egg masses that contained fewer and smaller eggs. Furthermore, fewer of these eggs survived. Based on our results, the relationship between *CLL* and *P. acuta* can be described as epizoic antibiosis at high infestation rates. Our study demonstrates the context dependency of the relationship between *CLL* and their hosts because other investigators found that snails can profit from *CLL* infestation in the presence of parasitic trematodes or remain unaffected by *CLL*. *CLL* could be a much more important factor influencing snail communities than previously assumed given this context-specific potential to influence the fitness of its hosts strongly and its host-species selectivity.

R07

BIOGEOCHEMISTRY OF A DIMICTIC LAKE REVEALED BY STABLE ISOTOPES

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The nature conservation area “Heiliges Meer” in the Münsterland, NW Germany, features a SW-NE trending chain of three larger lakes of different age and trophic level. They formed as a consequence of subsurface dissolution of upper Jurassic evaporites, causing collapse of the overlying sediment package. Collapse pits were subsequently filled with groundwater. From NE to SW, these lakes become younger in age from 2000 to 100 years, but subsurface peat deposits reveal that lakes have been formed in a similar way already 10000 years ago.
The largest lake, the weakly eutrophic “Großes Heiliges Meer”, exhibits a clearly stratified water column during the summer. The epilimnion (upper 5 m) is well mixed in respect to its chemical composition. The metalimnion (5-7 m below lake surface) displays the complete loss of oxygen via aerobic respiration and strong concentration gradients, particularly for redox sensitive dissolved constituents. Accordingly, the metalimnion and also the hypolimnion (7-10 m below lake surface) show substantial increases in Fe and Mn concentrations with depth. Sulfate is progressively depleted from 29 to 2 mg/L while dissolved inorganic carbon is increasing from 65 to 200 mg/L. This correlation suggests the anaerobic turnover of organic carbon via bacterial sulfate reduction in the anoxic bottom water. Support for this conclusion stems from the observed vertical change in the sulfate sulfur isotopic composition. While the epilimnion exhibits a uniform value around +13‰, reflecting the dissolved upper Jurassic evaporites, a progressive increase in $\delta^{34}S$ up to a value of +30‰ throughout the meta- and hypolimnion is consistent with bacterial sulfate reduction. Resulting hydrogen sulfide is present in the water column and is archived as iron sulfide minerals in the lake sediment. Dissolved inorganic carbon displays an equally uniform carbon isotopic composition in the well mixed epilimnion around -5‰, suggestive of biological carbon cycling and a contribution from atmospheric carbon dioxide. With depth, the dissolved carbonate carbon isotopic composition decreases towards a value around -14‰, revealing an increasing contribution from the turnover of organic material, initially via aerobic respiration and, further down in the water column, sulfate reduction. In addition, however, the carbon isotopic composition of the DIC is affected by carbonate dissolution in the subsurface, a signature that is transferred from the groundwater into the lake.

SS06

THE MACROINVERTEBRATE SEEDBANK PROMOTES COMMUNITY RESISTANCE TO DRYING IN TEMPORARY STREAMS

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Introduction
Aquatic macroinvertebrate communities in temporary streams are typically described as having low resistance to drying, meaning that few taxa survive within the dry reach. However, little research has examined the invertebrate ‘seedbank’, which comprises all aquatic life stages that remain viable in dry streambed sediments and from which active stages may develop only after inundation.

Methods
We synthesized datasets from studies which had experimentally rehydrated sediments from dry streambeds, to examine the importance of the seedbank as a macroinvertebrate resistance mechanism. Studies from across climate zones were included, to consider seedbank importance in relation to environmental harshness, which we estimated based on environmental data, in particular sediment moisture. We predicted that the importance of the seedbank (defined as the proportion of flowing river (FR) taxa present in rehydrated sediments (RS)) would decrease with increasing environmental harshness.

Results
A diverse macroinvertebrate assemblage, comprising up to 24 taxa per study and including up to 54% of taxa recorded in the flowing river, emerged from dry sediments following rehydration. A negative relationship was observed between the proportion of FR taxa present in RS and harshness, supporting our prediction. In addition, significant positive correlations were identified between sediment moisture content and community metrics (density and taxon richness) in some systems.

Conclusions
With climate change scenarios predicting an increase in streambed drying, maintaining habitats that facilitate the persistence of instream communities is an increasing priority. Our analyses identified strong relationships between sediment moisture and taxon richness, and river management and rehabilitation activities should therefore aim to retain moisture in drying sediments, by manipulating parameters such as riparian shading. Such strategies may maintain a rich seedbank that promotes community resistance to drying events.

Acknowledgement / References
We extend our thanks to Paul J. Wood, Andrew Boulton, Scott Larned and Emily Stanley for their contribution to this research.

R11

THE IMPACT OF FISH STOCK MANIPULATION ON AQUATIC MACROINVERTEBRATES AND WATERFOWL IN THE LEDNICE FISHPONDS NATIONAL NATURE RESERVE (CZECH REPUBLIC)

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The Lednice Fishponds National Nature Reserve is one of the most important wetland sites in the Czech Republic. The reserve consists of five large lowland ponds and was established in order to protect numerous species of waterbirds and endangered wetland plants. Despite this, the fishponds were not spared the intensive fish-and-duck farming, eutrophication and subsequent decrease in aquatic plants' and birds' populations during the second half of the 20th century. Since the 1990s, conservation management has been targeted on the conservation of the threatened wetland communities. An important step to achieve this ambition came with a new management plan in 2007, which included periodical summer drainages of ponds and lowering of fish stocks. A monitoring targeted on the effects of the latter measure on waterbirds, aquatic invertebrates and water chemistry was conducted in 2008–2010. Stocking of the common carp (*Cyprinus carpio*) in a lower density induced a mass occurrence of the invasive prussian carp (*Carassius gibelio*). However, these small young prussian carps served as a food source for some waterbirds and suitable environmental conditions were recorded also with this alien species. In ponds with a high water transaparency and abundance of chironomid larvae a higher abundance of insectivorous and piscivorous birds, and a higher number of waterfowl families were found, compared to ponds with high common carp densities and associated high nutrient concentrations, where only a limited number of birds were found. A high prussian carp density caused an inrease of the amount of blue-green algae, but affected the abundance of swimming ducks. Although the effect of the common and prussian carps on the studied wetland assemblages differed, total waterbird abundance and zoobenthos density were lower when the total fish density was high. The recorded patterns should be taken into consideration during the development of the management strategy for the conservation of threatened wetland communities in fishpond nature reserves.

SS12

RESTORATION AND IMPROVEMENT OF THE UPPER AND THE MIDDLE COURSE OF THE MÖHNE VALLEY

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Hydraulic engineering actions in the Möhne valley over previous centuries had a negative impact on both the river and its floodplain, leading to a 30% reduction in the length of the river. The consequences were bed erosion and fewer floods. Parts of the floodplain have been planted with spruce (*Picea abies*). The middle course is mostly cultivated intensively. This leads to run-off of fertiliser and pesticides as well as the need to maintain the structurally degraded status of the river.

The project aims to develop and restore the natural dynamics and structural diversity in the Möhne valley. Restoring the self-dynamic processes of the river should enhance the conservation status of species such as brook lamprey (*Lampetra planeri*) and bullhead (*Cottus gobius*). Furthermore is intended to improve the status of a number of floodplain habitats listed in the Habitats Directive, including alluvial forests with alder (*Alnus glutinosa*) and ash (*Fraxinus excelsior*). Reinstating species-rich pastures and meadows as well as special open land is another major aim of the project.

At five different sites restoration activities have been undertaken and are still on-going. The implemented measures include initiating morphodynamic processes, the lengthening of the water course and the restoration of the free migration for aquatic organisms. Another action of the project is the development of alluvial forests by the replacement of non-indigenous forest (spruce and poplars). The recovery of species-rich grassland from intensively used or fallow areas would be achieved by extensive, conservation-oriented land management.

R14

DISENTANGLING LONG-TERM RESPONSES OF CRUSTACEAN ZOOPLANKTON POPULATIONS TO MULTIPLE STRESSORS ACTING UPON A MESOTROPHIC LAKE ECOSYSTEM

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Lake ecosystems are exposed to multiple environmental pressures, which may act in concert to affect structure and functioning. These stressors may originate from large-scale phenomena (e.g. effects of a changing climate) or more localised events (e.g. changes in nutrient loading, introduction of non-native species). A major challenge for ecologists is to understand, model, and ultimately be able to predict, the impacts of these pressures on ecosystems. In recent decades, Windermere (UK) has experienced a long-term increase in water temperature, nutrient enrichment and the expansion of a non-native roach (*Rutilus rutilus*) population at the expense of native Arctic charr (*Salvelinus alpinus*). Using statistical modelling approaches and approximately 20 years of intensive monitoring data from this model system, we explored the combined effects of bottom-up and top-down pressures posed by these changes on the resident crustacean zooplankton community. Over the study period some taxa (e.g. *Daphnia* spp.) showed phenological shifts though no long-term abundance trend. In contrast, others (*Eudiaptomus gracilis*) showed a long-term decline in abundance. After capturing seasonal “trends” using generalised additive models, we found that long-term variations in the abundance of different zooplankton species were associated with different combinations of pressures, but that the influence of each pressure was not uniform among seasons. Our ability to predict future trajectories of change in lake ecosystems depends upon modelling effectively the species and season-specific nature of interacting drivers of change.

SS10

SILVER NANOPARTICLE EFFECTS ON STREAM MICROBIAL COMMUNITIES ON DECOMPOSING LEAF LITTER

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Current knowledge of AgNP toxicity is mainly based on laboratory studies with single species, which might not reflect their effects in natural environments. Therefore, it is essential for realistically assessing AgNP effects to apply approaches that take the ecological complexity and variability of natural communities and ecosystems into account. Litter-associated fungi and bacteria provide suitable model systems for community ecotoxicology because they play a fundamental role in the functioning of various ecosystems. They effectively degrade plant litter and produce substantial amounts of biomass that is subsequently channelled to higher trophic levels. This study assessed the short-term toxicity of AgNP on litter-associated stream fungi and bacteria in comparison to that of AgNO3 (Ag+). Prior to use, the nanoparticles were characterized in terms of size, surface charge and aggregation behaviour. Toxicity of AgNP in comparison to Ag+ was determined in inhibition tests based on a broad set of functional parameters. The specific sensitivity of fungal communities was assessed as sporulation rate and 14C-acetate incorporation into ergosterol. The specific sensitivity of bacterial communities was assessed by determining rates of 14C-leucine incorporation into protein. Moreover, potential extracellular enzyme activities (phosphatase, β-glucosidase and leucine-aminopeptidase), and respiration were measured to evaluate effects on overall microbial activity. Toxic effects of AgNP were variable, depending on the functional parameter used, and distinct from Ag+ toxicity. No inhibitory effect of AgNP on microbial respiration was observed, whereas Ag+ caused an inhibition. Both AgNP and Ag+ exposure stimulated potential phosphatase activity and reduced potential leucine-aminopeptidase activity. β-Glucosidase activity was stimulated by AgNP but reduced by Ag+. Finally, bacterial and fungal growth and sporulation were more strongly inhibited by AgNP than by Ag+. These findings suggest that dissolved ionic Ag (i.e. AgNO3) does not fully explain the observed toxicity of AgNP on litter-associated fungi and bacteria in streams. Overall, our study confirms the need to consider functional diversity using complementary indicators for ecotoxicological investigations on short-term AgNP toxicity.

