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SS3

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STREAM RESTORATION BY WOOD ADDITION – CONNECTING REACH AND BASIN SCALES BY ECOSYSTEM SERVICES

Traditional forests harvesting in temperate regions constraints the tree age distribution, impeding trees to age and fall. This management does not only affect terrestrial ecosystems, as dead wood might enter stream ecosystems, where is one of the most important structural elements. Failure to link ecological processes and their effects on human welfare has favored traditional forest harvesting that focuses on the maximization of the service wood provisioning, whereas the cost on other services from terrestrial and aquatic ecosystems is not considered. Here, we show that, in several stream reaches flowing through a temperate forest and into a drinking water reservoir, the lack of dead wood in streams has an important economic cost because of the effects on the services: fish provisioning, opportunities for recreation and tourism, water purification and erosion prevention. Reach scale active restoration actions by wood addition demonstrated that the total economical value of streams increased between 10 and 100 fold, accounting as much as 2.5 € per meter of restored river length and year. Among services, the service erosion prevention was that contributing the most to the total economical value. Cost-benefit analyses of the performed restorations at the reach scale, as well as two scenarios where restoration was carried out at the basin scale, by actively placing wood or passively allowing the forest to age in a 30 m forest ribbon at each side of the streams, pointed out major differences among stream orders, as the time required to recover the restoration investment ranged from 4 years in the stream order 1 to 35 in the stream order 3. Our valuation of the services provided by dead wood may prove useful in making appropriate decisions for a more efficient and sustainable use of forests fringing with stream ecosystems in temperate regions.

SS11

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MODELING INSTREAM NUTRIENT PROCESSES AT THE CATCHMENT SCALE: TESTING THE EFFICIENCY LOSS HYPOTHESIS

Streams and rivers transport nutrients from terrestrial sources and also serve as hot spots for nutrient transformation, storage and removal. Such systems thus become regulators of exported material to downstream ecosystems and their functioning should be considered as part of entire river networks. A hybrid process-based and statistical model (SPARROW, SPAtially Referenced Regression On Watershed attributes) was applied to the Llobregat River Basin, a highly impacted watershed in NE Spain, in order to evaluate the yearly annual nitrate and phosphate loads within the period of 2000-2006 and to study the processes affecting the nutrient transport and retention in the river channels. SPARROW estimates nutrient retention based on a first-order reaction, where the amount of nutrient uptake is directly proportional to the available nutrient concentration. Data of nutrient spiraling metrics have shown that the efficiency of process rates relative to concentration eventually declines. Therefore, the model was modified to include such efficiency loss and better capture the instream processes related to biological uptake. Model calibration results provided a reasonably good fit between measured and predicted loads. In the nitrates model, source variables such as the extension of forested land and cultivated land were strongly significant ($p < 0.005$). In the case of phosphates, significance reached the same levels for urban areas and forested land as sources. In the two models the stream decay coefficients were statistically significant, indicating the potential role of instream processing in limiting the nutrient export. Thus, this study suggests that it might be necessary to include the concept of a partial saturation effect in uptake efficiency (expressed as a power law)when estimating in-stream nutrient retention, which has not been taken into account in many previous modeling efforts of nutrient cycling at broad scales.

SS15

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USE OF EPILITHIC DIATOMS TO EVALUATE WATER QUALITY OF THE DELICE RIVER (KIZILIRMAK) IN TURKEY

Diatoms are known to be very sensitive to changes in chemical and physical variables such as nutrients. They respond quickly to such changes because of their short life-cycles and differing tolerances to the variables. Epilithic diatoms assemblages were used to evaluate water quality in the Delice River and its arms which is one of the main tributaries of the Kýzýlýrmak River. In this study, some physico-chemical characteristics and epilithic diatoms were investigated in the ten different sampling locality on the Kýzýlýrmak and Delice Rivers between May 2007 and September 2008. During the study totaly 173 diatom taxa were identified from the stations. Water quality were evaluated according to diatom taxa by using OMNIDIA Software Program. The results show that EPD-I, IBD, IPS, IDG, CEE, TDI and ROTTtp indices have quite high correlation with the physico-chemical variables and also, IDG, IPS, TDI and IBD indices seems to be the best for this study. Key Words: Kýzýlýrmak, Delice River, Diatom indices, OMNIDIA, water quality, Turkey,

O3

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THE EVALUATION OF THE WATER QUALITY AND TRACE METAL CONCENTRATION THROUGH THE KIZILIRMAK RIVER OF TURKEY

Kýzýlýrmak is the longest river of Turkey (1355 km). The river is starting at Kýzýldað in the Sývas province it flows across the Central Anatolian plain and enters the Black Sea near the town of Samsun. Rapid industrialization and the discharge of potentially toxic trace metals into the river have become many problem recently. Trace metal content of water, sediment and fish were evaluated together with water quality parameters during 2008 in The Kýzýlýrmak River. During the study 10 different localities were selected according to the pollution locality to observe the sources and bioacumulation through out from Sývas to Ankara Trace metal content (Al, Mn, Fe, Ni, Cd, Co, Cr,As, Pb, Hg, Cu) of water, sediment and fish species were determined by ICP-MS together with physico-chemical variables. According to Water Contamination Control Regulation 2004 Kýzýlýrmak River has III-IV class water quality in terms of SO4, Na and Al; II. Class in terms of Cl. Whereas the other metals were highly accumulated in the sediment of Kýzýlýrmak river. In this regard, the discharges of the wastes into the water should be continously monitored. Key Words: Heavy metal, water quality, criteria, Kýzýlýrmak River, Turkey

O4

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N/P RATIO OR ALLELOPATHY IS EFFECTING MICROCYSTIN PRODUCTION OF MICROCYSTIS AERUGINOSA

Microcystin production of cyanobacteria has been stimulated with different factors, i.e. temperature, light, nutrient inputs, grazing or allelopathy. Microcystis aeruginosa and Monoraphidium arcuatum were isolated from the same environment and generally found together in the bloom period of Microcystis. These strains were grown in batch cultures as monoculture and mixed cultures to examine the effect of N/P ratio and allelopathy on the growth of these two species and microcystin production of Microcystis. While N/P ratio greatly affected the growth rate of Microcystis, its influence on Monoraphidium is uncertain. Growth rate of mixed culture was also not affected by the N/P ratio. Distinct patterns were observed for the nutrient uptake of Microcystis and Monoraphidium. N-uptake was higher in Microcystis and showed variance among different N/P treatments. Intracellular microcystin content of Microcystis exhibited a high correlation with increasing N/P ratios and with duration of experiment, however, microcystin content of mixed culture decreased with the incubation period. External microcystin content changed variably with time but showed no differences in monoculture and mixed culture. Our results indicated that N/P ratio together with allelopathy have an effect on the growth and microcystin production of Microcystis.

O3

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MEDPACS AND ACADARI, BEYOND THE DEVELOPMENT OF ECOLOGICAL STATUS ASSESSMENT TOOLS FOR FRESHWATER ECOSYSTEMS: PREDICTING THE EFFECT OF GLOBAL WARMING ON MACROINVERTEBRATE COMMUNITIES OF SPANISH MEDITERRANEAN WATER-COURSES

A lot of freshwater ecology literature has been produced after the publication of the European WFD in 2000. Most focus on the development of assessment tools The MEDiterranean Prediction And Classification System (MEDPACS) was developed as one of these tools, able to assess the ecological status. At present it not only uses predictive approaches, but also that allows the calculation of many other metrics of macroinvertebrates. Moreover the option 'Biotic Indices' of the menu serves for all countries of the Mediterranean basin. MEDPACS (http://medpacs.ugr.es) was designed and developed as a modular flexible platform due to variety of biological indices and predictive models to be applied. This application has been implemented using Enterprise Java Beans 3.0 and Java Server Faces 1.2 technologies on server side and Ajax and Google Maps® on the client side. It runs in a Glassfish application server v2.1. MySQL server v5.1 was used to maintain the persistent data. It was developed withs NetBeans 6.5. Furthermore, a field data capture application has been designed for mobile phones and PDA devices provided with Windows Mobile® (ACADARI: Aplicación de CAptura de DAtos en RIos). It allows gather field data, to calculate different indices, also offers support to GPS devices; it has an specific application allowing the synchronization of the data captured with any computer running XP or later Windowsversion, it exports data in Microsoft Excel® format, and permits to download them on data sheets ready to be used in data processing, such as MEDPACS. Finally modeling has been used in a preliminary essay to predict the effects of global warming at different scenarios on the macroinvertebrates communities of rivers from the Spanish Iberian peninsula.

O6

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ENVIRONMENTAL PARAMETERS INFLUENCE THE HARMFUL ALGAL BLOOM AND BACTERIAL ABUNDANCE IN KÜÇÜKÇEKMECE LAGOON, ÝSTANBUL, TÜRKIYE

University, Faculty of Aquatic Sciences, Ordu Cad. No:200 34470 Laleli, Istanbul, Türkiye 2 Istanbul University, Faculty of Science, Department of Biology 34134 Vezneciler, Ýstanbul / Türkiye Küçükçekmece Lagoon is a small lagoon with brackish water and is located in Istanbul metropolitan area. It is connected to the Marmara Sea by a narrow channel 1.5 km long. Lake area is 16 km2 with maximum depth of 20 m. The lake is 10 km in length and its widest part is 6 km. The aim of this work was to evaluate the effect of the water quality on abundance and the spatial distribution of total phytoplankton and bacteria. At this purpose, water samples were collected at monthly intervals, from July 2006 to June 2008 at five stations. Total Phosphorus (mean 1441 µg/L), Soluble Reactive Phosphorus (mean 1049 µg/L), Total Nitrogen (mean 6.93 mg/L), Total Carbon (29.8 mg/L), Chloropyll-a (109 µg/L), Silicate (3.19 mg/L) and Secchi Depth (122 cm) were measured. The spatial and temporal dynamics of dominant phytoplankton taxa and bacterial abundance were related to measured water quality parameters. A shift in species composition have often been attributed to changes in nutrient ratios particularly TN:TP, TC:TP and TN:Si. Excessive growth of blue-greens, euglenophytes, dinoflagellates and total coliform bacteria showed its eutrophic conditions. The deterioration of water quality in the Küçükçekmece Lagoon negatively affect the use of the lagoon as a regional resource, and also important for its ecological, economic and recreational value.

SS6

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A COMPARATIVE ANALYSIS OF FISH ASSEMBLAGES' STRUCTURE IN REGULATED AND NON-REGULATED RIVERS FROM TEMPORARY AND PERMANENT BASINS

Flow regimes are responsible for several ecological processes on freshwater ecosystems. The construction of dams for hydroelectric and agricultural purposes, by changing the natural hydrologic regime of the streams, can cause significant changes on the structure of freshwater fish assemblages. In this study we identified which hydrologic variables are more affected by each type of regulation and analysed spatial and temporal differences on fish assemblages' structure of two permanent rivers of the north of Portugal, rivers Vez (with natural hydrologic regime) and Homem (a stream regulated by the constant hypolimnetic release of Vilarinho das Furnas hydroelectric dam), and two southern temporary streams, rivers Sado (regulated by an agricultural reservoir with null or reduced discharges) and Corona (a typical naturally temporary stream). In each of these rivers, fish were sampled by electrofishing in four occasions, namely June (spring), August (summer), October (autumn) of 2010 and January (winter) of 2011.In the temperate system, regulation for hydroelectric purposes strongly affected flood related variables, reducing the number and intensity of peak flows. On the other hand, agricultural regulation in the south caused an inversion of the hydrological cycle of typical temporary streams, since the water released during the summer period severely reduced the magnitude and duration of the habitual droughts. Regulated rivers, on both regions, presented a higher proportion of introduced species, probably related with a more opportunistic foraging behavior and less seasonally marked life cycles. Species richness was higher on the regulated systems, due to the presence of the exotic species, and species diversity of the assemblages presented higher values on natural sites. These variables varied along the year, mainly in the autumn where the first flushing flood occurs after the low flow period, reinforcing the importance of these phenoms as structuring factors of the fish community.

SS2

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TEMPORARY WATERS IN APULIA (SOUTH-EASTERN ITALY): BIODIVERSITY AND ENVIRONMENTAL FEATURES

The Mediterranean climate together with a karstic landscape, provides Apulia (south-eastern Italy) suitability for surface temporary waters. Very few studies have been addressed to check biological features of these peculiar environments in the region. In the framework of a research project financed by the Fondazione Cassa di Risparmio di Puglia on the Apulian temporary waters, an extensive sampling has been carried out from autumn 2010 to winter 2011. "Mediterranean temporary ponds" (code 3170 of the Habitat Directive) were identified on the basis of the plant associations. Main human activities and threats to the habitat conservation were also identified for each site. The study covered about 19,000 Km2 of territory. A total of 141 temporary waters were detected and analysed. Twenty of them were recognized as "Mediterranean temporary ponds", and some typical plant associations were characterized by the heterosporous pteridophyte Isoëtes japygia, an endemic species of Apulia recently described. Planktonic invertebrates were represented mainly by Crustacea. Among them Neolovenula alluaudi represents a new record for the Italian Fauna, Daphnia mediterranea proves to be a new records for the Italian mainland. Even thought Apulian temporary waters are region-wide spread, the "Mediterranean temporary ponds" are located only in the southernmost area of the region. A huge number of sites with a high number of Crustacea, some of which very rare, are not recognized as "Mediterranean temporary ponds", but likewise they should deserve protection because they are in a bad condition mainly because of the urbanization and the intensive agricultural activities. These results open a discussion on the gap of the Habitat Directive to indicate areas deserving conservation and might provide an useful support to the designation of new protected areas in Apulia.

O7

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THE EXOTIC AQUATIC MUD SNAIL POTAMOPYRGUS ANTIPODARUM (HYDROBIIDAE, MOLLUSCA): STATE OF THE ART OF A WORLDWIDE INVASION

Biological invasions are an ecological and economic problem in our global World. Human beings have overcome all biogeographical barriers, connecting all parts of the World, facilitating the spread of non-native species on a large scale. Consequently, human activities - such as international trade- are causing a decline in biodiversity and a biotic homogenization. While a few species have been unanimously classified as invasive due to the ecological and economic impacts on the invaded ecosystems (e. g. zebra mussel), other exotic species show contrasting invasive potential, depending on the properties of the invaded ecosystem or/and species traits. This is the case of the aquatic mudsnail Potamopyrgus antipodarum Gray (Hydrobiidae, Mollusca), which is a native species to New Zealand, but it has colonized most continents (Europe, Australia, America and Asia). This species can be a serious invader under certain circumstances (e.g. human-perturbed aquatic ecosystems), but it can also facilitate some native invertebrates at lower densities. The aim of this study was to review the available information on the worldwide distribution, impacts, and ecological traits of this snail that can help to explain its present distribution and potential impact in colonized aquatic ecosystems. The literature shows that most studies on mudsnail distribution have been conducted in Europe, North America and Australia, but a few studies are available for Asia. Mudsnail distribution is still unknown in other parts of the World. The intensity of mudsnail impact is related to the densities that it reaches in the invaded ecosystems. In general, a high abundance of mudsnail is achieved if the invaded ecosystems were previously perturbed by human activities. Our review can contribute to clarify the extent to which this mollusc can be a global threat for aquatic ecosystems.

SS8

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HOW RIVERSCAPE STRUCTURE AND BIOLOGICAL TRAITS DETERMINE DISPERSAL AMONG RIPARIAN/STREAM ORGANISMS: USING MICROSATELLITES TO HELP RESOLVE ECOLOGICAL QUESTIONS.

Molecular markers are becoming a more widely applied tool in studies of organism dispersal. Estimating the extent of gene flow contributes to our understanding of the relationship of landscape connectivity with the distribution and abundance of different species. This knowledge is valuable to both ecologists and resource managers in terms of population conservation and the prioritization and potential success of restoration programs. In a pre-alpine catchment having both natural and anthropogenic barriers, we used microsatellites to examine the population genetic structure of five obligate river species with strongly differing biotic traits and dispersal capacities. Study organisms ranged from two riparian species – a plant (Myricaria germanica) and a wingless grasshopper (Chorthippus pullus), both restricted to gravel bars – to three aquatic species: a mayfly with a terrestrial winged phase (Baetis rhodani), as well as a fish (Cottus gobio) and freshwater shrimp (Gammarus fossarum) with dispersal constrained to the water column. Genetic differentiation and diversity of each species revealed different patterns reflecting species-specific spatial connectivity, and habitat availability at the catchment scale and large-scale processes that influence population exchange outside the study catchment. Our results suggest that, depending on specific dispersal traits, species show different extents of sensitivity to landscape fragmentation resulting from on-going human induced reduction in connectivity and habitat availability.

SS9

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TAXONOMICAL, SIZE STRUCTURE AND GENETIC RESPONSES OF CLADOCERAN COMMUNITIES IN SUBALPINE LAKES TO 150 YEARS OF HUMAN PERTURBATIONS

During the past century, most European lakes have undergone a phase of eutrophication that altered their trophic structure and led to a cascade of ecological changes. Efforts have been undertaken to stop the external cause of eutrophication but interactions between decreased phosphorus inputs to the lake and concurrent climate change or fisheries management practices may prevent recovery along a simple reciprocal pathway. Pelagic cladoceran, of the genus Daphnia and Bosmina, are key-species for the transfer of matter and energy from the base of the food web to higher trophic levels. Because Daphnia and Bosmina carapace remains as well as Daphnia resting eggs accumulated in lake sediments, these subfossil remains represent a unique biological archive to unravel the trajectory of the pelagic cladoceran community in response to environmental changes over the long term, in terms of taxonomy, size structure and genetic architecture. Using a high-resolution paleolimnological approach, this study aimed at addressing the role of human-made changes (changes in nutrient level and fish communities in a context of climat change) on the trajectory of the pelagic cladoceran community over the last 150 years in two French deep subalpine lakes, Lake Geneva and Lake Bourget. More specifically, this study investigates i) how 'bottom-up' and 'top-down' changes affected the cladoceran community structure, ii) whether such changes in community structure arise only from phenotypic plasticity or came along with changes in cladoceran genetic architecture, through analysis of mitochondrial DNA of Daphnia resting eggs. Keywords: food web, cladoceran, top-down, bottom-up, genetic architecture.

SS14

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ERASING THE MOLLUSCAN RICHNESS OF FRESHWATER ECOSYSTEMS: A MEDITERRANEAN PERSPECTIVE

Introduction Freshwater ecosystems are a precious resource in the Mediterranean area, both in terms of high endemism and intense human demand. Far from receiving adequate protection to ensure sustained essential services, these habitats have been largely destroyed or modified deeply enough to drive native biotas to extinction. Methods and materials Recent changes in the molluscan assemblages are reviewed in four different types of freshwater ecosystems, based on historical collections, sediment samples and the record in long-lived native bivalves. The known or inferred dates of arrival and likely ways of introduction have been compiled for invasive freshwater mollusks in the Iberian peninsula. Results The Ebro river has suffered a catastrophic series of cascading impacts after the arrival and spread of exotics. Lake Banyoles was profoundly altered by the introduction of predatory exotic fish, and likely will undergo further upturning after arrival of invasive mollusks. Coastal marshes experienced profound changes in hydrology and pollution, causing the disappearance of once abundant and diverse assemblages. In the continent several species disappeared from the edge of their range, but under insular conditions this implied species extinctions. Spring-fed ecosystems probably take the heaviest toll, with extreme endemism facing exotics and disturbance. Crenobionts in real islands or ecological isolates are most vulnerable. The rate of successful introductions is increasing exponentially, accelerating the change towards banal, globalized faunal assemblages. Conclusions The number of critically endangered and recently extinct species in Mediterranean freshwaters is already high and keeps increasing. Species that rely on restricted habitats are at high risk, but this is also true for those affected by complex environmental changes at the scale of whole drainages. Human alteration opens windows for invasive species that will thrive depending on natural conditions and sociological matters. It is clear that the process of biodiversity loss and biotic homogenization is proceeding fast.

SS15

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AN ASSESSMENT OF THE POSSIBILITIES TO IMPROVE THE TROPHIC STATE OF RIVERS IN GIPUZKOA (BASQUE COUNTRY, NORTH SPAIN) THROUGH INCREASED SELF-PURIFICATION

Gipuzkoa (Basque Country, North Spain) is a mountainous and highly industrial region with a long history of water pollution. In the last decades, large investments in sanitation and wastewater treatment resulted in improved water quality and partial recovery of river biological communities. However, under current situation, further improvements solely based on technological approaches have become increasingly unfeasible. Therefore, our objective was to assess whether in-stream self-purification may be an additional factor contributing to the improvement of the trophic state of rivers in Gipuzkoa. We first analysed the loads of nutrients transported by Gipuzkoa's rivers, and compared them with the potential nutrient uptake rates (data obtained from the literature). Both of them are within one order of magnitude, suggesting that the self-purification capacity of river channels may influence nutrient concentrations. Second, we selected some river reaches where nutrient concentrations were the most important problems, and run the expert system STREAMES 1.0 to diagnose the problems, detect their causes and explore the likely solutions. The studied reaches differed in their problems, from diffuse nutrient inputs to point-source inputs associated with wastewater treatment plants, and in their potential solutions. Third, we empirically determined nutrient retention in two streams by means of constant-rate nutrient additions and of mass balances. We detected large differences in retention capacity between reaches, and siltation as one of the main problems affecting the self-purification capacity of the study streams. The results so far obtained point towards an important potential of in-stream self-purification to reduce nutrient loads, and to specific restoration activities that may improve the functionality and trophic state of the streams in Gipuzkoa.

O3

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THE DUERO DIATOM INDEX (DDI) FOR RIVER WATER QUALITY ASSESSMENT IN NW SPAIN: DESIGN AND VALIDATION

Diatoms are widely used to monitor river pollution because they are sensitive to water chemistry, especially ionic content, pH, dissolved organic matter, and nutrients. The study of ecological profiles of the diatom assembles provides the basis for the development of diatom-based metrics, which are developed in certain geographic regions but are frequently used elsewhere. Recent studies have suggested that diatom indices that were developed within one region are less effective when they are used in other areas. Therefore, the aim of this study was to develop a new diatom index at a regional scale, the Duero Diatom Index (DDI), in order to improve water quality assessments in rivers of the Duero Basin (NW Spain). DDI scores were calculated as the weighted average of six partial indices, each one for each environmental variable studied (pH, conductivity, biological oxygen demand, ammonia, nitrates and phosphates). These indices were brought together in a final metric, which provide an integrated value of water quality for the studied systems. The analysis of the correlation between IDD scores and physical-chemical variables of the rivers showed significant values ($p < 0.0001$) for conductivity, [NH4+-N], [NO3--N] and [PO43-P], being the correlation highest for phosphates ($r2 = 0.70$). Furthermore, significant statistical relationship were observed between DDI values and the chemistry-based General Quality Index values ($p = 0.006$), and the SPI diatom metric ($p = 0.04$). However, DDI demonstrated a better relationship with water chemistry than SPI diatom metric. The inferred environmental variables were correlated significantly with the environmental parameters measured. Our results show that the DDI created specifically for Duero basin rivers is better suited for water-quality assessment than SPI, metric developed for Central European watercourses, which has been used routinely for river biomonitoring in Spanish watercourse until now.

O3

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THE EVALUATION OF SPECIES CONSERVATION STATUS: A CASE STUDY FOR THE SPANISH AUTOCHTHONOUS CRAYFISH (AUSTROPOTAMOBIUS PALLIPES) IN THE CANTABRIAN RIVERS, NORTHERN SPAIN.

The development of new methodologies to assess river ecosystem impairment due to human activities has been substantially increasing during the last 20 years. However, important modifications to river ecosystems and losses of freshwater biodiversity have accelerated during this period of time. Current methods for assessing conservation status of species are based on estimating the risk of extinction, but nature conservation should not focus exclusively on endangered species, but on anticipating to that situation. In the present study we present a methodology to assess the conservation status of the Spanish autochthonous crayfish (Austropotamobius pallipes) in the fluvial network of Cantabria, northern Spain. The evaluation of the conservation status includes a series of specific indicators such as the distribution range, the population size and structure and the vulnerability to anthropic pressures and to foreign crayfishes (Procambarus clarkii and Pacifastacus leniusculus). The distribution range of A. pallipes was severely reduced in the whole region, where we identified 68 populations covering 63 km (the 1,6% of the potential range). In order to validate the methodology to evaluate population size (abundance) and structure (sex and age ratios) we characterized 11 populations. The structure and size of 4 of these populations was assessed as favourable, while the other 7 were impaired. Fifteen populations were considered vulnerable against human pressures, while other 12 were closer than 4 km to P. clarkii and P. leniusculus populations and therefore were also considered as vulnerable. Overall, the conservation status of A. pallipes in Cantabrian rivers was considered as unfavourable and vulnerable to anthropic pressures. Finally, the proposed methodology enables to enunciate specific restoration and/or conservation measures and allows investigating the effect that the presence, intensity and addition of new human pressures may have on this specie, so that managers and decision makers could consider carrying capacity for natural resource consents.

O7

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SPECIES INVASIONS, BIODIVERSITY AND RESILIENCE IN BOREAL LAKES

Species invasions are one of the foremost environmental challenges of the new Millennium threatening native biodiversity, and jeopardising ecosystem function, goods and services. Here we document the spread of a nuisance alga, Gonyostomum semen (Raphidophyta), which shows increased frequencies and magnitudes of bloom formation in boreal lakes. Despite reduced ecosystem service provision being documented during bloom events (reduced use of lakes for recreation, increased maintenance costs of water treatment facilities), consequences for biodiversity are not well known. We calculated G. semen biomass aggregation patterns and reconstructed their temporal patterns in 78 lakes over an 11-year study period (1997 – 2007) to gain insight into the mechanisms that mediate its successful invasion. Results showed highly dynamic and multiple biomass states both locally and at the landscape scale. Biomass assembly works in different scaling regimes, and reinforcement between and within scaling regimes makes management of blooms difficult. We also studied bloom impacts on phytoplankton and benthic invertebrate community structure in a subset of bloom-forming and bloom-free lakes. While phytoplankton communities were inherently more variable in bloom lakes relative to bloom-free lakes, overall taxon richness was similar between both lake types. Multivariate time series modelling revealed cross-scale resilience as a potential underlying mechanism explaining the paradox of similar species richness between bloom and bloom-free lakes. Likewise, neither invertebrate community structure nor turnover of community composition between littoral, sublittoral and profundal habitats was significantly altered as a result of recurrent bloom impacts. These results are encouraging because G. semen seems to entrain lake organization without fundamentally altering communities. The preliminary demonstration of high community resilience to bloom impacts suggests that G. semen currently poses no major threat to the taxonomic diversity in boreal lakes.

O8

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EKEY – ELECTRONIC MULTIPLE ENTRY KEY: A NEW TOOL FOR ENVIRONMENTAL MANAGERS TO IDENTIFY AQUATIC INVERTEBRATES.

Legal requirements increasingly oblige environmental managers to assess surface water quality by using aquatic macroinvertebrates as bioindicators. However, correct and efficient identification of these organisms can be challenging. This task is greatly facilitated by well-conceived identification keys, but most of the keys currently in use are based on a dichotomic structure and are available in print form only. Despite their broad use, these keys suffer from three major shortcomings: i) no choice in the order of use of identification criteria; ii) strongly restricted use of illustrations, especially photographs; iii) difficulty for the user to detect possible identification errors. Recent developments in electronic multiple entry keys have potential to solve these problems and open new prospects for substantially improving identification aids. We developed a new tool to build a multiple entry identification key on any taxonomic group. This software makes it possible to attach any kind of documents to illustrate the keys (images, films, 3D models, sounds, etc.) and automatically ranks the identification criteria according to their discriminatory power to facilitate rapid and reliable identification. We also used this concept to develop a new key for the identification of aquatic macroinvertebrates in Switzerland and neighbouring regions at the family level. It includes modules on Tricladida, Hirudinae, Mollusca, Crustacea, Ephemeroptera, Plecoptera, Odonata, Heteroptera, Coleoptera, Trichoptera and Diptera. To tailor the identification key to the needs of its anticipated users with various backgrounds, it was tested by nature conservation managers, consultants, governmental organizations, students and professors from primary school to university. These surveys revealed a strong interest of practitioners in the tool. Quality of the identification results was strongly improved and the time required for identification was markedly reduced. A live demo of the current version of the key will be presented at the poster session.

O7

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PATTERNS OF ZOOPLANKTON RICHNESS AND DIVERSITY IN SHALLOW PERIDUNAL PONDS: EFFECT OF LOCAL AND REGIONAL FACTORS.

The structure of aquatic communities is influenced by regional factors (the ability to colonize a new habitat through dispersal) and local factors (the adequate conditions for this species to establish). The objective of this study is to determine the influence of both factors on the zooplankton community during a hydrological cycle in a set of 8 peridunar ponds located in the protected area l'Albufera de Valencia and restored on different years. Some community parameters such as cumulative species richness, richness per visit, diversity of Shannon-Wiener, evennes, singularity, IFO and similarity between ponds (Simpson index and Euclidean distance) were calculated. Results showed a high influence of local environmental factors, mainly permanence of water, which determined a higher species richness in permanent ponds, but also a higher number of singular and rare species. Only conductivity had a negative effect on diversity. The time when the ponds were restored had also an important influence on richness, as new ponds had lower number of species than older ponds. Regarding similarity, it was not correlated with physical distance between ponds (showing that dispersal of organisms among them is high), while it was related with hydroperiod or restoration.

O3

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EFFECTS OF WATER POLLUTION ABATEMENT AND HYDROMORPHOLOGICAL RESTORATION ON MACROINVERTEBRATE COMMUNITY FROM THE VISTRE RIVER (FRANCE)

The Vistre river (France) is a hardly damaged stream, affected by a combination of both chemical and hydromorphological pressures. In order to improve its global quality and its ecological functioning, 2 kinds of action were led on 2 different reaches separated by 5 km. In 2004, a 2-km-long reach was morphologically restored, including meandering work and pebbles addition. In 2008, inputs of an old wastewater treatment plant (WWTP) were stopped due to the close of the WWTP whereas a new one, equipped with modern techniques and respecting the Europeans standards, was built 1 km downstream. Our objectives were to follow and compare the recovery of the aquatic ecosystem functioning after such modifications. Focusing on macroinvertebrate communities, we aim to first assess biological responses of such chemical and physical improvement and second to compare their respective responses. Invertebrates and environmental parameters were collected each September during the last 3 years on 6 sites : 1 reference site, 1 non-restored site reflecting the river before restoration works, 2 morphologically restored sites and 2 sites respectively downstream the old and the new WWTP inputs. Downstream these inputs, global water quality, macroinvertebrate richness and diversity improve rapidly in time and tend to be closest to the reference site. Even if in terms of current velocity and habitat structure, the two morphologically restored sites are very comparable to reference site, the water quality of this reach seems not good enough to observe significant recovery of macroinvertebrate community. Reference and restored sites show a higher proportion of Ephemeroptera and Trichoptera taxa, diversity and richness than non-restored site. Observed modifications in the functional structure suggest that ecological traits could be useful to assess the effect of morphological restoration management. Our results suggest that chemical and physical restoration works led separately limit the biological recovery.

SS1

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NITRIFICATION AND DENITRIFICATION RATES IN AN INTERMITTENT MEDITERRANEAN STREAM: DIFFERENCES BETWEEN A PERENNIAL AND A TEMPORARY REACH

Quantification of nitrification and denitrification rates and the analysis of the factors controlling both processes remain a growing area of study in streams ecology. Among all the studied factors, the effect of hydrology on both processes has been poorly examined. Intermittent streams account for the most streams of Mediterranean region. Given the predictions of climatic changes and the vulnerability of these systems, there is an urgent need to investigate how hidrological changes in these streams can affect biogeochemical processes. In this study we quantify the nitrification and denitrification rates in a Mediterranean intermittent stream (SE Spain) and we compared these rates between a perennial and a temporary reach. We analysed nitrification and denitrification (without amendement) (separated by 5 Km) from October 2009 to November 2010 accounting with 11 dates. The study period included a wet phase, where both reaches were connected, and two dry phases where reaches were disconnected and temporary reach was dry. Nitrification and denitrification rates ranged from 0 to 0.44 µg N g DW-1 h-1 and from 0.003 to 0.4 µg N2O-N g DW-1 h-1 respectively, being moderately lower in the temporary reach. Significant differences on nitrification rates between reaches were only found when temporary reach was dry, but not for all dates. We detected no significant differences on denitrification rates for most dates, but a pronounced increase was observed in the temporary reach while it was dry. Our results reflect that changes of hydrology regime may affect these biogeochemical processes. They also showed that sediments affected by recurrent dry periods have a great recovery capacity for N processing. Future research should focus on understanding how variation in hydrology regime controls biogeochemical processes dynamics, which should be included in models of N cycling processes in intermittent streams.

SS13

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TRENDS IN STREAM DISSOLVED INORGANIC NITROGEN IN FORESTED REFERENCE BASINS ACROSS US

Long term datasets offer invaluable information to assess the effects of global change on water resources and provide essential knowledge useful for developing management practices to remediate human-induced alterations of natural conditions. We synthesized stream nitrate and ammonium data collected over 12 to 37 years from 23 forested basins in 7 USFS Experimental Forest Research sites located across a gradient of atmospheric deposition and climatic conditions. Basins were chosen based on the absence of anthropogenic disturbances, other than atmospheric deposition, during the last 60 years. However, some basins were exposed to natural disturbances over the period of study. Specifically we want to answer: a) do reference basins across US show similar nitrate and ammonium trends? and b) do different sites across US present similar responses to disturbances? Results show contrasting trends among reference basins and similar responses to natural disturbances. For instance, between 1987 and 2007 stream nitrate concentration decreased in HJ Andrews (OR) and Hubbard Brook (NH), and increased in Coweeta (NC), although atmospheric deposition tended to decrease in all 3 sites and streamflow did not change significantly. On the other hand, nitrate concentrations generally increased after natural disturbances but varied in response times and magnitudes.

O5

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EFFECTS OF GLOBAL CHANGE ON THE BREAKDOWN OF ORGANIC MATTER IN MEDITERRANEAN RIVERS

Mediterranean rivers in the Iberian Peninsula are among those most affected by human activities, and scenarios of future climate change suggest increasing pressure on water resources, thus threatening even further their ecological status. In an attempt to assess the response of river ecosystem functioning to global change, we measured breakdown of organic matter at 77 sites distributed across the basins of 4 of the largest Mediterranean rivers in Spain: Ebro, Llobregat, Jucar and Guadalquivir. Study sites spanned a broad range of river sizes, of hydromorphological characteristics, of water quality, and of ecological condition. Tongue depressors made of untreated Canadian poplar were arranged in groups of 5, and three groups incubated at each site in summer 2010 for 54 to 106 days. After incubation they were recovered, carried to the laboratory, washed with tap water and tooth brushes, dried at 70 °C, weighed and ashed (500 °C) to measure remaining ash free dry mass (AFDM). Breakdown rate was calculated according to the negative exponential model. Additionally, we gathered from the water agencies information on catchment and reach physical characteristics, on water quality, and on biological communities at each reach. Remaining AFDM ranged from 99 to 16%, resulting in large differences in breakdown rates (0.027-0.00003 d-1). Wood breakdown showed no clear relationship with river size or water quality. At the highest elevation sites it was consistently low, but at lower sites data showed high dispersion. Breakdown rate tended to be negatively correlated to invertebrate biotic indices. Overall, results suggest breakdown of wooden depressors to be mediated by microbial activity, and this to depend on a complex interplay between temperature, nutrients, and pollution.

O5

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THE USE OF WOOD STICKS TO ASSESS RIVER ECOSYSTEM FUNCTIONING: COMPARISON WITH LEAF BREAKDOWN RATES

There is an increasing interest in river functioning, as it drives important ecosystem services. Among the many methods used to assess river functioning, litter breakdown has been suggested as one of the most convenient for routine assessment. Nevertheless, picking leaves and assembling leaf bags is highly time consuming, what led to some scientists to use alternative materials, like standard cotton strips or wooden sticks. The problem with these alternative materials is that there is no information on their performance under different conditions compared to that of typical leaf bags. Therefore, we performed an experiment to compare the breakdown rate of poplar tongue depressors to that of leaves of black alder, poplar, London plane, common oak, beech and Eucalyptus nitens. Tongue depressors were air dried, assembled in strings of 5 with fishing line. Freshly fallen leaves were also air dried, enclosed in 5 mm mesh bags (5 g per bag). All materials were incubated in two large streams (width ca. 30 m), one unpolluted, the other subject to severe pollution. Regularly the material was retrieved (5 replicates per site), dried (70° C, 72 h), ashed (500° C, 5 h), weighed, and breakdown rates calculated following the negative exponential. All materials broke down significantly faster in the unpolluted than in the polluted stream. Nevertheless, the species ranking remained constant: alder > poplar > eucalypt > plane > oak > beech > wood. Our experiment showed that wooden sticks perform similarly to leaf bags under different pollution levels. Therefore, they hold potential for assessing river functioning.

O6

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SENSIBILITY OF AQUATIC BACTERIAL COMMUNITIES TO CONTAMINANTS IN WINE-PRODUCING WATERSHEDS: APPROACH IN RIVERS AND LAKES

Lake and river environments in wine-producing watersheds receive large inputs of phytosanitary products (herbicides, fungicides, insecticides) mainly arriving through runoff during rainfall events. The present study evaluates the sensitivity of aquatic microbial communities from stream (la Morcille, E France) and lake (Léman and Aiguebelette, E France) environments to the organic fungicide Tebuconazole (TBZ). The TBZ is an inhibitor of the ergosterol biosynthesis and is expected to mainly affect fungi, but algae and bacteria may also be impacted by direct and/or indirect effects. Biofilm and plankton communities from reference and polluted sites in the two type of aquatic environments were exposed to low (2 microg/L) and high (20 microg/L) nominal concentrations of TBZ plus control conditions in microcosms experiments. The response of microbial communities was evaluated at the structural level (abundance, diversity) and functional level (primary production, respiration). Pesticide concentrations were also monitored throughout the experiments. Results showed that biofilms were highly reactive and had strong TBZ-degrading capacities (60-70% degradation after 3-weeks), whereas impact on plankton communities was negligible. In stream biofilms, TBZ decreased photosynthetic efficiency and heterotrophic respiration especially at the reference site. Instead, changes in algal and bacterial abundances were transient, but the proportion of dead bacterial cells increased. Responses of planktonic communities were rather different than on biofilms, bacterial abundances and esterase activity being favored by TBZ exposure. The present microcosm experiments evidenced that the functioning of microbial communities in aquatic environments can be significantly impacted by chronic TBZ exposure. The different sensitivity between biofilms and plankton communities might be explained by the different community structure and absorption modes of the pesticide. Further analyses on bacterial diversity could give some light on the tolerant species to this fungicide.

O7

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BETA-DIVERSITY OF BENTHIC INVERTEBRATES IN NEW ZEALAND FOREST STREAMS

The concept of beta-diversity, and how it should be measured, has been under much debate recently. We assessed beta-diversity of stream benthic invertebrates in eight regions across New Zealand and explored the relationship between beta-diversity, latitude and environmental variables. Beta diversity patterns were first explored by Whittaker's (1960) original multiplicative measure. We used as well the multivariate dispersion in each region as a measure of beta diversity. Finally we tested the null hypothesis of homogeneity in the multivariate dispersion among the eight regions for the macroinvertebrate community and environmental variation. Beta-diversity increased significantly towards higher latitudes and was closely related to environmental variables related to stream stability and topography. Historically, beta diversity has received notably far less attention than variation in raw species numbers, however beta diversity seems to be central for understanding mechanisms through which regional biotas are formed.

O6

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INFLUENCE OF A WASTE WATER TREATMENT PLANT ON THE RECOVERY PATTERN OF STREAM BIOFILMS AND THE SPATIAL SEGREGATION BETWEEN BACTERIAL AND ARCHAEAL NITRIFIERS

Streams receiving high loads of nitrogen (basically ammonium) from wastewater treatment plants (WWTP) are shown to be hot spots for nitrification. We examined the effects of these inputs on the recovery of stream biofilms along eight-weeks after a dramatic flood. We measured biofilm biomass, chlorophyll-a, nitrogen content, and community composition of ammonium-oxidizers. These parameters were compared between light- and dark-exposed biofilms at upstream and downstream sites of WWTP inputs, respectively. The results showed an increasing impact of the WWTP input on ammonium concentration and its isotopic signature as flood receded. Biomass and chlorophyll-a recovery was fast (<2 weeks) and no clearly affected by WWTP inputs, but significantly distinct between light- and dark-exposed communities. Biofilm 15N signature downstream of WWTP increased over time tracking the increase in 15N-ammonium. Biofilm ammonium-oxidizers were composed of both bacteria and archaea. These two phyla were segregated in space and their relative dominance changed over time depending on ammonium availability and the development of photoautotrophic organisms. These shifts may influence whole-reach nitrification rates and, thus, the dominant form and amount of nitrogen exported downstream.

O7

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SOME FRESHWATER HETEROTROPHIC FLAGELLATES FROM AKTAÞ LAKE (TURKEY AND GEORGIA)

This is the first study of free-living heterotrophic flagellates which has an important role in aquatic environments hence they are the consumers of bacteria and small phytoplankton, food for larger zooplankton. Furthermore they contribute at remineralization and recycling of elements essential for phytoplankton and microbial growth. In order to contribute to an understanding of the geographic distribution of free-living heterotrophic flagellates, we investigated the diversity of heterotrophic flagellates occurring in Lake Aktaþ, a tectonic lake which was a soda lake one decade a go but now a freshwater one after the opening of a gate to Kura River, located on the border of Georgia and Turkey with a total surface area of 27 km2. Lake Aktaþ is a significant site for migrating waterbirds. Samples were collected from 25th Jun. 2010 to 10th Oct. 2010 (n=5) and examined alive with a DIC microscopy equipped with a digital camera (Nikon D90 Model). Twenty species are reported from 14 genera and all flagellates described here appear to be cosmopolitan. To built up knowledge of ecological situation and biodiversity of lake more detailed further studies should be done with Cross-Border Collaboration

SS6

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EFFECTS OF FLOW REGIME ON STREAM CARRYING CAPACITY AND CONSERVATION STATUS OF BROWN TROUT POPULATIONS

The stream carrying capacity sets the potential maximum fish abundance a given freshwater system can support. Therefore, it provides a basis to evaluate the conservation status of populations and to assess the changes in their dynamics resulting from habitat and hydrological alteration or other anthropogenic impacts. On that basis, we estimated brown trout carrying capacity (K) in 51 study-sites of 34 Mediterranean and Atlantic streams located in four major basins. In the proposed model, physical habitat quality and quantity as well as competition of individuals for its use were considered the main environmental and biological factors limiting population size. Suitable available habitat was quantified as a function of stream flow through physical habitat simulations. A specific allometric territory size relationship was developed to define spatial requirements of individuals. Finally, K was estimated at study-sites for a 12-year period linking habitat and territory modelling and compared with population densities (D) to assess conservation status, measured through the D/K ratio. Carrying capacity and conservation status differed within and among basins. Likewise, determinants of D/K ratio differed among basins. Within Mediterranean drainages, in the river basin exhibiting the best conservation status, environmental factors such as extreme water temperatures and flooding episodes during emergence were the main drivers of spatio-temporal variations in D/K ratio. Meanwhile, most sites in the rest of Mediterranean basins displayed a low to very low D/K ratio. Agricultural land use and water pollution were the major determinants of density decline. Finally, the Atlantic drainages presented an intermediate conservation status with most sites showing medium D/K ratios, being urban land use and number of upstream dams the main sources of degradation.

O2

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WINTER PHYTOPLANKTON IN HYPERTROPHIC LAKE NERO WITH "PLANKTOTHRICHETUM" TYPE OF COMMUNITY FROM EARLY SUMMER TO LATE AUTUMN (LAKE NERO, RUSSIA)

The qualitative and quantitative studies of the phytoplankton, concentration of inorganic nitrogen, phosphate and chlorophyll "a" in the water column have been performed during the under ice period at a large, shallow hypertrophic Lake Nero over periods representing more than one decade (Math, 1999-2010). This lake is dominated by planktothrichetum type (S1) of phytoplankton from early summer to late autumn. Under ice abiotic conditions were characterized with very low of irradiance by thick ice with snow, absence or very low concentration of oxygen and by very high concentration of biogenic elements. 174 species and forms were found under ice Chlorophyta – 48, Euglenophyta – 30, Bacillariophyta-27, Cyanophyta – 27, Chrysophyta – 18, Cryptophyta – 16, Dinophyta – 7 and Xantophyta - 1. The biomass of the phytoplankton dramatically varied from 0,035 to 36,6 mg/l. Most of biomass consisted of the planktothrichetum and flagellates types of phytoplankton dominated by one or another group at different years (r=0,86). The roles of the abiotic factors were investigated using a principal component-based factor analysis. In first two principal components accounted for 76,3% of the total variability. The first component depends mostly on ammonium- and nitrate-nitrogen concentrations and oxygen. The second component involves as negative component mostly the concentration of phosphate and total phosphorus and percent of flagellates and positive the percent of Cyanophyta. Distributions representing the 1999-2010 data don't distinguish distinct patterns the most important factor shaping algal communities of Lake Nero. We discuss how common is the situation observed, as well as the correlations of the community compositions on the most important abiotic and biotic factors. This study was supported by RFBR grant 09-04-01771-a and Ministry education program.

SS8

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CLIMATE CHANGE WILL LEAD TO MASSIVE LOSS OF GENETIC AND CRYPTIC DIVERSITY

The effects of climate change on biodiversity are frequently investigated with species distribution models (SDMs). Despite the increasing availability of phylogeogaphic datasets, this approach was surprisingly not extended to intraspecific genetic diversity. Here we present an approach to combine SDMs and phylogeographic datasets. We study and compare range-wide genetic data and SDMs of 9 cold-adapted highland aquatic insects from Europe to evaluate the effects of projected climatic change on the genetic structure and diversity of montane aquatic communities. We estimate the potential loss of genetic diversity by quantifying the projected loss of haplotypes in shrinking distribution ranges of each species. We pay special attention to the loss of strongly diverged evolutionary significant units (>2% sequence divergence), as these may represent cryptic taxa or populations undergoing speciation. The modeled 2080 climate scenarios suggest that large areas of current distribution ranges will become unsuitable for mountain aquatic taxa, especially in central Europe and the Balkan Peninsula. Up to 3 species are directly threatened by complete extinction. Up to 52% of the haplogroups, and up to 87% of the found haplotypes lose all climatically suitable areas. Populations are projected to survive mainly in higher mountains, especially in the Alps and Fennoscandia. These areas will have a key role for conservation of European montane aquatic diversity.

O6

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SINGLE CELL ANALYSIS OF PHAGOTROPHY IN MIXOTROPHIC PROTISTS: PROS AND CONS OF ALTERNATIVE METHODS

During the last decades, inert particles (such us fluorescent latex microbeads or fluorescent labelled bacteria) have been widely used as prey surrogates to evaluate protist phagotrophy and their grazing impact on prokaryote communities. However, the accuracy of the estimations have been questioned based on the selective capacity on dead or alive preys observed in some protist. More recently, molecular techniques using fluorescent oligonucleotide probes (Fluorescence in situ Hybridization, FISH, and the Catalyzed Reporter Deposition-FISH, CARD-FISH), have been introduced to asses protist phagotrohy by quantifying the natural preys hybridized inside both ciliates and flagellates. In this study we compare both types of methods estimating phagotrophy in three mixotophic flagellates (Cryptomonas ovata, Chroomonas sp. and Ochromonas tuberculata) from cultures. Direct intake of fluorescent latex microbeads of bacterial size in short time incubations, were compared with the quantification of ingested Archaea and two subgroups of the domain Bacteria (Betaproteobacteria and members of Cytophaga-Flavobacteria of Bacteroridetes) all abundant in the algal cultures. Grazing measurements were performed at 4 hours time intervals during a day (12:12 light:dark conditions) and a minimum of 100 cells were measured in two sample replicates. Advantages and disadvantages of both methods in terms of time effort, sample manipulation, data obtained and information provided are discussed and conclusions on methodological constraints in current evaluation of phagotrophy in mixotophic protist at single cell level are drawn.

O6

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SHORT-TERM PHOTOSYNTHETIC ACCLIMATION OF THE CYANOBACTERIUM MICROCYSTIS AERUGINOSA TO IRRADIANCE AND TEMPERATURE: ECOLOGICAL IMPLICATIONS

Colonies of Microcystis aeruginosa (Kützing) Lemmermann origin blooms in freshwater ecosystems. The self-shading in the blooms is very intense. However, this species also appear as single-celled individuals at low densities and, consequently, they remain exposed to high irradiances. Because the blooms appear very rapid in the nature, the cells of M. aeruginosa must adapt to changing irradiance conditions very rapid. Thus, we study the short term photosynthetic acclimation of M. aeruginosa to irradiance and temperature. Three different strains (Ma2M, Ma5D and Ma17D), were exposed to two different irradiances (low light -LL- and high light -HL-, corresponding to 11.5 and 128 µmol photons m-2 s-1, respectively) and two temperatures (15°C and 20°C). We measured the photosynthetic pigment concentrations, and different parameters related to chlorophyll a fluorescence: PSII photochemical efficiency (ΔF/Fm'), electron transport rate (ETR), irradiance-saturated ETR (ETRmax) and ETR efficiency (αETR). Additionally, relationship between ETR and photosynthetic oxygen production, as well as the excess of PSII units, were also studied. Higher values of chlorophyll a (Chl a) and phycocyanin (PC) were found under LL conditions at both temperatures in the three strains of M. aeruginosa. Chl a/PC ratio differences among strains were observed under both HL and LL treatments at 20 °C. At 15 °C, these differences were also found under HL conditions and only in Chl a/PC ratio under LL. Significant differences between temperature treatments were also found. Significant ETR-E curves parameters between light treatment and among strains were only found under 15 °C treatment. A linear relationship between ETR and photosynthetic oxygen production for the five initial experimental irradiances, was found (r2= 0.965 and 0.715, for HL and LL, respectively). Moreover, LL cells showed higher PSII surplus than HL.

SS14

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CONTAMINANT AND PHYSIOLOGICAL DIFFERENCES OF SPANISH ZEBRA MUSSEL (DREISSENA POLYMORPHA) POPULATIONS.

Zebra mussel invaded Ebro River Basin in the 90s and now this species is distributed along this and neighbouring river basins such as that of Jucar river. Here we present the results from a three year study aimed to characterize contaminant and physiological differences of 11 established populations along the Ebro River and Jucar basin (Sitjar reservoir). Populations were sampled on early spring (March) and autumn (October). Up to 40 and 11 different contaminant and physiological responses, respectively, were measured. Contaminant body burdens included metals and persistent organic pollutants. Moreover, physiological and biochemical traits, such as filtering and respiration rates, gonadal development and biochemical responses (lipids, lipid peroxidation, DNA damage, multixenobiotic transporter membrane activities and antioxidant defensive systems) were also assessed. Results indicated important seasonal and geographic differences in the contaminant body burdens and physiological parameters among populations. In early spring most populations showed the highest levels of contaminants while their gonads exhibited an advanced maturation stage, the highest levels of lipids and the highest activities of the measured enzymes. Conversely, in late autumn most gonads were in a resting developmental stage whereas contaminant and lipid levels and most transporter or enzyme activities were low. Principal Component analyses evidenced that population differences in the studied parameters were highest in spring with Ebro's populations showing increasing physiological stress and contaminant levels towards downstream sites.Populations from Mequinenza had the best physiological condition showing the highest levels of lipids and of detoxification defences, and those from the Flix reservoir the lowest.

SS5

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ECOLOGICAL CONCEPTS AND THE MANAGEMENT SEMIARID FRESHWATER IN CLIMATIC CHANGES

Annual changes in water level is the main regulatory source of ecological processes in the semiarid region reservoirs. This factor is related to manifestations of the variability of regional climate conditions and global climate change, such as the recurrence of ENSO (El Nino Southern Oscillation). The Taperorá II reservoir (07°11'44"S 36°52'03"W) was monitoring during September- December of 1998, January - April of 1999, September - December of 2006 and January- April of 2007 to compare nutrient and phytoplankton dynamics between ENSO (1998; 2006) and non-ENSO (1999; 2007) years. The 1998 ENSO promoted a very intense dry period, the reservoir was 1 % of your total volume, that resulted in a complete mixed water column, an alkaline pH, high electric conductivity (σ= 6116,67S.cm-1), inorganic nutrient content (σ= 288,33gSRP.L-1; σ= 1167,47gNID.L-1) and chlorophyll (σ= 402,9g.L-1) . Phytoplankton assemblages were dominated by cyanobacterias S-strategists, Microcystes aeroginosa and Anabaena spirales. The diluter effect of increased rainfall in February and March/1999 exerceted a reduction of conductivity (σ= 1048,8S.cm-1) and dissolved nutrients (σ= 37,9gSRP.L-1; σ= 622,1gNID.L-1). Phytoplankton assembleges changed the species composition, the dominant taxa were the opportunist organisms of the nanoplankton (Chlorella vulgaris) C-strategists. The 2006 ENSO was moderated, promoted a long dry period but lower intensity than 1998. The reservoir presented 40 % of your total volume resulting in a moderated NID contents (σ= 119,7 gSRP.L-1; σ= 19,47gNID.L-1) , electric conductivity (σ= 460,53S.cm-1) and chlorophyll (σ= 8,10g.L-1) . The phytoplankton was dominated by S-strategists, diatoms adapted to turbulance and Cyanobacterias favoured by high NID. In 2007, after ENSO, the rain promoted a similiar diluter effect, but the intensity of this disturbance was lower. The phytoplankton assemblage was dominated by diatoms Melosira sp.

SS6

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MICROCHEMISTRY OF OTOLITHS: A NON MORPHOLOGICAL TRAIT FOR THE ANALYSIS OF FLUCTUATING ASYMMETRY IN TWAITE SHAD (ALOSA FALLAX)

Fluctuating asymmetry refers to population-level patterns of small random differences between left and right sides in bilateral structures of symmetrical organisms. It has been used as a measure of "general health" of the individuals, as it is the asymmetry that results from the inability of individuals to resist or buffer developmental accidents. The study of fish otolith chemistry is a rapidly expanding field in fisheries science, and some studies have identified substantial variance between the chemical composition of left and right otoliths within pairs. The aim of this communication was to test whether microchemistry of pairs of sagittal otoliths may be used for measuring stress by using fluctuating asymmetry analysis. Samples were obtained in two Galician river basins, Ulla and Miño. Otoliths were extracted and decontaminated, and then a suite of 9 trace elements (Ba, Li, Mg, Mn, Sr, Zn, Cd, Co, Pb) was assayed by inductively coupled plasma mass spectrometry (ICPMS). Statistical tests showed in general higher levels of fluctuating asymmetry for individuals collected in the Miño River. We discuss the potential relation of these levels to different factors, including parasitic infection by Anisakis sp., as knowledge on the mechanisms and pathways for the incorporation of trace elements to the otolith still presents important gaps.

SS3

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MODELLING PHYSICAL CHARACTERISTICS OF HABITATS FROM RIVER REACHES TO ENTIRE RIVER NETWORKS IN NORTHERN SPAIN

Physical river habitat characteristics constitute the setting in which fluvial biota dwell and thrive. Most studies dealing with the explanation of local or regional patterns of fluvial biota characterise the physical river habitat using different variables deemed as important to the objects of study. Understanding the spatial and temporal patterns of physical habitat characteristics and its determinants is, therefore, extremely important for advances in fluvial ecology and for the proper management, conservation and restoration of river ecosystems. In this study we analysed, predicted and then classified spatial patterns of physical river habitat characteristics at the reach scale (500 m reaches) for Atlantic (Cantabrian sea catchments) and Mediterranean (Ebro) catchments in the northern third of Spain. We concentrated on looking for the most important factors (i.e., climatic, hydrological, topographic) explaining variation among river reaches located in different parts of the studied river network. We used information gathered from more than 600 sites following a modified version of the River Habitat Survey methodology (RHS) in which, apart from the normal RHS variables, we obtained mesohabitat sequence composition and variation in water depths and widths. PCA analysis were used to summarise physical river habitat characteristics at the reach scale, and PCA scores were then modelled using Random Forests for all river reaches within the studied river network. Altitude, catchment area, valley shape and hydrology were all important variables in the model. A classification of all river reaches dependent on their predicted physical habitat attributes and the description of these classes within the entire studied river network proved to provide important spatial information on river physical habitat characteristics for river ecology, management and conservation.

O5

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EMPIRICAL MODEL OF THE POTENTIAL FLUX OF AQUATIC PRODUCTIVITY FROM LAKES AND STREAMS ONTO LAND

There is increasing recognition of connections across traditionally-defined ecosystem boundaries. Although the flux of matter and energy across ecotones can have important implications for the recipient ecosystems, assessing these linkages has been challenging. Here, we generate an empirical model of the potential flux of aquatic productivity from lakes and streams to land. We developed empirical relationships between lake and stream variables and insect production, and scaled these up to the landscape level. Estimated annual aquatic insect emergence in the 11214 lakes and 35856 stream segments from the State of Wisconsin (USA) was similar (0.6 ± 0.2 gC•m-2•yr•-1). However, the smaller total benthic area of streams results in lower mean insect flux (4.0 ± 18.0 gC•m-2•yr-1) and lower mean deposition to land (0.04 ± 0.18 gC•m-2•yr-1) compared with lakes (9.2 ± 20.3 gC•m-2•yr-1 and 0.06 ± 0.2 gC•m-2•yr•-1, respectively). There was higher total flux to land in north-central and north-western Wisconsin, which are areas with high density of small lakes. As a result of the relatively regular distribution of streams in WI, the distribution of lakes determined the main patterns of insect fluxes to land. Such hot spots of insect emergence could have diverse implications for terrestrial ecosystems, including support for terrestrial food webs surrounding the lakes, increased pollutant flux from lakes to land, or influencing bird migration pathways.

O5

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COMBINED EFFECTS OF LEAVE C:N RATIOS AND NUTRIENT STREAM AVAILABILITY ON ORGANIC MATTER DECOMPOSITION RATES

It is well known that when leaves fall into the stream water the microbial trial begins. Leaves may represent the main input of coarse organic matter into streams, fueling heterotrophic metabolism of fungi and bacteria. However, this metabolism may depend on nutrient availability from both the leaf litter and the water column. In this study, decomposition packs (n=324) containing two leaf species differing in elemental content (Alnus glutinosa and Platanus X hispanica) were incubated for 116 days in streams with low and high (i.e., receiving inputs from wastewater treatment plants; WWTP) nutrient concentrations in order to evaluate whether differences in leaf-litter C/N ratios and/or stream nutrient availability affected decomposition rates. Rates were calculated as a negative exponential decay of leave weight corrected by the temperature, since it is considered a pivotal modulated factor of biological activity. Results showed that leaves containing lower C/N ratios decomposed faster than C-enriched leaves. However, differences in leaf-litter decomposition rates became smaller at the end of the study, probably due to a higher recalcitrant fraction of the remaining organic pool on both species. On the other hand, nutrients supplied by WWTP effluents enhanced decomposition rates, but this effect was more remarkable for leaf-litter with low C:N ratios. Therefore, a synergistic interaction between C:N ratio of leaves and nutrient availability in the water column might be plausible; however, this appears to be constrained by the quality of the organic matter pool in the leaf-litter. Ultimately, these results suggest that human activity, either through land transformation or use of selected riparian species, may influence in-stream organic matter cycling.

SS3

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MORPHOLOGY OR WATER CHEMISTRY - ASSESSING THE DETERMINANTS OF MACROINVERTEBRATE COLONIZATION OF NEWLY RESTORED RIVERS

River restoration projects aim to increase habitat diversity to promote biodiversity and enhance ecosystem function. But the desired results can rarely be observed, especially for macroinvertebrates; there appear to be barriers to re-colonization. It is disputed whether barriers to dispersal (the physical and chemical habitat properties would be suitable, but they do not fall in the dispersal range of source populations) or establishment (after morphological restoration, the habitat is still not appropriate due to residual water quality impairment) are to blame. Or, asked the other way round: did we locally lose species because of physical or chemical habitat degradation? To answer this question, we performed an (ongoing) in situ experiment. At five sites within a representative lowland river system, we fixed four channels to the river bed. In a 2x2 factorial design, they were filled with either homogeneous or heterogeneous substrate as the physical parameter and a chemical impairment was added to half of them by adding slowly dissolving nitrogen and phosphorus fertilizer pellets at the upstream end. We followed colonization by macroinvertebrates and the seasonal variability by taking monthly samples (which will be continued until September 2011 to cover one year). Our data so far show that neither the treatment scale of morphology nor eutrophication seem to be great enough to affect community composition. We hypothesize that populations that managed to persist within a moderately deteriorated lowland river system are adaptable enough to cope with the stressors we applied with a reasonably (realistic) concentration/level. Restrictions in dispersal of macroinvertebrates might therefore be a more likely explanation for limited river restoration success.

SS5

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FROM PICOCYANOBACTERIA TO DAPHNIA – UNDERSTANDING SEASONAL CONTROLS CAN HELP CLIMATE CHANGE PREDICTIONS

Over the past decades large oligotrophic lakes in the South Island of New Zealand have been subject to the introduction of an invasive Daphnia species, intensified land use and climatic changes. Due to the paucity of long-term monitoring data, to predict likely impacts of climatic and land use changes we coupled physical modelling with physiological experiments and an analysis of the seasonal effect of environmental variables on populations of picocyanobacteria, eukaryotic phytoplankton and zooplankton. The effects of environmental factors differed from season to season and between picocyanobacteria and eukaryotic plankton; with temperature and light controlling eukaryotic algae, and competition, genetic diversity and nitrogen to phosphorus ratio controlling picocyanobacteria. The sensitivity of picocyanobacteria to changes in nutrient status is also supported by physiological experiments, thus confirming their suitability as early indicators for nutrient enrichment. Due to mild winters, late turnover and low nutrient concentrations, populations in these lakes do not follow the PEG model, and phytoplankton winter maxima can occur. Because of severe nutrient limitation climate change is unlikely to result in an increase in algal biomass in summer, unless land use changes cause nutrient enrichment. However community composition has already altered with an increase in small centric diatoms (Cyclotella) and decreased importance of picocyanobacteria and copepods in some lakes. Cyclotella has been found to increase in abundance in response to warming and decreased turbulence (Rühland et al 2008), and its abundance was correlated with water temperature. Combining physiological experiments, dynamic modelling of the physical environment and comparative study of multiple lakes assists predictions on future limnological outcomes, because each of these approaches provides useful and complementary information.

O1

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DIEL VARIATION OF PHYTOPLANKTON FUNCTIONAL GROUPS AND FOOD WEB INTERACTION IN A TROPICAL RESERVOIR IN THE SEMI-ARID REGION

Knowledge of diel variation and the vertical distribution of phytoplankton communities may contribute to a better understanding of the driving factors of key species. Applying functional-group classification provides important information on the causes of species selection in the pelagic community. Gargalheiras Reservoir (zmax= 15 m) is an eutrophic tropical reservoir, located in the semi-arid region (Northeast, Brazil). The aim of this study was to analyse the diel variation of phytoplankton functional groups during a rainy tropical period, in order to understand their changes in the vertical position related to light, mixing regime and food web dynamic. Phytoplankton, bacterioplankton and zooplankton communities were sampled every four hours, during a diel period in a vertical profile during a rainy season. During the study, the water column was mixed, with higher concentrations of DO to the bottom of the reservoir. The highest phytoplankton biomass was found during the early-evening (21 mg.l-1, 06:00 PM) to 10:00 PM (30 mg.l-1), decreasing at the beginning of the day. The dominant functional group (L0), typical from eutrophic lakes and tolerant to segregated nutrients, was represented by non gas-vacuolated Cyanobacteria. The dominance of the group was always greater than 80% in the epilimnion during all shifts, except at 10:00 PM, due to the co-dominance with the functional group M, represented by Microcystis protocystis. Vertical migration of medium-filter-feeder zooplankters, mainly Daphnia gessneri (Cladocera), was observed. Since they are efficient filter-feeders, it is reasonable to think that predation during the night and beginning of the day contributed to the observed decrease in phytoplankton biomass. The bacterioplankton biomass indicated a gradient higher production in the lower layer during the day and had the opposite behavior during the night. Grazing and adaptive strategies for maintaining the populations suspended in the water column were the main factors that drove the phytoplankton growth.

SS3

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REGIONAL VARIABILITY OF AQUATIC HABITAT PATTERN IN BRAIDED REACHES (EXAMPLE OF THE FRENCH RHONE BASIN)

650 km of braided reaches are still present in the Rhone basin in the French Alps (SE France), despite alpine rivers were strongly affected by human activity during last centuries (i.e. dams construction, sediments mining) inducing a simplification of riverine landscapes. In this study we explored the variability at large scale of braiding and aquatic habitat patterns from the analysis of 2000s aerial orthophotograhies of 53 braided reaches located in the French Alps. Photographies were processed by a semi-automatic classification method using eCognitionDefiniens software to obtain the riverscape mosaic. The analysis was focused on the active channel area (composed by unvegetated gravel bars and water channel network) and particularly on aquatic channel habitats. First we identified hydro-geographical types of braided reaches based on 3 main control factors such as I) the geographical position in the basin (slope and mean altitude), II) the hydrological conditions at the time of the observation and III) the morphological conditions represented by the available active channel: 6 types have been identified. Then we calculated parameters describing the braiding and aquatic channel habitat pattern (such as the braiding index and the diversity index). We also tested other parameters characterizing the braided planform. Finally we observed the geographical distribution of these parameters and their relation to control factors (hydrological and morphological conditions). Results show that at such a wide regional scale morphological conditions play a more important role than hydrological ones in structuring the braiding and the aquatic habitat pattern. These findings increase the scientific understanding of braided rivers but could also support decisions in conservation and management strategies. Keywords: braided rivers, regional scale, riverine landscape, habitat diversity, remote sensing.

SS6

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ASSESSING EFFECTS OF WATER DERIVATION ON FISH POPULATIONS IN UPSTREAM REACHES OF A MEDITERRANEAN RIVER BASIN

River ecosystems have been profoundly altered with industrial and urban pollution, alterations of natural hydromorphology and severe water derivation. Among others, the purpose of water derivation includes irrigation by agriculture, public water supply and energy production. Where water is scarce, like in Mediterranean streams, water derivation may cause alteration of the natural flow regime and negative effects on river ecosystem. During the past century, in some rivers of Catalonia, many hydroelectric power stations were constructed to produce energy for textile industries. We studied the effect of these derivations on fish assemblages in upstream reaches of Ter river basin, where around 90 hydroelectric power stations are still operating. Water derivations of these hydroelectric stations provoke an important reduction of streamflow below the dams. Using electrofishing techniques, we studied fish populations of 36 sampling sites (half of them affected for water derivation and other half as a control) of sixteen hydroelectric power stations. Several habitat variables were also measured. The results showed that water derivation provoked significant changes on river habitat. For example, in the affected sampling sites, the water column was lower, there were less riffles and more pools, less presence of refuges and lower values of a total Rapid Bioassessment Protocol. The most widely distributed freshwater fish species in the study area were brown trout, Mediterranean barbel, minnow and stone loach. In the affected sampling sites the populations of fish species were smaller and the average lengths and weights were lower. On the other hand, in the control sampling sites, there were the highest values of length and weight, the populations were more structured (wider ranges of lengths and weights) and individuals had better condition. Therefore, we show that water derivations due to hydroelectric power stations affect habitat river features and fish populations.

O7

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AQUATIC MACROINVERTEBRATE ASSEMBLAGE VARIATION AMONG SEASONS, SITES AND MICROHABITATS

The aquatic macroinvertebrate assemblages are important components of freshwater ecosystems, because of appearing with high abundance and diversity and with their wide range of ecological functions. In this study we assessed the abundances of benthic invertebrate species in three seasons (spring, summer, autumn), ten sites and five microhabitats. The samplings were carried out during 2009 in Mecsek Mountains, south-western Hungary using the internationally conventional AQEM assessment system. We tried to determine if the seasonality, the character of stream site or the microhabitat (types: sand, organic mud, gravel, stone, coarse particulate organic matter) has stronger effect on structuring the assemblages. On the other hand, the roles of the factors in the variances of abundance of particular insect groups were studied, too. Results of partial canonical correspondence analyses (pCCA) shows that the stream site character has the strongest effect and the weakest factor is the microhabitat-type, although all of the three factors have little role in structuring the aquatic macroinvertebrate assemblages. Analysing the main groups of aquatic insects (Coleoptera, Heteroptera, Ephemeroptera-Plecoptera, Trichoptera) by ANOVA we could tell that abundance changes of Ephemeroptera-Plecoptera and Trichoptera assemblages are mostly influenced by seasonality, and stream site character has major role in changing Coleoptera abundances. These phenomenons are due to the phenological characters or the seasonal dynamics of Ephemeroptera-Plecoptera and Trichoptera groups. To put it concisely despite of the small geographical range the sampling site differed in exposal, microclimate and bedrock which have stronger effect on the assemblages then the microhabitat-type, although other e.g. environmental factors, that are also strongly related to the certain stream site, might have much more bigger roles.

O4

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PERCH MEDIATED SHIFTS IN REPRODUCTIVE VARIABLES OF THE AMPHIPOD GAMMARUS LACUSTRIS IN LAKES OF NORTHERN RUSSIA

This paper focuses on the life-history, size- and sexual structure, and reproductive variables of the freshwater amphipod Gammarus lacustris from two small lakes in northern Russia, which differ in the presence / absence of the perch Perca fluviatilis. The size of ovigerous females, the number of eggs at stages 2 (E2) and 7 (E7), egg mortality, fecundity index, and the reproductive capacity were studied. The results obtained show that no significant differences exist in the size-dependent number of eggs (from 8 to 44 eggs per female in the size range of 7-18 mm) between the two G. lacustris populations studied. Those variables were approximated by a power function, as: lake with perch: E2 = 0.092 L 2.17 (R2 = 0.59, n = 63); and perch-less lake: E2 = 0.106 L 2.16 (R2 = 0.79, n = 41). There was no significant difference in the total abundance of the amphipod between lake with perch and perch-less lake. At the same time, a distinct effect of the presence of perch on the reproductive potential of G. lacustris was detected, primarily as a result of a decline in size of egg-bearing females, and in clutch sizes averaging 10.7 mm in the case of perch presence, versus 12.2 mm in the absence of that predator, and in 16 instead of 25 eggs per female, respectively. This difference in the reproductive capacity of G. lacustris between the studied lakes may be caused by selective perch predation, mainly on larger specimens of the gammarid. The females started to reproduce at smaller body sizes (7 mm) under predator exploitation than in the perch absence (9 mm). This 'early reproduction' can be considered an adaptation, raising the reproductive success of the amphipod, and some mechanism regulating the population size of G. lacustris under fish predation pressure.