SS03

EUROPEAN FRESHWATER BIODIVERSITY: TRENDS, PRESSURES, AND CONSERVATION PRIORITIES

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Freshwaters are among the most dynamic, complex, and diverse ecosystems. Covering only 1 per cent of the earth´s surface, they provide the habitats of over 10 per cent of all animals and over 35 per cent of all vertebrates. At the same time, freshwater biodiversity is declining faster than in most marine and terrestrial ecosystems. Demographic development, economic growth and climate change increase the pressure on freshwater resources through a number of major drivers, such as habitat fragmentation, pollution, and habitat loss.

Despite their pivotal ecological and economic importance, freshwater ecosystems have not been of primary concern in policy making. Therefore, efforts to address the loss of biodiversity need to be substantially strengthened, the economic value of biodiversity needs to be adequately incorporated into decision making, and there needs to be sufficient targeting, funding and implementation of policies to tackle biodiversity loss.

Throughout the last centuries rivers have increasingly become human-dominated ecosystems as a result of land reclamation, floodplain drainage, flow regulation, and channelization. Their domestication, i.e. the optimization for few ecosystem services, has led to the formation of novel biotic communities and to the truncation of vital ecosystem processes. This is particularly true for large European rivers. Domestication, combined with the rapid turnover of biotic communities, calls for a fundamental rethinking in future ecosystem management. Conservation will need to be complemented by, or perhaps even replaced by, increasing levels of management intervention, in order to create and maintain the desired ecological values of river-floodplain ecosystems.

PS1

REAL-TIME ACOUSTIC AND THERMAL CHARACTERIZATION OF RIVER LANDSCAPES

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The study of rivers and their heterogeneity at spatial scales at which relevant hydromorphological and ecological processes occur is crucial for advancing our understanding of river-ecosystems and for establishing adequate conservation strategies. Here we applied innovative acoustic and thermal tools as they apply to the real-time ecological study of river landscapes through a multidisciplinary research approach that blends purely physical studies of acoustic and thermal landscape patterns with the potential ecological outcomes. These tools provided a new set of “eyes” and “ears” through which we obtained useful insights into the fundamental natural and anthropogenic drivers that shape Alpine and lowland river-ecosystems. Our studies clearly showed, that underwater sound is a complex and robust signal, and hence, should be considered as an important and unique property of riverine ecosystems. The underwater soundscape provides an independent measure across a spatially continuous representation of habitat organization because it reflects important hydraulic (i.e., turbulence levels) and geomorphic (i.e., bedload mobility) dynamics. Soundscape analysis could be used to monitor river restoration measures that change the flow field and subsequent streambed sediment transport-deposition processes. Moreover, acoustic signals from particle collisions could be used to measure the intensity of bedload transport and distinguish size fraction transport based on frequency band intensity. Finally, underwater acoustic signals are most likely an important information cue for aquatic organisms for spatial orientation and positioning within suitable habitats. The application of thermal-infrared (TIR) imagery provides a unique opportunity to simultaneously map and quantify the surface temperature of aquatic and terrestrial habitats at a spatial scale relevant to ecosystem processes and biota distribution. This technique added critical information on broad spatial scales and allowed the detection and quantification of complex thermal mosaics that varied considerably over a 24-hour period, and between mean and high flow conditions. Moreover, a delay in response of fish distribution to a strong thermal gradient recorded in spring could only be assessed by the use of TIR imagery. TIR imagery could be used to identify area of groundwater-surface water interactions and to better understand the effect of thermal pollution zones such as water abstraction and industrial water discharge as well as of river regulation (e.g., groyne fields) on the thermal regimes of rivers. Finally, the TIR information gained is also expected to be crucial for quantifying and interpreting the effects of thermal heterogeneity on key ecosystem processes (e.g., organic matter decomposition and sediment respiration) as well as on diversity and behavior of organisms.

R08

EFFECT OF FLOOD EVENTS ON DIATOM COMMUNITIES AT DIFFERENT SPATIAL SCALES WITHIN A SEMIARID RIVER NETWORK

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Disturbance plays a central role in determining the structure of stream communities. Floods and droughts are the major forms of natural disturbance in flowing waters. The magnitude and frequency of flood disturbances are however not homogeneous throughout river networks, as the spatial extent of the disturbance is often limited to a part of the catchment, and floods can be partially incorporated in the system as flood waves travel downstream. To test this hypothesis, we characterized diatom community structure in 9 stream reaches of increasing drainage size (from 44 to 8900 km^2) within a semiarid catchment in the Southwestern United States (The Gila River). Community structure was thus determined before, during and after the monsoonal floods of 2006. NMDS ordination showed that differences between sampling dates on diatom community composition were evident, as well as differences between catchments of different size. Rank-abundance curves demonstrated that species richness generally decreased during monsoons except in large systems, and species dominance increased especially in small systems. Species dominance as well as species richness reached similar levels after the monsoons than those before the flood events. During monsoons larger systems were the least impacted, possibly indicating environmental stability of large systems enhanced by attenuation of discharge. One month after monsoonal rains diatom richness reverted to its pre-disturbance state. Recovery after rain period was very quick, maybe indicating that the response of diatoms to monsoons could be modulated by the predictability of the floods. Major impacts of global change are going to affect temporal variability in rainfall and the frequency of extreme events. If this occurs it will have profound effects in aquatic ecosystems, especially those in arid and semiarid zones, as can vary the ability of the diatom communities to respond to year-to-year disturbances.

R13

HISTORICAL ASSEMBLAGE DISTINCTIVENESS AND THE INTRODUCTION OF WIDESPREAD NON-NATIVE SPECIES EXPLAIN WORLDWIDE CHANGE IN FRESHWATER FISH TAXONOMIC DISSIMILARITY

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Anthropogenic pressures, by changing the species composition of assemblages also modified dissimilarities between assemblages (beta-diversity) for most taxa groups. Human disturbances caused an overall decrease in the dissimilarity between assemblages all around the world thus leading to a global biotic homogenization. However the relative contribution of species turnover and nestedness to these changes remain unknown. Here we disentangled the contribution of the turnover and nestedness components responsible from the changes in dissimilarity for the world freshwater fish assemblages. We first quantified the contribution of the species turnover to the change in dissimilarity across the six biogeographic realms. We then investigated how historical native species richness and species introductions and extirpations have contributed of this change in dissimilarity and its turnover component. We demonstrate that the worldwide changes in taxonomic dissimilarity are in a large part driven by a decrease of the contribution of the taxonomic turnover between river basins in all the six realms. The high distinctiveness between historical assemblages and the increase in the number of species shared within an assemblage pair decreased species turnover and were the major drivers of changes in dissimilarity. Analyzing the contribution of turnover to changes in taxonomic dissimilarity also revealed that taxonomic differentiation occurs under low introduction pressure and then rapidly turns to taxonomic homogenization as soon as the same species are introduced in the two assemblages of a pair. From an applied point of view, differentiation might therefore be used as an early warning to biotic homogenization.

SS07

COUPLED MODEL OF TURBULENT STREAM FLOW AND HYPORHEIC FLOW UNDER VARYING HYDRAULIC CONDITIONS.

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Exchange of water and solutes across the stream-sediment interface is an important control for biogeochemical transformations in the hyporheic zone with measurable impacts on nutrient cycling and solute attenuation in fluvial systems. We investigate the interplay between turbulent stream flow and flow in the streambed sediments under different ambient groundwater flow conditions. For this purpose, a three-dimensional modeling approach for coupling turbulent stream water flow with porous media flow, representing the hyporheic zone is used. The stream water flow is simulated by the open source computational fluid dynamics (CFD) software OpenFOAM which provides the pressure distribution at the streambed. It serves as the top boundary condition for the flow simulation in the hyporheic zone. The modeling approach is applied to three-dimensional generic pool-riffle sequences with different morphological properties and also to a real channel section of a mid-stream gravel bar. Changing stream discharges are considered as distinct steady state scenarios. In the groundwater model, depending on the hydraulic head conditions and the groundwater in- or outflow, the flow in the hyporheic zone is simulated. Additionally, transport and reactions of redox-sensitive compounds in the hyporheic zone are conducted.

Results show an increase in hyporheic exchange flow for growing discharge with a concurrent decrease in residence time. Ambient groundwater flow in both up- and downwelling direction diminishes significantly the hyporheic flow and extent. The fraction of circulating stream water through the hyporheic zone is in the range of $1x10^{-5}$ to $1x10^{-6}$ per unit stream length, decreasing with increasing discharge. For certain combinations of stream discharge and pool-riffle morphology undular hydraulic jumps occur and locally suppress hyporheic exchange flow and extent. Complex three-dimensional pressure distribution at the streambed cause significant lateral hyporheic flow components mainly shifted towards the stream bank with a mean lateral travel distance of 20 % of the longitudinal flow paths. Minor hyporheic flow paths exist that are opposed to the direction of stream flow and laterally shifted towards the stream centre.

R01

FACTORS AFFECTING THE DISTRIBUTION AND BLOOMS OF THE NOXIOUS RAPHIDOPHYTE *GONYOSTOMUM SEMEN* (EHRENBERG) DIESING

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Harmful algal blooms (HABs) are a growing problem as they are increasing due to e.g. anthropogenic and climate change. HABs may have negative impacts on ecosystem services, human health and may cause economic losses. *Gonyostomum semen* is a noxious mixotrophic phytoflagellate, with an expanding distribution in northern European countries. During blooms *G. semen* biomass may account for up to 98% total phytoplankton biomass, and annual blooms are common once *G. semen* has become established in a lake. *G. semen* has mostly being reported from forest lakes with high dissolved organic carbon and low pH. Despite this, the incidence of *G. semen* and the dynamics of its blooms are poorly understood. In this study, we aimed at determining the factors that affect the spatial distribution and bloom incidence of *G. semen* in boreal lakes. We analyze trends in detection and bloom incidence of *G. semen* in 146 lakes during a 19 year period (1992-2010), and test further the hypothesis by Rengefors et al. (2012) that an interplay between temperature and water color (a generally accepted proxy for dissolved organic carbon) can explain why *G. semen* is increasing in boreal lakes. We found that the occurrence of *G. semen* was mainly explained by warmer temperatures and longer growing seasons. Warmer temperatures also affected bloom incidence of *G. semen*, although to a lesser extent. In contrast, local-scale variables, i.e. pH and water color, were the best predictors for bloom incidences. Regarding the trends in distribution and bloom formation, we found that *G. semen* has become more common in lakes located in the Central Plains (south of Sweden) but not in lakes from the Fennoscandian region (northeast Sweden). In contrast to detection, the incidence of blooms and *G. semen* biomass did not increase significantly, but fluctuated among years and reached a maximum in 2003, especially in lakes from the Central plains. We conclude that due to ongoing brownification and climate warming boreal systems will likely become more susceptible to invasions of *G. semen.*

Rengefors, K., Weyhenmeyer, G.A., Bloch, I., 2012. Temperature as a driver for the expansion of the microalga *Gonyostomum semen* in Swedish lakes. Harmful Algae(18).

R03

MAXIMUM EFFICIENCY OF RIVER-BED CARBON FIXATION BY METHANOTROPHS

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The role of inland freshwaters in the global methane cycle is being revised, yet the fate of methane in rivers is still poorly defined compared to lakes. In addition to altering the balance of carbon gas emissions from rivers through oxidation of CH_4 to CO_2, methanotrophy may represent still unquantified chemosynthetic production. Key to quantifying such production is determining the carbon fixation efficiency of methanotrophy i.e. mol organic carbon produced, per mol CH_4 metabolised. Here we show that the gross carbon fixation efficiency (GCFE) of river-bed methanotrophs remains high (0.52 to 0.54), and within its theoretical maxima, across the seasonal range of methane concentrations and despite a 10-fold span in the rate of methane consumption. Moreover, we were able to quantify the GCFE of methanotrophy relatively simply during short incubations (< 15 h). Such highly efficient chemosynthetic production, if widespread, must represent a marked shift in how we perceive primary production in rivers, through their import and conversion of inorganic carbon (methane) back to organic carbon. We have now shown that river-bed gravels have a high capacity to consume methane, yet it is also known that in large rivers such as the Hudson, there is a high capacity to consume methane in the typically turbid water column. Studies of truly colossal catchments such as the Amazon and Congo highlight the import of vast amounts of terrestrial methane, yet the magnitude of methane consumption in those recipient waters is unknown. If such vast import of terrestrial methane supports methanotrophy, at the constant and maximum efficiency measured here, then, in parallel to the two conventional sources of photosynthetically produced carbon (autochthonous and allochthonous), we have been overlooking a significant ‘third way’ of energy production in rivers.

R09

ECOSYSTEM FUNCTIONING IN STREAMS UNDER HUMAN PRESSURE: AGRICULTURAL STREAMS AS AN EXAMPLE

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Direct measurement of ecosystem process rates, such as litter decomposition and algal productivity, are argued to provide an additional dimension in the bioassessment of human impacts on aquatic ecosystems. Such processes underpin key ecosystem services delivered from freshwater environments, including provision of food and clean water, and the mitigation of pollutants and toxins. However, the use of process-rate based measures in bioassessment is hindered by the limited understanding of (i) variation in the sensitivity of different ecosystem processes to contrasting anthropogenic pressure gradients, (ii) variation in different ecosystem processes along pressure gradients in relation to changes in community structure and diversity, and abiotic parameters and (iii) calibration of process-rate based metrics, including categorization of the reference vs impacted state. To address these deficiencies, we are studying four, well-defined human disturbance gradients (two hydromorphological, one forestry and one nutrient), and assessing simultaneous variation in physico-chemical, community and functional responses. Community structural variables include the responses of four taxonomic groups (diatoms, invertebrates, macrophytes, fish), while functional responses include litter decomposition, algal productivity and biofilm respiration. The first pressure gradient was sampled in Southern Sweden during summer and autumn 2012, and comprised ten streams representing an agricultural gradient: four having an excellent or good ecological status, two moderately impacted sites and three very impacted. Initial analyses of two functional responses, litter decomposition and algal production, indicate that both broadly increased in response to a strong nitrogen and phosphorus gradient across sites, reflecting bottom-up nutrient stimulation of the detrital and algal food webs. However, differences in the strength and shape of responses, including locations of asymptotes, highlight differential responses of the processes to additional stressors associated with agriculture, particularly sediments.

SS14

GOVERNANCE OF CAPACITY BUILDING IN WATER RESOURCES MANAGEMENT: A BOTTOM-UP APPROACH

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Capacity development plays a key role in developing countries in improving water quality and supply levels by enhancing capability of stakeholders, policy makers and water professionals at large. Traditional capacity development initiatives (incl. technical, managerial and financial aspects) have been mostly donor-driven, devoid of promoting indigenous roles and participation and pursued essentially in isolated approaches. However, ensuring sustainability and reacting to changing needs of partners in developing countries necessitates a holistic, ‘bottom-up’ and bi-directional approach. Taking the case of South Africa, this paper proposes a framework to better equip water professionals and stakeholders with tools and skills necessary for a sustainable capacity development approach. To do so, we examine governance structures and institutional arrangements in the water sector. Then we evaluate existing capacity development processes and ongoing policies on current water management practices. Further, we assess the performance of such tools; evaluate implementation challenges and investigate the required skills and expertise in various settings. Finally, we propose a joint management framework that could support the creation of a “knowledge exchange platform” and ensure diffusion of best practices in other similar regions.

Key words: water management, capacity development, bottom-up approach, South Africa

R01

GROWTH CHARACTERISTICS OF THE *NEOGOBIUS MELANOSTOMUS* (GOBIIDAE, PISCES) (PALLAS, 1814) IN THE KARABOGAZ LAKE (SAMSUN, TURKEY)

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This study, which was carried out between August 2011 and May 2012, investigates the growth characteristics of the *Neogobius melanostomus* (Pallas, 1814) species in Lake Karaboğaz (Samsun, Turkey) such as age distribution, age-length, age-weight, length-weight relationships and condition factor.
According to the results of the research, it was determined that the age distribution of the species in question ranged from I to IV and the female:male sex ratio was found to be 0.54:1. The results indicated that the total value of the whole population size varied from 100 to 184 mm and the weight value varied from 12 to 119 g. It was detected that the minimum and maximum height of *N. melanostomus* female individuals in Lake Karaboğaz were 100 and 161 mm, respectively, while the minimum and maximum height of the male individuals were 102 and161 mm, respectively. The weight was found to range from 12 to 70 g for female individuals and from 14 to 119 g for male individuals. As a result of the calculation of the length-weight relationship, the b value was found to be 3.09 and this value suggested allometric growth in *N. melanostomus* individuals in Lake Karaboğaz. The data obtained were compared with the results of the other studies conducted on this species and growth characteristics were found to be in accord with what is to be expected in normal fish populations.
Keywords: Lake Karaboğaz, *Neogobius melanostomus*, rock fish, growth characteristics, condition factor

SS13

MODELLING RESOURCE COMPETITION BETWEEN WATER PLANTS: THE IMPORTANCE OF LIGHT OVER NUTRIENTS

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Water plants are crucial for the ecological functioning of shallow standing waters (lakes, ponds and ditches). Water plants, especially submerged species, can be beneficial to other aquatic life by providing shelter, food and clear water conditions. Water plants can also be detrimental to other aquatic life, for example when floating water plants form dense mats which lead to dark anoxic underwater conditions. Nutrients are often held responsible for such a deterioration of the aquatic ecosystem, as eutrophication in the last decades has in general led to a shift in dominance from submerged water plants to floating water plants (and algae). However, the importance of light competition, next to nutrient competition, in causing this shift may be overlooked, because floating water plants are superior light competitors by shading the underlying submerged water plants and severely hampering their growth.

This study focuses on the importance of light over nutrients in the competition between water plants. We used the model PCDitch, which simulates the resource competition of water plants in ditches within an ecosystem context. This ecosystem context means that the nutrient and light conditions are not only affected by the water plants, but also by other processes in the ecosystem like abiotic, microbial and transport processes in the sediment and the water column. We considered six functional groups of water plants that each have their own strategy to extract light (by floating, emergent or submerged parts) and nutrients (uptake from sediment, water column or both). We assessed the importance of light over nutrient competition by comparing the situation where water plants do not shade each other (and only compete for nutrients) with the situation where they do shade each other (and compete for nutrients and light). The predicted outcome of the competition for both situations, for a range of environmental conditions and ditch types, were compared to field observations in Dutch ditches in the past 30 years (Limnodata Neerlandica data set), to infer which of both situations is most likely to occur and thus to assess the importance of light competition over nutrient competition.

SS14

POTENTIAL OF THE CONCEPT OF ECOSYSTEM SERVICES FOR SURFACE WATER POLICY IN THE CONTEXT OF THE EUROPEAN WATER FRAMEWORK DIRECTIVE (WFD)

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The concept of ecosystem services can potentially help water managers to operationalize the aim of the WFD by relating these services to the specific functions of local water bodies. The specific goals of the WFD and the success of measures set to reach them may beneficiate from an assessment in which ecosystem services are taken into account. Therefore, the aim of the present study was to evaluate the potential of the concept of ecosystem services for Dutch surface water policy in the context of the WFD. Ecosystem services are important for local, national, and global ecosystem-based policy design and decision-making. Since the Millennium Ecosystem Assessment in 2005, the importance of ecosystem services to human welfare is generally acknowledged, as well as the impact of human actions on the ability of the ecosystems to provide these services. However, until this day, specific methods for using ecosystem services in surface water policy are not available. Instead, water policy in the European Union is guided by the WFD.

The WFD was published in 2000 and aims at achieving good ecological status for Europe's surface waters. The WFD specifies several functions of surface water, and their protection levels. Water managers must take specific measures in order to reach the ecological objectives. A cost-effectiveness analysis of the measures is a substantial part of this management plan, as are exemptions on grounds of disproportionate costs of mitigation. However, the WFD guidelines do not elaborate on the methods for valuing the functions of water, nor on how to prioritize them.

The recognized functions of water in the WFD are similar to, and in some cases overlapping with the concept of ecosystem services, but for some ecosystem services, there is no direct link with the WFD or the management plans involved. The supply of drinking water for example, is protected by the WFD, but in practice, protective measures to ensure good drinking water quality are also beneficial to the ecological status of the water body.

This study assesses the degree to which ecosystem services already play a role in the level of protection that is aimed for within the WFD, specifically for the Dutch surface water policy. Cases in which specific measures may strengthen several functions are evaluated and the opportunities to further use the ecosystem services concept and exploit more win-win situations in surface water management are elaborated on.