SS8

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GLOBAL WARMING AND COLD STENOTHERMAL ORGANISMS: THE HSP70 HEAT SHOCK REPONSE OF DIAMESA CINERELLA (DIPTERA, CHIRONOMIDAE) FROM ALPINE STREAMS.

In glaciated area of the Alps, the ongoing increase of air temperature is causing glaciers retreating with consequent alteration of the hydrological and thermal regimes of glacial streams. In particular, it is expected that glacial streams will be interested, in medium-long term, by lower flow and higher water temperatures. The aim of this research is to investigate thermotolerance and HSP70 Heat Shock Response (HSR) in the aquatic larvae of Diamesa cinerella, an Alpine cold stenothermal Chironomid species (Diptera). Thermotolerance was evaluated as lethal temperature (LT100 and LT50) stressing larvae by direct short-term heat shocks (1h, from 26°C to 35°C). The HSP70 HSR was evaluated at transcriptional (RT-PCR), translational (RT-PCR on polysomal mRNA) and protein (Western Blot analysis) level. Despite the cold stenothermy of D. cinerella larvae, they showed a high thermotolerance, with a huge gap between the natural temperatures they experience and the critical limit of their survival. Regarding the molecular aspects, we have discovered that, after high temperature thermal stress, the level of hsp70 mRNA transcript and the level of hsp70 mRNA in active translation (bound to polysomes) were higher in comparison to the levels founded in the control. None increases of the HSP70 protein level were instead noticed after heat stress.Overall, these results are useful to a) implement knowledge on response to high temperatures of cold stenothermal benthic species and b) predict a possible future distribution of cold stenothermal aquatic insects within the scenario of global warming.

SS11

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TEMPORAL VARIABILITY OF IN-STREAM NET UPTAKE: IMPLICATIONS FOR INORGANIC NITROGEN EXPORT FROM CATCHMENTS.

To establish the relevance of in-stream processes on inorganic nitrogen (N) export at catchment scale it is essential to estimate whole-reach net N uptake rates that consider both uptake (assimilation, denitrification, and adsorption) and release (mineralization, nitrification, desorption) processes. We investigated the temporal variability of in-stream net uptake rates (U) of dissolved inorganic nitrogen (DIN) by analyzing 45 longitudinal transects of stream ambient DIN concentration in two contrasting headwater streams (one semiarid and one subhumid). For both streams, we found U > 0 (net N uptake) in ~ 35% of the cases, U < 0 (net N release) in ~13% of the cases, and U ~ 0 (N uptake ~ N release) in ~ 50% of the cases. On average, both streams were net sinks of DIN showing slightly positive values of U, though the variability of U was larger at the semiarid stream (0.159 ± 1.79 microg N/m2/s) than at the subhumid stream (0.101 ± 0.3 microg N m/2/s). We found no statistical differences between streams or among seasons, yet U > 0 occurred mainly in autumn. Annual in-stream net DIN retention estimated from our empirical measurements was similar between streams and showed high interannual variability (range = 0.029 to 0.181 kg N/ha/year). The contribution of in-stream N retention to catchment N export was larger at the subhumid catchment (from 23% to 59%) than at the semiarid one (from 19% to 28%). Simulations with the INCA model supported that in-stream N uptake processes reduce catchment N export, but the model underestimated the contribution of in-stream processes, especially for the subhumid catchment. Together these results highlight the relevance of in-stream processes on the N export from catchments, but also illustrate that this relevance can vary seasonally as well as interannually.

O2

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CHANGES IN FLOODPLAIN CHANNELS INDUCED BY RESTORATION: HABITAT AND MACROINVERTEBRATE RESPONSES

Changes in hydrological connectivity drive biodiversity and ecosystem functioning in floodplains, with lateral connectivity playing especially a major role in shaping the habitat conditions and the macroinvertebrate diversity. Human activities, among others, tend to reduce the lateral connectivity and increase floodplain terrestrialization and biodiversity loss. The restoration of floodplain systems is therefore of growing concern and the enhancement of lateral connectivity is a major objective. We studied four secondary channels of the Rhône floodplain (France) that were subjected to different types of restoration. We analysed macroinvertebrate and environmental data collected one year before, and during a period of five years after restoration. Five environmental variables were combined into a synthetic index to depict the lateral connectivity with the main river. Changes in macroinvertebrate assemblages were related to the changes in lateral connectivity induced by restoration. The lateral connectivity increased in the channel that was reconnected to the main river and remained high five years after restoration. An immediate increase was observed in the dredged channel, followed by a rapid decrease, while the control channel remained constant in time. Macroinvertebrate metrics changes were positively related to changes in lateral connectivity. Alien species numbers and densities increased in all the channels after restoration. Modifications of the lateral connectivity of floodplain channels lead to predictable changes in several macroinvertebrate metrics. We therefore recommend restoration programmes to take into account the type of restoration due to the different consequences highlighted. Because the homogenization of lateral connectivity levels can reduce the diversity of macroinvertebrates, we advise the preservation of different levels of lateral connectivity to maintain a high level of biodiversity at the floodplain scale. Due to the interference among a large number of parameters, studies based on long-term monitoring are critical to assess the durability and trends of restoration works.

SS11

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15N LONGITUDINAL PATTERNS IN BIOFILMS AS INTEGRATIVE SIGNAL OF N PROCESSING DOWNSTREAM OF WASTEWATER TREATMENT PLANT INPUTS

Despite significant advances in wastewater technology, effluents from wastewater treatment plants (WWTP) still discharge high loads of nutrients into freshwater ecosystems. These inputs drive abrupt changes in the physical and chemical properties of recipient waterbodies, which affect the biota and the nutrient cycling. Several studies have shown that WWTP-influenced streams have lower nutrient uptake efficiency than streams not subjected to these inputs. However, fewer studies have focussed on examining the relevance of different biogeochemical processes on nutrient cycling in these streams. In this study, we examined nitrogen (N) dynamics along different WWTP-influenced streams, by considering both in-stream biogeochemical processes and N-transfer to biofilms, and how it varied among them. To address this objective, we measured the variation of N (nitrate and ammonium) concentration and 15N signature, and the N content and 15N signature of stream biofilms along 1-km reach from 5 WWTP-influenced streams within Tordera's catchment (NE Spain). The WWTP outflows contributed to 23.6-99.8% of the stream discharge. Results showed that the effluent input generally caused an abrupt increase in ammonium concentration and 15N signal, while effects were more reduced for nitrate. We also observed a dominance of nitrification along the reach in 3 of the streams, and a net loss of dissolved inorganic N (DIN) in 2 of the streams. In addition, 15N signatures of biofilms traced those of DIN forms, indicating a transfer of WWTP-derived DIN into stream microbial communities. This provides insights of the influence of biofilms on N cycling in these highly N-loaded streams. Finally, different responses observed among streams reflected differences in both N loads from the WWTP effluents and the local characteristics of the streams. Together, these results show that WWTP-influenced streams have the capacity to regulate N-loads from the WWTP effluents. Consideration of the WWTP-stream biogeochemical coupling may help improving water management plans.

SS3

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HABITAT HETEROGENEITY, RESPIRATION AND HYDROLOGICAL DYNAMICS IN AN ALPINE FLOODPLAIN IN SWITZERLAND

Riverine floodplains are the most biologically diverse and productive ecosystems worldwide and are composed of a mosaic of different habitat types ranging from, e.g., terrestrial floodplain forests to aquatic channels. They can serve as model ecosystems to investigate the linkage between environmental heterogeneity and ecosystem functioning. The investigated 4 km long and up to 600 m wide alpine floodplain (800 m asl; Urbachtal, Innertkirchen, CH) is influenced by large scale up-welling and down-welling dynamics. Hyporheic water is known to have, e.g., higher nutrient contents that enhance ecosystem processes. This study focuses on ecosystem respiration, an important process integrating the energy flow through biotic compartments of aquatic and terrestrial ecosystems. We combined spatio-temporal assessment of hydrological conditions, habitat properties, aquatic (O2 consumption) and terrestrial respiration measures (CO2 production) using respiration chambers, and an Infrared Gas Analyser (IRGA) with bacterial counting by flow cytometry to (1) examine habitat heterogeneity within the whole floodplain, (2) determine the main environmental drivers of respiration, and (3) show the influence of up-welling/down-welling dynamics on respiration. The results show high habitat heterogeneity in measured habitat properties, respiration activities, and the amount of bacteria. In general, channel and gravel habitats showed the lowest activities, whereas activities were highest in alluvial forest and meadow habitats. A strong seasonal effect was evident for all habitats. The main drivers of respiration were determined as temperature, organic matter content, and amount of bacteria. The influence of hydrology could be shown via higher respiration values of habitats in the up-welling zone. These results underline the highly heterogeneous character of riverine floodplains and contribute to a more detailed and holistic understanding of the linkage between environmental heterogeneity and ecosystem functioning.

SS10

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NOT ALL SPECIES ARE EQUAL: INCORPORATING PHYLOGENIES AND TRAITS INTO TRADITIONAL DIVERSITY INDECES

Species within a community are not equivalent. Some are more phylogenetically related than others, some are more functionally redundant than others. Traditional and widely used diversity indeces, however, assume species neutrality. In order to better describe diversity of a community, these indeces should not only consider species abundance but also incorporate evolutionary and functional relatedness of species. Our main hypothesis is that a community should be considered more diverse if harboring species more phylogenetically distant related and species with low functional redundancy. However, species evolutionary relatedness not necessarily matches species functional relatedness because species traits may or may not be conserved through evolutionary history. In order to investigate how species phylogenetic and functional relatedness can affect the performance of traditional diversity indeces (e.g. the Shannon index), we analyzed local trait profiles of 60 aquatic macroinvertebrate communities (genus level, site scale) along a large latitudinal gradient (from Sweden to Morocco) and related them to their phylogeny. We calculated the traditional Shannon diversity index of each community, and a modified index that weighted the evolutionary and functional relationships of genera within each community. Latitudinal patterns of traditional and modified Shannon diversity index were compared. Our results showed that patterns differed and we advocate that the modified Shannon index better captures diversity. The non-neutral character of species should be taken into account when assessing diversity or promoting conservation programs at any spatial scale.

O4

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MINERAL SHIELDS IN THE CLADOCERA: THE IMPORTANCE OF HYDROXYAPATITE FOR THE STOICHIOMETRIC BALANCE OF PHOSPHORUS IN DAPHNIA.

The mechanisms behind inter- and intra-specific variation in phosphorus relative to carbon and nitrogen are not yet completely understood. At present, the difference among specific growth rates (growth rate hypothesis, GRH) is the main accepted factor explaining variations in stoichiometric balances. However, hydroxyapatite is the mineral shield of crustaceans together with calcium carbonate and may also play a crucial role for the variations in the body phosphorus pool but their influences have not yet been studied. To fill this gap we investigated the relative importance of phosphorus in the mineral shield of Daphnia (Cladocera, Crustacea) and its relevance for the body phosphorus pool. Our objectives were (1) to describe the mineral composition of freshwater zooplankton and (2) to investigate the relationship between the variability in the specific body mineral composition and those of water. We analysed the main elements of the ashes, quantified the relative importance of hydroxyapatite and calcium carbonate by mass balance equations and confirmed the mineral composition with X-ray diffraction. We showed that hydroxyapatite is the main structural mineral compound of cladocera contributing from 30 to 75% to the specific total P content in the animal. Hydroxyapatite content explains about 85% of phosphorus content variability from different Daphnia species. Therefore, we show that in addition to the GRH, the phosphorus variability in Cladocera can be explained by differences in the mineral phosphorus content. We found that the mineral phosphorus content increased with water alkalinity, which in turn is directly related to bicarbonate concentration ($r = 0.97$; $p < 0.001$). Water bicarbonate availability can limit crustacean carapace remineralisation process and therefore can be considerated as a limiting factor to bicarbonate deposition.

O3

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BIOFILMS' ANTIOXIDANT ENZYME ACTIVITIES RESPONSES TO MULTIPLE-STRESS IN FLUVIAL SYSTEMS

Antioxidant enzyme activities (AEA) are mechanisms to cope with oxidative stress and they play an important role in nature. AEA responses to metal toxicity have been studied in previous laboratory and microcosm experiments indicating that AEA may respond to both acute and to long-term exposure. However, experimental results have not been validated, so far, with field investigations. The goal of this study was to describe natural patterns of AEA of fluvial biofilms under natural (non-impacted) conditions and identify AEA changes driven by metal pollution. Physical and chemical parameters, metal speciation, metal bioaccumulation, the main algal groups and AEA such as catalase (CAT), ascorbate peroxidase (APX), glutathione reductase (GR), glutathione-S-transferase (GST) and superoxide dismutase (SOD) were measured during an annual cycle in three river sites which differ in metal pollution. It was observed that AEA in biofilms changed seasonally, responding to factors such as temperature and background metal concentration (iron in this case). On the other hand, seasonal changes were not observed in the most metal-polluted site. Biofilm communities growing under high metal pressure (Zn > 350 µg/L) were adapted to the prevailing conditions, and this adaptation was shown in terms the community composition (increasing the percentage of green algae), a loss of diatom species and a decrease in their photosynthetic efficiency. The concomitant loss of AEA temporal variability obtained indicates that community adaptation may have caused a functional diversity decrease. Thus, a combination of AEA measurements with other biomarkers is proposed as a field tool to assess environmental damage caused by multiple-stress factors.

O3

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ANTIOXIDANT ENZYMES AS BIOMARKERS OF OXIDATIVE STRESS IN FRESHWATER BIOFILMS

Freshwater biofilms are regularly used as indicators of perturbations in streams. Among the different tools developed to assess their status, the functional ones are usually related with essential processes (e.g. photosynthesis). Along with these tools, we propose the use of antioxidant enzymes activities (AEA) as biomarkers specific of oxidative stress. Laboratory and field experiments highlighted the potential of AEA to reveal both sudden and chronic perturbations. In laboratory, sudden light reduction inhibited catalase (CAT) in biofilms adapted to high-light intensity whereas ascorbate peroxidase (APX) was activated by a sudden increase in light intensity or after 6h of exposure to the herbicide oxyfluorfen. In this last example, APX was found to be a more sensitive biomarker than photosynthetic parameters. The long-term adaptation to colonization conditions led to slight differences between AEA of the different communities but constrained their capacity to respond to further stress. Indeed, depending on the oxidative stress undergone during colonization, biofilms may have developed different antioxidant defences and so different levels of resistance to oxidative stress (as indicated by AEA response pattern). In shade-adapted biofilms copper exposure provoked an increase in APX while in biofilms adapted to higher light intensities APX remained stable. In biofilms chronically exposed to oxyfluorfen (75-150µg/L), CAT increased after 6h of exposure to higher oxyfluorfen concentrations (15-1000µg/L) whereas in controls CAT was activated only after exposure to intermediate concentrations (15-75µg/L). In the field, a translocation experiment performed in a metal-polluted stream showed that after few days AEA discriminated highly impacted site from less polluted sites while after several weeks AEA allowed the reference site to be discriminated from more polluted sites. In conclusion, AEA may be used for early detection of sudden perturbations inducing oxidative stress but also to reveal oxidative stress chronically undergone by communities (by determining AEA pattern along stress gradient).

O2

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USING HYPORHEIC DATA IN EVALUATING RIVERS FOR CONSERVATION

Over the last 20 years, research on hyporheic habitats has confirmed the importance of the vertical dimension in river system functioning. However, in Britain river conservation evaluation tends to be two-dimensional, focusing laterally on river channels, riparian areas and floodplains, and longitudinally on the connectivity of rivers upstream and downstream. Many different attributes have been used to evaluate rivers for conservation, including the naturalness of features and processes, physical diversity, and the presence of rare or threatened species. Taxon richness is a criterion frequently used in conservation assessments, but standard approaches do not include biota in sub-surface areas of the river bed. In a study of the hyporheic zones of rivers in Scotland, an estimate was made of the contribution hyporheic invertebrates make to invertebrate taxon richness. Samples from hyporheic zones, obtained using a combination of Bou-Rouch pumping and Karaman-Chappuis pit sampling, were compared with kick-samples taken during routine monitoring by the Scottish Environment Protection Agency. Data from 20 sites on 17 rivers showed that hyporheic invertebrates contributed between 23% and 57% (mean = 35%) of total taxon richness. Most assessments of river conservation value in Britain are made to select nationally important Sites of Special Scientific Interest, or internationally important Special Areas of Conservation under the EC Habitats Directive. However, criteria for selection do not consider the contribution that hyporheic zones make to taxon richness, nor their role in ecosystem functioning. In addition, the importance of maintaining connectivity between river beds and the hyporheic zone is not recognised within the EC Water Framework Directive. Adding a hyporheic component to conservation assessment of rivers would help focus attention on these important areas, but bring with it a range of implications for defining site boundaries and for site management.

O3

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IMPACT OF CHRONIC AND PULSE PESTICIDE EXPOSURES ON PERIPHYTON COMMUNITIES

In aquatic ecosystems, exposure to pesticides can be variable. Especially, floodings are associated to elevated contaminants concentrations that influence the impact on biological systems. A study was undertaken to highlight the impact of a herbicide (diuron) applied in mixture with a fungicide(tebuconazole) on natural biofilms during flooding events. We investigated in a mesocosms experiment the responses of biofilms to chronic and pulse exposures of diuron and tebuconazole. Biofilms were grown in 2 series of 2 outdoor channels: one series was non-contaminated and the other exposed to chronic contamination. After 4 weeks, one channel of each series was exposed to 3 successive pulses, each pulse being followed by 1 week of restoration. Impacts on biofilms were assessed by measuring pesticide concentrations and community structure using DGGE. At a functional scale, photosynthesis efficiency was quantified during each pulse and the induced tolerance to diuron was estimated (PICT). Diuron was adsorbed in the biofilm during each pulse and desorbed 24h after recovery period began. Photosynthetic efficiency was correlated with concentrations of pesticides and no differences between biofilm from chronic/pulsed channels and control/pulsed channels has been observed during the first pulse. In contrast, during the second and third pulses, photosynthetic efficiency of biofilms chronically exposed to pesticides appears to be less impacted by the rising concentrations of pesticides during the pulses. These changes were in accordance with the induced tolerance of periphyton to diuron. The PICT approach could then be a useful tool for bioindication and to assess the relative effects of different pesticides exposure-scenarios. Thus, pulsed and chronic exposures cannot be considered separately for assessing the effects of pollutants on non-target organisms in lotic systems, since in situ hydrological dynamics combine base-flow (chronic) and flood (pulse) periods.

SS13

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INTERPRETING LARGE-SCALE MONITORING NETWORK DATA, IN A BOUNDARY SETTING APPROACH FOR BIOLOGICAL COMMUNITIES TO ENVIRONMENTAL PRESSURES IN NATURA. CASE STUDY OF THE FRENCH RIVER NETWORK WITH PHYSICO-CHEMICAL VARIABLES AS A PRESSURE IMPACTING THE SCORE OF

The implementation of the WFD is the occasion for European member states to organise monitoring networks. Water basin managers have to report ecological status based on data gathered in these networks (biological, physical, chemical data). This objective enables the establishment of national scale and long-term time series. For the evaluation, difficulties arise in dealing with a multi-pressure context. The purpose of this study is to define a boundary setting approach based on monitoring network results. This implies interpretation of the links between aquatic communities and environmental pressures, for which numerous constraints arise for larger monitoring networks. First the geological and geographical variability induces hydro-chemical and hydrological contrasts that should be considered. The second aspect is the way to aggregate data from heterogeneous sources (biological and physico-chemical networks with different temporal and spatial setting). Finally the operational implementation which needs to answer to societal needs has to be harmonised with the scientific demands. We present a case study of the link between macro-invertebrate communities by using the French bioindicator (IBGN) and physico-chemical variables (e.g. NO3-, NO2- , PO43- …) for the entire French river network monitoring database to illustrate the concepts to tackle these constraints. A typology built on the physico-chemical state of a reference river network delimits homogeneous regions. Within each region the tipping points of the in natura response to physico-chemical pressure are determined with a statistical modelling approach to derive the macroinvertebrate community threshold for good ecological status. This boundary setting approach based on field conditions allows for a more accurate goal setting incorporating local context and/or global change.

SS11

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NITRATE TRENDS IN SPRINGS AS A FACTOR INFLUENCING SURFACE WATER QUALITY

Water pollution from non-point agricultural sources is a major concern in water management, as it determines nitrate levels in rivers, wells and springs. In particular, springs are the origin of brooks and creeks tributaries to larger streams. They reflect the hydrological processes that occur at the subsurface layers and its response to fertilizer application. In this contribution, we study nitrate variations in spring water as a function of geological setting, hydrological behavior and land-uses, as a potential threat to downstream surface water quality. Nitrate concentration, electrical conductivity (EC), and spring discharge were measured in 13 springs -out of a database of 131- in the Osona region (NE Spain), every two weeks from January 2010 to February 2011. Average nitrate concentration in springs ranged from 8 to 380 mg/L. Using the entire database, springs located on surface formations overlaying sedimentary rocks, with agricultural activity, had the highest nitrate concentrations. This result indicates an expected influence of fertilization practices; but a weak control by geological features. Spring discharge was generally related to main rainfall periods. Minor precipitation events, however, were not reflected at the spring hydrograph, indicating water storage recovery and nitrate retention in the soil. High nitrate and EC values were usually recorded during discharge peaks. Variations in water storage and preferential flow paths controlled nitrate leaching towards the springs, and its further contribution to streams. Geostatistical analysis of discharge, EC and nitrate time-series pointed out different processes that control nitrate variability in spring flow. In conclusion, nitrate contribution to streams from springs shows a variability that is a response of soil hydrology. Different nitrate trends will then control surface water quality in brooks and creeks. Policies oriented to preserve their ecological status should consider this variability in rehabilitation actions. This study was funded by projects CGL2008-06373-C03-03/BTE (Spanish government), 2008ACOM.00041 (Catalan government and Consell Comarcal d'Osona).

SS10

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GLOBAL PATTERNS OF LEAF LITTER DECOMPOSITION IN STREAMS: IMPLICATIONS FOR ECOSYSTEM FUNCTIONING AND BIODIVERSITY IN A CHANGING CLIMATE

Leaf litter decomposition is among the most important ecosystem processes in the biosphere and is particularly sensitive to climate warming. In a worldwide study, we used latitudinal gradients as surrogates for future temperature changes to assess the effects of future climate change on decomposition rates and the relative importance of different decomposers. Our results suggest an increase in microbial decomposition, directly related to the temperature rise, and a comparable decrease in shredder-mediated decomposition. The latter would be caused by the decline of shredders in warmer climates, with the risk of losing the shredder guild altogether. This scenario is supported by current distribution patterns of shredders, which are more abundant and more diverse at higher latitudes, in relation to temperature-related physiological constraints and biogeography. Our findings point to potentially important biodiversity losses, and to changes in the functioning of stream ecosystems, under climate change scenarios. This would include a higher release of CO2 to the atmosphere and a decrease in the production of recalcitrant fine organic particles. As inland waters are a significant component of the global carbon cycle, we might even expect changes beyond the stream ecosystem in global biogeochemistry, and a possible positive climate feedback.

SS11

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BIOGEOCHEMICAL EVOLUTION IN SMALL WATERSHEDS AND STREAMS

Terrestrial biogeochemical theory describes how nutrient limitation, cycling, and losses should change over the course of rock weathering, soil development and plant succession. Key to the development of these predictions has been observations of solute exports from small watershed ecosystems. These observations indicate that loss rates of bioavailable nutrients in stream waters are diagnostic of nutrient limitation status in the plant-soil systems of land ecosystems. There has been less consideration of how terrestrial ecosystem development may constrain geomorphic dynamics, succession and biogeochemical cycling within small watershed stream channels and how such changes may in turn affect dissolved exports to rivers and gaseous emissions to the atmosphere. Here we apply conceptual and analytical tools to ask how macroscopic patterns of nutrient limitation and cycling develop over time in terrestrial and aquatic components of small watershed ecosystems and evaluate how these patterns emerge across different climates and geologic settings. We develop a simple theoretical framework that describes external forcing versus internal organization of phases and lags in nutrient limitation, cycling, and transport between terrestrial and stream ecosystems and evaluate predictions using data from chronosequence, climate sequence, and small watershed and stream studies. We discuss how these patterns are expected to vary across biomes, particularly between humid temperate and tropical forests, and landscapes differing in drainage density, relief, and parent material. Our analysis has implications for our current understanding of cross-system controls on nutrient cycling and loss, multiple element limitation and potential feedbacks to the global climate system.

O10

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INTEGRATING ALGAE AND OTHER MICROBIAL COMMUNITIES INTO THE DETRITUS-BASED FOOD WEB IN TANK-BROMELIADS

Bromeliaceae are common neotropical plants. Due to their interlocked leaves, many of them form tanks that collect water and organic detritus. We assessed the importance of algae within microbial communities in five species of tank-bromeliads encountered in contrasting environmental sites in a neotropical primary rainforest around the Nouragues Research Station, French Guiana. The distribution of both algal abundance and biomass was examined according to physical parameters, morphological characteristics of bromeliad species and in regard to the structure of other aquatic microbial communities. Using a 24-h incubation of manipulated samples from the bromeliad Catopsis berteroniana, we evaluated the impact of mosquito foraging on algae, other microorganisms and rotifers. Counts of bacteria were performed by flow cytometer. Protists and rotifers were enumerated by microscopic techniques. Algae were retrieved in all bromeliad species with mean densities ranging from ~102 to 104 cells/mL. Their biomass was positively correlated to light exposure and bacterial biomass. Based on carbon content, algae represented a tiny component in shaded bromeliads but accounted for up to 30 percent of living microbial carbon in tanks of Catopsis berteroniana, a carnivorous bromeliad located in a high-light exposure area. Thus, while nutrient supplies are believed to originate from wind-borne particles and trapped insects (i.e., allochtonous organic matter), our results indicate that primary producers (i.e., autochtonous organic matter) are relevant in this insectivorous pitcher plant. Results of communities' manipulation indicate that the prey assemblages were greatly altered by the predation of mosquito larvae. Grazing losses indicated that the dominant algal taxon, Bumilleriopsis sp., like protozoa and rotifers, is a significant part of the diet of mosquito larvae. We conclude that algae are a relevant functional community of the aquatic food web in C. berteroniana and might form the basis of a complementary non-detrital food web.

SS15

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FISH COMMUNITY STRUCTURE IN EUROPEAN LAKES: THE ROLE OF EUTROPHICATION, CLIMATE AND HYDROMORPHOLOGY ALTERATIONS

With the establishment of the European Water Framework Directive there is an urgent need for expanding our knowledge on how anthropogenic pressures, such as eutrophication and hydromorphological alterations affect fish communities in lakes. We assessed the main environmental variables influencing broad scale patterns of fish community structure in European lakes and analyzed how the fish community structure changed along pressure gradients. We compiled data on standardized fish monitoring with multi-mesh sized gillnets from 1632 lakes (11 European countries). By means of regression tree analysis we assessed the relationship between fish community descriptors and environmental and pressure variables. Eutrophication, identified as the percentage of agricultural land in the catchment and the total phosphorus (TP) concentration in the lakes, was the main pressure affecting the density of fish in European lakes. A TP concentration around 24 ìg L-1 represented a threshold for a significant increase in lake fish densities, both in numbers and biomass. Fish density was also sensitive to geographical/climatic factors. Thus, warmer and lowland European lakes, usually more eutrophied, tended to have higher fish densities and lower biomass:number ratios than cold and high altitude European lakes. Fish richness and diversity were mainly related to morphologic and (bio)geographical/climatic variables, respectively, and larger and deeper lakes in warm areas of Eastern Europe tended to be the richest and more diverse in species. No relationships were traced between fish community descriptors and anthropogenic alterations other than eutrophication. These findings have implications for the development of fish assessment systems for European lakes, as they suggest (1) that fish densities are sensitive to eutrophication pressure and thus a valuable ecological quality indicator for lakes, and (2) that morphologic, (bio)geographical and climatic parameters should be accounted for when assessing the effects of anthropogenic pressures on fish richness, diversity and abundance.

SS10

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EFFECTS OF MULTITROPHIC DIVERSITY ON ECOSYSTEM FUNCTIONING IN THE DETRITUS BASED FOOD WEB OF A STREAM

The high species extinction rates worldwide have stimulated large research efforts addressing the consequences of changes in biodiversity for ecosystem functioning. Nevertheless, the relative roles of different components of biodiversity such as species richness within and among trophic levels as well as dissimilarity among species remain poorly understood. In a temperate stream, we tested effects of changes in species richness of leaf litter and its dissimilarity in resource quality as well as species richness of shredders on litter decomposition and related processes. We exposed various combinations of litter and shredder species in microcosms and assessed effects on litter mass loss, fungal biomass, microbial respiration, changes in litter nitrogen concentrations, and shredder performance. Rates of these processes varied strongly among litter species, thus reflecting effects of litter quality (mainly lignin concentrations) on activity of microbial decomposers. Furthermore, correlations among these processes were strong, which highlights the important multiple roles of microbial decomposers in litter processing. However, differences in process rates among litter species did only rarely translate in diversity effects on process rates when mixing these species. In general, shredder feeding was surprisingly low and had only little influence on litter mass loss and microbial activity. Consequently, interactions among decomposer groups and litter species during decomposition were weak, reducing the set of mechanisms potentially resulting in diversity effects on process rates. The results of our experiment therefore support findings from previous studies in this context that highlight the importance of trophic complexity for diversity effects. Furthermore, our results indicate that changes of diversity within trophic levels depend on strong interactions among these trophic levels to be reflected in process rates.

SS9

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LAKE ECOSYSTEM RESPONSES TO LATE QUATERNARY ENVIRONMENTAL CHANGE IN THE SE PACIFIC FROM SEDIMENTARY PIGMENT AND ISOTOPIC GEOCHEMICAL DATA OF RARAKU LAKE (EASTER ISLAND, 27°S)

A multi-proxy paleoecological approach was developed to determine lake responses to Glacial and Holocene climate changes in the SE Pacific. Photosynthetic pigments,;13C and;15N in sediments, were analysed in a composite core of 19 m depth for the last 34 cal kyr BP from Lake Raraku. Marker pigments analysed show a diverse assemblage. Increased productivity between 17.3 and 12.5 cal kyr BP, indicated by the ubiquitous;-carotene, may have been related to increased precipitation and runoff to the lake resulting in higher nutrient supply. Cyanobacteria, chlorophytes and phototrophic bacteria were particularly well represented from ca. 32.6 to 11.6 cal kyr BP. The series of high Zeax/Echin ratio's concomitant with the presence of Oscillatoriaceae (oscillaxanthin) point to the relative dominance of Chroococcaceae and Oscillatoriaceae versus Nostocaceae until ca. 17.3 cal kyr BP. Brown strains of Chlorobiaceae (isorenieratene) dominated along that time interval. After ca. 17.3 cal kyr BP, green strains of Chlorobiaceae (chlorobactene) appeared followed by Chromatiaceae (okenone) and high contributions of filamentous cyanobacteria and chlorophytes. The presence of phototrophic bacteria indicates oxygen depletion either beneath the uppermost living layer of the benthic cyanobacterial mat, or somewhere in the water column possibly associated with stratification. The transition to Holocene was characterized by an increase in algal development ca. 10.2 cal kyr BP, with high contributions of planktonic groups (alloxanthin; Cryptophyta) and diatoms (diatoxanthin) followed by a drop of all groups. With some exceptional episodes and the uppermost part of the record, there was a near absence of pigments along the Holocene. High values of;15N during earlier and mid-Holocene were indicative of denitrification processes (isotopically light N2 degassing at neutral pH) and anoxic conditions, which is consistent with the development of a swamp partially favored by the infilling of the lacustrine basin. Results were discussed in terms of how catchment factors interact with in-lake processes to determine lake ecosystem evolution.

SS3

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FINE SEDIMENT INFLUENCES ON BENTHIC INVERTEBRATE ASSEMBLAGES AT MULTIPLE SPATIAL SCALES

Introduction Fine sediment is considered one of the most pervasive of pollution problems. Consequently, most research has focused on fine sediment associated with human activity. In some circumstances, large volumes of fine sediment can enter rivers as a result of natural geomorphic processes, although there is a paucity of information on how these non-anthropogenic inputs affect stream ecosystems. The river Isábena (Southern Pyrenees) carries large volumes of fine material as a result of overland flow from badland areas. Our aim was to assess the importance of habitat conditions at different spatial scales for benthic invertebrates, with a particular focus on those related to fine sediment. Materials and methods We assessed the influence of habitat characteristics at the patch, reach and catchment scales on invertebrate assemblages across the Isábena catchment. These included sedimentary variables (e.g. grain-size distribution and % fine sediment in the riverbed) and a range of hydraulic, riparian and catchment characteristics. Redundancy Analysis (RDA) was used to identify the key environmental variables influencing assemblages and to assess the relative importance of conditions at each scale. Results and remarks Invertebrate assemblages were species poor and densities were low (55 ind/m2) in those reaches most impacted by fine sediment. Conversely, assemblages where fine sediments were almost absent were richer and heterogeneous (up to 4000 ind/m2). RDA indicated that assemblages across the catchment were driven by a range of local sedimentary and hydraulic conditions. However, a small number of reach and/or catchment scale variables proved to be as useful as preditors of assemblage structure as the patch characteristics. The work emphasises the hierarchical influence of habitat conditions on biota, with those catchment and reach scale characteristics which affect fine sediment supply having an important influence on benthic invertebrate assemblages found in patches of stream bed. The results further our understanding of the interaction between spatial scales and how these influence stream biota.

SS12

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RELATIONSHIP BETWEEN AN EPILITHIC BIOFILM AND ITS ASSOCIATED MEIOFAUNA UNDER TWO PATTERNS OF FLOOD DISTURBANCE IN THE GARONNE RIVER (FRANCE)

Introduction River epilithic biofilms are subject to flood events. Generally, in the middle part of the Garonne river, four to eight critical flood events (with a mean daily discharge ≥ 300 m3 s-1) a year remove the epilithic biofilm and its inhabitant fauna from their support, i.e. the cobble bank surface. This study combines data from two long term observation periods. Absence of flood events during a 9 month period during December 2004 - February 2006 permitted development of high biofilm biomass. Contrarily, biofilm development was frequently interrupted by critical flood events during September 2008- September 2010. This difference in hydrological conditions was used to examine if hydrologic scenarios have, directly or through biofilm status, an influence on the pattern of community composition, recolonisation process and resilience of the biofilm-associated meiofauna. Method and Materials To this purpose, biofilm and meiofauna temporal evolution and the factors driving their development during the two periods with different patterns of flood disturbance were compared. Results and conclusions Nematodes and rotifers were the most abundant groups in the biofilm accounting on average for 88 % and 3.3% of the total meiofaunal density and biomass respectively. Nematodes were more strongly affected by the frequency of the critical floods than rotifers in terms of both density and biomass. Results allowed to distinguish different recolonisation patterns between nematodes and rotifers. Redundancy analyses involving abiotic and biotic factors indicated that proportion of nematodes and rotifers depended on the duration of the low water period following spring floods. Biofilm biomass and the proportions of epilithic microalgal groups were determined as significant factors for the most disturbed period, suggesting that the extent of coupling between the biofilm and its associated meiofauna depended on the frequency of the hydrological disturbance.

SS5

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PROJECTING THE FUNCTIONAL MODIFICATIONS IN STREAM FISH COMMUNITIES UNDER CLIMATE CHANGE

It is now widely recognized that future climate change will substantially affect animal and vegetal species and communities. Potential effects of climate change have been widely studied at the species level, mainly by forecasting future shifts in species distribution that have been amongst the most observed responses for the last decades. However, less is known about community responses to projected climate modifications and few studies have focused on the consequences of species range shifts on the functional structure of communities. Our goal was therefore to assess the functional consequences at the community level of potential shifts in fish species distribution in French streams under climate change. Using ensembles of ecological niche-based models and a consensus approach, we first projected potential shifts in the distribution of 35 common fish species in France under future climate change scenarios. Then, we overlapped the projections obtained from multiple species to produce descriptors of fish communities. Information about 19 ecological and biological traits of fish species were combined to these projections in order to investigate potential functional changes in fish assemblages composition and structure. We also used measures of functional diversity, specialization and originality. Overall, we found that the functional structure of fish communities could be substantially modified. For instance, fish communities could become dominated by species larger in body size and a decrease in the average trophic and specialization levels could occur as well. In addition, future fish communities could become more similar in their functional traits composition than they currently are suggesting a potential functional homogenization. However, contrasting patterns were also found depending on the position of the stream reaches along the upstream-downstream gradient. These results thus indicate that future climate change could result in a great alteration of the roles performed by fish communities in aquatic ecosystems functioning.

O10

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ROLE OF GAMMARUS LACUSTRIS (CRUSTACEA : AMPHIPODA) ON PLANKTON COMMUNITY STRUCTURE IN AN ALPINE SHALLOW LAKE (LLARG D'ENGORS, EASTERN PYRENEES)

Benthic habitats are generally not considered in plankton studies, although some species can actually feed on both habitats. Many amphipods such as Gammarus lacustris have traditionally been considered as a herbivore or a detritivorous scavenger, but they have also been found to prey in the plankton of some lakes. We tested the hypothesis that G. lacustris has an important role in structuring the plankton community of alpine lakes by experimentally removing the amphipod from large (1500L) in situ enclosure experiments. The mesocosms (four replicates for both treatment and control) were sampled monthly during most of the ice-free period (July to October 2010). In the absence of G. lacustris (treatment), we found higher abundance and biomass of Cyclops abyssorum nauplii, copepodites CI and CII and the rotifers Keratella quadrata and Euchlanis dilatata compared to control (presence of G. lacustris) at natural densities. There were no differences in adults of C. abyssorum or Daphnia longispina females indicating that the differences found were not due to different C. abyssorum predation or competition with D. longispina. Therefore our results suggest that G. lacustris mainly predates in lower size taxa. Chlorophyll-a and Nutrient concentrations were not significantly different between treatment and control although changed seasonally. C. abyssorum copepotite biomass was correlated with the concentration of (especially) total phosphorus in the absence of G. lacustris. This relationship was lost with the presence of the amphipod, indicating that all copepod stages were affected by G. lacustris predation. We found a good agreement between the lake and control, indicating that our results are robust and representative of what might be happening naturally in the lake. We show that G. lacustris is the top predator of the plankton community of this alpine shallow lake and that in the lake likely alternates feeding in the benthos and the plankton.

SS11

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SOLUTE TRANSPORT THROUGH A RIVER NETWORK. DO STREAM SYSTEMS REALLY A GOOD JOB?

Stream networks are complex hierarchical structures that optimize the water and matter transport from terrestrial to marine environments. At the same time abundant biogeochemical studies revealed that fluvial ecosystems continuously process and transform organic and inorganic matter. However our knowledge is mostly based on findings obtained from reach-scale field studies and/or on well bounded laboratory experiments. By contrast is emerging the evidence that we ignore to what extent these findings can be extrapolated through an entire river network (Fisher, Sponseller, Heffernan JB. 2004). In this study, an intensive longitudinal hydro-biogeochemical monitoring was performed along the entire stream network (8.5 km length along its main course) in a small forested Mediterranean catchment (Fuirosos catchment, 15 km2). The objectives were: i) To calculate the total water and solutes (DIN, PO4, DOC) masses and associated residence times in the fluvial network; ii) To situate biogeochemical quantitative (i.e. solute concentrations) and qualitative (i.e. DOM optical properties) discontinuities to identify more biogeochemical reactive portions of the river network and iii) To perform solute mass balances to assess the effectiveness of river network in solute retention and release. This study was performed by the students of the "Applied hydrology and watershed management" course of the "Master of Fundamental and Applied Ecology" of the University of Barcelona and University of Girona.

SS6

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RESPONSE OF FISH COMMUNITY STRUCTURE TO RIVER FLOW: APPLICATION TO THE BIOLOGICAL VALIDATION OF ENVIRONMENTAL FLOWS IN THE LOWER EBRO RIVER

The fish fauna from the river banks' habitats from the lower stretch of the Ebro River (Northeast Iberian Peninsula) was assessed. The fish community is clearly dominated by introduced species both at number of species and abundance levels (approximately 60% and 90%, respectively). A significant relationship between water velocity and the proportion native/introduced, regarding fish abundance, was found. Moreover, it was established a critical water velocity threshold from which native species become dominant (0.4 m/s). As water velocity directly depends on river flow, a relationship between mean annual flow scenarios and the proportion of native/introduced species was established, throughout habitat modeling. This methodology was used to perform biological validation of different proposals of mean annual flows for the lower Ebro River. The suitability of such proposals is discussed.

O7

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FISH AS ECOLOGICAL TOOLS TO COMPLEMENT BIODIVERSITY INVENTORIES OF BENTHIC MACROINVERTEBRATES

Sampling benthic macroinvertebrates in large rivers has several limitations, arising not only from the selectivity of traditional sampling gears but also from difficulty in capturing organisms that inhabit the deeper zones and high current velocities. Considering the importance of benthic macroinvertebrates as a food resource for fishes, the sampling restrictions in sediment collection done by dredges, and the importance of surveying benthos biodiversity, the objective of this study was to evaluate the stomach contents of five commonly-occurring invertivorous fish species as a means of complementing a benthic macroinvertebrate inventory. Three sampling campaigns (fish and benthic macroinvertebrate) were conducted in a reach of the Araguari River (Brazil), approximately 9 km long and 90 meters wide. Astyanax altiparanae, Leporinus friderici, Leporinus amblyrhynchus, Iheringichthys labrosus and Pimelodus maculatus were the fish species collected and studied. To determine benthic macroinvertebrate taxonomic richness, a total of 54 Van Veen sediment samples were obtained. We compared lists of the benthic taxa found in fish stomachs with those from the sediment samples. Independently of sampling period, additional benthic macroinvertebrate families or classes were provided by identifying fish stomach contents. We found a total of 30 taxa in this study, including 5 unique taxa (or 17% of the total) in the sediment samples, 9 unique taxa (30%) in the stomach samples, and 16 taxa (53%) common to both. The NMDS and ANOSIM analyses showed a significant separation between Van Veen sediment samples and two fish species stomachs contents - L. amblyrhynchus and P. maculatus. These results indicate that fish can be used as additional samplers and are an efficient method to complement the benthic taxonomic inventory obtained through traditional sediment sampling techniques in large rivers.

O6

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ON THE ROLE OF BIOTIC INTERACTIONS AS DRIVERS OF THE PLANKTONIC FOOD WEB STRUCTURE IN A MARITIME ANTARCTIC LAKE

Biotic interactions and resource availability are both factors likely controlling the food web structure in freshwater ecosystems. Antarctic lakes are simple environments suitable for testing basic principles of functional ecology. This simplicity and the environmental hardness of the region encourage to explore the actual role of biological interactions, particularly, those involving microbial food web pathways. In this work, effects of predation and resource availability on the microbial plankton of an Antarctic oligotrophic lake (Lake Limnopolar, Byers Peninsula, Livingston Is.) have been assayed during several consecutive summers (2002 to 2007). As a rule, results show that nitrogen and phosphorus were both in short supply, although the limiting nutrient could vary. We also found evidences for the potential existence of a trophic cascade in the pelagic food web of the lake, mediated by a strong top-down regulation of protozoa populations by copepods, which indirectly benefits pico-sized organisms. Furthermore, both top-down and bottom-up forces acted in concert, thus resulting in the higher picoplankton abundances (both heterotrophic and autotrophic). Our findings suggest that these trophic pathways are channelized through ciliates, whose abundance declined markedly in response to the increases of copepod densities. The selective grazing of protists over picoplankters furthermore favoured a shift of the bacterial size structure. Additionally, some nutrient turnover was associated to zooplankton. Although other studies we conducted in the same site show how the ice dynamics and the stability of the lake may greatly explain the plankton succession, the community structure, particularly the abundances and the age structure of metazoan zooplankton, may also determine the response of the whole community to disturbances (i.e., nutrients inputs). This points out that these communities could be regulated not only by physical mechanisms, thus partly overturning the traditional dogma regarding the extreme physical control on these ecosystems.

O8

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RESPONSE OF STREAM MACROINVERTEBRATES TO SALINIZATION: A MESOCOSM APPROACH

Salinization is expected to become a critical threat to freshwater ecosystems due to sea-level rise and increases in the severity and frequency of drought. In many regions of the world, salinization caused by intensive agriculture and mining activities has already impacted freshwater ecosystems. Salinity has toxic effects on most aquatic macroinvertebrate species but the effects of salinization at the community level are not well known. Here, we evaluate the response of stream macroinvertebrate communities to increased salinity in a mesocosm experiment. The study was conducted in a mesocosm facility with 12 artificial stream channels. Different volumes of stream and salt-saturated water were mixed to yield four treatment solutions with conductivities of 300 µS/cm (control), 1500 µS/cm, 2500 µS/cm and 5000 µS/cm. Twelve stones were transferred from a nearby stream to each of the channels, which were fed by natural stream water for one week in order to allow for algal colonization and stabilization of the invertebrate community. Each salinity treatment was then continually applied to three channels for a three-day period. Three stones and drift collected from each channel were sampled every 24 hours. The lethal effects of salinity were assessed by the changes in invertebrate densities on the stones and in the drift, while sub-lethal effects were evaluated though the measurement of algal biomass (related to invertebrate consumption rates) and the biomass and size of individual invertebrate organisms. The community-level effects of the salinity treatments were assessed using Principal Response Curves, which quantify the multivariate community response in each treatment over time, relative to the control. Finally, the different treatment levels were used to evaluate minimum-threshold effect of salinity on community composition, which is considered to be around 5000 µS/cm for stream macroinvertebrate taxa.

O6

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COLONIALITY VS. UNICELLULARITY IN PHYTOPLANKTON: AN ANALYSIS OF THE FUNCTIONAL TRADES-OFFS

The first phytoplankton forms are dated from 3.5 billion-years ago and several evolutionary lineages brought to current high diversity of life forms. Colonial forms are present in some of the clades but not in others and the structure of the colonies differ among groups. This raises the question about the functional constraints for unicellular forms to evolve into colonial ones. Depending on how the colony is built there are large differences on size, aspect ratio and density respect the original unicellular organisms, which modify the physico-chemical constraints related to growth and decay. Phytoplankton needs to overcome the diffusion limitation of resources. When arranged in colonies, the average transport distance within the complex enlarges and diffusion becomes increasingly less efficient throughout the colony matrix. Besides, some morphologies may increase sinking rates and, as a consequence, higher growth rates are required to compensate the decay effect. In this regard, we may hypothesize that colonies will either require environments with higher nutrient requirements or will show specific adaptations to increase the nutrient availability to cells. In this presentation, we review the existing data on functional properties of phytoplankton colonies and compare them with those of unicellular forms. The results indicate that parameters related to nutrient uptake (particularly to phosphorus) are those that functionally most differentiate colonial from unicellular forms and different types of colonies among them.

O3

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BIOAVAILABILITY OF COPPER IN A RESERVOIR WITH COPPER SULPHATE ALGAECIDES APPLICATION

Application of copper sulphate (CuSO4) as an algaecide in Brazililian reservoirs is responsible for high concentrations of copper (Cu) in the sediment of some water bodies. Cu concentrations in sediments were found above the level considered toxic by the Canadian Environmental Agency (PEL - Probably Effect Level) and above regional backgrounds levels in some Brazilian reservoirs with CuSO4 application. The application of CuSO4 to control the algal bloom occurs in Juquery reservoir, a public water supply reservoir in metropolitan region of Sao Paulo. In order to analyze the bioavailability of Cu in the sediment of Juquery reservoir, a sampling was performed in 10 points along the water body. An Ambühl Bührer collector was released twice at each point. The first three centimeters of the sediment column were removed and stored in airtight plastic bags. One sample was intended for the determination of volatile sulfide (AVS) and simultaneously extracted metals (SEM) and the other to the determination of total organic carbon (TOC) and particle size. Were determined in situ: EH, pH and temperature, in the sediment, and dissolved oxygen (DO) in the water-sediment interface. The values for EH (70 ± 32.2 mv) associated with DO values (8.3 ± 1.3 mg/L), indicate the presence of oxidative processes and the possibility of metal bioavailability. However the grain of the sediment consists mostly of silt and clay, which represents a possible binding site for divalent metals, decreasing the probability of metals release in the the water column. Furthermore, the relation SEM-AVS was less than zero, indicating that Cu was not bioavailable. Despite Cu was not bioavailable, it is necessary to reduce the inputs of N and P in Juquery reservoir's tributaries, in order to reduce the algal biomass and, consequently, stop the application of CuSO4. Otherwise, reservoir's 'good quality' will be at risk.

SS2

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DIVERSITY OF PLANT ASSEMBLAGES WITH ISOETES HISTRIX IN MEDITERRANEAN TEMPORARY PONDS: IMPLICATION FOR CONSERVATION.

Plant assemblages characterized by the presence of Isoetes histrix, referable to the priority habitat 3170*, grow in very shallow water (few centimetres) with a flooding period not longer than 2-3 months. These conditions are observed in the edge of temporary ponds with a concentric organization of the vegetation, due to the concave morphology of the basin (habitat-A) and in the whole area of small temporary ponds characterized by a flat morphology (habitat-B). In order to evaluate if the plant assemblages differed in structure and temporal dynamic and to identify the major drivers affecting species composition, 14 temporary ponds (7 corresponding to habitat-A and 7 to habitat-B) were monitored at three times throughout 2010 in Sardinia. The results showed that the plant communities growing in the two habitats were strongly different (Global R=0.75; significance level of sample statistic =0.002). The species more abundant in habitat-A were: Trifolium subterraneum, Agrostis salmantica, Bellis annua and Isoetes histrix; in habitat-B: I. histrix and Anthoxantum aristatum. SIMPER analysis pointed out that these 5 species were the more responsible of the dissimilarity between the compared assemblages. Only in habitat-B significant differences between the first and third sampling date were found (Global R=0.501; significance level of sample statistic =0.003). Canonical Correspondence Analysis revealed that the following key environmental factors were related to plant structure assemblages: geomorphologic pond structure, defined as presence/absence of zonation (23.0% of the total variance) and geology, particularly the granitic substratum (14.4% of the total variance). As the two habitats present peculiar characteristics and they represent different aspects of the priority habitat 3170* it should be recommended to ensure the conservation of both taking in account that the habitat-B is more vulnerable because it is more ephemeral and smaller.

O5

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CONSEQUENCES OF AQUATIC SUBSIDIES ON THE DISTRIBUTION AND STRUCTURE OF RIPARIAN CONSUMERS

Transfers of nutrients, matter, and organisms across habitat boundaries (spatial subsidies) can change the structure and dynamics of populations, communities, and food webs in recipient habitats. Streams and their adjacent terrestrial environments share a long edge boundary, and therefore offer exceptional models for the study of how transfers of spatial subsidies affect recipient habitats. However, while terrestrial to aquatic subsidies have been reasonably well studied, research on aquatic-terrestrial subsidies is more limited. We studied aquatic-terrestrial subsidies along a gradient of eight boreal streams varying in nutrient content in south central Sweden. Between May-November 2009, we took monthly samples of the lateral distribution of emerging aquatic insects and their terrestrial consumers at distances of 1, 10, 50, and 100 meters from the stream edge using pit-fall and sticky traps. In addition, we sampled benthic invertebrates and emerging insects from the streams. In this presentation we will describe the consequences of the timing, magnitude, and quality of these subsidies on the distribution and structure of recipients.

SS6

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VARIATION IN LIFE HISTORY TRAITS OF INVASIVE MOSQUITOFISH ALONG SPATIAL GRADIENTS

Variation of life history traits along spatial gradients is poorly understood in invasive species and particularly in freshwater ï¬ sh. We examined life history variation in a highly invasive ï¬ sh (Gambusia holbrooki) along latitudinal and upstreamâ€“downstream river gradients and we assessed the effects of age on this variation. Mosquitoï¬ sh were sampled from the lowest reaches of ten rivers along 6Â° of latitude between France and Spain, and seven sites along the upstreamâ€“downstream gradient in three of the rivers. We examined abundance, population structure, size-at-age and other life history traits along these gradients. Lower reaches and lower latitudes resulted in higher reproductive effort and lower body condition. These patterns were nonlinear and strongly depended on age. Independently of size, age groups differed in reproductive effort, in the gonadal weightâ€“size relationship and its variation along spatial gradients. Mean size-at-age did not vary with latitude (so the intra-speciï¬ c version of Bergmannâ€™s rule does not apply) and in contrast increased upstream in rivers. Our ï¬ ndings suggest that for life history traits of fishes, river longitudinal variation might play a role as important as climate, with often differential effects. Results also illustrate the poor knowledge of spatial variation of life history traits of freshwater organisms.

SS7

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DEVELOPMENT AND ENVIRONMENTAL IMPACTS OF AZOLLA FILICULOIDES IN THE IBERIAN PENINSULA UNDER THE CLIMATIC CHANGES

Azolla is a worldwide heterosporous floating or semi-aquatic pteridophyte, which contains a permanent endosymbiotic prokaryotic community (bacteria and cyanobacterium) living in the dorsal lobe cavity of the leaves. The cyanobacterium - Anabaena azollae - is a photoautotrophic filamentous organism, capable of nitrogen fixation, which allows the host to grow in aquatic environments devoid of combined nitrogen, but enriched with phosphorus. This fern was introduced in Europe in the mid- XIX century as an ornamental plant, namely in botanical gardens, and quickly spread into the nature. The first reference to Azolla (classified as A. caroliniana) in the Iberian Peninsula was made in 1907 at the Royal Botanical Garden of Madrid. However, it was mainly with the development of the rice culture in Portugal and Spain that this plant spread into the nature through sporocarps contamination of the imported rice seeds. Azolla has a life cycle composed of two types of reproductive processes: a vegetative one and a sexual one. In adequate environmental conditions, the first type allows the plant to double its biomass in two or three days, giving rise to massive blooms, forming long mats that cover water bodies with serious consequences to the ecological, social and economic levels. Due to the climatic changes (e.g. subtropicalization of South of Europe) and high nutrient concentration present in water bodies, Azolla has spread, being present almost in all of the Iberian Peninsula. In this work we refer the causes and consequences of two major blooms provoked by A. filiculoides which occurred in the international rivers Guadiana and Tagus in the years of 1993 and 2009. Finally, we propose a transnational programme for Azolla control, integrated in a European Observatory for weeds management.

SS9

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COMBINING AQUATIC CHEMISTRY AND PALAEOLIMNOLOGICAL TECHNIQUES: THE RECONSTRUCTION OF CO2 SATURATION IN AN ALPINE LAKE THROUGHOUT THE HOLOCENE

Among the constrains limiting cross-fertilization between palaeolimnology and current limnological studies, despite that both are dealing with the same ecosystems, is the scarce overlapping in the variables they effectively measure. Connections are usually established on rather general conceptual bases but achieving a quantitative common playground is difficult. Here we provide an example of how palaeolimnological techniques can be applied to investigate long-term water chemistry dynamics. A diatom sediment record was used to assess the long-term inorganic carbon dynamics in poorly acid-buffered lake. Using a training set of 115 high-mountain lakes in the Pyrenees, we found that both alkalinity and pH independently explained some of the variability in diatom assemblages. Transfer functions for both variables were developed and applied to a Holocene record from Lake Redon and CO2 changes calculated. CO2 saturation broadly followed alkalinity, which in turn was related to summer and autumn air-temperature fluctuations. In general, warmer climate during the ice-free period led to higher supersaturation, due to increased alkalinity, which facilitated retention of CO2 from respiration, and decreased primary production (assessed by diatom fluxes). Only during the early Holocene, there were periods of extreme undersaturation, corresponding to cold periods of low alkalinity (<20 µeq L-1), and suggesting carbon limitation of primary production. The winter and spring climate, which determines the ice cover duration, appears to be relevant for CO2 saturation only during periods when the organic matter content of the sediments was low (<22%). Longer periods of ice cover led to lower lake CO2 saturation, suggesting that the ice cover influence on internal nutrient loading may regulate lake productivity fluctuations under low allocthonous nutrient and organic matter inputs. Alkalinity ca. 20 µeq L-1 and sediment organic matter ca. 22% appear as critical thresholds in the way lake CO2 levels respond to climate fluctuations in these lakes.

SS1

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DISSOLVED ORGANIC MATTER IN TEMPORARY STREAMS: SPATIOTEMPORAL VARIABILITY IN A MEDITERRANEAN CATCHMENT

Dissolved Organic Matter (DOM) is a fundamental driver of carbon processing in streams and rivers, and leads the relationships between terrestrial and aquatic ecosystems and between the lotic and lentic sections of watersheds. Whereas DOM properties and dynamics have been widely studied in permanent rivers, its variability in temporary streams appears to be poorly addressed, especially regarding the factors determining its spectroscopic characteristics. In this study we evaluate the spatial and seasonal variability in dissolved organic carbon concentrations and in several qualitative DOM spectroscopic descriptors including SUVA254, fluorescence index, colour intensity by means of a440, as well as excitation emission fluorescence matrices. Sampling was done in the island of Menorca (Western Mediterranean) from fall 2007 to winter 2008 in 7 temporary stream tributaries belonging to a single catchment selected for its varied lithologies and traditional land uses defining a cultural landscape with an equilibrated mosaic of Mediterranean evergreen forests and traditional extensive pastures. The analysis of DOC concentrations and optical descriptors depict higher levels of organic carbon, coloured DOM and aromatic compounds during the first torrential events of the hydrological cycle (in autumn) than during the rest of the year. These materials gradually increase their lability and autochthonous character, as confirmed by the marked differences in the EEMs-derived descriptors between winter and spring. Our results highlight the importance of catchment's surface wash-off as a fundamental driver of DOM dynamics in temporary streams.

SS15

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MACROPHYTES BUFFER THE EFFECTS OF NUTRIENT INPUTS IN LAKES EXPERIENCING RESIDENTIAL DEVELOPMENT

Lake management is a pressing problem in the Laurentian region of Quebec where the population has nearly doubled since 1971. Residential development is concentrated along the shore of the lakes, yet this disturbance rarely translates to increased concentrations of phytoplankton and open water nutrients. Lakes typically remain transparent (Secchi depth > 4 m) and oligotrophic (TP < 10µg/L). However, there are signs that the littoral area is being affected. We observed the sediment poral waters of densely inhabited lakes to be 6-7 times richer in nutrients than those of less populated water bodies. In this study, we tested whether macrophytes sequester land-derived nutrients thus acting, at least temporarily, as a buffer against open water eutrophication. To this end, in mid-summer 2010, we intensively sampled the aquatic vegetation of 6 lakes differently affected by residential development. We also monitored seasonal changes (May-November) in macrophytes in a selected lake. Our findings showed that macrophyte cover, biomass, specific composition, and nutrient (N and P) tissue content were affected by residential development. These data allowed us to estimate spatial and temporal trends in the quantity of nutrients stored in the macrophytes. This storage represented a significant fraction of the nutrient inputs to the lakes, which was estimated by empirical equations based on shore and watershed use. The ability of aquatic vegetation to slow open water enrichment is not boundless. Therefore, residents and managers should monitor changes in macrophyte biomass and composition and consider this information in evaluating the state of such lakes. Then, appropriate action may be taken in order to prevent generalized lake eutrophication, which can be irreversible.

O3

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EPIPHYTIC DIATOMS ALONG ENVIRONMENTAL GRADIENTS IN EUROPEAN SHALLOW LAKES.

Diatom-based methods have been successfully used worldwide to assess the trophic status in lenthic habitats. Several studies have demonstrated the efficacy of epiphytic diatoms as indicators of nutrient load in shallow lakes and wetlands. The purpose of this study was to examine the relative importance of environmental factors in explaining the structure of epiphytic diatom communities in European shallow lakes. The effects of lake chemical, morphometric and geographical predictors on diatom assemblages was tested using distance-based, canonical correspondence and regression analyses. Results show that epiphytic diatom communities respond mainly to chemical variables, overriding the effects of lake depth, size and location. Moreover, the clustering of studied systems based on TP levels is found consistent with their classification according to the indication value of inhabiting diatom taxa. Epiphytic diatoms offer then a workable tool for developing shallow lake typologies and classification systems in European countries. Further testing and concretion of the most relevant limnological variables would improve the applicability of diatoms as environmental proxies for shallow lakes.

O7

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DISTRIBUTION AND RICHNESS OF AQUATIC MACROPHYTE SPECIES IN RELATION TO ENVIRONMENTAL FACTORS IN WATER BODIES OF CATALONIA (NE SPAIN).

The relationships between vascular aquatic macrophyte occurrence and richness and environmental variables were assessed across 90 water bodies along a 2400 m altitudinal gradient. Up to 40 environment variables were measured and a total of 85 species of aquatic macrophyte were identified in the surveyed water bodies, which correspond to 8 different typologies. PCA ordination based on 19 water chemistry variables shows two main gradients: mineralization (PC1) and eutrophia (PC2). PCA ordination based on 16 sediment variables shows to main gradients: calcareous-siliceous geology (PC1) and texture (PC2). BEST analysis selects pH, TOC, sulfates and sediment titanium as the best combination of variables to explain aquatic macrophyte distribution. However when adding 5 lake physical and geographical variables, a single variable is selected as the best: altitude. CCA among species and environmental variables (water and sediment) clearly segregates coastal lagoon, temporary pools and alpine lakes over two main gradients: mineralization (CCA1), and production (CCA2). PCA based on environmental data segregates the same typologies and all ordinations performed show high correlations with altitude. Species richness peaks between 100 and 200 m a.s.l. and correlates positively with the occurrence of vulnerable species but no relationships are found with non-native species. GLM and GAM show a positive correlation among richness, eutrophication and typology (only temporary pools are significantly different, having higher average richness). To sum up, environmental gradients are strong and mainly related to altitude, leading to well defined extremes both for environmental parameters and aquatic flora.

O6

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GENETIC DIVERSITY OF EUKARYOTIC ULTRAPHYTOPLANKTON IN THE OLIGO-MESOTROPHIC LAKE PAVIN DURING THERMAL STRATIFICATION ONSET

Ultraphytoplankton communities, i.e. autotrophic cells;m, form an important component of freshwater ecosystems (Callieri et al. 2007, Winder 2009) which absolute biomass may be as larger as the one recorded in marine environments (Bell and Kalff 2001). They are composed of picocyanobacteria and eukaryotic cells that exhibit clear seasonal succession in freshwater habitats (Crosbie, Teubner and Weisse 2003, Callieri et al. 2007, Winder 2009, Pick and Agbeti 1991, Winder 2009, Padisak et al. 1998, Crosbie et al. 2003) and play essential role as energy source for aquatic food webs (Azam et al. 1983). So far the diversity of autotrophic picoeukaryotes has not been extensively studied in freshwater habitats compared to marine environments. We investigated the diversity of eukaryotic ultraphytoplankton over the cold isothermal mixing conditions of late winter to the full establishment of the thermal stratification in early summer in the euphotic layer of Lake Pavin (Massif Central, France). In order to target the eukaryotic photosynthetic cells, ultraphytoplankton concentrated samples were first sorted by flow cytometry with a FACSvantage SE (BD Biosciences, San Jose, CA, USA). 16S rRNA gene plastid clone libraries were then constructed using PLA491F and OXY1313R primers (Fuller et al. 2005). The phylogenetic analysis of the seven clone libraries constructed (coverage values from 91% to 99%) revealed 23 OTUs affiliated to Trebouxiophyceae (11) and other Chlorophyceae(2); Chrysophyceae(3), Eustygmatophyceae (1), Bacillariophyceae(2), Dinophyceae(1) Cryptophyceae (1) and 2 Haptophyceae that included 1 Prymnesiophyceae. Analysis of RFLP profiles from 614 clones revealed a shift in the eukaryotic ultraphytoplankton from communities with high diversity index during the mixing period (H'=1.96) to communities dominated by Trebouxiophyceae during thermal stratification (H'=0.81). Plastidial 16S RNA genes thus offer a good tool for the study of ultraphytoplankton in freshwater ecosystems, where enhanced competition seemed to limit diversity in the stratified summer water column.

SS10

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A TRIBUTE TO BJÖRN: BIODIVERSITY AND STREAM ECOSYSTEM FUNCTIONING, A PARALLEL BETWEEN AQUATIC FUNGI AND MACROINVERTEBRATE COMMUNITIES

Investigations by Prof. Björn Malmqvist over more than three decades have deeply changed our views on stream ecosystem functioning, in particular regarding the determinants and effects of diversity of macroinvertebrate communities. While his pioneer studies have documented the tight link between aquatic communities and the structure of the riparian ecotone, his more recent concerns have focused on the role of biodiversity on both performance and stability of ecosystem functions. Here, we attempt to explore the similitudes and divergences of such relationships observed with fungi as another major component of woodland stream food webs. Based on field studies and laboratory manipulations, our observations together with literature data tend to show that fungal communities are equally responsive to the diversity and composition of the riparian forest. They however fail to demonstrate consistent effects of fungal diversity on magnitude of rates of leaf litter decomposition, i.e. a key ecosystem function in woodland streams. The diversity of assemblages of fungal decomposers decreases the variability of rates of fungi-mediated litter decomposition, which suggests, like for detritivorous macroinvertebrates, a role of diversity in the stabilisation of process rate together with an insurance against environmental stress effects. Moreover, the diversity of fungal communities may interact with that of upper and lower trophic levels, suggesting diversity effects complexifying and a difficulty in predicting the impact of generalized biodiversity losses in natural systems.

SS8

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POPULATION GENETIC STRUCTURE OF AQUATIC INSECTS IN STREAMS DIVIDED BY WATER RESERVOIR

It is well known, that fragmentation of riverine systems can influence genetic structure of natural populations in aquatic organisms. However, majority of studies is focused on larger animals like fish, or describe disruption impacts in larger scale. In this study we tested possible influence of such a fragmentation in a small scale, and we analysed populations of insect species. We used several aquatic or semiaquatic insects with different life histories, collected in streams in the environment of the Small Carpathians (western Slovakia). The streams were equally cut into two parts by reservoir retaining water for agriculture and fishery. As a model organisms, species of Coleoptera, Trichoptera and Ephemeroptera were chosen. Samples were collected from inlet and outlet of respective reservoir. For haplotype analysis, we used ca 350bp fragment of cytochrome b mtDNA. We used Fst statistic to provide general measure of genetic differentiation across species studied. The first results suggest very low impact of fragmentation caused by small reservoirs on the haplotype polymorphism in more agile species (usualy those with aquatic larvae and well flying adults), and higher impact on species with both larvae and adults aquatic. The data on genetic variability of insect species showed that construction of reservoirs can influence genetic structure also in the small scale. Beside population study, the data on intraspecific variability will aslo serve for development of determination technology of animal species using DNA samples. This contribution/publication 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 R&D Operational Programme funded by the ERDF.

SS8

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GENETIC STRUCTURE OF DIVING BEETLE POPULATIONS IN HIGH TATRA MTS

High mountain lakes and ponds of glacial origin belong to the most remote and undisturbed aquatic environments over the world, and their recovery from anthropogenic pollution, classification, and reactions to the climate change are hot topics of freshwater research. Population genetic studies of alpine lakes inhabitants mostly describe the genetic patterns in a large scale (between mountain ranges). However, we still know very little about population structure of alpine aquatic organisms, especially macroinvertebrates, within smaller areas. In the High Tatra Mountains, there are more than 110 permanent lakes of glacial origin and many other small ponds. In 2009, we promoted the study of genetic variability of 2 diving beetles, Agabus bipustulatus solieri and Agabus guttatus (Coleoptera: Dytiscidae). For haplotype analysis we used ca 350bp fragment of cytochrome b mtDNA. Samples were from about 25 lakes and ponds (located on Slovak and Polish side of the High Tatras), belonging to 11 different valleys. Seven and eight haplotypes were identified respectively with different distribution across study area in both species. We used Fst statistic to provide general measure of genetic differentiation across species studied. High proportion of lakes was characterized by single haplotype and majority of haplotypes were restricted to only one of the sampled valleys. Results of analysis based on molecular methods can contribute considerably to the knowledge on the distributional trends, recolonization or identifying possible refugia of the species. Consequently they can help to preserve these unique aquatic environments and their biodiversity. Beside population study, the data on intraspecific variability will aslo serve for development of determination technology of animal species using DNA samples. This contribution/publication 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 R&D Operational Programme funded by the ERDF.

SS10

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NICHE SEPARATION AND BIOLOGICAL TRAIT RESPONSE TO HYDRAULIC STRESS OF BENTHIC MACROINVERTEBRATES IN A LARGE REGULATED RIVER

Invertebrate communities respond to flow alterations with shifts in species richness, abundance and distribution. Further, species exhibiting high hydraulic niche marginality may give habitat predictability and are more sensitive to hydrological alterations. On the other hand, the response of invertebrate biological traits to hydraulic conditions is difficult to interpret without a priori predictions, either considering discharge variation or hydraulic stress, and only a few studies have been made. The macroinvertebrate community structure and their biological traits were characterized in the lower Ebro River (NE Spain) along a hydraulic gradient by using the niche separation and the fourth corner method analysis, respectively. Quantitative benthic samples were collected simultaneously with measurements of the mean water velocity, depth, the percentage cover of macrophytes in the benthic habitat and the interstitial dissolved oxygen concentration. Froude number and Reynolds number were also calculated.The mean water velocity was the best explanatory variable for the benthic macroinvertebrate distributions and functional structure and all structural and functional metrics were negatively correlated with this variable. Of the studied taxa, some species showed hydraulic niche separation within the same family (e.g. Chironomidae, Baetidae), subfamily (Orthocladiinae), or genus (Cricotopus spp.) while others presented niche overlap as a group (e.g. Naididae). Many of the biological trait categories responded to increasing hydraulic stress according to a priori predictions (e.g. largest sizes, reproduction by cemented aquatic eggs, ¡Ýsemivoltine, temporary attachment, swimmers, tegument respiration, filter-feeders), while other trait categories did not present a clear response (e.g. life cycle duration) or responded without a priori predictions.

O1

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THE EUROPEAN EEL (ANGUILLA ANGUILLA) POPULATIONS IN THE SPANISH TRITURARIES OF THE RIVER MIÑO (NW SPAIN).