SS06

ASSESSING THE EFFECTS OF DROUGHT AND THE RECOVERY PROCESSES OF FISH ASSEMBLAGES IN A MEDITERRANEAN BASIN

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Methods for assessing the effects of drought in temporary rivers are still less developed than those for perennial waterways, despite intermittent rivers constituting a large proportion of all waterways globally. With climate change likely to increase the intensity and frequency of drought events, it is important to identify metrics that respond adequately to drought effects on fish assemblages, in order to create appropriate tools for the management, protection and restoration of aquatic biodiversity. In this study, we examined the effects of two consecutive droughts (2007, 2008) and the recovery processes of fish assemblages of Evrotas River, (Southern Greece), during 2007-2010, at various spatio-temporal scales. These effects and processes were assessed using selected fish-attributes (such as relative density, biomass, species composition, species richness, species size class distributions) in perennial and intermittent sites and river reaches.
In intermittent sites/reaches -where drought effects were more pronounced compared to perennial sites/reaches that were much more stable- density increased during both drought events, while biomass increased during the 1st event and decreased substantially during the 2nd drought event, an effect probably related to a disturbed fish size structure, with large individuals lacking and smaller fish and yearlings being dominant. Furthermore, a shift in species composition was observed in intermittent sites/reaches, with stagnophilic species tending to increase during and after the drought events, while rheophilic species decreased. Recovery in terms of density and species richness was relatively rapid (within one year), in contrast to fish biomass, species composition and age structure that recovered at a much slower pace, indicating that different community elements recover at different rates. In conclusion, fish biomass, species composition and size structure appear to adequately reflect the effects of hydrological regime alterations on the biota, long after the hydrological disturbance is over. In contrast, the effectiveness of density, commonly used in assessing habitat quality and population size, is limited in the case of intermittent rivers reaches, since during drought events fish tend to aggregate in the remaining wetted reaches and thus fish densities become artificially increased, even though high mortalities and a substantial drop of population abundance has actually occurred.

R01

LONG-TERM MONITORING OF FUNGI AND INVERTEBRATES OF A DENDROTELMATA

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Tree holes are natural cavities in tree trunks, which are filled with rain water and dead organic matter. These freshwater habitats offer exclusive properties to a number of biota and they are, therefore, crucial for preserving biodiversity. Our main goal was to perform a long-term (2003-2008) monitoring of a tree hole (*Acer platanoides*), and to obtain a deeper knowledge on biodiversity, species interactions and functional properties of these ecosystems. The rainwater runs off the canopy (through-fall or stem-flow) transporting numerous fungal species (airborne and phyllosphere fungi) to the tree hole. Aquatic and aero-aquatic hyphomycetes are also colonizing these habitats. Spores of 140 fungal taxa and some unknown fungal species were detected in our samples. The fungal community and the invertebrate assemblage play an important role in the foodweb of water-filled treeholes and their composition is mostly affected by weather parameters.

SS07

IMPACT OF DRY-REWETTING HYDROLOGICAL CYCLE ON BIOAVALABILITY OF DISSOLVED ORGANIC CARBON MOLECULAR WEIGHT FRACTIONS IN A MEDITERRANEAN STREAM

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Mediterranean fluvial systems are subject to severe drought - rewetting cycles that influence biogeochemical processing. These extreme periods also modify the direction and magnitude of lateral water fluxes between the stream surface water and riparian groundwater becoming an excellent experiment to explore the abrupt changes affecting dissolved organic matter (DOM) fluxes and composition across the stream riparian-interface. In this study the variability in DOM concentration and composition, over consecutive drought and re-wetting periods, are considered in terms of dissolved organic carbon (DOC) and nitrogen (DON), DOC:DON ratio, and bioavailable DOC (BDOC) and DON (BDON) for whole water and three molecular weight fractions (MW) (High (HMW): >10 KDa; Medium (MMW): 1-10 KDa and Low (LMW): <1 KDa). The results show that during the drought period differences in DOM characteristics between riparian groundwater and surface waters are minimal, while during the rewetting period, the riparian compartment would be a biogeochemical DOM transformation “hot spot”. Considering the entire study period, only DON presented significant changes in the contribution of the different MW fractions. Changes in DOC lability (BDOC content) are not related to a single MW fraction. On the other hand, BDOC is positively related to DON concentration and inversely related to DOC:DON ratios, evidencing that DON is an important driver of DOM lability. Furthermore, the DOC:DON ratio presents a threshold value for discriminating between labile and refractory MW DOC fractions.
In consequence, this study highlights that DOM lability is greatly influenced by DON concentration and DOC:DON ratios rather than to molecular weight, prompting the necessity to further examine the role of DON on DOC fate in fluvial systems.

R09

EXTRAPOLATION AND DIAGNOSTICS MODELS : HOW TO PREDICT ECOLOGICAL STATUS OF UNSURVEYED WATER BODIES OF EUROPEAN RIVERS.

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To achieve a good ecological status for all water bodies in time, the Water Framework Directive (WFD) raises serious problems for political decision-makers and water managers who adress many questions for aquatic scientists.
During the last ten years, most of the research works carried out within the scope of the WFD was dedicated to development of bioassessment tools based on different biological quality elements (algae, benthic fauna and fish), using data from national monitoring networks.
However, not all water bodies are surveyed across European countries, due to both technical limitations and economic reasons.
Within this context, it is therefore very important to strengthen the direct monitoring of water bodies to develop efficient methods for the classification of non-monitored water bodies based on robust and homogeneous predictive models based on causal relationships between biological quality elements (and consequently ecological status) and multiple impairments and stressors at catchment and local scales.
We developed a model for the classification of non-monitored water bodies. This model is based on land cover, water quality and hydromorphological pressures and allow making a spatial extrapolation of ecological status at the scale of water bodies. It is developed using classification and regression tree method and have a very good predictive efficiency.
We completed this extrapolation model with other models (using partial least square regression methods) aiming to make the diagnosis of pressures responsible for bad status of water bodies. These models explain benthic invertebrates, diatoms and fish index using land cover, water quality and hydromorphological pressures and allow to assess the relative impact of each type of pressure and the response of each biological quality element.
The development of such a pressures/impact models is a very promising alternative to compensate the availability of local monitoring data. Even if these models are of course not able to solve all water manager's problems, they may help them to optimize monitoring programs and to assign an ecological status to those water bodies which are not surveyed, based on the pressures acting at a local and/or regional scales and the statistical relationships established for surveyed sites located in the same pressures context.

R13

VARIABILITY AND PLASTICITY OF GROWTH RATE OF THE INVASIVE ZEBRA MUSSEL IN ANTHROPOGENIC WATER-BODIES

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The uncontrolled spread of the plant and animal invasive species is one of the major environmental problems in the present days. Zebra mussel (*Dreissena polymorpha*) is important invasive clam. It is very effective ecosystem engineer, which has an impact on all parts of the water ecosystem. Flooded sand-gravel pits and quarries offer a wide range of environmental conditions, which reflect a large plasticity of Zebra mussel life strategy. Its growth rate is in particular influenced by the abiotic factors of the water-bodies.

The aim of this study was to observe plasticity of growth rate of Zebra mussel individuals depending upon diverse physical and chemical factors. Six different water-bodies in the Czech Republic (three sand-gravel pits and three quarries) were selected for the study. The flooded quarry Výkleky was chosen as a central locality. In this experiment, the individuals were changed among compared water-bodies. The growth rate was observed by the help of the experimental cages. During three year long experiment, the experimental cages were taken out several times per year and the length of shells was measured. Water samples were taken for the analysis of abiotic parameters (temperature, pH, conductivity, oxygen saturation, nutrient content, food supplies parameters and metal content).

The growth rate and final size of individuals were different in observed water-bodies. We recorded substantial increase of growth rate of the individuals from the quarry Výkleky, which were transported to the compared localities. On the other hand, the individuals from the compared water-bodies, which were transported to the quarry Výkleky, decreased their growth rate. Zebra mussel individuals have considerable ability to adapt to changeable environmental conditions. The variability of Zebra mussel growth rate depends on environmental conditions of the water-bodies. Studied sand-gravel pits are more suitable habitats than flooded quarries.

SS07

FAUNISTIC ASSEMBLAGES OF ALPINE SPRINGS – VARIABILITY OR STABILITY?

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Springs are spatially restricted ecotones at the interface between groundwater and superficial water. In low mountain ranges they are usually fed by deep groundwater and drain large catchment areas. This results in relatively stable environmental conditions, which are an important prerequisite for the colonisation of the typical faunistic species assemblages. At high altitudes catchment areas are naturally smaller and springs are often fed by surface-near aquifers. Moreover, snowmelt and glacial melt water additionally influence the environmental conditions in the springs. In this study we intensively examined thirteen springs in the Bernese Alps (CH) during one year. The water temperature and the solar radiation were continuously monitored, additional environmental parameters such as the electrical conductivity were measured, and a quantitative sampling of the macrozoobenthic assemblages of the uppermost parts of the springs was conducted three times during June 2010 and July 2011. We assume that (a) the springs at high altitudes are less stable than the springs at lower altitudes and that (b) the decrease in environmental stability influences the distribution of crenobiontic and crenophilous taxa. The analysis of the temperature even revealed an increase of stability at high altitudes, whereas springs at lower altitudes exhibited higher temperature as well as discharge amplitudes. The electrical conductivity showed a high variability in the springs at high altitudes indicating an influence of snowmelt water. Glacial melt water plays a less important role in the springs we investigated. The variability of the electrical conductivity was an important environmental factor for the macrozoobenthic assemblages. However, they were most of all significantly influenced by the altitudinal range of the springs. This indicates that the altitude range functions as a superior environmental factor integrating all parameters that change along the altitudinal gradient.

SS08

IMPACT OF DAMS ON BIOGEOCHEMICAL PROCESSES IN IBERIAN RIVERS

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Reservoirs are a common feature of Iberian landscapes. These infrastructures modify the hydrological regime of rivers, potentially causing important changes to ecosystem structure and function which are yet not fully understood. The objective of this study was to determine the impact of hydrologic regulation by dams on in-stream net nutrient uptake processes. We predicted that nutrient uptake rates would be greater downstream from dams without hydropeaking, because in-stream communities below this type of dams suffer lower natural disturbance by floods and have more stable environmental conditions that promote higher nutrient and energy demand. We sampled river reaches located upstream (control) and downstream (impact) of three reservoirs in the Ebro river basin: Mediano-El Grado (835 hm^3), Siurana (12 hm^3) and Margalef (3 hm^3). We measured longitudinal changes (along the river reaches) and temporal changes (over 24h cycles at the upstream and downstream end of each river reach) in dissolved nutrient and carbon concentrations within each river reach (control or impact) at each site during three seasons (summer, autumn and winter). With these data, we estimated dynamic whole-reach net uptake rates of total dissolved nitrogen (TDN), phosphorus (TDP) and organic carbon (DOC). Physical and chemical parameters varied considerably among sites, seasons and reaches. In general, most parameters showed higher seasonal variability in control than in impact reaches. Differences in TDN and TDP concentrations between control and impact reaches were important only in Margalef, while DOC concentrations differed consistently between control and impact reaches at all sites. Net uptake of TDN tended to be higher in impact than in control reaches at all sites, whereas net uptake of TDP and DOC as well as day-night differences showed no consistent pattern across sites, seasons and reaches. Overall, our results suggest that the profound changes in environmental conditions caused by damming may produce relevant discontinuities along river networks in terms of in-stream biogeochemical processes.