The European eel Anguilla anguilla L. is a catadromous migratory species with an European panmictic stock declining to critical levels. Serious concerns have been expressed at an international level about the need for immediate implementation of conservation measures throughout the continental range of the species. The political response has been an EU Regulation for the recovery of the stock of European eel, obliging all Member States to develop National Eel Management Plans. The EU eel recovery plan is built on the principle that each country river systems should permit at least 40 % of the biomass of spawner escapement that migrated to sea during former pristine conditions to restoring the species to sustainable levels. There is a need therefore for reliable information on eel populations. During the summer of 2010 we undertook electrofishing surveys in 23 sections of 14 Spanish tributaries of the lower Miño, in order to establish the present distribution of the species and the status of the stock. Density and biomass values showed high variation among sampling stations, with maximum density values of 0.4 ind./m2 and biomass of 6 g/m2, and minimum density values of 0.005 ind./m2 and biomass of 0.23 g/m2. Medium values of biomass of silver eels for each tributary attained 35.59% (sd = 12.38) of the total number of eels, a low value that is probably related to the presence of barriers to migration that shorten the available habitat. Additionally, the percentage of females (large eels >45 cm) is very low (8.7%), indicating the inability of individuals to attain upper sections of tributaries, given that eels in upstream river sections typically differentiate as females.

SS13

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DISTRIBUTIONAL SHIFTS OF STREAM FISH OVER THE LAST DECADES

Aquatic ecosystems being acknowledged as the most vulnerable to global change, understanding the ecological impacts of such pressures is a crucial challenge of the twenty-first century. In particular, poikilotherm organisms as stream fish are predicted to be strongly affected by climate change. However, although recent studies have revealed numerous examples of species responses to contemporary climate change, evidence for stream fish is still lacking. In this study we investigated distributional shifts of common stream fish in France during the last decades. We used repeated surveys in the 1980s-1990s and the 2000s on more than 5000 sites for each period, distributed within the main hydrographic basins. Species distributions were modeled across the whole French hydrographic network independently for these two periods. Species limits and ranges along elevation and upstream-downstream gradients were then compared, showing substantial shifts in species distribution. Finally, detected spatial changes were compared to the potential modifications in fish species distribution previously projected by niche-based models under several climate change and species dispersal scenarios, including dispersal limited by dams and full dispersal.

O4

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PHOTOSYNTHETIC PLASTICITY OF MACROPHYTES GROWING IN SHALLOW LAKE OF ¡§FUENTE DE PIEDRA¡¨ TO ACCLIMATE TO INCREASING IRRADIANCE DURING AN ANNUAL CYCLE

Submerged macrophytes growing in shallow waters should cope with changeable light conditions. While low irradiance values could lead to unsustainable energy yield, high values of Photosynthetic active radiation (PAR) or ultraviolet radiation (UVR) could induce photodamage. We addressed the study of the main contributors to the benthic vegetation in the atalasohaline, shallow lake ¡§Fuente de Piedra¡¨: Ruppia drepanesis, Althenia orientalis and Lamprothamnium papulosum. The photosynthetic performance of these macrophytes was study throughout an annual cycle. For this purpose, the biomass, irradiance-onset saturation parameter (Ek), compensation point of photosynthesis (Ec), photosynthetic efficiency (£\), irradiance-saturated net photosynthesis (NPmax), dark respiration (DR) and pigment content were computed. Simultaneously, vertical attenuation coefficient (Kd) for PAR, UVA and UVB radiation was also measured. Transparency of water increased with time of the year, as revealed by the diminution of Kd for PAR, UVA and UVB ($P<0.05$) throughout the year; moreover, Kd values for PAR were negative correlated with biomass ($r= - 0.767$; $P<0.05$). The values of NPmax in A. orientalis was increased ($P<0.05$) throughout the year, with a peak in August (0.17 ¡Ó 0.05 ƒÝmol O2 g-1 DW s-1). On the contrary, no significant differences were found in the other two species. Photosynthetic efficiency (£\) and Ek did not show significant differences neither between species nor during the year. A. orientalis and R. drepanensis Ek values increased throughout the year ($P<0.05$), while a decrease was observed in L. papulosum ($P<0.05$). The concentration of Chl a, Chl b did not changed through the year in any of the species. By contrast, TC content increased in the three species over the sampling period. The growth of dense macrophyte beds contributes to increase water transparency. Related to this, the studied macrophytes showed enough plasticity for the acclimation to increasing irradiance, avoiding a photosynthetic efficiency decrease, especially in the case of A. orientalis.

O1

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THE SPATIO-TEMPORAL VARIABILITY OF MACROINVERTEBRATE COMMUNITIES IN UPLAND PORTUGUESE STREAMS

Mediterranean stream habitats are highly variable in space and time. We assessed the ecological spatio-temporal variability of six upland tributaries of the Minho, Douro and Mondego river systems located in central and northern Portugal. We conducted periodic surveys of the macroinvertebrate community to describe seasonal change (November, March, May and August) and compare pool and riffle habitats. Macroinvertebrates were collected by kick-sampling. Habitat characterization was made using a modified version of River Habitat Survey (RHS), including a detailed description of benthic habitats (substrate size, % occurrence, embeddedness). Parameters of water quality (temperature, conductivity, pH, dissolved oxygen) were also measured. Insecta dominated macroinvertebrate communities, accounting for 95% of all fauna. At the family level taxa richness was comparable between riffles (78 taxa) and pools (74 taxa). Taxa richness and abundance were highest during summer (May-August) and lowest in early spring (March). This pattern reflected temporal trends in the commonly occurring families, Chironomidae, Leuctridae, Leptophlebiidae, Rhyacophilidae and Elmidae. In contrast, Limoniidae, Nemouridae, Heptageniidae and Sericostomatidae were characterized by populations that were more stable across seasons. Differences in distribution and abundance were also apparent between habitats with Simuliidae, Hydropsychidae, Philopotamidae, Baetidae and Hydraenidae more common in riffles and Leptophlebiidae, Sericostomatidae, Dytiscidae and Limnephilidae more common in pools. Analyzed at the genus and family level these trends reflected differences in macroinvertebrate traits with filter feeders and grazers more abundant in riffles, while shredders and predators were more abundant in pools. In addition to spatial patterns in feeding and behaviour macroinvertebrates also differed in size and life--cycle characteristics with large, longer-lived individuals tending to be most common in the temporarily more permanent pool habitat. These data indicate how traits mediate the distribution and abundance of macroinvertebrate in the spatio-temporally variable environments of upland Atlantic-Mediterranean streams.

O4

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LIGHT HISTORY INFLUENCES THE RESPONSE OF FLUVIAL BIOFILMS TO ZN EXPOSURE

This study evaluated the relationship between short-term light stress and Zn toxicity on fluvial biofilm communities' photoacclimated at different light conditions. Biofilm communities photoacclimated to 25 µmols photons /m2 s (low light-LL biofilms), 100 µmols photons /m2 s (medium light-ML biofilms) and 500 µmols photons /m2 s (high light-HL biofilms) were characterized by different structural (chl-a, total biomass-AFDW, extracellular polymeric substances-EPS, algal groups and diatoms taxonomy) and physiological (ETR-I curves and photosynthetic pigments) parameters. HL biofilms showed a higher light saturation intensity-Ik and a higher production of xhantophylls pigments than LL and ML biofilms (mainly functional photoacclimatation mechanisms). In contrast, LL biofilm communities had more diatoms, lower AFDW and EPS content than ML and HL biofilms (mainly structural photoacclimatation mechanisms). For LL and ML biofilms, a sudden increase of light irradiation produced photoinhibition (decreasing both photosynthetic efficiency-?'PSII and capacity-?PSII) and an enhancement of non-photochemical quenching (NPQ) processes coupled with an increase of deepoxidation ratio-DR as a photoprotective mechanism. Furthermore, exposure of ML and HL biofilms to low light irradiation caused an increase of their ?'PSII and ?PSII, and a decrease of the NPQ and DR processes as a result of increased photosynthetic efficiency without the need to develop mechanisms of photoprotection. The influence of light stress on Zn toxicity (1500 µgZn/L) was evaluated for each biofilm community. Zn toxicity was enhanced when light stress was also occurring (co-occurrence) mainly to LL biofilms. Larger inhibition on the ?'PSII and ?PSII and a decoupling of NPQ versus DR processes were observed, indicating a substantial damage of the xanthophyll cycle. This study demonstrated the influence of light on the sensitivity of biofilm to Zn.

SS3

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FUNCTIONAL COMPONENTS OF FLUVIAL LANDFORMS: WHAT DOES IT MEAN AND HOW DOES IT WORKS ?

The concept of functional ecogeomorphology developed originally from the study of fluvial systems represents an insightful framework for describing fluvial landforms as structures adjusting to external physical forces, and also as functional components contributing to the complex play of interactions and reciprocal adjustments between biotic and abiotic elements of hydrosystems. We propose to extend the model of functional ecogeomorphology by classifying fluvial landforms in three fundamental components: abiotic, neutral and functional. The various possible combinations of these three components are presented and discussed in the scope of evolutionary geomorphology. Riparian vegetation responds to hydrogeomorphic disturbances and environmental changes and also controls to e certain extent these changes. According to the theoretical elements provided in the first part of the talk, we propose that the control of sediment erosion and deposition by pioneer riparian vegetation is a key geomorphological and ecological (i.e., biogeomorphic) function within fluvial corridors. Three different biogeomorphic functions, all related to the concept of ecosystem engineering, were identified on the River Tech, Western Pyrenees; France: (i) the function of pioneer herbaceous communities to retain fine sediment and diaspores in the exposed zones of the active tract near the water resource, facilitating recruitment of further herbaceous and Salicacea species; (ii) the function of woody vegetation to drive the construction of forested islands and floodplains; and (iii) the function of stabilized riparian forests to act as 'diversity reservoirs' which can support regeneration (resilience) after destructive floods.

SS15

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PREDICTION OF ECOLOGICAL QUALITY IN RUNNING WATERS AND IMPLICATIONS FOR MANAGEMENT.

The Water Framework Directive (WFD) requires the assessment of water bodies and, based on the results obtained, that strict quality levels must be met within a stipulated period of time. Soil use affects aquatic and riparian habitat quality and contributes to diffuse contamination. But how dependent are the aquatic communities on the modifications and characteristics of landscape patterns at local and regional (catchment) scales? These are essential considerations that must be taken into account for developing appropriate management plans in order to meet WFD defined quality classes. Using data obtained during 2010 from monitoring of lotic ecosystems across North Portugal, we related the Ecological Status and the EQR of diatom and invertebrate communities with a high number of environmental variables, namely point and non-point pollution types expressed at different scales. Results obtained from multivariate analysis, applying parametric and non-parametric procedures and from generalized linear and additive models (GLZ and GAM) allowed us to identify the most convenient procedures necessary for attaining Good Ecological status. The ecological status can be predicted from a reduced number of variables (namely by regression models with logit link function), where water quality and soil use local and regional levels display an important contribution. Biotic communities are dependent on different stressor types (expressed by non-parametric multiple regressions) and that justifies an integration of all the biological data, but they are also dependent on a reduced number of variables. Consequently, important implications for catchment management arise from this work.

SS15

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RIVER INFLOW MIXING IN A STRATIFIED MEDITERRANEAN RESERVOIR (BÉZNAR, SPAIN)

Limnologists have traditionally accepted that a negatively buoyant inflow entering a larger water body will plunge beneath the surface and flow downward along the bottom as a density current until reaching the level of neutral buoyancy, where it forms intrusions. Laboratory experiments, though, suggest that a significant fraction of inflow water entering linearly stratified water bodies might be distributed throughout the water column above the theoretical level of neutral buoyancy. The general goal of our study is to characterise the fate of river inflows in a Mediterranean reservoir (Béznar, Spain) both at seasonal and shorter (hourly) time-scales, and to understand the physical processes controlling the pathways of river inflows within the reservoir. Experimental data collected in-situ supported by a three dimensional (3D) hydrodynamic model (Smith, 2006) are used to further understand the processes controlling the fate of river inflows at short-times scales. Detailed tracer experiments demonstrated that vigorous mixing between reservoir and river water occurred prior to the formation of intrusions. Intense dilution rates occurred in the first 100 m after the inflows entered the reservoir, in a region where the behaviour of the inflows were dominated by the initial inertia. Furthermore, data collected during the tracer experiments showed that the weak stratification and vigorous mixing rates made the river water formed several intrusions at the separation point, exploring several depths in the water column above the theoretical level. The larger the mixing rates, the further the intrusions were above their theoretical level of neutral buoyancy, and hence, the higher the probability of reaching the surface layer by entrainment. We conclude that the characterisation of the inflow river and the injected nutrient load spatial distribution might allow the assessment of biological responses to high nutrient pulses introduced by river inflows, which may influence the water quality of reservoirs.

SS1

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SURFING THE WAVE: INVERTEBRATE FLUXES IN THE ADVANCING WETTED FRONT OF A TEMPORARY RIVER FOLLOWING A 6 MONTH DRY PERIOD

Temporary rivers are alternating aquatic and terrestrial ecosystems that are functionally linked. When rewetting of previously dry reaches occurs, shifts from terrestrial to aquatic conditions can be brutal: terrestrial invertebrates colonizing dry riverbed may be flushed downstream, while aquatic invertebrates from upstream perennial reaches may drift and colonize newly rewetted sediments. However, very little is known about the effects of advancing wetted fronts on aquatic and terrestrial invertebrates in temporary rivers. In this study, we examined advancing wetted front invertebrate composition and fluxes at sites previously dried during 2 to 6 months. An important rainfall event triggered the rewetting of a 14-km long reach in the Albarine River (France), generating an advancing wetted front moving downstream at a rate of ~ 10m.min-1. We determined invertebrate assemblage and fluxes in the advancing wetted front at 12 previously dry sites and 2 upstream perennial sites using drift nets and flow velocity recorders. Total invertebrate fluxes at previously dry sites were 150-fold higher compared to perennial sites. Aquatic invertebrates represented 40% of total drift fluxes at perennial sites, and only 10 % at previously dry sites. However, most of the terrestrial invertebrates in the advancing wetted front (i.e., > 95%) were dead. Furthermore, we found no longitudinal changes in aquatic and terrestrial invertebrate density and richness. These results suggest that rewetting is a "catastrophic" event for terrestrial invertebrates colonizing dry riverbeds rather than a possible mechanism for dispersion.

O2

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A COMPARATIVE STUDY OF THE EFFECTS OF EUCALYPT, PINE AND BROADLEAF FORESTS ON THE FISH COMMUNITIES OF PORTUGUESE UPLAND STREAMS

Production forestry is increasing worldwide. In Portugal, 38% of the land is dedicated to forestry, with Pine and Eucalypt plantations account for 23% and 21% of forest cover respectively. Transforming the catchment landscape, plantation forests represent a radical change to the habitat quality and energy base of river ecosystems. We studied the fish communities in Eucalypt (N=6), Broadleaf (N=5), Pine (N=5) and mixed Pine and Eucalypt (N=2) river ecosystems. Quantitative fish samples were collected by multiple pass electrofishing. Fish were identified to species, recording the weight, fork length and the overall condition of each individual. Fish habitat was characterized using a modified version of the HABSCORE survey. Water physicochemical parameters (dissolved oxygen, water temperature, pH, conductivity, water current velocity) were measured in situ. Water samples were collected for subsequent determination of nutrients. Overall taxa richness was low ranging from 1 to 5 across sites. Although only present in low abundances brown trout (Salmo trutta) was only caught in Broadleaf forested streams, where water temperature was significantly lower than at Eucalypt forests. The Iberian endemics ruivaco (Achondrostoma oligolepis) and the northern Iberian chub (Squalius carolitertii) were dominant in Eucalypt and mixed forest streams. The European eel (Anguilla anguilla) was an occasional, present in Eucalypt and mixed forested streams. Ordination analysis revealed that community structure was also related to riparian conditions and the complexity of the river habitat. Our results show that catchment and river habitats are important mediators of the distribution and abundance of fishes. They suggest how management of riparian and river habitats might mitigate the impact of production forestry. Ongoing research is aimed at elucidating the role of terrestrial food subsidies in these contrasting forested systems.

SS6

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NEW DATA ON THE POPULATION OF THE ENDEMIC SPECIES ACHONDROSTOMA ARCASII (PISCES, CYPRINIDAE) IN THE RIVER MIÑO BASIN (NW SPAIN)

The red roach, Achondrostoma arcasii (Steindachner 1866), is a small Iberian endemic cyprinid. It is restricted to the northern half of the Iberian Peninsula, except in those rivers flowing down northern slopes of the Cantabrian mountains. Its standard length varies between 4.7 and 10.4 cm, but studies focused on its biometric characteristics are still scarce. In this study, we surveyed the biometry and the age-structure of populations inhabiting 15 Spanish tributaries of the River Miño. Additionally, we offer biomass and density values of each sample site. A total of 240 individuals were caught by electrofishing in August 2010. All specimens were measured (fork length) to the nearest millimetre and weighed to nearest 0.1 g. We used the Moran-Zippin´s method for estimating densities and Leslie & Davis model for estimating biomasses. Population age-structure was determined using the Peterson method. The condition coefficient (CC) was calculated according to Fulton´s equation CC=100W/L3 (L is expressed in cm and W in g). Red roach densities and biomasses varied within the tributaries, with mean values of 0.06 ind/m2 and 0.53 g/m2. It was the only fish species present in one of the sites, where density attained 3.68 ind/m2 and biomass 7.75 g/m2. Mean fork length ± SD and mean weight ± SD found were 8.08 cm ± 0.356 and 9.04 g ± 1.075 respectively, with significant differences among rivers ($p<0.005$). Condition coefficient was similar for all the tributaries, and population age-structure varied within 1+ and 4+. Characteristics of A. arcasii populations in the studied tributaries of the River Miño do not differ markedly from those in other rivers of the Iberian Peninsula, except for the site where it was the only species, where it was probably introduced.

O7

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DISPERSAL ACTIVITY OF AQUATIC COLEOPTERA AND HETEROPTERA SPECIES: BODY SIZE AND SPECIES DEPENDENT RESPONSES FOR CHANGING OF ENVIRONMENTAL FACTORS?

Almost all aquatic Coleoptera and Heteroptera species can fly and flying is the most important, almost the only way of dispersal between aquatic habitats. Although more than 100 papers deal with the dispersal flight and half of them also with the effects of environmental variables, due to the use of light trapping in most of these studies, our recent knowledge is based on mainly the evening or night flight, an important, but only one period of mass dispersal activity. In our study both the daily and the seasonal dispersal dynamics were studied in 2005 under various environmental circumstances by monitoring insects attracted to highly and horizontally polarizing shiny black plastic sheets laid on the ground. During weekly samplings (30 days, 24 hours every day) insects landed on three 9×3 meter sized test surfaces were collected continuously by manual sampling and insect aspirators. Samples were separated hourly and the environmental variables were continuously registered. More than 45000 individuals were captured, belonging to 86 (69+17) aquatic Coleoptera and Heteroptera taxa. Species and/or species groups could be characterized by different seasonal and diel dispersal activity patterns. We observed and defined 3×3 seasonal and inside of the seasons 3-6-3 diel types. Effects of the meteorological variables on each species were studied in detail. Significant effects were detected in the cases of wind speed, light intensity and air temperature. We determined the species dependent thresholds for flying including the optimal circumstances for mass dispersal. Significant differences were found among species, each taxon has their own thresholds. Correlation between the number of individuals, body sizes, species traits, functional groups and specific threshold were also investigated. Our results suggest that seasonal and daily composition of the dispersing assemblage strongly affected by the specific response and different tolerance of each species for changing of environmental circumstances.

O1

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IMPACT OF DEPLOYMENT DATE, SAMPLING DATE AND EXPOSURE TIME ON THE SUCCESSION OF EPIFAUNA ON ARTIFICIAL SUBSTRATA IN A TEMPERATE DAM RESERVOIR

Due to the increasing anthropogenic pressure, natural habitats in waters are often disturbed or replaced. Thus, understanding the process of colonization of a novel habitats by epifaunal assemblages is essential. We studied the succession of epifauna on artificial plant-like substrata at two sites: among submerged macrophytes and beyond the vegetation in the shallow waters of a lowland dam reservoir. Subsequent groups of substrata were deployed in June, July, August and September. Samples were taken after 1, 2, 3 and 4 months of exposure, until October, therefore we could compare the substrata differing in exposure time, sampling date or deployment date. Epifauna inhabiting the substrata which were deployed at the earliest dates (June, July) and had a short exposure time (1 month) were the most distinct from the others. On the other hand, faunal assemblages on the substrata collected at the latest dates (September, October), were the most similar to each other. The sampling time affected the structure of invertebrate assemblages much more strongly than the exposure time and deployment date. This suggests a low stability of the communities developing the artificial habitat and their high dependence on external conditions and seasonal changes. We have also found some differences between the epifaunal assemblages at both sites. For the substrata deployed among macrophytes, the most characteristic taxa were: Chironomidae larvae (Glyptotendipes spp., Endochironomus sp., Paratanytarsus sp., Procladius sp.), amphipod Pontogammarus robustoides (G.O. Sars), Oligochaeta (Stylaria lacustris <L.>, juvenile Limnodrilus sp.) and snails (Acroloxus lacustris <L.>, Bithynia tentaculata <L.>, Physa fontinalis <L.>) while Dikerogammarus villosus (Sovinsky) (especially juveniles), Dreissena polymorpha (Pall.), Chelicorophium curvispinum (G.O. Sars), chironomids (Cricotopus sp., Dicrotendipes sp.) and snails (Radix sp., Gyraulus albus <O.F. Müller>, Valvata piscinalis <O.F. Müller>) dominated at the station without plants. The presence of macrophytes slightly affected the taxonomic composition of epifauna assemblages and contributed to greater share of plant-dwelling forms.

SS1

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INVERTEBRATE RESPONSES TO REWETTING IN A TEMPORARY RIVER IN FRANCE: EFFECTS OF PRECEDING DRY PERIOD DURATION.

Rewetting marks the shift from a terrestrial ecosystem to an aquatic ecosystem in temporary rivers. The forms and rates of responses by aquatic invertebrates to rewetting depend on desiccation resistance during preceding dry periods. As desiccation resistance is likely to vary with dry period duration, we examined invertebrate responses to rewetting of sediments exposed to various dry period duration in a French temporary river. Sediment dry period duration ranged from 1 hour to 150 days prior to sample collection. Half of the taxa initially present in dry sediments were either terrestrial and semi-aquatic, but the onset of flow simulated by a 32-d experimental rewetting led to the appearance of numerous and diverse aquatic invertebrates in all samples. Aquatic assemblages varied with the duration of the preceding dry period: taxon richness decreased linearly with dry period duration while density decreased exponentially. These patterns indicate that a large number of individuals from desiccation-sensitive taxa were eliminated rapidly after flow ceased, and a low-density assemblage composed of a small number of desiccation-resistant taxa persisted during prolonged dry periods. Overall, these results suggest that a temporal ecotone exists for about a week after the disappearance of flowing water, and before the terrestrial system stabilizes.

O5

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LINKS BETWEEN CONSUMER AND RESOURCE QUALITY: A LEAF LITTER DECOMPOSITION EXPERIMENT

Headwater streams tend to be heavily shaded by riparian vegetation, which limits autochthonous primary production and provides high inputs of allochthonous organic matter. Leaf litter constitutes the most relevant fraction of these inputs. Leaf litter decomposition process is subjected to its specific chemical composition which, at the same time, might determine changes in the colonization communities. We conducted a decomposition experiment to understand how changes in structural elements (CNP) and macromolecular compounds (lipids and soluble carbohydrates) of leaf litter were related with microorganism and invertebrate colonization, and how these changes were reflected in invertebrate body tissues content. The decomposition of Populus nigra leaves was studied in a third order Mediterranean stream by using the leaf litter bags technique for 96 days in winter. Invertebrates associated with leaf litter were identified and stoichiometrically analyzed. Decomposition rates were calculated by linear regression and leaves chemical composition and enzymatic activities (ß-glucosidase, xylosidase, cellobiohydrolase, phenoloxidase) were also analyzed. Leaf litter composition changed over time, increasing its nutritional quality. C:N and C:P ratios decreased gradually until day 84, and then leveled off. However, these ratios differed by at least one order of magnitude between consumers and resources, suggesting a strong nutrient limitation in P. nigra leaves-based food webs. No significant differences were found in lipid and carbohydrate content in the leaves during the decomposition process, although polysaccharide degrading enzymatic activities (ß-glucosidase, xylosidase, cellobiohydrolase) increased gradually. Invertebrate richness and, especially, biomass also enhanced with time. The results provide evidence that decomposition is a complex process which involves both bottom-up and top-down controls. Initially, the dynamics of the invertebrate community seemed to be related to the quantity and quality of the resource (bottom-up control). However, the presence of large individuals, mainly predators, exerted a top-down control at the end of the experiment.

O3

De Los Ríos, Jesús [1] ; Conde-Álvarez, Rafael M. [2] ; Rodríguez Pérez, María Dolores [3] ; Flores Videla, Pauli [4] ; Figueroa, Félix L. [5]

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WATER FRAMEWORK DIRECTIVE (2000/60/EC) OF EUROPEAN UNION CONSIDERS THE USE OF SPECIES COMPOSITION AND ABUNDANCE OF AQUATIC MACROPHYTES AS A BIOLOGICAL QUALITY ELEMENT FOR ECOLOGICAL ASSESSMENT. DIFFERENT STUDIES HAVE BEEN FOCUSED ON DEVELOPING INDICES FOR

Water Framework directive (2000/60/EC) of European Union considers the use of species composition and abundance of aquatic macrophytes as a biological quality element for ecological assessment. Different studies have been focused on developing indices for this goal during the last years. Nevertheless, little attention has been paid to the choice of appropriate sampling sites for monitoring system to control the spatial system variability and the use of quantitative metrics including replicates. Biomass spatial distribution of submerged aquatic macrophytes throughout the surface of the brackish shallow small lake "Laguna Salada" (South of Spain) was analyzed. The lake surface was divided by a regular grid of 30 sampling point situated every 70 m. A Global Positioning System (GPS) was used to position sampling places in situ. Biomass samples were taken in triplicate and the dry weight biomass was measured after drying samples (70 °C for 48 h). Isoline mapping of biomass were obtained by use of interpolation methods. The result indicates than the species show different spatial distribution patterns throughout the lake. Ruppia drepanensis was the dominant specie on southwest side of the lake with biomass values of 1500 g DW m-2. Lamprothamnium papulosum dominated in deeper areas with biomass values around 800 g DW m-2. By contrast, almost all shore of the lake was covered by a dense bed of Chara galioides. The endangered aquatic macrophyte Althenia orientalis showed a more localized distribution on the northern side. The results reported in this study indicate good ecological state of the lake and it should be considered as the base from which to select the right sampling points for monitoring of this wetland in accordance with the guidelines of Water Framework directive and Ramsar recommendations.

O3

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MAPPING OF BIOMASS DISTRIBUTION OF THE SUBMERGED MACROPHYTE INHABIT IN THE BRACKISH SHALLOW LAKE "LAGUNA SALADA": SELECTION OF SAMPLING POINTS FOR LONG TIME MONITORING ACCORDING TO THE EUROPEAN WATER FRAMEWORK DIRECTIVE

Water Framework directive (2000/60/EC) of European Union considers the use of species composition and abundance of aquatic macrophytes as a biological quality element for ecological assessment. Different studies have been focused on developing indices for this goal during the last years. Nevertheless, little attention has been paid to the choice of appropriate sampling sites for monitoring system to control the spatial system variability and the use of quantitative metrics including replicates. Biomass spatial distribution of submerged aquatic macrophytes throughout the surface of the brackish shallow small lake "Laguna Salada" (South of Spain) was analyzed. The lake surface was divided by a regular grid of 30 sampling point situated every 70 m. A Global Positioning System (GPS) was used to position sampling places in situ. Biomass samples were taken in triplicate and the dry weight biomass was measured after drying samples (70 °C for 48 h). Isoline mapping of biomass were obtained by use of interpolation methods. The result indicates than the species show different spatial distribution patterns throughout the lake. Ruppia drepanensis was the dominant specie on southwest side of the lake with biomass values of 1500 g DW m-2. Lamprothamnium papulosum dominated in deeper areas with biomass values around 800 g DW m-2. By contrast, almost all shore of the lake was covered by a dense bed of Chara galioides. The endangered aquatic macrophyte Althenia orientalis showed a more localized distribution on the northern side. The results reported in this study indicate good ecological state of the lake and it should be considered as the base from which to select the right sampling points for monitoring of this wetland in accordance with the guidelines of Water Framework directive and Ramsar recommendations.

SS12

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TESTING THE EURYOECIOUS CHARACTER OF NEMATODES AGAINST THE ALTITUDINAL ENVIRONMENTAL GRADIENT OF MOUNTAIN LAKES

Nematodes are thought to be euryoecious in relation to many environmental gradients. Some authors consider, however, that the wide environmental tolerance of nematodes is questionable, as doubts on the validity of nematode species currently in use still await for molecular genetic investigation. The taxonomic problem is more likely when comparing geographically distant samples, but it should be minimised when considering strong environmental gradients for geographically close samples. Based on this assumption, here we test the hypothesis that nematode species are highly euryoecious, taking advantage of the environmental gradients existing across mountain lakes, particularly that related to the altitudinal gradient. We surveyed 82 mountain lakes in the Pyrenees. The distribution of 30 nematode species was statistically tested for geographical coordinates (including altitude) plus twenty-eight environmental variables related to the physical, chemical, and productivity conditions of each lake. Our results reveal that among the most common species collected (i.e. present at least in four lakes, n = 20) none but one showed any occurrence pattern in relation to altitude. Multivariate analyses indicate that the capacity of environmental factors to explain nematode distribution patterns is rather low. This contrasts with the strong response to the altitudinal environmental gradient of most other invertebrate groups, and supports the idea that many nematode species are highly euryoecious (although not necessarily cosmopolitan). We also analysed nematode richness in relation to altitude, and compared it to that of other invertebrate groups collected during the same survey. This time in agreement with other invertebrates, nematodes exhibit a hump-shaped species richness pattern in relation to altitude. Therefore, nematodes show that richness patterns among mountain-lake invertebrates can also appear even without a strong influence of species-environment relations.

O7

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BIOFRESH: INTEGRATING FRESHWATER BIODIVERSITY DATA

Scientists and water managers have collected a vast amount of data on freshwater organisms, but these data are often not publically available. One of the aims of the BioFresh (EU-funded FP7) project is to set up an on-line data portal designed to integrate and provide open and free access to freshwater biodiversity data from all possible sources. This information portal, available at http://data.freshwaterbiodiversity.eu/ is constructed as a data discovery tool, and allows scientists and managers to complement, integrate, and analyze distribution data to elucidate patterns in freshwater biodiversity. The georeferenced data will enable revealing the status and trends of freshwater biodiversity, and the services that it provides. The portal further envisages providing access to tools to visualize the response of freshwater biodiversity to environmental variation including climatic and socioeconomic pressures. This approach will not only shed new light on how freshwater biodiversity responds to global, European, and local environmental change and its drivers, but will also help to better manage the services provided by aquatic ecosystems by incorporating biodiversity science into effective conservation strategy, environmental agreements or related policy instruments. The data that were integrated during the first year of the project, already allow us to shed some light on the biodiversity patterns and data gaps that emerge and to demonstrate the potential of this integration approach.

SS1

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LONGITUDINAL CHANGES IN EPILITHIC MICROBIAL COMMUNITY STRUCTURE ALONG AN INTERMITTENT RIVER: INFLUENCE OF DRYING/REWETTING CYCLES

Microbial communities residing in temporary running waters are exposed to extreme environmental changes. However, the relationships between hydrological features and microbial community structures remain largely unexplored. Here, we examined changes in epilithic community structures along a longitudinal intermittence gradient in the Albarine River (France). Biofilms were collected on natural substrata at 14 sites scattered along a 12-km river section where shifts in community structures were expected to be controlled by the intermittence gradient (flow permanence, drying frequency or drying duration). Denaturating gradient gel electrophoreses were used to assess prokaryotic and eukaryotic community richness and diversity (16S rDNA and 18S r DNA fragments). In parallel, biofilms were characterized in terms of epilithic biomass (AFDM), chlorophylle-a content and bacterial cell numbers. Principal Component Analysis (PCA) ordination plot based on prokaryotic and eukaryotic richness, bacterial cell numbers, epilithic biomass and chlorophylle-a content revealed a longitudinal ordination of the sampling sites suggesting intermittence gradient influence. We found significant univariate relations between epilithic biomass, chlorophylle-a content, prokaryotic richness and hydrological variables whereas no clear pattern was observed concerning bacterial cell numbers and eukaryotic richness. Significant relations were positive with flow permanence but negative with drying duration and frequency. The DGGE pattern analysis (Correspondence Analysis) showed that the prokaryotic community composition reflected changes in flow intermittence. This was not the case for eukaryotic community, suggesting the need to investigate different eukaryotic groups (e.g diatoms). This work essentially demonstrates that drying frequency regulates biofilm growth (total and algal biomass) and that intermittence gradient affect prokaryotic community composition.

SS4

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MAJOR ROLE OF CARBON DIOXIDE AND METHANE EMISSIONS FROM BEAVER DAMS AT THE LANDSCAPE LEVEL IN THE BOREAL REGION OF QUÉBEC

Dramatic declines in both hunting and predation pressure in the past decades have resulted in a large increase in beaver populations throughout north America. Beaver dams are hot spots of biogeochemical activity, and in particular, of CO2 and CH4 fluxes. Here we present results of a large-scale survey of beaver dams in the Abitibi region of Northern Québec. The region is dominated by mixed boreal forest boreal, and beaver dams now cover from 1 to over 3% of the territory. We sampled a wide range of beaver dam types that exist in this landscape, and found widespread and often massive supersaturation in both CO2 and CH4, often exceeding 10,000 ppm in both simultaneously. The resulting CO2 and CH4 fluxes averaged 70 and 120 mmol m-2 d-1, respectively. The CO2 fluxes are 3-fold higher than the average fluxes for the lakes in the region, and 100-fold higher in the case of CH4. Our results thus suggest that beaver dams may play a role in the regional C balance that is comparable to that of lakes, which occupy a much larger total surface area.

O7

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HYDROLUTOS, AN EXTRAORDINARY AQUATIC ORTHOPTERAN GENUS (ORTHOPTERA: ANOSTOSTOMATIDAE: LUTOSINI) FROM GUYANA HIGHLANDS

The South American Hydrolutos species are medium-sized flightless anostostomatids. The genus was known by 4 species described from 4 different peculiar flat-topped table mountains – tepuis in SE Venezuela by Issa and Iaffe (1999): H. auyan, H. chimantea, H. roraimae, H. aracamuni. The community of the summits of tepuis is considered a distinct and discontinuous biogeographical province called Pantepui, ranging from 1,500 to 3,000 m a.s.l. and covering an area of about 5,000 km2 (Berry et al. 1995). Tepuis are acknowledged islands supporting high endemism, including many aquatic species with an endemic geographical distribution. Recently, Hydrolutos breweri, a new species was described by Derka and Fedor (2010) from Cueva Charles Brewer at Churí-tepui (Chimantá Massif, Venezuela). Material was collected inside the cave Cueva Charles Brewer manually or using a hydrobiological kick-net and stored in pure ethanol. Other species were observed at Auyán tepui and Mt. Roraima. Morphological characters of H. breweri were studied and photographed using a stereomicroscope. The main difference of the genus Hydrolutos is in sternal and pleural area covered by fine microtrichia forming a plastron, generally unique within orthopterans. All members of the genus inhabit aquatic habitats. Individuals were observed walking and swimming inside the streams and walking outside the water. Thanks to high ability to cling by means of strong legs and tarsal claws they are able to move even against strong current. Two of them - H. breweri and H. roraimae, were observed in quartzite caves. Because of permanent darkness in caves, individuals of H. breweri and H. roraimae are active 24 hours, not only during the night as it was reported for other members of the genus. However, they can not be considered troglobionts because of lack of typical adaptations. Occurrence of more undescribed species can be expected in streams at other tepuis. The present study was supported by projects APVV-0251-07 and APVV-0213-10.

O3

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GROWTH OF AUTOTROPHIC BIOFILMS IN RIVER BED SEDIMENTS AT A MICROCOSMS SCALE

The importance of the biofilm formation onto bed sediments is directly related with the role of sediments as sinks of pollution, and to their increased stability when they are covered by a biofilm, thus limiting their resuspension and potential pollutants release. In this study the biofilm formation onto bed sediments was monitored during 60 days at a microcosms scale in three experimental fluvial channels with a dark: light photoperiod of 18:6 and constant laminar flow. Each channel contained sediments of three geographical areas of the Anllóns River (NW Spain) corresponding to A Ponte, Corcoesto and Ponteceso respectively. Water was taken from the Anllóns River, and it had undetectable chemical and biological oxygen demand, neutral pH, EC of 0.16 mS cm-1, 0.08 mg l-1 of total phosphorus and 0.42 mg l-1 of total nitrogen. Every week the following analyses were performed: chlorophyll a, phaeophytin, total and soluble carbohydrates, dehydrogenase activity and phosphatase. Also, the algal composition of each channel was identified. Samples showed similar compositional trends, with very low values of total and soluble carbohydrates and dehydrogenase activity, as well as phaeophytin, which increase progressively during the 60 days period. Instead, chlorophyll a showed in all cases higher starting values, increasing slightly during the first 30 days and stabilizing afterwards. Phosphatase showed similar values, with slight increases during the first 30 days of the experiment, and a subsequent stabilization or even a slight decrease at the end of the experiment. Taxonomic analyses identified diatoms as the predominant species (Heterokontophyta, Bacillariophyceae) of Nitzchia genus (mainly N. dissipata) and also Fragilaria capucina, Cymbella, Hippodonta capitata, Navicula cryptocephala, Surirella sp., Cocconeis placentula, Gyrosigma, Achnanthidium minutissimum, Achnanthes lanceolata, Navicula capitatoradiata, Nitzschia sp. and Surirella sp. Chlorophyta Scenedesmus sp. was also observed. Also, in two channels were found Cyanophytas Nostoc sp. and Leptolyngbya sp.

O6

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SHOULD SINGLE-CELL PHOSPHATASE ACTIVITY BE QUANTIFIED ON 3D IMAGES?

The FLEA technique (Fluorescence Labelled Enzyme Activity), also known as ELF technique (Enzyme Labelled Fluorescence), provides enzymatic activity information at the single-cell level. The technique was improved when epifluorescence microscopy and 2D (dimension) image analysis were used to quantify the single-cell enzyme activities. Nevertheless, limitations arise when values are compared between species of different size because quantifications are based on a 2D representation of 3D objects. In this study, we compared classical 2D with 3D restorative deconvolution microscopy measurements in fluorescent beads and in natural phytoplankton species with ELF-labelled phosphatase activity. Standard fluorescence intensity beads quantification confirmed that 3D restorative deconvolution measurements kept relative fluorescence intensities. Besides, the ratio between 2D and 3D measurements was dependent of object size: the bigger the object, the higher the difference between 2D and 3D quantification. A similar pattern was observed within different shape and size phosphatase active phytoplankton cells. Therefore, enzymatic activities measured in 2D images may underestimate values in large cells. In resume, 3D restorative deconvolution microscopy is a suitable method to compare single cell ectoenzymatic activities of different size species of microplankton, whereas 2D measurements remain a good option for intraspecific and for small cells comparison.

SS6

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COLONIZATION PATTERNS OF THE NORTHEASTERN SPANISH WATERSHEDS FOR THE INVASIVE MOSQUITOFISH (G.HOLBROOKI)

Biological invasions are one of the most important threats to global biodiversity, and human-assisted dispersal is among the principal causes of the increasing introductions worldwide. Molecular genetic analyses are useful tools to improve our knowledge on invasive species and to understand their establishment patterns in new territories. This work aimed to determine the relevance of individual dispersal and multiple independent introductions during the spread of the species along watersheds. Using microsatellite loci, we assess patterns of genetic diversity of G.holbrooki among 15 locations from three northeastern Spanish Mediterranean watersheds (Muga, Fluvià and Ter). Moderate levels of population structure were found in the whole studied area (FST= 0.13). Clustering analyses suggested a maximum of six genetically differentiated units. However, the population relationships fit with the hydrographical pattern. A single genetic unit was detected within each basin, but contacts were suggested among downstream populations of the Muga and Fluvià drainages. These two rivers end in the same marsh area subjected to occasional flooding periods, thus promoting gene flow between these mosquitofish populations. Results also suggest that a single founder event is enough for mosquitofish to invade an entire watershed, and once a single population is established, mosquitofish expands through the whole river basin with suitable habitat conditions. This population pattern is in agreement with the metapopulation model described in the native rivers of North America. Interestingly, singular founder events were suggested for mosquitofish populations from Banyoles Lake and Onyar River, both tributaries of the Ter River. The closeness of these two locations to the most populated city of the area probably favored separated human-assisted introductions, different from the one observed in the Ter's mainstream. This finding suggests an increased risk of multiple introductions in the vicinity of populated cities.

O1

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PATTERN OF DVM (DIEL VERTICAL MIGRATIONS) OF ZOOPLANKTON IN THE LATVIAN LAKES WITH AN EXAMPLE OF TWO LAKES FROM THE SOUTH EASTERN PART OF THE COUNTRY

Recent debates indicate season as an initiation cause for the DVM of zooplankton species incorporated with other factors, i.e., temperature, oxygen, water physical movements, grazing and predation. The DVM of zooplankton in the Latvian lakes have not been studied exhaustively and a very few published data until present are known. This research describes and analyses the possible DVM pattern for zooplankton in the Latvian lakes. The study on DVM of zooplankton was carried out in 2008 in two Latvian lakes – Svente (24-h survey in July and September) and Brigene (24-h survey in August). Zooplankton samples were collected with sampling range of 5 m each at 4-h intervals during 24-h. In addition to those samples, several environmental variables were measured once per 24-h. Zooplankton numeral changes within 24-h had greater amplitude overall in lake Svente in July, than in lake Brigene. Both lakes suffered from oxygen decrease during the autumn. In September in lake Svente zooplankton was mostly located in the upper water layer, total amount of zooplankton had decreased and DVM seemed not to persist. Apart from that vertical distribution pattern during 24-h for copepods, nearly all most abundant cladoceran species and some large size rotifers showed a trend of increase during twilight when animals shifted to upper water layer. This pattern suggests that there might be considered an impact from seasonally caused environmental factors (oxygen limitation) along with invertebrate predators such as Limnocalanus macrurus and/or vertebrate predators Coregonus albula (both present exclusively in lake Svente). Otherwise there was no DVM pattern observed in September and suggested an initiation of DVM closing for season. There can be found marked differences between DVM for species from different lakes (Svente and Brigene) and from different seasons (Svente July and Svente September). Research was supported by project No. 2009/0214/1DP/1.1.1.2.0/09/APIA/VIAA/089.

SS13

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A MULTIPLE-TRAIT BASED APPROACH FOR ASSESSING THE EFFECTS OF RESTORATION MEASURES ON THE MACROINVERTEBRATE COMMUNITIES OF TWO BY-PASSED SECTIONS IN A LARGE EUROPEAN RIVER.

In 1998 a large restoration project was implemented, from a national initiative, to restore the French Rhône ecological attributes. The restoration measures included increases of minimum flows in selected by-passed reaches, rehabilitation of connections with secondary channels in the same reaches, and restoration of pathways for large migratory fishes. We address the potential of a multiple-trait based approach to assess the indirect effects of minimum flow increase on functional integrity in two by-passed reaches (minimum flow raised in 2000 and 2004 for Pierre-Bénite and Chautagne reaches, respectively). We considered the macroinvertebrate surveys of two selected by-passed reaches to assess the effects of minimum flow increases on the species and trait composition of communities. The Pierre-Bénite reach (PBR, downstream) was surveyed at 8 occasions (over 1995-2000) before and 8 occasions (over 2001-2008) after restoration. The Chautagne reach (CHR, upstream) was surveyed at 7 occasions (over 1997-2002) before and 6 occasions (over 2006-2009) after restoration began. Multivariate analyses demonstrated a significant change in taxonomic composition in PBR (explained variability=0.174; simulated-P=0.001) and CHR (0.198; 0.001). These changes were reflected in the trait community composition in PBR (explained variability=0.195; simulated-P=0.001) and CHR (0.239; 0.028). In PBR, significant trends observed after restoration included a decrease in proportions burrowers, sprawlers, and shredders whereas the proportion of clingers and passive filter feeders and that of individuals laying numerous eggs and being plurivoltine increased. In CHR, significant trends observed after restoration included a decrease in proportions of individuals with long-life duration of adult, protecting their eggs, and that of shredders whereas the proportion of small-sized individuals laying numerous eggs increased. Our results shows that restoration measures on minimum flow increases can affect the trait composition of communities by favouring individuals adapted to higher hydraulic constraints and advocate for long-term surveys of communities before and after restoration.

O8

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SPECIES DISTRIBUTION MODELLING OF STREAM INVERTEBRATES UNDER CLIMATE CHANGE SCENARIOS

Estimations of range dynamics of stream macroinvertebrates under novel climatic conditions are scarce. We used species distribution models (SDMs) in a stream network of the lower mountain range of Central Europe to quantify the effects of climate change on 38 stream macroinvertebrates. These species were divided in headwater species, euryoecious species and river species guilds, following their stream zonation which was used as a proxy for their temperature tolerances. Species range changes as well as altitudinal shifts until the year 2080 were simulated using the A2a and B2a IPCC climate warming scenarios and by means of consensus projections of four algorithms as implemented in the BIOMOD package in R. Models showed that the projections differed between guilds, predicting a reduction of headwater species' range sizes, a variable change of euryoecious species' range sizes and an expansion of river species' range sizes under the A2a and B2a scenario, respectively. All guilds were predicted to shift towards higher altitudes along the river continuum. Thus the models predict a reorganisation of species composition and community structure along the river continuum induced by novel climatic conditions. We further expanded the modelling framework to a continental scale to identify large scale patterns of species from different ecoregions due to novel climatic conditions. The results of these two approaches are presented and discussed.

SS5

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THE EFFECT OF WARMING ON FRESHWATER BENTHIC INVERTEBRATE COMMUNITIES: A MESOCOSM EXPERIMENT.

Temperature is one of the most important drivers for every biological system. Despite a detailed knowledge on how temperature increase affects processes at the individual level, our ability to predict how warming will affect systems at higher levels of complexity is still limited. Using an experimental approach, we assess how a simulated warming scenario (ΔT +4°C) alters the structure and the functioning of freshwater benthic communities. The effect of such manipulation on the community size spectrum and the biomass standing stock of benthic invertebrates are qualitatively predicted integrating the Metabolic and the Stoichiometric ecological theories. To test our predictions we also ran experiments assessing the effect of warming on leaf breakdown rate and grazing rate. An overall steepening of the community size spectrum and a decrease in biomass support our hypothesis, providing evidence that warming will affect important community parameters. Moreover, we observed a shift toward primary consumer dominated communities, suggesting that warming will disproportionally affect higher rather than lower trophic levels. Benthic invertebrate communities are central to the functioning of freshwater ecosystems, and so our study demonstrates that, in order to correctly calibrate management strategies for potential climate change scenarios, it is mandatory to further our knowledge of how impacts that act at individual levels propagate throughout ecological networks.

SS12

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SMALL SCALE PATTERNS OF MEIOFAUNA IN BRYOPHYTES

Aquatic bryophytes provide suitable habitat for diverse invertebrate fauna by increasing stream heterogeneity and reducing flow velocity. Meiofaunal composition in these microhabitats is mainly neglected. Meiofauna as a term cover small metazoans that pass through 1000 or 500 ìm sieves, but retained on 62 or 40 ìm sieves. These organisms play important role in the diversity, abundance and functioning of food web dynamics of the whole benthic community. In freshwater ecosystems this group includes diverse fauna such as Turbellaria, Rotifera, Nematoda, Gastrotricha, Oligochaeta, Tardigrada, Crustacea and small insects larvae. This study was conducted in National Park Plitvice Lakes, where 16 oligotrophic lakes form a cascading barrage hydrosystem mutually joined by numerous moss covered travertine barriers and waterfalls. Bryophytes and associated fauna were sampled monthly, from February 2009 to January 2010, in three microhabitats differing in flow velocity (slow, medium, fast). Main goal of our study was to establish the role of flow velocity to small-scale variability of meiofauna in bryophytes. A total of more than 100 taxa of meiofauna were indentified during investigation. Rotifers dominated (52 taxa), followed by nematodes (27 taxa) while other groups of organisms were found in small number. In fast water current rotifers achieved significant highest abundance, averaged 219 ind cm–3. They show statistically significant positive relation to flow velocity, while gastrotrichs, tardigrads and microturbelarians show negative relation to flow velocity. Positive relationships were established between meiofauna and food resources, i.e. different fraction of organic matter.

O6

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TEMPERATURE CHANGES INTERSPECIFIC RELATIONSHIPS AMONG AQUATIC HYPHOMYCETES

Aquatic hyphomycetes are an ecological group of fungi that play a key role in plant detritus decomposition in streams. Temperature is an important environmental factor influencing the occurrence and distribution of aquatic hyphomycetes. According to the Intergovernmental Panel on Climate Change, air temperature is predicted to increase 1.8°C to 4.0°C until de end of this century and, therefore, it is important to ascertain how increasing temperature can affect the interspecific relationships among aquatic hyphomycetes. In this work, we compared the radial growth rates of four widespread aquatic hyphomycete species (Lunulospora curvula, Heliscus submersus, Articulospora tetracladia and Variscosporium elodeae) in all possible combinations of 1 to 4 species at different temperatures. Malt extract agar plates were inoculated with agar plugs collected from the edge of 15-day-old colonies of the 4 fungi in monocultures or in multicultures keeping the total inoculum size constant. Cultures were kept at 13.5°C, 16°C and 27°C, and the radial growth was measured every 3 days, during 12 days. When fungal species were grown alone, growth rates varied with temperature and species identity. H. submersus, L. curvula and V. elodeae showed higher growth rates at 27°C, while the opposite was observed for A. tetracladia. Growth rates of fungal species in multicultures changed with temperature, species number and identity. Growth rates of L. curvula decreased in multicultures of 4 species at 13.5°C, but increased for V. elodeae. In the case of A. tetracladia, growth rates decreased in multicultures of 3 species at 27°C and no effects of species number was found for H. submersus. Overall, temperature changed interspecific relationships among fungi and this may have implications to plant detritus decomposition in streams under the predicted warming scenario. 'The Portuguese Foundation for the Science and Technology supported this work (PTDC/CLI/67180/2006), I. Fernandes (SFRH/BD/42215/2007) and S. Duarte (SFRH/BPD/47574/2008).'

O6

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MULTIPLE GLOBAL CHANGE STRESSORS (UV RADIATION, NUTRIENTS AND TEMPERATURE) ENHANCE BACTERIOPLANKTON ACTIVITY IN A MEDITERRRANEAN LAGOON (LA CONCEJA, RUIDERA NATURAL PARK)

Bacterioplankton is a key sensor to test the effect of global change stressors on aquatic ecosystems due to high sensitivity to environmental changes and their short-time of generation. Knowledge of the multiple stressor effects is, particularly relevant when their combined effect cannot be predicted from the individual effects of each stressor. Our aim was to assess the interactive effect of main global change stressors (UVR, P-load linked to dust-aerosol transport, global warming) in Mediterranean region on different bacterial community proxies: bacterial production, bacterial abundance, productivity and growth rate. Our experimental approach was performed in July 2009 using in situ mesocosms in the oligotrophic lake La Conceja (Ruidera, 850 m) following two steps: i) a 2x2 factorial design (in triplicate) manipulating quality of incident solar radiation (+UVR, -UVR) and the availability of nutrients (+P, -P); ii) an experiment in which, besides the two above factors, temperature was manipulated (lake temperature, 5°C above). Our result revealed an inhibitory effect of UVR on BP, which however did not translate into a decrease in bacterial abundance. P-enrichment interacted antagonistically with UVR on BP. Thus, P-enrichment eliminated damage-UVR effect on PB. Nevertheless, this interactive UVRxP effect was synergistic on bacterial abundance. These opposing responses were responsible of the lack of interactive effect on normalized variables as productivity or growth rate. The inclusion of additional stressor (increased temperature) acted in the same direction as P-enrichment, becoming to a stimulatory higher order interactive effect (UVRxPxT) on BP. This net effect of joint stressors on BP may be explained by commensalistic relationship between decomposer and primary producers.

O8

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CHARACTERISING THE DIVERSITY OF FLUORESCENCE DOM COMPONENTS IN HETEROGENEOUS DATA SETS: USE OF CHROMATOGRAPHIC PROCEDURES FOR EEM PEAK RECOGNITION AND DECOMPOSITION.

Since the seminal paper of Coble 1996, Excitation-Emission Matrices (EEM) have become a widespread method for the qualitative characterization of dissolved organic matter (DOM). EEM measurement is a straightforward analysis in the laboratory. However, their subsequent interpretation and getting the most amount of information from them, is still an on going challenge. Up to current days, the most successful method for the analysis of large EEM data sets is Parallel Factor Analysis (PARAFAC). It creates a model which decomposes EEMs into their individual components based on the variability in their fluorescence intensity within the data set. This may constitute a limitation for components which are low represented in the data set, or which exhibit little variability, as they may not be detected or distinguished from other components. Consequently, for heterogeneous EEM data sets PARAFAC may not succeed in validating a model which fully reflects the diversity of fluorophores they contain. In this context, we propose an alternative approach inspired on procedures from the field of chromatography. Peak positions were detected by interpreting the first and the second derivative of the EEM matrices. After that, the shapes of the recognized peaks were determined by least squares fitting 2D Gaussian functions to the EEM. This procedure was applied to water samples collected in a river longitudinal gradient under contrasted hydrological conditions, containing a large diversity of fluorescent DOM components. Our results suggest that this approach can be a suitable tool for the characterization of heterogeneous EEM data sets.

O3

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DIATOM BIOTOPOLOGY OF THE MEDITERRANEAN REGION

Freshwater diatoms are extensively used for ecological assessment in Europe. Most studies are limited to small geographic areas or at most considering an entire country. Nevertheless, it's important to understand distribution patterns at large scales for wide application of biological methods. The aim of this study was to explore Mediterranean freshwater diatom community patterns from unimpacted samples (260) considering data from six countries (Cyprus, France, Italy, Portugal, Slovenia, Spain). Analyses were performed with PRIMER 6.1.13 software. Diatoms were grouped after CLUSTER analysis (group average) and similarity percentages – species contributions analysis (SIMPER). To test for significant differences between groups the ANOSIM test was used. Cluster analysis identified nine groups based on diatom assemblages. Within group similarities (SIMPER: Bray-Curtis) varied between 35 and 41%. Groups are significantly different from each other (ANOSIM: Global $R=0.82$, $p<0.001$). Groups 1 and 8 were the most dissimilar (93.9%), while groups 6 and 7 were the least dissimilar (71.4%) sharing Achnanthidium minutissimum and A. pyrenaicum as the most representative diatoms. The most representative diatoms for group 1 were Achnanthidium minutissimum, Gomphonema pumilum var. elegans and Achnanthidium lineare while in group 8, diatoms found in more than 50% of the samples, were Nitzschia palea, Fragilaria Vaucheriae, Achnanthidium minutissimum and Amphora veneta. Group 1, composed almost entirely of Cyprus' samples, was characterised by low altitude (average of 223 masl), medium conductivity (average 500 µScm-1) and non-siliceous geology; group 8 showed higher altitude (average 354 masl) and lower conductivity (average 300 µScm-1)with samples mainly from siliceous background. Cyprus is being separated from the other countries based mainly on geology (Ophiolite). Other equally large dissimilarities between diatom groups reveal the importance of geology for diatom distribution. Groups 6 and 7 are from calcareous sites while group 8 is mainly siliceous.

SS5

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PREDICTING HOW CYANOBACTERIA WILL RESPOND TO FUTURE ENVIRONMENTAL PRESSURES - A REVIEW OF SEVERAL MODELLING STUDIES

Introduction There has been increasing evidence that the recent changes in climate have had an effect on lake phytoplankton communities. This effect is often expressed by changes in phenology and/or abundance of certain phytoplankton types. The latter is of notable concern because it has been suggested that it is likely that Cyanobacteria will increase in relative abundance under the predicted future climate. However, testing such a qualitative prediction is challenging and usually requires some form of numerical computer model. Methods and materials Therefore, over the last 6 years, the process-based phytoplankton community model PROTECH (Phytoplankton RespOnses To Environmental CHange) has been applied to numerous lakes in the UK, examining the sensitivity of these lakes to changes in climate (e.g. water temperature, flushing rate) and other common environmental pressures (e.g. nutrient load). Results These studies, taken collectively, generally show an increase in relative Cyanobacteria abundance with increasing water temperature, decreased flushing rate and increased nutrient loads. Furthermore, they suggest that whilst the direct effects of climate change on the lakes can change the timing of bloom events and Cyanobacteria abundance, the amount of phytoplankton biomass produced over a year is not enhanced by these changes. Finally, there is also a trend amongst the results for an increased response by the phytoplankton community (particularly Cyanobacteria) to the climate changes tested with increasing nutrient load. Conclusions Therefore, because the phytoplankton (Cyanobacteria) of these temperate region lakes are more sensitivity to climate pressures when subject to high nutrient loads, the ability to manage the predicted pressures from climate change still lies at the local level through a reduction in nutrient inputs to the lake.

AO0

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CHANNEL FORM, WATER FLOW, AND RIVER ECOSYSTEM FUNCTIONING

Because of the serious effects of pollution on water supply, water agencies have historically paid much closer attention to water quality than to other aspects of river integrity. More recently, however, it became evident that human impacts on channel form and water flow are also impairing seriously river health and thus threatening the benefits the society can derive from these ecosystems. Most river ecosystem functioning depends on river hydromorphological integrity, as shown by the relationship between hiporheic flow and nutrient retention, or the effects of channel complexity on storage and breakdown of coarse organic matter. Additionally, changes in channel form or water flow often lead to shifts in composition of biological communities, which in turn affect ecosystem functioning. Human activities are speeding up through the planet as a result of increased population and more powerful technologies. This is leading to increased rates of modification in river channels in such a way that, even where water pollution is decreasing, river biota does rarely recover to high status. Therefore, it is necessary to make an effort to understand the main principles underlying the relation between channel form, water flow and river ecosystems, so we can design the best strategies to recover truly functioning rivers in the current, highly modified landscapes.

O5

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THE EFFECT OF NUTRIENT CONCENTRATIONS AND RATIOS ON PERIPHYTON BIOMASS

The purpose of this study was to evaluate the effects of nutrient ratios and total nutrient concentration (TNC) on periphyton biomass in artificial streams using water from four Irish streams. Stream water N:P ratio were manipulated (high > 50, medium 15-30, low < 10) together with nutrient concentrations (three levels) over a 2 weeks period (July-October). Results indicated that algal biomass as chlorophyll a (Chl-a) response to the treatments differed from the controls in three of the four streams. These three streams showed significant interaction between N:P ratio and nutrient concentration. Periphyton response to the TNC treatments and N:P ratio was varied: two of the three showed a significant response to both TNC treatments and N:P ratio indicating phosphorus limitations as expected from the ambient ratios. The third stream showed just significant response to TNC and was a case of co-limitation by both N and P despite the low N:P ratio. This results suggests that N:P ratio can be a useful indication of predicting nutrient limitation in stream water

O1

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POPULATION SIZE RESPONSE TO LARGE-SCALE RECRUITMENT MANIPULATION OF THE MAYFLY BAETIS BICAUDATUS

The influence of recruitment on population dynamics has been overlooked in stream insects, despite having been demonstrated convincingly in other systems. Although strong inference can be made from empirical relationships between recruitment and population sizes of organisms, a definitive test of recruitment limitation requires manipulating recruitment at relevant spatial and temporal scales. The goal of this study was to manipulate recruitment (oviposition) of the mayfly Baetis bicaudatus in multiple streams during one year, and the next year measure the abundance of late-stage larvae at the end of the cohort. Preferred oviposition substrates (large rocks protruding from the stream surface) were increased, removed or left unmodified in 45-m reaches of streams (N = 4) of a high-altitude drainage basin in western Colorado, USA. This manipulation altered not only resultant egg densities oviposited by B. bicaudatus females, but also the abundance of late stage larvae of this cohort estimated one year after the manipulation. This outcome is consistent with the hypothesis that recruitment can limit larval population size at the scale of a stream reach. Furthermore, per capita daily loss rates from the egg stage to late stage larvae were also affected by manipulating recruitment, primarily because reaches with zero recruitment gained individuals by immigration. Average per capita daily loss rates did not change in stream reaches in which recruitment was experimentally increased. Thus, increased larval abundance in this treatment could be attributed to higher initial population sizes rather than changes in loss rates from before to after the manipulation. This large-scale experiment demonstrates that alteration of preferred oviposition habitats can affect population sizes of organisms with specialized oviposition behavior.

SS4

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IS AQUATIC METABOLISM HIGHER IN NATURAL THAN IN RESTORED WETLANDS? A CASE OF STUDY IN A SEMI-ARID FLOODPLAIN.

The metabolism of aquatic ecosystems is an important measure of the efficacy of wetland restoration, as an indicator of the system efficacy to process energetic resources. For this reason, in this study we aim: i) to compare the aquatic metabolism of constructed and natural oxbow lakes under the basic assumption that natural ecosystems will sustain a more intense metabolic balance due to more abundant organic matter and structured communities, and ii) to identify the main environmental factors controlling such metabolic balance. To that end, pelagic and benthic ecosystem metabolism (based on the dark and light method) and physicochemical features were studied in two natural and two constructed oxbow lakes in the floodplain of a regulated river (Middle Ebro River, NE Spain) in May–June 2010. During the study period, the pelagic net productivity (NEPw) ranged from -0.037 to +1.006 mgO2•L-1•h-1; whereas the benthic net productivity (NEPc) values were in the range of -0.033 to +0.962 mg O2•L-1•h-1. Analyses of variance showed that productivity (both NEPw and NEPc) was significantly higher in natural than constructed oxbow lakes, as initially expected. This might be due to differences between constructed and natural oxbow lakes in terms of organic matter inputs, historical sediment accumulation, habitat heterogeneity and biotic community structure. Net ecosystem productivity (both NEPw and NEPc) appeared to be mainly controlled by nutrients as total dissolved phosphorus and nitrate; whereas respiration was negatively related to total dissolved phosphorus. These results suggest that both natural and constructed lakes are carbon sinks at short term fed by both autochthonous organic matter and allocthonous terrestrial inputs. Understanding the functional processes investigated in this study can inform management and restoration of floodplain ecosystems.

SS5

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HUMIC LAKE LADIES IN TROUBLE

We studied experimentally, whether the effects of decreasing water transparency and increasing fish density on the feeding rate of planktivorous fish are gender-dependent. We expected that the feeding efficiency of females decreases steeper with increasing water colour than the feeding rate of males. The experiments were conducted with perch (Perca fluvialitis), which are visual predators. Additionally, we collected field data and studied the effects of water colour on the growth rate and feeding activity of male and female perch. The results of the experimental study were supported by field data, which revealed a significant effect of water colour on the feeding activity of females and on the gender growth difference in planktivorous 3-year-old perch. The results suggested that variations in water quality may be a factor behind the population dependency of dimorphism in fish.

O4

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QUICK PHYSIOLOGICAL CHANGES IN RESPONSE TO RADIATION CONDITIONS AND UV-B ENHANCEMENT IN AN AQUATIC LIVERWORT

We studied the diel responses of the aquatic liverwort Jungermannia exsertifolia subsp. cordifolia to radiation changes under laboratory conditions. The samples were exposed to three radiation regimes: P (only PAR), PA (PAR + UV-A), and PAB (PAR + UV-A + UV-B). The day was divided in four periods: darkness, a first low-PAR period, the high-PAR plus UV period, and a second low-PAR period. After 15 days of culture, we measured different variables in the four periods of the day on two consecutive days. Among the variables measured, we analyzed the global amount of UV-absorbing compounds (as the bulk UV absorbance of methanolic extracts) and the concentration of different hydroxycinnamic acid derivatives, both in the soluble (mainly vacuolar) and insoluble (cell wall-bound) fractions of the plant extracts. PAB samples increased the bulk UV absorbance of the soluble and insoluble fractions, and the concentrations of p-coumaroylmalic acid in the soluble fraction and p-coumaric acid in the cell wall. Most of these variables showed significant diel changes and responded within a few hours to radiation changes (more strongly to UV-B), increasing at the end of the period of high PAR plus UV. Fv/Fm, PSII, NPQ and the xanthophylls forming part of the xanthophyll cycle showed significant and quick diel changes in response to high PAR, UV-A and UV-B radiation, indicating dynamic photoinhibition and protection of PSII from excess radiation through the xanthophyll cycle. Thus, the liverwort showed a dynamic protection and acclimation capacity to the irradiance level and spectral characteristics of the radiation received.

O1

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ANALYSING SIZE-STRUCTURE PATTERNS OF NORTH-AMERICAN AND IBERIAN FRESHWATER FISH SPECIES

Quantifying size structure within and among different ecosystems is important in ecology as it can provide clues about the underlying processes that shape ecological communities. Actually, body size is a fundamental trait of organisms and can therefore greatly influence ecological interactions, with important consequences at the population and community levels. For instance, average body mass of species has been shown to scale negatively (with log scales) with relative population density (i.e. small organisms are typically very abundant while the largest organisms tend to be the rarest). Although this allometric relationship has been frequently described, the determinants of size structure variability across different levels of organization (species, populations and communities) and across different ecosystem types are far less understood. In this study, 220 North-American and 120 Iberian regional communities were used to quantify and compare the variation between fish individual size and properties of individuals, population and assemblages. The individuals' size distributions (ISD) of the North-American and Iberian ecosystems, expressed as the allometric relationship of the body sizes of all individuals, displayed important similarities in terms of slope and strength. On the contrary, the general allometric relationship computed for both ecosystems (i.e. between average body mass and average abundance of each local community) differed significantly with comparable values of strength and slope as the ones found with the ISD in North-America and no significant linear relationship in the Iberian region. This study of cross comparison of size-structure at different levels of biological organization in two different ecosystem types allow improving our understanding of the role of body size in structuring communities, which could ultimately have important implications for predicting the responses of natural ecosystems to future environmental change.

SS13

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MULTIANNUAL CHANGES OF LAKE MICROPLANKTON ASSEMBLAGES IN A HIGH MOUNTAIN LAKE: LINKING CLIMATE VARIABILITY AND FLUCTUATIONS IN COMMUNITY COMPOSITION.

High mountain lakes were among the freshwater ecosystems first introduced as sentinels of global change. Because of their remoteness they are mostly driven by atmospheric variability. The formation of an ice and snow cover during several months of the year make them particularly sensitive to climate variability as tendencies in several month are integrated and impinge in the lake system in the key thawing period. However, little is known about the effect of the cover variability on the assemblage composition and main groups dominance. A long-term microplankton monitoring program have been established in lake Redon as part of the Limnological Observatory of the Pyrenees (LOOP). Here we report microplankton time series of the first 6 years of observation at four week sampling intervals (April 2005 to December 2010). The term microplankton here is loosely used and includes phytoplankton, heterotrophic flagellates and ciliates. More than one hundred species have been identified. Phytoplankton is mainly dominated by Chrysophytes and Chlorophytes, ciliates by Holotrichs and Oligotrichs and heterotrophic flagellates by colorless Chrysophytes, all of them showed specific seasonal patterns. Main interannual changes appear related to the duration of the ice cover, and the effects propagate throughout the growing season for most planktonic groups.

SS10

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ANTHROPOGENIC STRESSORS ON STREAMS AND RIPARIAN ZONES CAN HAVE LARGE EFFECTS ON PREDATORS IN ADJACENT HABITATS BY REDUCING PREY SUBSIDIES

Ecologists have discovered relatively recently that streams and riparian ecosystems are tightly linked by fluxes of invertebrate prey in both directions across their boundary that influence predators in adjacent habitats. Therefore, it stands to reason that anthropogenic stressors in one habitat (e.g., streams) could have effects that propagate to the adjacent habitat (riparian zones). Here we summarize results from comparative studies and manipulative experiments in streams and riparian zones in Japan and the western U.S. to assess how deforestation, salmonid invasions, and riparian livestock grazing affect prey fluxes and predators in adjacent habitats, and whether multiple stressors interact. The set of studies show that both the fluxes and the predators can be strongly affected by these anthropogenic stressors in stream-riparian ecosystems. For example, traditional season-long riparian cattle grazing along western U.S. streams resulted in 44-81% less input of terrestrial insects, and 33-54% less trout biomass, compared to more progressive rotational systems that mimic native ungulate grazing. Moreover, single stressors caused effects large enough that there was relatively little scope for additional effects from a second stressor. For example, a field experiment with rainbow trout (Oncorhynchus mykiss) invasion in Japan reduced aquatic insect emergence by 35% and riparian spiders by 65%, whereas cutting off most prey flux with a mesh greenhouse (a drastic treatment) reduced spiders by only an additional 18%. The importance of these fluxes, and the effects of stressors on them, must be considered in any attempts to restore these linked ecosystems.

O1

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RECOVERY SCENARIOS FOR MACROINVERTEBRATE COMMUNITIES OF A TROPICAL CATCHMENT (VELHAS, BRAZIL) AND RESTORATION OF URBAN STREAMS: IS IT POSSIBLE TO GO BACK?

The ultimate aim of bioassessment is to improve the ecological quality of streams, which includes not only their hydromorphological aspects (as the riparian vegetation, land use, variety of habitats, flow regimes) but also their biological communities towards adequate reference conditions. The catchment of Velhas River (Minas Gerais, Brasil) covers 29 173 km² containing a different array of conditions from natural vegetation to the highly populated Belo Horizonte Metropolitan Area (≈ 5 million people) and mining areas. With this study we aimed to define abiotic and biological reference conditions (based on macroinvertebrate communities) for the whole catchment and abiotic and biological target levels for the recovery of the streams. Moreover, we evaluated the ecological recovery of 4 urban streams where rehabilitation measures were undertaken in 2007-2008. We used data from 37 sites gathered 4 times a year (2003-2010). A PCA based on geomorphological, geographical and climatic aspects showed the existence of two main stream types. The communities of reference sites were biologically distinct (PERMANOVA: Pseudo-F=2.0902, p=0.021) but didn't vary significantly between seasons (p>0.05). A PCA based on pressure data of reference and disturbed sites showed a degradation gradient on PC1 (81% of variability explained) mainly driven by nutrients, conductivity, O2, TDS and habitat degradation, which was used to set 4 degradation classes. SIMPER analysis allowed the determination of the expected communities at a given disturbance level. Finally, we evaluated the distance between the communities of each of the 4 urban streams and the reference condition. An MDS showed that all sites and samples are very different from reference and there were no significant improvements in the communities. The communities have very low equitabilities (dominance curves) over years, and after 2 years are still dominated by Oligochaeta and Chironomidae, even though abiotically, the streams improved 2 classes on average.