R11

HABITAT RESTORATION IN AN URBAN CHANNEL – THE MÜNSTERSCHE AA – EXPERIENCES FROM MONITORING OF A PILOT ACTION

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The Münstersche Aa is a tributary stream of the River Ems in Northern Germany. According to the typological classification for Central European running waters, its natural quality is that of a 'sandy lowland stream' for the rural reaches, whereas the urban stretch is a 'lake outlet stream'. Mid of the last century, following eventual flooding of adjacent built-up areas, the urban stretch of the Aa was sealed and straightened with a concrete bed and bordering in order to control the peak flow risk. Minimum runoffs are regulated by weirs. Nowadays, the Münstersche Aa presents itself passing through the city area as a poor drain construction.
In the last years, city authorities have acknowledged the current situation as inconsistent to both the 'good ecological status' claimed for running waters by the standards of the European Water Framework Directive and to the societal demands for constructionally attractive integration of the Aa into the city scenery. Consequently, a series of plans for restructuring of the Aa channel have been drawn up. Following this need for action, stream model tests were carried out to prove the possibility to meet the flood protection requirements even with a restructured bed of coarse gravel, combined with nature-oriented structures. However, it was shown that much coarser substrate than the autochthonous fine sand is needed to ensure longer-lasting stability of the sediment layer to high-runoff events.
Currently, an in-situ 1:1 scale model test is run over one year as a pilot action: within a 15m-long reach, the concrete bedding was replaced by the structures found suitable in the model tests before. This practical pilot phase is accompanied by intensive monitoring of the stability of the structure positions and bed form, morpho-dynamic changes by use of terrestric laser-scan, conventional surveys, digital terrain modeling, and morpho-dynamic simulations. Further aspects included in this study are the succession of the macroinvertebrate community, specifically in chironomids, the sedimentation, decomposition, and long-term fate of the organic seston originating from the upstream lake, and the influence of infiltration and exfiltration processes on the groundwater.
The results of this pilot study are expected to yield essential information for the future restoration measures encompassing the entire urban stretch of the Münstersche Aa, thus enhancing both its ecological and esthetic status on a significantly larger scale.

R08

A PHENOMENOLOGICAL APPROACH FOR CROSS-SYSTEM ANALYSIS OF CLIMATE EFFECTS ON TEMPERATURE PATTERNS AND ECOSYSTEM RESPONSE IN AQUATIC SYSTEMS

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To predict the coherence in local responses to large-scale climatic forcing among aquatic systems, we developed a new concept to compare long-term data of dimictic waterbodies. Acknowledging the strong relationship between climatic conditions and the thermal structure of aquatic systems, we selected four phenomenologically defined phases of physical characteristics: inverse stratification during winter, spring overturn, early thermal stratification and summer stagnation. The phases are considered to respond sensitive to climate warming but also critically influence biotic key processes. Based on threshold temperatures, phases were classified in a dual code (cold/warm). The start of the phenomenological phases was defined by simple markers. In our integrative approach, global irradiation is involved in processes that determine epilimnion temperature directly. Second, it is auto-correlated with other meteorological variables that co-determine lake temperature. Third, we demonstrate that gradients in cumulative irradiation are a suitable signal to determine the latitudinal time shift in the beginning of phenomenological phases. Accounting for the latitudinal gradient in seasonal timing of phases by 2.2 days per degree latitude, we determine a high spatial and temporal coherence (84%) in warm-cold patterns for lakes within a latitudinal gradient from 47 to 59°N.
Besides, we introduce a new approach to test ecological sensitivity to specific warming scenarios by combining the cold - warm patterns with statistical box-plot-analyses of abiotic and biotic criteria. Our approach allows differentiating easily between instantaneous and time-delayed ecological responses to seasonal warming pattern. Exemplarily, we show that warming during early thermal stratification (during spring) controls food-web mediated effects on key species (*Daphnia, Leptodora*, perch) during summer. For stability frequency in July, a significant effect of warming both during winter and summer stagnation was found. The probability of warm phases during early thermal stratification shows a significant warming trend from 0 to 58% from 1975 to 2010 and will exceed 97% in 2030. Our approach provides also the basis for defining climate scenarios for experimental or theoretical studies.
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Wagner, A., et al. (2012): A phenomenological approach shows a high coherence of warming patterns in dimictic aquatic systems across latitude. Mar. Biol. 159: 2543-2559.

R11

MITIGATING PUMPING STATIONS AS MAJOR FISH MIGRATION BARRIERS IN THE LOWER NETHERLANDS

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The Water Framework Directive (WFD) commits EU member states to achieve good ecological status of surface waters by 2015. Fish is one of the biological quality elements for which standards for a good status have been set. Migration barriers are serious obstacles in meeting these standards. In the lower Netherlands, the creation of many polders has resulted in fish habitat fragmentation. Polder-draining pumping stations cause high passage mortality during downstream migration, and block upstream migration. Removal of the stations is no option. Their negative effects on fish migration can only be mitigated, but not at the expense of pump efficiency. We evaluate mitigation measures taken by two water boards at five locations. Two conventional pumps were replaced by innovative fish-friendly alternatives: one axial pump and one screw pump. At the third location a newly built pumping station was equipped with a fish-friendly screw pump and a one-way (upstream) bypass fishway. Efficiencies of the new pumps are equal to or greater than those of the old pumps, and meet predefined requirements. At the final two locations two-way siphon fish ladders were installed as bypasses for the conventional pumps. All adjustments were made in 2011. We monitored fish passage and mortality during upstream (spring) and downstream (autumn) migration in 2009 (T_0) and 2011/12 (T_1). Species and numbers attempting to negotiate the barriers were estimated from fyke-net catches near pump inlets. Actual passage and mortality rates were assessed using fyke nets, set up behind the pump and fishway outlets. Overall pump passage mortality (T_0: 27.0%; n=2349) declined after installing fish-friendly pumps (T_1: 0.1%; n=37178). This was most pronounced for European eel, as compared to the perch (Percidae) and carp (Cyprinidae) families. Mortality among large Cyprinidae (>15 cm) was higher than among smaller fish in all pump types. No passage mortality was observed in the fishways. Except for European eel, higher numbers of fish passed the pumps at T_1 than at T_0. Although most species present used the fishways, numbers were relatively low during downstream migration. More fish used the route via the adjacent pump. For three out of the five polders concerned, we expect the mitigation measures to cause higher scores on the WFD fish metrics. Irrespective of this, by restoring interconnectivity between water bodies, the measures contribute to gene flow and local biodiversity.

R10

HYDROMORPHOLOGY AND LANDSCAPE CONTROLS ON THE MEAN AND VARIANCE OF LAKE TROPHIC STATUS AND WATER CHEMISTRY

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Variance in lake properties can provide powerful insights into important phenomena such as incipient ecosystem state change that cannot be assessed by examining means. However, controls on variance have been less well studied compared to the central tendency. At the landscape scale, we hypothesise that hydromorphology, defined by hydrology (e.g., lake hydrologic position within a river network, groundwater connectivity, water residence time and flow regime) and morphology (basin depth, complexity and hypsometry; catchment area and topographic complexity), is an important control on among-lake differences in temporal dynamics. To test this, we calculated median and variance metrics for total phosphorus, chlorophyll, colour and alkalinity based on 5 years of spring and summer data from nearly 200 Irish lakes. We then used the random forest algorithm to compare the predictability of these metrics by landscape features grouped into hydromorphology, terrestrial, and human disturbance categories. Based on preliminary analyses for a subset of these lakes, we found that in general the mean, coefficient of variance (CV), and spring to summer ratios were not correlated. This suggests that each of these metrics was controlled by different mechanisms. Further, predictability tended to be lowest for CV and highest for the mean. Chlorophyll was less predictable, not surprising as it is likely most influenced by in-lake trophic dynamics not accounted for in our models. On the opposite end of the spectrum, alkalinity mean and variance metrics were highly predictable by a combination of geology and hydromorphology predictors. Finally, hydromorphology metrics such as runoff, catchment stream density and soil permeability, were among the most important predictors. One possible explanation for the low predictability of variance is that in this first round of analyses we did not include metrics related to flow regime, which will better capture climatic controls on variance. The results to date suggest that inter-annual variance is less predictable than the mean at the landscape scale at least over the 5 year time interval. Hydromorphology metrics provide substantial added predictability reflecting the importance of considering lakes, streams and groundwater as integrated aquatic systems.

SS07

GROUNDWATER FAUNA IN THE BAUMBERGE SPRINGS, CENTRAL MÜNSTERLAND, NW GERMANY

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In the central Münsterland, NW Germany, the small mountain ridge Baumberge rises up to 187 m above sea level and the Upper Cretaceous rocks form a flat syncline by relief inversion. The internal structure is marked by an aquifer of permeable sandy marlstone (Baumberge Formation) on top and an aquitard of lesser permeable clayey marlstone (Coesfeld Formation) at the bottom. Groundwater flows mainly through a porous and fractured rock with limited karstic regions. High spring discharge can be observed after heavy rainfall when the syncline is filled with groundwater until it overflows at the boundary between aquifer and aquitard. Groundwater flow passes through porous and fractured rock. The Baumberge region represents a sparsely populated area with a high influence through agriculture.

Groundwater is defined as an unique ecosystem which is controlled by aquatic communities and energy flux (Griebler & Mösslacher, 2003), so that variations in the chemical composition directly affect the groundwater fauna. Additionally, temperature, oxygen- and pH-content as well as hydrostatic pressure modulate the abundance and diversity of groundwater fauna (Griebler & Mösslacher, 2003).

Previous research on the Baumberge springs included studies in hydrogeology, hydrochemistry and ecology (Göbel, 2010). The groundwater is a Ca-HCO_3-type water. The hydrostatic head amounts 47 m in the deepest point of the trough, with the result that the hydrostatic pressure there is about 470 hPa. The groundwater temperature varies between 9.9 and 10.1 °C and the oxygen content is about 42.0 up to 58.1 %.

The Baumberge region is a self-contained spring catchment with a groundwater fauna comprising (mostly) invertebrates, few fungi and bacteria (Preuß, 2010).

Selected springs are studied with respect to their faunal composition and compositional variations between them. Our approach includes a characterization of the chemical composition of the spring water in order to identify its influence on faunal abundance and diversity. Preliminary hydrochemical data show that the spring water is generally poor in total organic carbon (0.9 up to 1.4 mg/l) and rich in dissolved inorganic carbon and nitrate. Alongside our investigations, new sampling methods for springs will be developed.

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SS11

EFFECTS OF FLOODS ON THE WATER QUALITY AND PRODUCTIVITY OF A HYDROLOGICALLY DEGRADED URBAN FLOODPLAIN

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The pulsing of the river has significant effects on the nutrient cycling and primary production in floodplain water bodies. Alterations in the hydrological connectivity of floodplains might thus have severe impacts on basic ecosystem functions. The Lobau is a former dynamic floodplain of the Danube situated at the eastern border of the city of Vienna. The floodplain was cut off from the river in the course of regulation measures in the 19th century. In its present state, the Lobau is groundwater fed and back-flooded from its downstream end. Currently, sustainable management measures are in negotiation which allow for a hydrologically controlled re-connection of the floodplain with the Danube. In order to predict the effects of an increased input of nutrient-rich Danube water on the water quality of the backwaters, we investigated the change in water chemistry, DOM composition, and chlorophyll-a-concentrations in the backwaters following two floods in 2009 and 2012 which differed in magnitude and duration.
The connectivity of the different water bodies and the magnitude of the floods largely determined changes in water quality during and after flooding. In 2009, major parts of the Lobau were inundated, leading to an extensive water exchange with Danube water. In highly-connected water bodies, both conservative (e.g. conductivity, nitrate) and non-conservative (e.g. phosphate, ammonium, chlorophyll-a) parameters approached the level of the Danube during flood peak, but showed a rapid recovery after the peak. Backwaters with a low connectivity showed similar reactions during the flood, but exhibited increased $P\text{-}PO_4$ and total P-concentrations after the flood, indicating an enhanced nutrient exchange between water and sediment after the inundation of predominantly dry areas. The results were supported by lab experiments in which repeated drying and re-flooding enhanced the release of phosphate from floodplain sediments. In 2012, the flood reached only the highly-connected downstream parts of the Lobau. Backwaters with a low connectivity did not change in water chemistry despite increased water levels through enhanced groundwater input. Phytplankton biomass significantly increased in high-connectivity water bodies after the flood in 2009, but decreased in low-connectivity backwaters. The flood in 2012 had no significant effects on chlorophyll-a-concentrations.