O6

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SELECTIVE FEEDING ON ARCHAEA BY SOME MIXOTROPHIC FLAGELLATES IN NATURAL ASSEMBLAGES

Protists are increansingly recognised as highly specialised consumers. Efforts are being made to understand their selective feeding and its relevance to matter and energy transfer within microbial food webs. However, little is still known about selective grazing in the aquatic microbial loop in natural conditions beyond size selection. In this study we analyze the changing feeding preferences of some mixotrophic flagellates from a high mountain lake. Species feeding patterns were established using a catalyzed reported deposition – fluorescence in situ hybridization (CARD-FISH) protocol, particularly suited to assess the predation of mixotrophic flagellates on prokaryotes. Ingested Archaea and three subgroups of the domain Bacteria (Actinobacteria, Betaproteobacteria and members of Cytophaga-Flavobacteria of Bacteroridetes) were quantified in Cryptomonas ovata, Rhodomas sp. and Dinobryon cylindricum. Single-cell changes in the amount of ingested preys were followed during 15 hours. Our results show differences in the feeding behaviour of the three flagellates: whereas the largest species Cryptomonas and Dinobryon did not feed selectively and the amount of ingested preys were only slightly higher during night; Rhodomonas showed a marked preference for Archaea and large dayly fluctuations in prey amounts. This study demonstrates that relatively close species (e.g., the two cryptophytes analyzed) can exhibit very different degree of selective grazing in natural environment. These differences indicate that the taxonomic composition of the protist community may be relevant in determining the intensity of flagellate grazing and, eventually, the temporal changes in both microbial preys and predators.

O5

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LONG-TERM EFFECTS OF RIPARIAN VEGETATION DIVERSITY ON STREAM-DWELLING MICROBES AND LITTER DECOMPOSITION

Manipulations of plant litter diversity have been shown to affect litter decomposition and to alter the structure of aquatic assemblages. However, most experiments addressing biodiversity effects have been conducted at small temporal scales. Here, we used a pool of 3 common riparian plant species in Portugal (alder, oak and eucalyptus), to examine the potential long-term impacts of riparian diversity loss on litter decomposition and associated microbes. Fine-mesh bags containing mixtures of the 3 leaf species were immersed in a mixed-forested stream to allow microbial colonization. After 2 weeks, leaves were retrieved and placed in microcosms to simulate plant species loss. For that, all combinations of 1 to 3 non-colonized leaf species were enclosed in mesh containers and a set of colonized leaves was used as inoculum. This procedure was repeated each 30 days during 6 months keeping leaf species composition constant. In every 2 months, we assessed leaf mass loss, fungal biomass and microbial diversity by the number of operational taxonomic units (OTUs) from denaturing gradient gel electrophoresis, using primers targeting rDNA for bacteria, fungi and ciliates. The highest diversity on litter was found for bacteria (68 OTUs), followed by fungi (41 OTUs) and ciliates (31 OTUs). Litter decomposition, fungal biomass and the structure of microbial assemblages on each litter species varied along time. Fungal biomass and diversity of fungi and ciliates were affected by litter species diversity. After 6 months, fungal biomass on oak and eucalyptus was highest in mixtures with 3 litter species. Also fungal diversity on each litter species was highest in leaf mixtures, especially at longer times. Results suggest that changes in riparian vegetation, at longer time scales, can alter the structure of stream microbial assemblages and affect litter decomposition dynamics in streams. I Fernandes (SFRH/BD/42215/2007) and S Duarte (SFRH/BPD/47574/2008) were supported by FCT

SS3

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LONGITUDINAL PATTERNS IN RIPARIAN HABITAT COMPOSITION IN RIVERS FROM THE CANTABRIAN REGION, NORTHERN SPAIN

Riparian habitat composition was examined using specifically designed botanical maps (vegetation polygons at 1:5.000) from nine rivers in the region of Cantabria (Northern Spain). These rivers have been declared fluvial Special Areas for Conservation (SACs). In order to determine the longitudinal patterns of riparian habitat composition we first searched for river reaches where riparian forest has its natural lateral dimensions and we analyzed the relationship between different return period floods and the width of the riparian forest. Once the riparian area was defined by choosing the area originated by the appropriate flood (50 years flood), we analyzed the longitudinal gradient of riparian habitats by dividing the river network from source to mouth in 500 meters length river reaches. Climatic and geological data were extracted from available maps, while hydrological data were obtained from previous studies in the area. Moreover, valley topography characteristics were obtained from a Digital Elevation Model (DEM: 5x5 m). Detrended Correspondence Analysis (DCA) was carried out in order to look for main environmental factors determining longitudinal changes in riparian habitat composition. Alluvial forest with alders and ashes was the predominant riparian habitat in middle and lower reaches, along with pedunculate oak forest and mixed forest. Within the upper reaches, riparian forests were narrower and composed by a mixture of riparian and upland vegetation, dominated by oaks and beeches. Local discontinuities arose in narrow rocky valleys, where holm oaks and Tilio-Acerion forests become predominant. Shrub willows were common in the most degraded river stretches. Finally, we determine for each habitat the environmental variables which govern its distribution. Altitude, slope angle, geology and valley morphology seem to be important factors controlling the longitudinal distribution of riparian habitats.

SS2

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CHARACTERIZATION OF HAPTOPHYTE BLOOMS IN AQUACULTURE PONDS BY THE ESTUARY OF THE GUADALQUIVIR RIVER (SW SPAIN)

Estuaries support a wide range of human activities. Aquaculture ponds at Veta La Palma (Doñana Natural Area, SW Spain) are an example of the sustainable use of estuaries. The aquaculture area of Veta La Palma is composed by 45 rectangular, 70-hectare shallow ponds, connected to each other and to the Guadalquivir River estuary. We studied the phytoplankton and benthic communities focusing on the occurrence of haptophytes and its relation to environmental conditions. Hydro-meteorological variables and nutrient concentrations were measured every two weeks at four sites in two aquaculture ponds (February 2009-December 2010). 39 and 51 were recorded, respectively, in the phytoplankton and phytobenthos (total richness of 62 taxa). The size-abundance distribution was dominated by micro-sized phytoplankton cells (2-5 um), such as Diacronema sp. and Isochrysis sp. (Haptophytes) with blooms of up to 2*106 cel/ml. Adittionally, Nitzschia acicularis, Gyrosigma balticum (Bacillariophytes), Nannochloris oculata, Tetraselmis sp., Monoraphidium circinale and M. contortum (Chlorophytes) were common in all samples. The benthos was dominated by Bacillariophytes (Gyrosigma balticum, Navicula sp., Nitzschia aff. sigmoidea, Pleurosigma salinarum and Tryblionella apiculata) while cyanobacteria were represented by a few filamentous taxa (Jaaginema sp. and Phormidium sp.). P-availability was tightly regulated by the adsorption capacity of silt particles in these turbid shallow systems where inorganic suspended matter range widely (20-200 mg/l). Dissolved inorganic Nitrogen reached up to 250 uM in summer and, though it was depleted during winter floods, it did not become limiting during the study period. Hydro-metorological fluctuations were more likely related to the blooms of haptophytes. Isochrysis sp. bloomed on 3 occasions at high temperature (20-30 °C) and conductivity ranges (10-30 mS/cm) while Diacronema sp. bloomed once during a period of low-medium temperature (10-20 °C) and conductivity ranges (5-10 mS/cm). Their growth in laboratory cultures could provide further information on the ecology of these two taxa.

O3

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RISK ASSESSMENT OF MIXTURES: STUDY OF THE NATURE OF INTERACTION BETWEEN POLLUTANTS IN COMPLEX MIXTURES BY THE COMBINATION INDEX METHOD

Biota is usually exposed to complex mixtures of pollutants; however due to simplicity most ecotoxicity studies and risk assessment strategies focus on hazard of individual chemicals or mixture interaction based on a selected level of effect on the organism. It is usually assumed that the nature of the interaction is independent of the effect level for the same organism. In this work we present our findings on the influence of the effect level (EC) on the predicted toxicity of complex mixtures of pollutants towards aquatic organisms. For these purpose, we are using the Combination Index (CI) method to identify and quantify synergistic and antagonistic interaction of pollutants in complex mixtures. CI is based on the additive definition by Berenbaum (CA concept) but with further development. We found that the nature of the interaction strongly varied with the different levels of effect (ECx) and the selected organism and the most usual situation was a dual behavior synergism/antagonism or antagonism/synergism along the range of EC levels. An increase in the complexity of the mixtures led in general, to an increase in synergism or decrease in antagonism in the whole ECx range. An additive effect was usually found at EC levels near the EC50. These are the levels of effect which also usually fit more closely to the CA or IA model predictions, and may be the reason why such models have been repeatedly unsuccessful to predict toxicity of mixtures at low EC levels.

SS9

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BIOMARKER SEASONALITY IN LAKE VAN, TURKEY

Lake Van in Eastern Anatolia (Turkey) is a key site to understand continental paleoclimatic and paleoecological conditions. Our aim was to assess the seasonality of biomarkers for primary productivity, nutrient input, and anthropogenic impact, as well as those used for temperature reconstructions, and establish possible links. We used monthly and annual sediment traps deployed between June 2006 and August 2007 at 35 and 440m. Understanding the lake dynamics and biomarker export should allow us to evaluate the information stored in Lake Van's sedimentary archive and distinguish natural climate variability from anthropogenic impact. We measured a range of biochemical parameters such as total mass and organic carbon fluxes, Chlorophyll a transformation products, fucoxanthin, alkenones, and glycerol dialkyl glycerol tetraether (GDGTs) and alkanes. Our data show strong seasonality of the primary productivity and community structure, potentially due to stratification/mixing regime changes as well as nutrient input. The long-chain alkenone composition and degree of unsaturation also showed seasonal variations, while the UK'37-based reconstructed temperatures remained remarkably constant throughout the year. Isoprenoid GDGTs concentrations were low, except for caldarcheol and crenarchaeol. Hence, while changes in the mesophile archaea abundance (crenarchaeol) could be assessed, the below detection concentrations of the minor isoprenoid GDGTs, precluded the use of the isoprenoid GDGTs based TEX86 index. Terrestrial input (based on branched GDGTs likely derived from soil bacteria) was linked to increased precipitation and snowmelt. Summer n-alkanes were mainly derived from natural sources, while in winter we observed a marked increase in anthropogenic contamination related n-alkanes. This was supported by seasonal changes of hopane and sterane maturity indices. All studied biomarkers in Lake Van hence reflected distinct seasonal environmental changes, therefore indicating their potential use in future long-term or reconstruction studies.

SS4

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TEMPORAL EVOLUTION OF DISSOLVED ORGANIC CARBON IN A TEMPERATE WATERSHED: LAKE GENEVA AND RIVERS OF CANTON GENEVA, SWITZERLAND

Over the past decades, an increase in of dissolved organic carbon (DOC) concentrations has often been reported in rivers of the Northern Hemisphere. Long-term DOC increases may have a significant impact, not only on the global carbon cycle, but on freshwater food chains and drinking water quality. Driving mechanisms are poorly understood; observations having been attributed to a variety of causes (e.g., changes in air temperature, solar radiation, precipitations, soil moisture, timing of ice break-up and snowmelt, length of seasons, land use, atmospheric deposition chemistry). When evaluating published data, it is easily observed that (i) most studies deal with water draining peat or forested areas, (ii)data from climatic zones other than boreal systems are limited, (iii) most data come from networks devoted to the monitoring of acidic systems (DOC changes in such systems might be due to reasons linked to acidification recovery and not be generally applicable). For these reasons, it is particularly urgent to find and analyse long temporal series of DOC data in water systems from other latitudes. We are studying the temporal evolution of DOC concentrations in a temperate watershed: Lake Geneva and rivers of Canton Geneva, Switzerland, for which water quality has been monitored for more than 25 years. Lake Geneva is one of the largest lakes in Western Europe and one of the most studied. The hydrological network of Canton Geneva constitute an interesting watershed because of the variety of physico-chemical, biological and lithogenic characteristics encompassed. Temporal trends from 1984 to 2010 are being assessed by applying the seasonal Kendall test and the magnitude of the temporal trend is obtained using the Sen's test. Noticeable changes in DOC behaviour have been observed in Lake Geneva waters in recent years, with a statistically significant increase in DOC concentrations in the water column.

SS13

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SALMO TRUTTA IN MEDITERRANEAN AND TEMPERATE EUROPEAN RIVER DRAINAGES: FORECASTING FUTURE DISTRIBUTION PATTERNS

Cold-water fish species are expected to face strong habitat reductions in response to climate changes. Here, we predict the potential future distribution of Brown trout Salmo trutta in three major European river catchments (i.e.; Ebro, Elbe and Danube) with distinct hydrological regimes. We first modelled the current distribution of Brown trout using different datasets for occurrences, and data on current air temperature, precipitation (both derived from WorldClim) and stream topography (derived from CCM2). We calibrated Species Distribution Models for 70% of all stream segments using the GLM, GAM, and MARS statistical models, and validated models with the 30% remaining subset. At last, we made predictions of species occurrences for 2080's future scenarios (A1b IPCC derived from CIAT). Models had a high performance level for both calibration and validation datasets (AUC >0.90) and annual mean temperature and annual precipitation were the factors that most contributed to the variance explained (each with >20%). Forecasts for 2080's were consistent on predicting dramatic shifts of species occurrences within the three catchments. For the Ebro, the probability of occurrences is expected to decrease more drastically in all stream segments (probability of occurrence forecasted was <0.5) than for the other catchments; only for the western headwaters of the Danube, a large region is expected to have >0.5 probability, while for the Elbe the areas with a probability >0.5 are almost inexistent. Possible model refinements include considering species dispersal ability as well as landscape dispersal impediments. Therefore, results can be even more alarming. Conservation and management recommendations should urgently focused on the areas identified as highly vulnerable to extinction risk.

SS8

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DIVERSITY AND HABITAT SEGREGATION OF ARCHAEAL LINEAGES IN STRATIFIED KARSTIC LAKES

Archaeal assemblages from several karstic lakes of the Banyoles lacustrine system differing in their stratification pattern and trophic status have been examined by 16S rRNA cloning and sequencing to analyze their alfa- and beta-diversity and distribution patterns. A total of 675 clones from both planktonic and sediment samples were finally analysed. Most of these clones (75%) affiliated to the Crenarchaeota, mainly to the Miscellaneous Crenarchaeotic Group (MCG) and the Marine Group I.1A. The remaining clones (25 %) affiliated to several lineages of uncultured Euryarchaeota, such as the Marine Benthic Group D, the Miscellaneous Euryarchaeotic Group (MEG) and the Deep Sea Euryarchaeotic Group (DSEG). Beta-diversity analysis revealed clear habitat segregation patterns according to environmental parameters. Remarkably, half of the clones from anoxic, sulfidic waters (54%) affiliated to MCG, a lineage composed by phylotypes recovered from very diverse environments and putatively identified as heterotrophic anaerobes. In clear contrast, 95% of the clones recovered from the unique oligotrophic habitat studied (basin C-II in Lake Banyoles) were assigned to a single OTU affiliated to the Marine Group I.1A. This OTU grouped 164 clones with high sequence identity (>97%) to uncultured archaeal ammonia-oxidizers. In this regard, phylotypes putatively involved in ammonia oxidation were nearly absent in libraries constructed from lakes with anoxic, sulfide-rich hypolimnia. Only one of the studied habitats (basin C-IV) showed a dominance of euryarchaeotal clones, affiliated to MEG and DSEG lineages, over crenarchaeotal ones. Considering the large amount of reduced iron and sulfur compounds in the anoxic hypolimnion of this basin, it is tempting to assume similarities with hydrothermal vent habitats. Further comparison using UniFrac metrics and PCoA analysis highlighted the importance of environmental conditions on the habitat segregation of archaeal lineages in the studied systems.

SS8

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LOSS OF PYRENEAN GLACIERS LIKELY WILL HAVE A STRONG NEGATIVE EFFECT ON REGIONAL POPULATION-GENETIC DIVERSITY OF <I>BAETIS ALPINUS</I> (EPHEMEROPTERA)

There is increasing evidence that intraspecific genetic diversity within and among stream networks is significantly enhanced by contributions from unique headwater populations. Evidence is particularly strong in basins with steep gradients (i.e., in mountains). In many mountainous headwaters across Europe, key ecological drivers (e.g. flow regime, water temperature) are influenced by the runoff from glaciers, which have lost significant mass over the past century. We asked what the effects of this glacial mass loss might be on the distribution of population-genetic diversity in stream networks currently influenced by glaciers. We selected four glacierized basins in the Pyrenees (all within the Pau catchment, France) – where the vestigial glaciers are expected to disappear within this century – and we sequenced a portion of the mitochondrial COI gene for 11-13 individuals of Baetis alpinus from each of 4 stream reaches per basin. Sample reaches varied from 2250-1650 m elevation, from headwaters (stream order 0-2) to 4th-order. We also estimated glacial influence at each reach by measuring a suite of physico-chemical variables sensitive to changes in water source contributions. Overall, we found that population structure was significantly greater among high-altitude headwaters with strong glacial influence than among larger streams at lower altitudes or higher-altitude streams with minimal glacial influence. Differences in temperature regime between stream types may interact with physical isolation of glacial headwaters across steep drainage divides to yield this striking population-genetic pattern. Our results suggest that the impending loss of small glaciers in the Pyrenees will have a strong negative impact on basin-scale genetic diversity, through both (1) the loss of a unique habitat type, and (2) a decrease in the glacial meltwater runoff that sustains headwater stream habitat.

SS2

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ENVIRONMENTAL VARIABILITY AND CONNECTIVITY: KEY FACTORS TO PRESERVE HIGH MACROINVERTEBRATE DIVERSITY IN A HIGHLY NESTED POND NETWORK

Nestedness has been widely used to measure the structure of biological communities and occurs when species-poor sites contain subsets of species-rich ones. In nested pond networks there are species which occur more frequently than expected in species poor sites, and ponds whose assemblages are dominated by species largely absent from species rich sites (termed idiosyncratic). These have great interest for conservation, maintaining high biodiversity in nested systems. We analysed the macroinvertebrate assemblages and the environmental characteristics of 80 ponds sampled across the Doñana National Park (SW Spain). Twenty-one of these ponds were sampled monthly from inundation to desiccation during two years with different rainfall. The Doñana pond network, which is mainly composed of natural temporary ponds and some permanent ponds, was highly nested, but with a high number of idiosyncratic species and ponds. Differential colonization (due to different dispersal abilities of species) and the environmental heterogeneity detected in the system were important drivers of the nested pattern. In ponds studied monthly, a predictable gradual increase of nestedness from inundation to the start of desiccation was detected in each year, despite macroinvertebrate assemblages showing high inter and intra-annual variation. During desiccation, ponds with shortest hydroperiods dried up first whilst more permanent ponds still held more stable conditions, a situation which resulted in non-nested macroinvertebrate assemblages. High environmental variability and connectivity are essential to maintain high biodiversity in nested pond networks.

O1

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EFFECTS OF FOOD TYPE AND AVAILABILITY ON CONSUMPTION AND GROWTH OF LARVAL SERICOSTOMA VITTATUM RAMBUR (TRICHOPTERA).

Terrestrial litter inputs are a major food source in small forested streams, but their quality and availability depend on several processes occurring in stream channels, from sorting and storage in different microhabitats to microbial colonization or physical fragmentation. Therefore, even at very small spatial scales, large differences can occur in food quality and availability, which in turn can affect shredder consumption and growth. In an attempt to evaluate the effects of these small-scale differences on shredder performance, larvae of the caddisfly Sericostoma vitattum were raised in laboratory streams, in a factorial experiment with food taken from a short stream reach. The two factors analysed were food type (conditioned Alnus glutinosa leaves, natural leaf packs, and thick debris jams) and availability (low, 2mg/invertebrate · day; high, 10 mg/invertebrate · day). Consumption and growth rates were measured every two weeks. Consumption rates did not differ between treatments when food availability was low, but were significantly higher on jam material when availability was high. Growth rate was highest on alder leaves at both availability levels, and lowest on jam material despite highest consumption rate. Results suggest that, although thick organic deposits can make up a large proportion of the organic matter stored in a stream, their contribution to shredder secondary production is relatively low.

SS2

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SURFACE AND INTERSTITIAL WATER AND SEDIMENT CHARACTERISTICS DRIVING BOTULISM PREVALENCE IN THE MANCHA HÚMEDA BIOSPHERE RESERVE

The Mancha Húmeda is a wetland district of international importance for birds, but its status as a Biosphere Reserve is under review, because of non-sustainable development, including sewage inputs to natural wetlands. Sewage treatment plants are usually not capable to cope with extreme pollution or storm events; these pulses stimulate plant and invertebrate animal population growth for short periods, but result in plant and vertebrate die-offs once this stimulus subsides. Under these conditions, anoxia, nutrient enrichment, and dead organic matter rich in proteins provide optimal conditions for multiplication of the vegetative form of the bacterium Clostridium botulinum; this process occurs just after spore germination and may involve the production by Clostridium of type C paralyzing toxin, which usually causes waterfowl die-offs. There seems to be a general agreement on the environmental factors driving botulism outbreaks, but revision of optimal ranges of values of these factors shows striking discordances among different literature sources. Besides, interstitial water chemistry is not taken into account, and predictive models lack an ecological approach, despite complex interactions are reported. This study intends to provide further insight on this question. We monitored 24 sampling stations distributed throughout three wetland sites, every two months, during a year. Nineteen parameters were measured in surface water, eight in interstitial water, and five in sediments. A botulism outbreak occurred in one of the sites at the end of August. The outbreak was preceded by a bloom of the duckweed Lemna minor, and a decrease in dissolved oxygen, planktonic chlorophyll, and pH values.

SS13

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TRENDS IN MACROINVERTEBRATES ASSEMBLAGES IN THE CONTEXT OF GLOBAL CHANGE OVER A 30-YEAR PERIOD (1977-2008) : CASE OF THE MIDDLE LOIRE.

A long-term dataset collected from the middle Loire river from 1977 to 2008 gives us the opportunity to describe temporal trends in several environmental factors under the global change and to assess their influence on benthic macroinvertebrates communities.

Continuous daily recordings of water temperature, flow, conductivity, dissolved oxygen and pH, and monthly recordings of biological oxygen demand (BOD), suspended sediments, nitrates, phosphates and chlorophyll a, have been sampled for thirty years. In the same period, pluriannual samples of macroinvertebrates have been collected. Trend tests are used to describe the long-term evolution of the environmental parameters while a correspondence analysis highlights biological information contained in faunal lists. Finally, correlation tests and regression models are performed to define the influence of each factor on the benthic community. The use of selected physiological and ecological traits of macroinvertebrates will also illustrate results via a fuzzy coding analysis.

Trend tests on annual means show a significant rise in water temperature (+ 1.6°C) associated with a significant drop in flow (-150 m3/s) over this period. Factors related to photosynthesis underline a decline in phytoplankton, with chlorophyll concentration divided by 20 in thirty years. The structure of the macroinvertebrates assemblages follows a clear temporal evolution, mainly correlated to spring and summer water temperatures, flow, BOD and chlorophyll (R^2 ≈ 86%). Current global change, especially the significant rise in air temperature, seems to explain the major part of thermal and hydrological regimes changes. Contrary to expectations, eutrophication of the Loire river is decreasing, probably as a consequence of the reduction of phosphorus inputs. Then, the thermal, hydrological and trophical co-evolution seems to be mainly responsible for the drift of the benthic community to an eurythermal and limnophilic assemblage. This hypothesis is comforted by the evolution of the physiological and ecological traits that are related to these parameters.

SS10

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SPATIAL AND TEMPORAL VARIATION IN THE RELATIONSHIP BETWEEN BIODIVERSITY AND ECOSYSTEM FUNCTIONING IN STREAMS

Over the past decade, Prof. Björn Malmqvist and his colleagues presented experimental evidence on the potential importance of aquatic biodiversity for ecosystem functioning. Most recently, Prof. Malmqvist was concerned with increasing the realism of this research, in particular addressing (i) when and where diversity is important for ecosystem functioning in situ and (ii) the form these relationships take across a range of environmental conditions. We initiated research addressing the above questions using leaf decomposition as a model ecosystem process, and focussing on the importance of detritivore diversity for this process across spatio-temporal environmental gradients. Leaf litter bags containing one of two leaf species (Alnus glutinosa and Betula pubescens) were deployed in two habitats, pools and riffles, during autumn and spring, in six streams. During autumn, stoneflies were substantially more abundant in riffles than pools, and detritivore richness and biomass in this habitat positively influenced decomposition rates, whereas pool decomposition, in comparison, presented slower rates. In contrast, caddisfly abundance and diversity was very high in pools during the spring, which switched the trend in decomposition rates, with more rapid decompositions in the slower flowing habitat. Furthermore, the speed of decomposition differs between seasons and between habitats within seasons, with marked differences in the decomposition rates of the two leaf species in all cases case. Thus, our results show that decomposition processes are regulated not only by seasonal and habitat-based differences in environmental characteristics, but also strongly by differences in the composition and diversity of invertebrate assemblages. In particular, the performance of detritivores on leaf species of contrasting quality appears to be more context-dependent than expected.

SS8

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SPATIAL- TEMPORAL PATTERNS AND SHIFTING ROLE OF BACTERIA IN ECOSYSTEM FUNCTIONING IN SWISS ALPINE FLOODPLAINS

Microbes are crucial in the functioning of terrestrial and aquatic ecosystems, being the driving force behind metabolic processes, and nutrient retention and cycling. The ongoing climate‑induced landscape change in alpine regions will likely influence microbial community structure and hence ecological services provided for downstream waters intensively used by humans. We conducted this study to better understand the influence of water source (water geochemistry) and tempo‑spatial variation in potential driving factors (organic matter content) on hyporheic microbial biofilms. Three floodplains, incorporating glacial and groundwater streams, were chosen to assess factors driving bacterial community structure and functioning. Bacterial abundance was lowest in glacial streams and highest in groundwater‑fed streams. CARD‑FISH revealed temporal variation in the abundance of Alpha‑, Betaproteobacteria and Cytophaga depending on the catchment. Temporal effects were most pronounced in glacial streams as shown by CARD‑FISH and ARISA. Enzymatic activities of bacterial communities showed different spatio‑temporal patterns between floodplains and the two water types. Results indicate high regional variability (among alpine catchments) in microbial community assembly with local drivers dictating within catchment variation.

O6

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FUNCTIONAL BACTERIAL DIVERSITY IN THE EPIPSAMMIC BIOFILM AT THE LLOBREGAT RIVER

River benthic microorganisms are highly responsible for decomposition, use and uptake of flowing water solutes. Their decomposing activity is mainly determined by their enzymatic capabilities which might be reduced in low diverse communities at highly polluted sites. At the same time, floods and droughts modulate the pollution effects in Mediterranean rivers. The effect of a pollution gradient on the functional bacterial diversity of the epipsammic biofilm was analysed in the Llobregat River (NE Spain). This river is a major drinking water source and is subjected to periodic floods and droughts. The bacterial density, functional diversity and richness, community respiration, and content of extracellular polymeric substances (EPS) were analysed in five sites along the main axis. In parallel, we tested the potential application of the Biolog EcoPlatesTM for analysing the heterotrophic functional diversity and compared the results between frozen (-80°C) and unfrozen sediment samples using this technique. Significant differences in functional diversity, bacterial density and EPS content were observed between sampling sites. Specifically, in the middle two points, a decrease in richness and metabolic capacity of the biofilm community was measured. These results could be linked to the occurrence of a flood before the sampling, which homogenized the epipsammic biofilm community along the river and diluted pollutant concentrations. This was especially observed at those sites submitted to urban and industrial point pollution at the mouth of the Llobregat. On the other hand we observed that some metabolic capacities of the community in the frozen samples were inhibited as shown by the reduction of positive wells when applying the Biolog Ecoplates. Therefore the use of this technique appears to be useful to define microbial functional response patterns in fresh environmental samples

O6

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EFFECTS OF LITTER QUALITY AND QUANTITY ON MICROBIAL COMMUNITY STRUCTURE, BIOMASS AND ENZYME ACTIVITIES DURING STREAM SUCCESSION

Changes in riparian vegetation during stream corridor succession can have profound effects on stream ecosystems. We hypothesized that the structure and activity of microbial communities (bacteria and fungi) establishing during different stages of succession depends on the quality and quantity of allochthonous litter inputs. To test for such effects, we used outdoor experimental stream channels stocked with leaf litter in varying qualities and quantities that reflect different stages of stream succession. Treatments were: 1) an open-land stage without any litter, 2) an early successional stage with grass litter (Calamagrostis epigejos), 3) a transitional grassland-forest stage with a mix of grass and birch tree litter (Betula pendula), 4) a young forest stage with birch litter only, and 5) a mature forest stage with 2.5 times the amount of birch litter stocked in the precedent treatment. Fungal biomass exceeded bacterial biomass on both litter types, but was absent in sediment and did not vary among treatments. Activities of carbon-acquiring enzymes (â-glucosidase, xylosidase and also chitinase) did not vary among litter treatments and were higher on grass than on tree litter. Lignin-degrading enzyme activities (phenol oxidase and peroxidase) were only detected in sediment, and peroxidase activity was more important in stream channels without tree litter. Activities of nitrogen- and phosphorus-acquiring enzymes (leucine-aminopeptidase and phosphatase) were decreased in sediment when tree litter was present. Bacterial community structure varied among treatments on the two litter types tested, and also in sediments. Fungal community structure also varied among litter treatments, but only on tree litter. Overall, these results reveal clear effects of litter quality on both microbial community structure and enzyme activities during stream ecosystem succession, and especially on activities related to nitrogen and phosphorus cycling.

O5

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PO4-UPTAKE AND RELEASE IN AGRICULTURAL HEADWATER STREAMS - IMPACTS ON STREAM RESTORATION

Due to intensive land use and agricultural management practices, headwater streams in north- eastern Austria are heavily impacted and degraded in terms of morphology, structure and nutrient cycling. In the current study, we identify relevant uptake mechanisms for PO43-, the limiting resource in these nitrogen enriched water bodies, with regard to whole stream uptake and the importance of uptake processes in comparison to oxic release from the sediments. We compared shaded natural and restored stream reaches to open degraded reaches concerning PO43- uptake and release on the choriotope and on the reach scale, in order to identify restoration measures capable of reducing PO43- in the stream water. Biological uptake, adsorption, and oxic release from the sediments were studied within lab experiments. Undisturbed sediment samples were taken to the lab and exposed to different nutrient concentrations in the overlying water column under light and dark conditions. We calculated uptake and release rates from changes of PO43- concentrations in the water after a defined time of exposition to the sediments. Whole reach PO4 uptake was determined using short term PO43-additions in natural, restored, and degraded stream sections. Reach-scale uptake rates were calculated from the decline of PO43- concentrations along the stream course via a first order nutrient uptake regression curve. PO43- uptake was dominated by autotrophs, and therefore highest in sediments of open stream reaches with high algal biomass. Adsorption processes were limited because of the already high nutrient loads in the sediment, and can be neglected in comparison to the high release rates from the sediments. PO43- uptake on the reach scale tended to be slightly higher in natural and restored stream sections but showed a high temporal and spatial variability among study reaches. The study shows that future restoration projects should focus on reducing phosphorous inputs via riparian buffer strip management.

SS13

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APPROACHING THE INTERACTION OF CLIMATE CHANGE AND INVASIVE SPECIES USING SPECIES DISTRIBUTION MODELS

Climate change and invasive species are acknowledged as two of the most important causes of biodiversity loss in freshwater ecosystems, and they are expected to cause major species extinctions in the near- and long-term future. Invasive species are more likely to adapt to changing climatic conditions than native species because they are usually abundant, tolerate a broad range of climatic conditions, cover wide geographic ranges and have highly competitive biological traits. However, few authors have identified specific consequences of climate change for invasive and native species simultaneously. In this study, we evaluate the joint threat posed by climate change and two invasive species (Dreissena polymorpha and Pacifastacus leniusculus) on the distribution of two endangered freshwater species (Pseudoanodonta complanata and Austropotamobius pallipes). To that end, species distribution models (SDMs) were calibrated with the species current distribution in Europe and projected onto current and future climatic scenarios. As a result, the 2050 scenario suggests that D. polymorpha will benefit from climate changes (+47% range size) moving its range of distribution up to 3¢ªN latitude, and spreading in Russia, Denmark or Norway. Accordingly, its overlap with the native P. complanata is predicted to increase (from 60 to 66%). In contrast to our predictions, the ranges of both P. leniusculus and A. pallipes are contracted ca. 20% under a climate change scenario, and their overlap decreases (from 70 to 65%). Areas showing an increasing climatic suitability for invasive species in the north of Europe should be monitored for early detection; whereas invasive species under decreasing climatic suitability in southern Europe may become more vulnerable to eradication plans. Results from this study provide important insights into the joint threat posed by climate change and invasive species on native species, and how SDMs can inform effective prevention of species invasion and conservation of native species over large-scales.

O5

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CLIMATE CHANGE SCENARIOS EFFECTS ANALYSES OVER THE RIPARIAN VEGETATION DYNAMICS IN A MEDITERRANEAN REACH (MIJARES RIVER, SPAIN)

Mediterranean rivers are considered among the most threatened environments by the climate change. Terde is a natural stretch located in the Mijares River (Spain) which has been considered as a representative study site to analyze the potential effects of climate change over the Mediterranean riparian vegetation. Two climate change scenarios were selected as the more probable pessimistic and optimistic emission scenarios for the 2070-2100 period, SRES A2 and SRES B2 respectively. The reference period (1960-1990) hydrometeorological series were adapted to consider the monthly variations expected by the HadCM3-PROMES regional climate model. The temperatures series were increased additively. Consequently, the input potential evapotranspiration was higher for the climate change scenarios. The precipitation and flow daily series were modified multiplicatively to obtain the scenarios required inputs, resulting on lower values for the flow series and precipitation series with no clear tendencies of increase or decrease comparing to the reference period data. Both the reference period and the climate change scenarios were analyzed with two different models. By the RibAV model, for riparian zonation analyses, we considered the evapotranspiration index to decide which plant functional type was simulated in each simulation point at the end of the analysed period. With the RIPFLOW model, for vegetation distribution in space and time analyses, we simulated the vegetation succession or retrogression in response of physical parameters. The results were coherent with both models, in terms of a relatively small impact and in the same direction. With the two climate change scenarios, the riparian area shows a decrease of the early succession phases, a major presence of gravel bars near the channel, an increase of older phases presence and a generalized reduction on evapotranspiration rates at the end of the period under climate change assumptions. These simulated trends were more pronounced in the worst scenario.