R02

GENETIC DIVERSITY AND CONNECTIVITY OF *GAMMARUS FOSSARUM* IN A GERMAN LOW-MOUNTAIN RANGE

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In their natural state, freshwater ecosystems are highly diverse and provide important ecosystem services to society. Human-caused alterations, however, have lead to the degradation of freshwater ecosystems, reduced the biodiversity and thus pose a threat to ecosystem services. As a political consequence, the protection and restoration of running waters and their biodiversity has been raised to a central goal. A focus of restoration projects is to improve species diversity. Besides species diversity, the genetic diversity contained within species is highly important for intact ecosystems. A lack of genetic diversity leads to a reduced evolutionary potential of populations to respond to stressors, adapt to changing environments and recover from disturbances. To maintain the genetic diversity, gene flow between populations by successful dispersal events is important. Determining the dispersal potential of freshwater species, and thus predicting the connectivity between populations is difficult, because gene flow is affected by several extrinsic factors (e.g. geographical distance, geological relief and hydrological barriers) and also by the dispersal ability of a species.

In this study we analyzed the genetic diversity and connectivity of the amphipod crustacean *Gammarus fossarum* in headwaters of a German low-mountain region in (Sauerland). *G. fossarum* is a locally abundant and ecologically important keystone species. We investigated genetic polymorphisms in two fast evolving genetic marker systems – a fragment of the mitochondrial cytochrome c oxidase 1 gene (29 populations) and four microsatellite loci (7 populations). The overall diversity of the populations was low and both markers showed a high differentiation of the populations indicative of strong isolation of geographically distant but also adjacent populations. A small but significant correlation was found among genetic distance and river distance between sampling sites. The correlation found between genetic and euclidean distance was higher and also significant. Together with the patterns found with the microsatellites this indicates infrequent overland dispersal. A possible explanation could be passive transport by animal vectors. To prevent further reduction of the genetic diversity, it is important to restore the chemical quality and hydromorphological structure of freshwater ecosystems and to remove physical obstacles to dispersal.

R14

INTERACTIVE EFFECTS OF KEY ENVIRONMENTAL VARIABLES CONFINE THE ECOLOGICAL NICHE OF PLANKTONIC MICROEUKARYOTES

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Since Hutchinson's seminal papers (1958, 1965) it is generally assumed that the realised in situ niche is narrower than the fundamental ecological niche of an organism. The latter describes physiological tolerance ranges in relation to abiotic (e.g., temperature, light, pH) and biotic factors (e.g., food, predation, competition) that can be assessed in the laboratory individually. A typical example is the temperature reaction norm that has been measured for many species in the laboratory. Similarly, parameter estimates derived from food uptake experiments as a function of food concentration (functional response) and growth rates vs. food concentration (numerical response) are used in food web models to predict the behaviour of a population or a functional guild (e.g. herbivores) in situ. Mathematical models are exceedingly useful tools to analyse the potential interaction of several factors. However, there is surprisingly little experimental evidence supporting the interaction of the most important ambient variables. Summarising recent results obtained with planktonic protists and rotifers, this study demonstrates how the interaction of several key environmental variables (temperature, pH, food quality and quantity) may confine the ecological niche of planktonic microeukaryotes to a narrow range. Ignoring the manifold interactions may lead to dramatically incorrect conclusions with respect to the ecological potential (tolerance) of individual species.

R06

MICROBIAL FOOD WEB INTERACTIONS WITHIN BIOFILMS

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Environmental biofilms are considered hot spots of microbial life. They contribute significantly to the matterflux in aquatic ecosystems, particularly in running waters, shallow lakes and groundwater systems. Biofilms potentially harbor all relevant microbial groups including bacteria, algae, protozoans, fungi and small metazoans and their densities usually exceed those in planktonic systems by some orders of magnitude. However, ecological studies mostly focus on bacteria or algae within biofilms and biofilm functions mediated by them. Studies on the occurrence and role of the highly abundant grazers (protozoans and small metazoans) are rare, particularly in comparison to the numerous studies on grazers and food web interactions within planktonic systems. One reason for this underrepresentation might be the common but erroneous view that bacterial biofilms are generally resistant against microbial grazing. It is therefore necessary to develop a conceptual framework on microbial food web interactions within biofilms. Here we will review recent findings on the role of micro-grazers in altering the structure and functions of biofilms and mediating the within-biofilm matterflux. We will develop a conceptual food web model with respect to the origin of resources used (autochthonous vs. allochthonous), food quality and food web complexity. It will be illustrated that grazers are an essential component of environmental biofilms, altering both structural and functional attributes of the biofilm.

SS01

DIFFERENCES IN TEMPORAL DYNAMICS OF TAXONOMIC AND FUNCTIONAL DIVERSITY UNDER VARIABLE ENVIRONMENTAL FORCING

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In most biodiversity studies taxonomic diversity is taken as the measure for the multiplicity of species which is often considered to represent functional diversity. However, taxonomic diversity and functional diversity may be inconsistent e.g. when many functionally similar species contribute to a certain community. Such differences between both diversity measures are of particular interest in diversity research for understanding diversity patterns and their underlying mechanisms. We analysed a 20-year time series of phytoplankton from Lake Constance to determine when taxonomic diversity and functional diversity exhibit similar or contrasting seasonal patterns. We found an overall weak positive relationship between taxonomic diversity and functional diversity with a distinct seasonal pattern. The two diversity measures were positively correlated from early spring to mid-summer and mostly negatively correlated from autumn to late winter. At the annual scale, spectral analysis revealed that the overall variability of taxonomic diversity is dominated by fluctuations at low frequencies, such as the annual, whereas in functional diversity, higher frequencies contribute substantially to the overall variance. The decline in taxonomic diversity along with stable or increasing functional diversity in the second half of the year is seen as a result of niche differentiation together with competitive exclusion. Under such conditions, several different sets of traits are suitable to thrive, but within one set of functional traits only one (or very few) taxa can persist. The combined analysis of taxonomic diversity and functional diversity allows for deeper insights into the temporal community organisation and niche differentiation.

R10

MULTI INDEX ASSESSMENT OF STREAMS AND ASSOCIATED UNCERTAINTIES: APPLICATION TO MACROPHYTES

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The European Water Framework Directive (2000) imposed chemical and biological assessments in streams. If studies of chemistry uncertainties exist for a long time, few similar studies are still recent in hydrobiology. Our aim is to study impacts of uncertainties – understood as any action that may cause a data error – on biotic metrics (diversity, abundance), biotic index and final assessment. We focus on the French index: IBMR (Indice Biologique des Macrophytes de Rivière, AFNOR, 2004) based on the macrophyte compartment. From literature, among the sources of uncertainties it appears that the operator factor had the least influence, the seasonal variation and shading had a slightly stronger effect. And the habitat change had the major impact. We chose to analyse uncertainties based on the operator effect both on field and in laboratory such as taxa omission, identification error and abundance change. To study the uncertainties propagation on the IBMR, we will use reliable floristic sheets which will be artificially modified. Firstly a matrix of identification errors will be created with confusion score between taxa difficult to differentiate. Secondly, a selection module using this matrix will complete a random exchange without human bias. Thus the creation of new erroneous floristic sheets will allow us to measure the deviation from the reference.

SS07

FAUNISTIC CHANGES ALONG AN ALTITUDINAL GRADIENT IN SPRINGS IN THE BERNESE ALPS (CH)

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Springs are distinct habitats which provide special conditions for macroinvertebrates. Species assemblages in springs in low mountain ranges differ greatly from those in high alpine ranges. It is however unknown how the composition of the species assemblages changes along an altitudinal gradient as it is common for example for plant communities. In this study we investigated natural springs along an altitudinal gradient in the Bernese Alps (CH) from 500 m a.s.l. up to 2500 m a.s.l.. We hypothesize that species richness as well as abundance will decrease along the gradient as the environmental harshness increases with altitude. During June 2010 and July 2011 the spring fauna was quantitatively sampled three times in over 40 springs along this altitudinal gradient. We continuously monitored air and water temperature and analysed structural and chemical parameters. Geological and vegetation parameters were mapped as well. The results show clearly that there is a strong altitudinal gradient in the sprecies richness. Contrary to our assumption diversity peaks at an intermediate altitude at about 1500 m a.s.l., in the area around the forest line. There is no continuous decrease of diversity along the altitudinal gradient. The abundance does not show any trend and varies strongly in all springs, independent from the altitude. The water temperature decreases continuously with altitude and can therefore not be the single driving factor for the species distribution. A possible reason for the peak of diversity at the intermediate altitude could be the microclimatic conditions, with relatively low water temperatures and sheltering woods, favouring both crenobionts as well as alpine species. Moreover, anthropogenic impacts lower the diversity in the springs at lower altitudes. The highly species rich area around the forest line will be affected strongly by the impacts of the climatic change such as changes of the precipitation characteristics and hereby changing snowfall intensity and duration. For future alpine biodiversity conservation it is very important to know more about the processes determining biodiversity patterns in these vulnerable alpine habitats.

R05

AN INTER-BIOME APPROACH TO ASSESS THE IMPACTS OF AGRICULTURAL LAND USE ON STREAM ECOSYSTEM FUNCTIONING

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The expansion and intensification of agricultural land use and the associated riparian deforestation, nutrient inputs and modification of habitat heterogeneity represents an ongoing threat to stream ecosystem functioning. Such stressors can influence stream ecosystems worldwide in a similar manner and are hypothesized to alter key environmental characteristics, which in turn may cause the loss of functional attributes and lead to biome-independent homogenization of stream ecosystem functioning. It is difficult, however, to jointly address these influences by measuring a single function due to the complex interaction of agricultural derived stressors. Therefore an integrated approach was being developed that combines the quantification of stream food-web processes (secondary production, stable isotopes) with analyses of ecosystem productivity in order to obtain a holistic understanding of energy and matter fluxes at the ecosystem scale. As a means to test the hypothesis of agricultural derived functional homogenisation independent of the biome affiliation, research in temperate (Harz Mountains) and Neotropical (Brazilian Cerrado and Atlantic forest) streams are conducted. Within this context, we will present methodological approaches and preliminary results of two subprojects focusing on microbial biofilm structure and function as well as the quantification of benthic secondary production and organic matter fluxes through the food web.

R13

EFFECTS OF *DIKEROGAMMARUS VILLOSUS* ON A RIVER FOOD WEB

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Invasive species are assumed to affect native communities by replacing competitors, overexploiting prey species or altering ecosystem structure. However, these assumptions are seldom tested because population-level effects of invasive species are difficult to investigate and large-scale observations often lack statistical power.

We performed an outdoor flow-through channel experiment manipulating the density of the invasive amphipod *D. villosus* and analysing its effects on the benthic community of the Upper Elbe River. We therefore exposed substratum-filled baskets inhabited by benthic invertebrates for 8 weeks to three different *D. villosus* densities in three mesocosm channels each. We hypothesized *D. villosus* to alter invertebrate community structure and to reduce physiological fitness indicators of benthic invertebrates in the high-density treatment. In addition, density, population structure, trophic position, and fitness of *D. villosus* were compared between the treatments to assess any density effects of *D. villosus* on its conspecifics.

We will present first results of the field experiment to assess the interactions between an invasive species and native benthic invertebrates by quantitatively analysing trophic interactions and its population-level effects.

R12

USE OF SATELLITE IMAGES FOR MONITORING RIVER SYSTEMS

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Given the above tasks and assignments there is a number of activities within the institute aimed at using and testing the potential of remote sensing images for a broad field of applications, e.g. monitoring of vegetation on floodplains (by department U3 – vegetation studies and landscape management) or to support the operational surveillance for maritime oil pollution (by department M4 – geo-information and remote sensing). With support of the European FRESHMON project, department M3 (groundwater, geology and river morphology) is currently testing the potential of satellite images for monitoring the temporal and spatial dynamics of suspended particulate matters in river systems.

For the example of the Weser and Elbe estuaries, in-situ measurements have been compared to results obtained from a temporal series of automatically generated maps of SPM distributions based on remote sensing data. The key finding of the analysis is a good agreement with the natural variability of the turbidity zone observed along the course of both estuaries. Spatial patterns of suspended particulate matters is another valuable information which is not visible by means of in-situ measurements but could have been derived from this series of remote sensing images. Such patterns can be further interpreted and give a more detailed insight into sediment transport dynamics. As an overall conclusion, satellite images are found to be a valuable source for additional data that can well supplement in-situ monitoring of SPM concentrations in estuaries.

R07

THE EFFECT OF AGRICULTURAL LAND USE ON QUALITY, QUANTITY AND SEASONAL FLUCTUATIONS OF DISSOLVED ORGANIC CARBON AND NITROGEN EXPORT THROUGH HEADWATER STREAMS

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Headwater streams export significant loads of dissolved organic matter (DOM) that they directly receive from the catchment soils. They deliver the DOM to downstream ecosystems, and this forms connective links between terrestrial and larger stream systems. The quality and quantity of the DOM is mainly determined by the prevailing biochemical processes in the catchment soils, and thus also by the dominant land use in the catchment. Agricultural land covers about 40 percent of the land surface at the global scale. Increased DOM concentrations have been found in streams draining this areas. Furthermore, changes in DOM quality compared to pristine land use have been observed. Due to fertilizer application, agricultural areas exhibit increased nitrogen levels, and thus dissolved organic nitrogen (DON) can be an important pathway for nitrogen loss from agricultural soils. In contrast to DOM and its dissolved organic carbon (DOC) subpool , results from comparable studies on DON quality an composition are inconsistent, due to analytical constraints regarding the commonly applied indirect determination of DON from dissolved inorganic nitrogen (DIN). Especially in agricultural catchments with high nitrogen loads, the importance of DON hence may be underestimated. We evaluated the effect of land use on DOC and DON quality and quantity, and compared the seasonal variation of DOC and DON exported from agricultural and near-pristine forest catchments. We used size-exclusion chromatography (LC-OCD-OND) to measure DOC and DON and its sub-fractions (humic substances, non-humic high molecular weight substances, low molecular weight substances). Additionally, we characterized the whole DOM pool by applying absorbance and fluorescence measurements and subsequent parallel factor analysis (PARAFAC). Results showed that seasonal fluctuations of DON and DOC composition and quality differed between agricultural and forest land use. Further, agricultural catchments exported higher DON loads than forests, characterized by microbially altered material with lower C:N ratios and increased molecular weight. The effect of land use on concentration and loads was more distinct for DON compared to DOC. Accordingly, DON quantity and quality vary in response to land use, and DON may be an underestimated but important component of biogeochemical fluxes through agricultural headwater catchments.

SS13

IMPACT – A MODELLING APPROACH TO ASSESS THE EFFECT OF PRESSURES AT DIFFERENT SPATIAL SCALES ON HABITAT CONDITIONS AND RIVER BIOTA.

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Most rivers in developed countries are affected by multiple pressures at different spatial scales ranging from the reach scale (local morphological alterations), river network scale (dams, reservoirs, missing source populations), catchment scale (land use effect on water quality and discharge), to the global scale (climate change). There is statistical evidence that all these pressures potentially influence river biota and that large-scale pressures may even limit biological assemblages and constrain the effect of reach-scale restoration, but it is difficult to infer causal relationship from these statistical analysis. Complementary experiments and modelling to investigate the governing processes can help to identify the main bottlenecks for biota and to guide river management and restoration.
A novel modelling approach will be presented that was developed in the IWRM.NET project IMPACT. Models for pressures at different spatial scales were coupled to assess the effect of climate change on discharge and in turn on river morphology, habitat conditions, and stream biota (fish and invertebrates) compared to the impact of other anthropogenic pressures at the catchment, river network, and reach-scale. The coupled models were: A catchment-scale rainfall/runoff model to predict discharge and water quality, morphological models to assess the effect on planform and geometry, hydro-/morphodynamic models to model local habitat conditions, dispersal models to assess the potential species pool for re-colonization, and habitat models to describe the assemblages that can be expected at the reach-scale. Moreover, an interaction model for the effect of biota on water quality will be incorporated in the future.
This approach was applied in three contrasting catchments and near-natural study reaches: a perennial, meandering sand-bed river in Northern Germany (Treene), a perennial gravel-bed river in south-western France (Célé), and an intermittent gravel-bed river in southern Portugal (Quarteira). The present conditions were compared to future climate and land-use scenarios. Besides presenting the modelling approach, the main challenges and problems will be discussed and more detailed results given in the following presentations.

SS07

CONTRASTS IN BENTHIC AND HYPORHEIC FAUNAL RESPONSES TO AN EXTREME SUPRA-SEASONAL DROUGHT

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Although commonly sharing species, invertebrate communities in benthic and hyporheic zones are seldom sampled concurrently, even though the hyporheic zone may serve as a refuge from unfavourable conditions during floods and drought. During hydrological drought, reduced flow and water loss may impose different pressures on these two associated assemblages. We sampled benthic and hyporheic invertebrate and water chemistry at monthly intervals at four sites during a high magnitude drought, to compare assemblage responses to variable surface water loss. Benthic invertebrate assemblage composition changed gradually at all sites during the drought, largely due to variation in abundance of aquatic insects associated with adult emergence. In contrast, the trajectory of change in the hyporheic assemblage composition displayed a ‘stepped response’ linked to the increasing abundance of *Gammarus pulex*. The contrasting faunal responses during drought demonstrate that the benthic community response cannot be assumed to reflect that of the hyporheos. This has implications for river restoration projects, which by focussing on the surface stream, may limit benefits for the wider ecosystem.

R05

HABITAT-SPECIFIC FOOD WEB STRUCTURES IN SMALL STREAMS – INTERACTIONS BETWEEN PREDATORS

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Diverse benthic communities of temperate streams include a wide variety of predators with different habitat preferences, e.g. for pools or riffles. We assume that this results in mesohabitat-specific food web structures with differences in trophic fluxes. This hypothesis was tested by means of mesohabitat-specific quantification of the prey consumption by invertebrate and vertebrate (fish) predators. Data were collected during three years in two 2nd order mountain streams inhabited by two benthivorous fish predators (*Gobio gobio* and *Barbatula barbatula*). We estimated consumption rates of fish and the most important invertebrate predators directly using gut fullness and evacuation rates. Predator biomasses in the pool and riffle habitats were estimated by mesohabitat-specific invertebrate sampling, electrofishing and 24-h video observations of fish habitat use. We found that the structure of the food webs differed between pools and riffles regarding the higher consumer levels. Total consumption seemed similar but the relative importance of certain predators, as indicated by the quotient between consumption by fish and by invertebrate predators, differed between mesohabitat types. From these results we conclude that food web quantifications in spatially structured ecosystems should discriminate between mesohabitat types for a more realistic picture.

SS13

A PEATLAND CARBON AND NITROGEN MODEL FOR ANALYZING THE LONG-TERM EFFECTS OF ATMOSPHERIC NITROGEN DEPOSITION AND CLIMATE CHANGE ON NORTHERN PEATLANDS

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Elevated nitrogen deposition and climate change alter the vegetation communities and carbon (C) and nitrogen (N) cycling in peatlands. To address this issue we developed a new process-oriented biogeochemical model (PEATBOG) for analyzing coupled carbon and nitrogen dynamics in northern peatlands. The model consists of four submodels, which simulate: (1) daily water table depth and depth profiles of soil moisture, temperature and oxygen levels; (2) competition among three plants functional types (PFTs), production and litter production of plants; (3) decomposition of peat; and (4) production, consumption, diffusion and export of dissolved C and N species in soil water. The model is novel in the integration of the C and N cycles, the explicit spatial resolution belowground, the consistent conceptualization of movement of water and solutes, the incorporation of stoichiometric controls on elemental fluxes and a consistent conceptualization of C and N reactivity in vegetation and soil organic matter. The model was evaluated for the Mer Bleue Bog, near Ottawa, Ontario, with regards to simulation of soil moisture and temperature and the most important processes in the C and N cycles. Model sensitivity was tested for nitrogen input, precipitation, and temperature, and the choices of the most uncertain parameters were justified. A simulation of nitrogen deposition effect over 80 years demonstrates the advantages of the PEATBOG model in tracking biogeochemical effects and vegetation change in the ecosystem.

R06

CENTURIES OF BURIED MICROBES - PRESERVATION AND DEGRADATION OF ORGANIC MATTER IN LAKE SEDIMENTS

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Sediments contain a historical record of lakes and their catchments in the form of pollen, diatom shells, or zooplankton carcasses. Sediments are also characterized by high levels of microbial activity, including the anaerobic recycling of organic matter. Despite some research into redox-dependent microbial processes in lake sediments, many of the microbial key players remain uncharacterized. We conducted a vertical screening of microbial diversity and chemical parameters in the sediments of Lake Stechlin, an oligotrophic lake in a forested landscape in northern Germany. Four cores from a small transect in 30 m depth were sliced into 15 different layers, the lowest being at 28 cm sediment depth. Nutrients, relevant elements, and heavy metals were measured in pore-water and solid matter. Diversity was measured in all three domains of life with pyrosequencing. In general, planktonic phyla (phytoplankton and zooplankton) were often degraded within the first 10 cm, while each phyla harbored a specific half-life. Surprisingly, we found almost no allochthonous DNA remnants from plants or fungi from the lake catchment. In contrast, sediment bacteria were present in all depths, although they decrease in importance relative to Archaea with increasing depth, where we found some Archaea with unknown affiliation. Bacteria may play a key role in transforming the energy from eukaryotic residuals to Archaea. To date, no single chemical parameter (e.g. methane, phosphorous, CN, depth) is correlated with differences in sediment layers, suggesting an influence of a broad combination of factors. Our comprehensive approach outruns previous studies and renders it possible to compare all biological organism present in a lake sediment. This allows to conclude on their biotic and abiotic interactions.

R10

IMPACT OF CATCHMENT LAND USE, HYDROLOGY AND MORPHOLOGY ON METRICS OF MACROPHYTE COMMUNITY COMPOSITION.

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Metrics of macrophyte community composition, abundance, trophic response, habitat utilisation and functional attributes are used to derive ecological status for Irish lakes. The relationship between these metrics and ecological status is based on in-lake characteristics such as transparency, nutrient and chlorophyll-a concentrations. Although species composition is difficult to predict due to e.g. hydrological connectivity and stochastic processes, metrics which do not rely on individual taxa may provide greater predictive power over a larger number of lakes and lake types. We related lake and catchment morphology, hydrology and land use to a number of these metrics to allow extrapolation to an unmonitored lake network. Variability in the selected metrics was explained by physical catchment characteristics such as geology (% limestone, % peat) and morphology (catchment slope), highlighting the importance of lake and catchment setting to in-lake processes. Prediction of macrophyte community metrics in unmonitored lakes could provide lake managers with information on factors contributing to overall ecological status. Such information may help identify lakes for remediation or further study.

R03

A SURVEY ON THE ALPINE LAKES OF VERCENIK MOUNTAIN (RIZE/TURKEY): ZOOPLANKTON OF YAYLA LAKES

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In this study, zooplankton in 3 alpine lakes with a mean altitude of 2900 a.s.l. (Lake At, Lake Yayla and Lake Kumlu), which are located at Rize-Verçenik Mountain area was determined and relationships between zooplankton and enviromental variables were examined by using canonical correspondance analysis (CCA). The water quality parameters were recorded, zooplankton counts were calculated and all results were ecologically evaluated. In the studied lakes a total of 16 species were identified, of these 11 belonging to Rotifera, 4 to Cladocera and one to Copepoda. In was noted that out of a total 16 observed taxa, 12 were at Lake At, 8 were at Lake Kumlu and 7 were at Lake Yayla. According to CCA, the parameter that has the strongest effect on species distribution was electrical conductivity while the weakest was altitude.

R09

GREATER TEMPORAL VARIABILITY IN STREAM METABOLISM INDICATES LAND-USE DISTURBANCE

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Stream metabolism (gross primary productivity and ecosystem respiration) is increasingly used as an indicator for assessing river health because mean values are responsive to spatial variation in stressor intensity. Resilience theory suggests that temporal variability in key ecosystem properties, like metabolism, will make ecosystems less resilient to disturbances. Therefore, variability in metabolism may be a useful predictor of ecosystem resilience and impending regime shifts. Little is known about how stress intensity influences temporal variability of stream metabolism so we measured within-week and seasonal variation in stream metabolism at 13 stream sites across a land-use impact gradient over 9 years. Variance in stream metabolism was strongly dependent on the mean with increasing variability associated with increasing mean values. Using non-parametric analysis, within-week and seasonal variation in stream metabolism was significantly related to land use intensity. Results suggest that temporal variability in stream metabolism is indeed amplified by catchment land use intensity; however it is not clear whether the concept of alternative stable states, that is predicted in resilience theory and observed in lakes ecosystems, will also apply to rivers and streams.

R14

FUNCTIONAL CHARACTERISTICS OF METABOLIC ENZYMES IN *DAPHNIA* REVEAL ADJUSTMENTS TO CHANGES IN TEMPERATURE CONDITIONS

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The poikilothermic planktonic crustaceans of the genus *Daphnia* can adjust metabolic properties and physiological performance to a broad temperature range. Biochemical analyses of enzymes involved in carbohydrate metabolism in *Daphnia* focused on selected isoforms of PGM (phosphoglucomutase), PGI (phosphoglucose isomerase) and LDH (lactate dehydrogenase) in *Daphnia.* Both, acclimation temperature of the animals and assay temperature affect enzyme activity and substrate affinity. In response to persisting temperature changes, differential subunit expression supplies individuals with more suitable subsets of isofoms. This phenotypic plasticity can rapidly adjust enzyme activity, resulting in appropriate enzyme properties for the new conditions within an individual and thus increase thermo-tolerance.
On the population level, selection of genotypes with different allozymes of glycolytic enzymes results in microevolutive processes. Accordingly, the abundance of animals carrying specific variants of these enzymes of interest changes along with the season or along a vertical temperature gradient within the lake. The presentation will aim at an integrative view from biochemical and molecular properties of these enzymes to the animals' physiological performance at elevated temperatures and resulting shifts in genotype contribution to the *Daphnia* assemblage.

SS12

THE WAY AROUND THE OBSTACLE: HOW FISH SPECIES MAKE USE OF NEW FISH PASSES

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The way around the obstacle: How fish species make use of new fish passes

Like most other rivers, the Lippe used to be cut into bits and pieces by weirs and other obstacles for aquatic organisms. During the last years, several migration barriers have been made passable.

The Lippe weir in Hamm-Heessen is still needed to stabilize the water level for the foundations of a castle, so instead of removing the weir a fish pass was built around it in the project “LIFE+ Lippeaue” in Hamm. Efficiency control was carried out for more than a year using fish traps and electrofishing.

The entrance of the fish pass is too far away from the obstruction to be found by most fish, so only a limited number of individuals was expected to use the pass. Instead, thousands of fish of 33 species were counted in a year, the highest numbers reached by roach (*Rutilus rutilus*), ruffe (*Gymnocephalus cernua*), perch (*Perca fluviatilis*) and bleak (*Alburnus alburnus*). The migrants were mostly young of the year that probably did not all “want” to go upstream but moved about in search of profitable feeding grounds. Nevertheless, such movements contribute to a genetic exchange between the fish upstream and downstream from the weir.

In addition to the near natural fish pass a vertical slot pass was built at the same weir by the Lippeverband. The entrance to this technical pass is much better. A comparison showed that the slot pass was used by more large fish and by more individuals of rheophilic species, but possibly by fewer small individuals. So the two passes seem to supplement each other.

SS06

VARIABILITY OF HAZARDOUS SUBSTANCES AND MICROBIAL PROCESSES IN RIVERINE SEDIMENTS SUBJECT TO FLUCTUATING FLOW CONDITIONS

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The global mean rates of precipitation and evapotranspiration are expected to increase, causing flood and drought events of higher intensity and frequency in the Mediterranean area as well as in several other regions of the world. Considering the risks and consequences of climate extremes, the southern Mediterranean temporary rivers represent either significant water resources directly accessible for agricultural and industrial purposes, either aquatic ecosystems to be preserved. In Europe, the Water Framework Directive (WFD 2000/60/EC) includes a list of 33 priority substances with the aim to regulate the limits of concentrations in surface waters and to develop environmental quality standards for sediment and biota. This list includes polycyclic aromatic hydrocarbons (PAHs) and nonylphenols (NPs) both potentially hazardous to human health and natural ecosystems.

Temporary rivers are naturally characterized by a high variability of the hydrological cycle that influences the availability of nutrient and organic matter (OM). The microbial transformation of the detritus to biomass in the sediments, is a key processes with regard to the C-flux in the lotic systems as it represents the link between sedimentary OM (including pollutants) and the food web.

The results obtained in the frame of the EU Project MIRAGE, give a snapshot of the variability of two classes of pollutants and microbial processes in sediments from a temporary river of Southern Italy, in different hydrologic conditions from flood to drought. The observed changes in the sediments were mainly related to PAH contaminations: large mobility during high flow and accumulation during low flow. The contamination by NPs was less affected by hydrological conditions and the level of the contamination can be considered rather constant. Changes were evident in the microbial strategies that induced a progressive decline of the functional microbial properties passing from high flow to no flow. It is interesting to note that drought acts both on the reduction of bacterial cell activity and on micropollutant concentration (i.e. PAHs). The significant reduction of the microbial metabolic rates does not imply the complete cessation of the C-flux, as resident communities showed residual activities.The management of temporary rivers have to consider the different diffusion of micropollutants in relation to hydrological regime as well as the diffrent contribution of the microbial activity to OM degradation.

SS01

MORPHO-FUNCTIONAL CLASSIFICATIONS OF PHYTOPLANKTON IN DEEP KARSTIC LAKES

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Morpho-functional classifications of phytoplankton are increasingly used in ecological studies of different aquatic ecosystems. Classifications based on morphological and functional traits group species with common features and similar structural and functional characteristics in order to achieve a better understanding of the functioning of ecosystems, and are powerful predictors of the dynamics of a particular ecosystem. The aim was to explore the adequateness of the functional classifications in detecting changes in the phytoplankton assemblages of deep karstic lakes by comparing three different classifications: (a) functional groups (FG) by Reynolds *et al.* (2002) revised by Padisák *et al.* (2009); (b) morphofunctional grups (MFG) by Salmaso and Padisák (2007); (c) morphologically based functional groups (MBFG) by Kruk *et al.* (2010), and to detect how well can the biomass of phytoplankton groups based on different classification systems be explained by environmental conditions in two different karstic lakes. The investigation was conducted in the National Park Plitvice Lakes. Samples were collected monthly throughout 2009 and 2010 at 5 m intervals from the surface to the bottom in the deepest part of the lakes Kozjak and Prošće. Both lakes presented low phytoplankton biomass (Kozjak avg. 0.11 mg l^{-1}; Prošće avg. 0.30 mg l^{-1}). Several centric (*Cyclotella* spp., *Discostella stelligera*) and pennate diatoms (*Synedra* sp., *Ulnaria ulna* var. *acus*) together with the chrysophycean *Dinobryon divergens* were dominant in Kozjak, whilst Prošće was characterized by chrysophyceans (*D. sociale*, *D. divergens*), cryptophyceans (*Cryptomonas* sp.) and planktonic diatoms (*Stephanodiscus* sp., *Fragilaria crotonensis*). CCA performed on functional classifications revealed that the best results in describing the phytoplankton succession were obtained using the MBFGs approach although it is less sensitive in describing variability of individual descriptive algal groups in this environment than FGs and MFGs. The functional and morphofunctional classification showed a high level of similarity in explaining phytoplankton variability in relation to environmental factors, thus proving to be rather useful and applicable to deep karstic lakes. The functional classification is a more sensitive indicator of the effects of processes in environment than traditional taxonomic classification. Current position of some descriptive species in functional classifications will be discussed in detail.

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