O7

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HIGH DIVERSITY AREAS OF CONTINENTAL ALGAE: THE CASE OF MURCIA, SOUTH-EAST OF SPAIN

HIGH DIVERSITY AREAS OF CONTINENTAL ALGAE: THE CASE OF MURCIA, SOUTH-EAST OF SPAIN MªEUGENIA GARCÍA-FERNÁNDEZ & MARINA ABOAL Laboratorio de Algología. Departamento de Biología Vegetal. Facultad de Biología. Universidad de Murcia. E-30100 Murcia. España. E-mail: mariaeugenia.garcia2@um.es; maboal@um.es

Despite their importance as refuges of biodiversity, semiarid regions have been scarcely studied. The province of Murcia, as part of the Mediterranean basin contains high biodiversity of plants but little is known of the continental algae. The goal of this study is to select areas of high diversity for algae in the province of Murcia. All published and unpublished data on macroalgae from Murcia province were compiled. Each locality was assigned 10x10 km UTM coordinates. A large variety of freshwater, brackish water and terrestrial environments were sampled: rivers, temporary streams and ponds, springs, reservoirs, salt pans, caves and reservoirs. The criteria used to identify high diversity areas were: taxa richness, rarity, vulnerability and a biodiversity index. The proportions of total, rare, and vulnerable taxa included within the first 10 grid cells of each criterion were studied. Pearson correlation analysis was also calculated to identify relationships between ranking procedures.

A total of 181 taxa of macroalgae and 69 grid cells were included in the analysis. The taxa richness criterion has the highest number of total taxa (151 taxa, 83.43%), while the biodiversity index includes the highest number of rare (28, 77.78%) and vulnerable (37, 86.05%) taxa. Twenty four high diversity areas have been selected, most of them belonging to freshwater systems. Although the province of Murcia is located in the most arid area of the European continent it presents high biodiversity of algae. Identifying areas with relevant features of biodiversity is useful to rank priorities and to optimize resource investment in conservation.

SS1

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PLANT COMMUNITIES OF AN EPHEMERAL STREAM IN THE AQUATIC-TERRESTRIAL TRANSITIONAL PHASE

One of the most common freshwater ecosystems, temporary streams, are still poorly understood. In order to decrease the knowledge gap on these systems, we analyzed the composition and pattern of plant communities along and across an ephemeral Mediterranean stream (Doñana Parks, SW Spain). Geomorphologic, hydrologic, edaphic and local radiation parameters were also studied. During the late Spring wet-dry interface, annual plant communities evidence the short-term processes governing the stream before the flooded areas have completely dried. Riparian forest, on the other hand, reflects long-term effects of the aquatic-terrestrial alternation. In these dual systems, where form and function are intrinsically related, the alternative functioning (high/low flows) present a carry-over effect over time that condition each other. Geomorphic processes are intense during the wet-phase, with widespread channel reshaping, sediment classification or bar creation. Run-off contribution from surrounding areas erodes margins, opens new tributaries and provides colonisable surfaces for other propagules, promoting lateral integration of plant communities. The decrease of flow during the transitional wet-dry phase promotes the deposit of finer fractions and the dispersion of seeds, roots and rhizomes, favouring plant integration along the stream. As flooding recedes, sucessional processes develop and competition structures annual-plant communities on the new surfaces while water availability becomes the main controlling factor. Light competition among different stratum is also noticeable. Geomorphologic processes are scarce during dry-phase, but water transport can continue below the streambed occasionally creating pipes that redistribute water, sediments and nutrients. Plant communities occupy lateral and longitudinal patches where substrate-type, flooding duration and access to summer edaphic water are different. Alpha diversity is low and cross-sectional beta diversity is high with a high spatial turnover. Desiccation of pools is slower and the anoxic sediment limits plant diversity to specialists. Finally, first autumn rainstorms can maintain "mixed" grasslands communities of xerophilous and hygrophilous species.

SS6

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EFFECTS OF HYDROLOGICAL ALTERATION ON IBERIAN FRESHWATER FISHES: WHAT DO WE KNOW?

Most rivers in the Iberian Peninsula suffer from severe hydrological alteration, due to the existence of many large dams and extensive water abstraction for agriculture. In this talk, we aim to demonstrate that the extent of hydrological alteration is poorly documented in the Iberian Peninsula (and likely elsewhere) and that the consequences of water abstraction on fish populations are largely unknown. The fish fauna of most Iberian streams is relatively poor in native species richness but rich in presence of endemisms, in particular cyprinids. However, many of these native species are strongly declining and officially endangered, although systematic and broad-scale description of this decline is poor, due to the lack of fish monitoring in most basins. Meanwhile, many exotic species have been introduced to the Iberian Peninsula and are thriving, particularly in lower reaches of large, regulated rivers. The role of hydrological alteration on this invasive success has long been suspected but has not been well documented so far. In a long-term ongoing study, we are monitoring the fish populations along the Tordera stream, a small Mediterranean stream which lacks large dams and weirs but suffers from severe water abstraction to the point that long stream stretches are generally dry during many weeks in summer, whereas hydrological models suggest that they should not be. Of course, this has profound implications in the whole ecosystem, in particular regarding fish, which nevertheless periodically recolonize the dry sites. These artificial droughts have been underestimated in bioassessment and implementation of the Water Framework Directive in Catalonia (and likely other Mediterranean regions) and need further study. Other large-scale unpublished data suggest that the alterations of hydrological regimes are not well represented in official river bioassessments and related databases, but may have effects on the presence, abundance and richness of native fishes.

O6

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IMPACT OF ATMOSPHERIC DEPOSITION ON THE PHYTOPLANKTON SIZE STRUCTURE IN A MESOTROPHIC MEDITERRANEAN RESERVOIR

The Mediterranean basin receives massive airborne plumes of Saharan dust under particular meteorological conditions mostly occurring during spring and summer. During stratification periods, limited run-off inputs into reservoirs make atmospheric loading to be relevant for plankton communities. Although there is a broad literature concerning biogeochemical responses of inland and marine waters to atmospheric deposition, scarce studies deal with its impact on the plankton size-structure. In order to clarify the significance of dust inputs on the plankton community, we conducted a multi-approach study in a strongly P-limited reservoir (Beznar, South Spain) by combining both field measurements and laboratory experiments. Correlation analysis using field data of nutrient (TP and TN) atmospheric deposition rates and total chlorophyll a concentrations in the upper layer at three different sampling locations along the reservoir have not shown any significant relationship. However, results from laboratory enrichment experiments with atmospheric dust have evidenced a notable increase in chlorophyll a concentrations in the pico-nanoplankton fraction (< 20 µm) while no effect was observed on the largest phytoplankton fractions.

O6

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POTENTIAL TO SIGNIFICANT N2O EMISSIONS FROM THE SEDIMENT OF A FREE WATER SURFACE CONSTRUCTED WETLAND

Nitrogen removal efficiency is a key aspect in the functioning of constructed wetlands (CW) as wastewater treatment systems. Net nitrogen loss is mainly carried out by microorganisms by means of nitrification and denitrification processes. However, incomplete denitrification may result in the emission of greenhouse gases such as nitrous oxide (N2O). Vegetation coverage ensures a good water restoration capacity mainly by the stimulation of the associated microbiota. Unfortunately, little is known about how vegetation affects the relative abundance of denitrifiers that may not complete the denitrification process in CWs. We determined the abundance of denitrifiers in relation to the presence or absence of Phragmites australis and Typha latifolia in sediments of the Empuriabrava free water surface CW (FWS-CW) collected at 4 dates. After DNA extraction, quantitative PCRs were performed for genes coding the 16S rRNA, nitrate reductases (narG and napA), nitrite reductases (nirS, nirK) and nitrous oxide reductases (nosZ). The presence and the type of vegetation were found minor factors controlling the abundance of all denitrifying genes, whereas the sampling period, mainly marked by the hydraulic retention time (HRT) and nutrient concentrations significantly affected some of the genes analyzed. Nitrate reducers were more abundant when low HRT values and high nitrate concentrations were recorded. Denitrifiers were clearly dominated by NirK-type bacteria, which were found almost 100 fold over the abundance of NirS-type. Interestingly, nosZ abundance was lower than the other denitrifying genes, especially during high HRT rates, indicating the relatively low abundance of bacteria able to complete the last reduction step in the denitrification process. This genetic potential for the accumulation of N2O was maintained throughout the year and must be taken into account in the use of future ecosystem services such as CWs.

O3

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SURVIVAL AND LENGTH EFFECTS OF AGROCHEMICAL BINARY MIXTURES ON BUFO BUFO LARVAE

Agrochemicals are used to improve agricultural production and to controll undesirable plants and animals. Effects of these chemical compounds in non-target organism are difficult to evaluate, among others causes, due to the chemical interactions and/or combinations that occurs in ecosystem. Amphibians epitomize the worldwide biodiversity loss, which has been named as the "sixth mass extinction". In addition, agrochemicals have been proposed as one of the major threat of these vertebrates. Ammonium nitrate, is one of the most commonly used fertilizers worldwide, and is known to produce negative effects on anuran tadpoles, including increased mortality, anatomical abnormalities and delayed growth and development. On the other hand, copper sulphate is used as fungicide during spring and autumn and also causes effects on survival, growth and development. Both chemicals co-occur in aquatic ecosystem where amphibian larvae are present. In this study Bufo bufo, a widespread European amphibian, was used in static toxicity tests under laboratory conditions. Effects on mortality and total length were analyzed under different combinations of both chemicals at sublethal concentrations. The concentrations used in this study are environmentally relevant, and occur in several wetlands where B. bufo larvae inhabit. Results showed that B. bufo larvae were high sensitive to this heavy metal exposure and sensitive to this fertilizer exposure. In addition, results obtained in binary mixtures show the complexity of the effects, that chemicals combinations generate on aquatic organism. Furthermore, different responses were found at different exposure time and at different chemical combinations of both chemicals in mortality and length. The results obtained in binary mixture tests show the complexity of the effects that chemical combinations generate on aquatic organism

SS2

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BIODIVERSITY IN MEDITERRANEAN TEMPORARY PONDS: CONTRASTING SPACE/TIME PATTERNS AMONG MULTIPLE ORGANISM-GROUPS

The effectiveness of surrogate taxonomic group approaches in addressing conservation programs and setting out priority areas for conservation has been widely debated in the last decades. In this sense we evaluated the congruence among spatial and temporal biodiversity patterns of five organism groups within the priority habitat 3170* Mediterranean Temporary Ponds (MTP). The three objectives of the study were: (1) to identify the main source of variability of the biodiversity of each group; (2) to compare the temporal patterns of biodiversity among groups; and (3) to test if exists a cross-taxon congruence in biodiversity parameters The five groups of organisms incorporated in this study (macrofaunal active and passive dispersers, microcrustaceans, macrophytes and microalgae) present different ability to respond to environmental changes and different dispersion capacity. The sampling was made simultaneously three times throughout the hydroperiod in six MTP located in Sardinia. The biodiversity parameters used in this study were: Species richness, Variation in taxonomic distinctness, Average taxonomic distinctness, Index of Faunal Originality, and Shannon-Wiener diversity. We performed a variation partitioning for each biodiversity parameter of each organism group in order to find its relationship with water, landscape and pond characteristics. We also compared the temporal variability of the biodiversity values for each group. Finally, we established the relationships among biodiversity parameters by means of a PCA analysis. Our results suggest a lower importance of landscape characteristics for active dispersers than for passive ones. Moreover, no variability explained by the pure effect of pond and landscape variables was observed for the macrofaunal active dispersers, whereas these two categories explained a significant proportion for the other groups.

SS12

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CONTRIBUTION OF MEIOFAUNA TO LOTIC FUNCTIONAL PROCESSES

Since the publication of the special issue in lotic meiofauna in 2000 in the Freshwater Biology journal, over 120 papers have focused on freshwater meiofauna. From these studies, 53 papers were conducted in lotic habitats, 32 were conducted in lentic habitats and one conducted in both systems. The others were experiments conducted in the laboratory, taxonomic studies, theoretical approaches and studies of hyporheic systems or caves. From all these studies, the 85% of the papers were published in journals with Impact factor and only the 15% were published in non-listed journals. The last paper of that special issue (Robertson et al. 2000) intended to resume the current knowledge of lotic meiofauna at that time, stressing the weak points that further research should strengthen. The final dissertation mainly concerned to the under-representation of manipulative experiments and studies of the influence of large scale processes on community assemblages. Following some of these proposals, we conducted several manipulative experiments in a 3rd-order Mediterranean forested stream, the Fuirosos (NE Spain). In all these experiments, hydrology was the most thriving factor affecting directly or indirectly the meiofaunal assemblages. Direct effects were assessed by means of resilience measures to floods and exploring their adaptative traits to hydrologic disturbances. Indirect effects of hydrology were concerned to food availability. The whole successional process of organic matter colonization was studied, including bacteria, fungi, protozoans, meiofauna and macroinvertebrates to track the fate of allochtonous Carbon though the stream compartments. The effects of a continuous nutrient addition were also assessed during a 2y period. Differences in the meiofaunal community were observed in terms of density and biomass. An increase of the secondary production of microcrustaceans was also attributed to the increased nutrient content. However, the high intraannual variability exhibited in the Mediterranean systems was also affecting since water scarcity increased nutrient impact on these communities.

O3

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INCREASING BIODIVERSITY BY RIVER RESTORATION – AN UNREALISTIC GOAL?

Introduction River restoration has absorbed substantial resources, often with the aim of increasing biodiversity by re-engineering the environment. Many restoration projects have lacked effective post-project monitoring and frequently there has been little or no pre-project survey or other adequate experimental control. Consequently it is often impossible to determine with certainty whether the presumed biodiversity benefit has been achieved. This paper examines the goals of restoration and the appropriate methods for monitoring outcomes. Methods A canalized section of the River Teifi (Wales) is the subject of a proposed restoration scheme. The results of a pre-restoration survey of the benthic invertebrates, and the existing literature on river canalization and restoration, are used to examine the expectations of benefits arising from the 're-meandering' of river channels. Results and Conclusions Analysis of the literature on the effects of canalization, and of the pre-restoration data from the Teifi, suggests that the assumption that species richness is adversely affected by canalization may be misplaced. This could be a significant contributory factor to the frequent inability to demonstrate biodiversity increases post-restoration. The Teifi shows clear differences between canalized and natural reaches, but these are not evident simply in species richness. Data from the Teifi also serve to illustrate the importance of data that are sufficiently extensive to identify confounding factors and to achieve adequate statistical power.

O6

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CHYTRID PARASITISM: A MISSING FACTOR INVOLVED IN THE DECLINE OF CYANOBACTERIAL BLOOMS

Freshwater ecosystems are submitted to anthropic forcing (e.g. nutrient increase) which leads to eutrophication and consequently increases cyanobacterial bloom events. These events have both socio-economic and environmental consequences. Currently, physico-chemical factors contributing to the development or to the decline of cyanobacterial blooms are perhaps well known, at least compared to biotic factors. Among these factors, the particular case of chytrid fungi mainly known as phytoplankton parasites in freshwater lakes has been ignored. The objective of the present study was to investigate the functional role of parasitic fungi (i.e. chytrids) in the decline of the autumnal bloom of the cyanobacteria Anabaena macrospora in the eutrophic Lake Aydat, Massif Central, France. We follow a complete cyanobacterial bloom event during two months, with high sampling resolution. Cyanobacterial dynamic, fungal diversity, and the prevalence and intensity of chytrid infections were investigated via epifluorescence microscopy. The main findings clearly have highlighted that, at the natural community level, a single cyanobacterial host species (Anabaena macrospora) can be parasitized by two different parasitic fungal species belonging to the same genus (Rizosiphon). One of these chytrids, R. crassum, was largely dominant. For the first time, the complete life cycle of this chytrid was described in a field study. We have shown that up to 30% of filaments in A. macrospora population were parasitized. Within filaments, 95% of vegetative or specialized cells could be affected by chytrids infection. Interestingly, the second chytrid species, R. akinetum, preferentially infected the resting spores (i.e. akinetes) of the host, despite its minor occurrence compared to R. crassum. Overall, we conclude that chytrid parasitism could weakened the trophic bottleneck from cyanobacterial blooms by transforming a significant part of these blooms into fungal zoospores, well known as an upgraded food source for zooplankton in aquatic ecosystems

SS10

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SPECIES INTERACTIONS AND LEAF DECOMPOSITION IN STREAMS: BJÖRN MALMQVIST'S UNIQUE CONTRIBUTIONS

In the late 1960s stream ecologists in North America rediscovered the importance of allochthonous organic matter for forested headwaters. This sparked interest in understanding detritus dynamics and the process of leaf litter decomposition in aquatic systems, and Björn Malmqvist was one of the pioneers of this new direction in Europe. Trained as a classic ecologist with a primary interest in fish populations, he and his colleagues published, in 1978, a remarkably complete study on stream organic matter dynamics which reflects a distinct ecosystem perspective. But it took Björn another 15 years before he made his first genuine contribution to understanding leaf decomposition. In combining his background in species interactions with the ecosystem perspective, he asked whether top-down effects of predators on stream detritivores could influence a critical ecosystem processes - the decomposition of leaf litter. The answer to this question is yes, as he showed in carefully conceived experiments involving a predator and detritivorous stoneflies feeding on leaves. Today these relationships would be called a trophic cascade. A shift in focus of this type of work from ecosystem effects of species interactions across trophic levels, to those within the detritivore guild, became one of the finest examples demonstrating unequivocal species diversity effects on an ecosystem process. Björn was also the first, with his collaborators, to counter spreading criticism of these so-called biodiversity-ecosystem functioning experiments by designing a clever study in which effects on decomposition were assessed under realistic scenarios of local species extinctions. These experiments showed that considering the sequence of species loss is essential when forecasting the ecosystem-level consequences of biodiversity loss. One of the next steps in this field is to increase realism further by combining the across and within trophic level interactions to assess functional consequences of changing biodiversity. Björn was keen on tackling this task.

SS15

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IS BENTHIC FAUNA RELEVANT TO ASSESS ECOLOGICAL QUALITY OF RESERVOIRS?

In order to define the ecological status of lentic ecosystems, the benthic fauna is one of the biological quality elements that are taken into consideration. In most of the cases, these communities are used to characterise hydromorphological alterations of the littoral zones of natural lakes as they well reflect local conditions. As a consequence, benthic macrofauna is generally considered as no relevant to assess ecological status of reservoirs when water level fluctuation occurred. However profundal macrobenthic fauna was also reported as a good indicator of the capacity of the lake in recycling the organic matter. Therefore this biological quality element can complete the diagnostic given by phytoplankton resulting in nutrient loading in the lakes. The aim of this work was to analyse the response of these oligochaeta communities to general degradation of French reservoirs. A modelling procedure is implemented in this study to analyse the relationship between taxa composition and abundance and pressures (agricultural or urban land cover, population density, nutrient concentrations…) for more than 100 French reservoirs. The first results of the underdevelopment tool will be presented. They highlight the interest of this biological quality element in bioindication of man made lakes.

O2

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BIOGEOGRAPHIC TOOLS FOR PROPOSING CONSERVATION AREAS FOR ZOOPLANKTON DIVERSITY: THE CASE OF THE ALTO GUADALQUIVIR REGION

Nowadays different processes linked to human activities such as habitat fragmentation and the alteration/destruction of ecosystems have triggered a decline in global diversity. Biogeography plays an important role in understanding species distribution patterns and implementing effective conservation techniques. The Mediterranean region has a biota with a complex biogeographical history, where dispersion and vicariance events act together. In this context, wetlands are special sites providing a variety of environmental conditions and ecological niches that can be occupied by a high taxonomic diversity. Zooplankton is one of the predominant groups in inland waters, and the knowledge of their diversity represents useful information for biogeographic studies, and so on recognizing and making proposals for protected areas based on scientific criteria. The Alto Guadalquivir region located in the southeast of the Iberian Peninsula has plenty of wetlands, which are characterized by high zooplankton species diversity. However, up to date, no biogeographical studies do exist. The aim of this study is to use two complementary approaches: cluster analysis and parsimony analysis of endemicity (PAE), using presence-absence data of branchiopods and copepods, in order to make a classification of the wetlands and to identify the phenomena that interfere with the distribution of species. Our results indicate the existence of three areas where dispersion phenomena have played an important role in the distribution of species. Based on our sectorizaction results, we propose conservation strategies for these ecosystems. The conservation proposal includes 98% of the total species present in the study region. Finally, we highlight the need for more detailed studies including other taxa to corroborate these protection areas.

O6

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EFFECTS OF PARTICLE TRAPPING ON THE DEVELOPMENT OF PHOTOTROPHIC BIOFILMS

Several authors have reported on the effects of siltation on benthic algae, the focus has been on the associated stressors such as light attenuation or nutrient enrichment. However, smothering and clogging with suspended particles also affect the physical structure of biofilms, and it is hypothesized, that this results in a decrease in the micro-niches in the spatial arrangement of biofilms, leading to a shift from a vertically organized community towards a uniform community dominated by a less diverse group of algal morphotypes. To test this hypothesis, this study investigated the effect of suspended particles using naturally colonized benthic algal communities from two different environments (turbid peatland ditches and clear rainwater fed ponds). These two communities were exposed to different concentrations (0, 200, 400 and 800 mg/L) of respectively peat particles and suspended clay during a five week laboratory experiment in specially constructed conical incubation vessels. Particle concentrations up to 400 mg/l had either no effect (turbid peatland community) or a positive effect (rainwater pond community) on algal biomass (estimated by chlorophyll a, cell abundance and algal coverage in the biofilms, for both organic and inorganic particles). However, the highest particle concentrations (800 mg/l) caused a decrease in algal density by 50-60%. Species diversity of green algae was negatively correlated to particle concentrations in both communities (respect. r2 = 0,94 and r2 = 0,60). Green algae species were the group most negatively affected, leading to the prominence of motile diatom morphotypes and cyanobacteria under high particle exposure. It is concluded that suspended particles interfere with the physical habitat of attached algae when trapped in biofilms, thus strongly modifying species composition of the algal community, and reducing diversity.

SS11

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THE EFFECT OF FLOW VARIABILITY ON THE SEDIMENT NUTRIENT DYNAMICS IN AN INTERMITTENT MEDITERRANEAN STREAM

A feature of Mediterranean and other arid and semi-arid streams is hydrological intermittency which is expected to increase by changes in the flow and flood regime induced by climate change and human uses. These hydrological conditions predispose entire stream channels or reaches to drought periods therefore, sediments in these systems may be exposed to desiccation periods. Although not widely studied, there are evidences that sediment drying influence on biogeochemical processes underlying ecosystem functioning. Intermittent streams are also characterized by a high degree of variability in both the drought frequency and drought period of the various morphological elements in the stream channel. In this study we quantified the effect of drought period on the sediment N and C availability at reach scale. We also analyzed differences in nutrient content between main channel sediments and point bar sediments within the same reach. For that, we compared two hydrologically different reaches from the same stream, a permanent vs temporal reach, from October 2009 to November 2010. We observed that drought increased the sediment nitrate concentration and decreased the sediment organic carbon concentrations. Changes in nutrient concentration during drought also affected distinctly to main channel sediments and point bar sediments. Both spatial scales (among reaches and within reaches) of differential drought pattern may generate a variable patchy distribution of nutrient "hot-spots" and "hot-moments" affecting in-stream processes after rewetting.

O3

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ONTOGENIC SHIFTS IN RNA:DNA RATIO IN FOURTH INSTAR LARVAE OF PRODIAMESA OLIVACEA (DIPTERA, CHIRONOMIDAE): IMPLICATIONS FOR ECOTOXICOLOGICAL ASSESSMENT.

Determination of RNA concentration or total RNA content is becoming increasingly common for assessing growth or even stress levels of an organism. The rationale for this association is that variations in growth rate or mechanisms needed to cope with stress are usually associated to an increase or decrease in protein synthesis. There is therefore a relation to ribosomal RNA, which comprises most of the total cellular RNA. Contrastingly, the amount of DNA per cell nucleus is almost constant. RNA levels may be then normalized through division with DNA concentration, indicating the level of metabolic activity. One of the problems for interpreting changes in RNA and DNA concentrations is the variability related to growth status and ontogenetic development, which may hamper their use in ecotoxicological assessment. The aim of this study was to follow RNA:DNA ratio dynamics during the ontogenetic development of fourth instar larvae of Prodiamesa olivacea (Diptera, Chironomidae). Samples were collected in 2011 in the Sar River (Galicia, NW Spain). To follow ontogenetic changes in RNA and DNA levels, thoracic imaginal discs were used to group larvae into five age groups: (i) recently moulted 4th instar larvae, (ii) early 4th instar larvae (iii) medium 4th instar larvae (iv) early prepupae and (v) late prepupae. Additionally we measured levels in pupae. RNA and DNA were extracted from the same sample using TRIzol® Reagent (Invitrogen). Extracts were measured with a Thermo NanoDrop 1000 after DNase and RNase digestion. RNA:DNA ratio shows a negative trend throughout the 4th instar until they enter the pupa phase, when RNA:DNA ratio increases slightly. This trend likely reflects the high protein synthesis rate both at early phases of the 4th instar and at the pupa phase, as well as the morphogenetic differentiation undergone.

O5

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CHANGES IN MOLECULAR SIZE DISTRIBUTION IN DISSOLVED ORGANIC MATTER IN A MEDITERRANEAN RIVER: STORM FLOW VS. BASE FLOW

Dissolved Organic Matter (DOM) in rivers is an heterogeneous mixture, within a chemical perspective, that plays a key role on ecosystem functioning of freshwater and marine ecosystems. One of the most diverse aspects of this "cocktail" is the molecular weight (MW) distribution of chromophoric and fluorophoric components of DOM. These optical properties are useful for proxy quality, source and potential fate of DOM. In the present study the High Performance Size Exclusion Chromatography (HPSEC) was used to perform a physical separation of DOM in function of its MW. A Mediterranean river (895 of km2 drainage area, 61.5 of km of river channel length) was sampled in its longitudinal continuum during storm flow and base flow conditions. On one hand, it has been evidenced that the chromophoric and fluorophoric components give complementary information about spatial variability. However, the extent to which this variability occurs depends largely on hydrological conditions. At storm flow conditions, DOM was clearly dominated by higher molecular weight fractions, indicating the prevalence o aromatic compounds with high carbon hydrophobic content (lo pongo?). By contrast, during base flow conditions chromatograms were more complexes acquiring relevance the small fraction of DOM.

SS3

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RIPARIAN CORRIDOR CHANGES IN THE GUADALETE RIVER (CÁDIZ, SOUTHERN SPAIN) AS A CONSEQUENCE OF FLOW REGULATION AND AGRICULTURE SOIL EROSION

Dimension and characteristics of the riparian corridor of Guadalete river downstream Arcos reservoir have been studied by comparison of 1956, 1984 and 2004 air-photographs series, in order to infer the morphological river trends along the last decades due to flow regulation and land-use changes. Several vegetation and geomorphic units have been distinguished within the riparian corridor, and their evolution together with several morphological variables have been studied in the aforementioned periods. A significant decrease of fluvial territory and the area of bare gravel bars is observed, with an important increase of the mature riparian forest area. Previous Salix formations mixed with Tamarix and Nerium oleander existing along the former gravel-bed dynamic river, have been substituted by vegetated strips dominated by Eucaliptus camaldulensis lining both sides of the actual muddy-bed, fixed channel. The analysis of flow records has shown the hydrological alteration, with special significance on the extreme values and their seasonality. Annual and intra-annual variability have dramatically decreased, with a significant reduction of the ordinary winter floods, meanwhile summer low flows have increased due to irrigation. The application of the "recruitment box model" within these hydrological alterations allows to understand this Eucaliptus invasion. The frequency reduction of floods with a relatively high sediment transport capacity together with the increase of sediment arrival at the channels from the erodible agricultural fields have resulted in a progressive reduction of the cross-section of the channel and its gradual stabilization, favoring the rapid growth of vegetation. These effects are largely responsible for river channel encroachment and reduction of its flood conveyance contributing to increase recent flooding damages. A watershed scale approach taking into account land use and water resources management is required for restoring the river corridor functioning, aimed to improving the interrelationships between flows, sediments and vegetation coping with actual human water demands.

SS13

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IDENTIFICATION OF THE LIMITING FACTORS TO FRESHWATER PEARL MUSSEL (MARGARITIFERA MARGARITIFERA) RECRUITMENT IN THE NORTH TYNE CATCHMENT, NORTH-EAST ENGLAND.

The freshwater pearl mussel (Margaritifera margaritifera) is endangered and declining throughout its entire range. On the rivers North Tyne and Rede, North-East England, the pearl mussel population has been estimated at approximately 50,000 individuals (2006) but shows little or no recruitment. The present study is aimed at 1) identifying the factors responsible for the lack of recruitment in the North Tyne/Rede population from historical flow, habitat, water quality data and from new data collected from fish and mussel surveys; 2) designing an evidence-based restoration plan to be implemented in the catchment. So far, analysis of historical data suggests that several factors may contribute to their decline, in particular: 1. Spates resulting from hydropower releases on the River North Tyne from Kielder Reservoir which increase shear stress and flush sediments and juvenile mussels downstream. 2. Lack or decline of suitable benthic habitat for mussels at all life stages. 3. Availability of potential fish hosts: Atlantic Salmon (Salmo salar) and /or brown trout (Salmo trutta). 4. Influences of land use changes over the past decades. This work emphasises the challenges faced when studying the linkages between environmental factors and the ecology of a species with a complex life cycle. It also highlights the need for a sustained, long term, corporate philosophy when assessing complex ecological changes.

SS10

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DOES STABLE TEMPERATURE FAVOR CONTINUOUS REPRODUCTION BY THEODOXUS FLUVIATILIS AND EXPLAIN ITS HIGH DENSITIES IN SOME KARSTIC SPRINGS?

Karstic springs have generally a distinctive invertebrate fauna. In Central Portugal Theodoxus fluviatilis is one of the most common invertebrate in these springs, but population rapidly decreases downstream. The objective of our study was to investigate the reason for such distribution. We found that the species was more abundant in cobble-boulder substrates than in finer substrates or on macrophytes. Densities ranged from up to ~ 9000 individuals m-2 in the spring to zero at 3800 m downstram. Water chemistry was virtually unchanged whithin this section and therefore densities of T. fluviatilis were not correlated with any of the measured physical and chemical parameters (Spearman rank correlation; $p>0.05$). In the spring the yearly temperature ranged from 15.3 to 16.6 and egg masses and juveniles were observed during all year. A population dynamics analysis did not revealle cohorts. The <0.1°C daily variation in the spring contrasted with the 5°C variation 900 m downstream. We propose that the high densities of T. fluviatilis in the studied spring are maintained by continuous recruitment, mediated by the constant high temperature.

SS11

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IMPROVING WATER DISSOLVED ORGANIC NITROGEN MEASUREMENT IN FRESHWATER SYSTEMS WITH HIGH INORGANIC NITROGEN CONCENTRATIONS: A COMPARISON OF DIALYSIS, ANION-EXCHANGE PRETREATMENT AND SIZE-EXCLUSION CHROMATOGRAPHY

In anthropogenically impacted freshwater systems with high nitrate or ammonium (dissolved inorganic nitrogen, DIN) concentrations, the measurement of dissolved organic nitrogen (DON) concentration is often associated with high analytical errors. The reason for this is that DON concentration is usually calculated as the difference between total dissolved nitrogen (TDN) and DIN. Hence, the accumulated measurement errors of DIN and TDN lead to high analytical errors of DON concentrations at high DIN:TDN ratios. We compared recovery rates and applicability of two pretreatment and one analytical method with the aim to increase DON measurement accuracy: Dialysis-pretreatment (DP), anion-exchange pretreatment (AEP) and size-exclusion chromatography (SEC). DP and AEP have already been proposed in the literature and are used to remove nitrate (AEP) or all DIN (DP) prior to measurement. For SEC, a SEC-column was coupled to an on-line nitrogen-detector. This approach allows for the direct measurement of the DON concentration, because DON is quantitatively separated from DIN prior to analysis by the SEC-column. With this method, we found high DON recovery rates for model substances and also natural samples with high DIN:TDN-ratios. DP was also removing DIN from natural samples with high DON recovery rates, but AEP resulted in low DON recovery rates due to irreversible binding of a part of the DON to the anion exchange resin. For one sample, SEC needs 2 hours including measurement, whereas DP needs a minimum of 48 hours after which the samples still need to be measured. On the other hand, SEC is much more expensive than DP. Hence, SEC and DP proved to be equally accurate alternatives for the measurement of DON at high DIN:TDN ratios with the SEC being less time consuming but more expensive.

SS6

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USE OF TWO-DIMENSIONAL HYDRAULIC MODELING TO ASSESS PASSAGE FLOW CONNECTIVITY FOR SALMON IN STREAMS

The maintenance of hydrologic connectivity in river networks has become an important principle for guiding management and conservation planning for threatened salmon populations, yet our understanding of how fish movement is impaired by spatial and temporal variation in connectivity remains limited. In this study, a two-dimensional hydraulic modeling approach is introduced to evaluate flow connectivity in relation to passage requirements of adult steelhead trout (Oncorhynchus mykiss) in coastal California streams. High-resolution topographic data of stream reaches with distinct channel morphology were collected by terrestrial LiDAR surveys and linked with water surface measurements to calibrate hydraulic model simulations. Quantitative metrics of longitudinal flow connectivity were developed to assess fish passage suitability in relation to stream discharge. Measured flow data from the 2008-09 winter season and simulated long-term records indicated that suitable passage flows occur with relatively low frequency and duration at all sites, suggesting that instream flow protections for fish passage are warranted. Results from the hydraulic modeling simulations were compared to two alternative methods for assessing passage flows. A regional formula used by the State of California to identify minimum instream flow needs provided conservative estimates of passage flow requirements, while an approach based on riffle crest water depths substantially underestimated flow needs. The hydraulic modeling approach employed in this study may be particularly useful for testing the assumptions behind alternative environmental-flow assessment methods and for evaluating habitat-flow relationships in stream reaches of particular importance, such as critical habitat for threatened species.

SS10

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FOREST-STREAM LINKAGES: THE RESPONSE OF BROWN TROUT TO WOODY DEBRIS AND TERRESTRIAL INVERTEBRATE INPUTS

In small forested streams, the diet and growth of brown trout is expected to be affected by the surrounding forest, both through the forest's effect on instream habitat structure and on prey availability. In this presentation we focus on trout responses to woody debris and terrestrial invertebrates, two factors influenced by riparian zone structure, potentially affecting brown trout (Salmo trutta), both directly and indirectly. Using a combination of laboratory and field experiments, we examined the effects of woody debris and terrestrial invertebrates on prey availability and on the growth rates, diets and behavior of different size-classes of trout. The field experiments showed that addition of high densities of large wood affected trout growth in a positive way. This positive effect of large wood on trout growth may be related to prey abundance, as indicated by the high standing crop of aquatic macroinvertebrates on the wood. The positive effects may also be related to decreased energy expenditures by the trout, as trout increased their feeding efficiency and decreased their swimming activity and level of aggression as wood densities were increased in a laboratory experiment. Terrestrial invertebrates are generally assumed to be a high quality prey resource for fish, and our field experiments showed that reduction of terrestrial invertebrate inputs had a negative effect on trout growth. The availability of terrestrial prey in the stream was also coupled to trout diet and linked to growth, as fish with high growth rates had high proportions of terrestrial prey in their diets. Many of our results were also dependent on fish-size and the effects on growth were generally stronger and more consistent for large trout.

SS11

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STORMWATER NUTRIENTS IN URBAN CATCHMENTS: ARE DESIGNED ECOSYSTEMS EFFICIENT IN NUTRIENT RETENTION?

Urban landscapes, in which land cover, hydrologic flowpaths, nutrient loads, and capacity for nutrient retention are altered, are poorly understood in terms of their potential for nutrient retention. We established a network of stormwater monitoring sites in hierarchically nested catchments of Scottsdale, Arizona that vary in size from 5 to 17,000 ha and feature different stormwater infrastructure designs. Complete sampling through storm hydrographs of autumn (monsoon) and winter (frontal storm) events in 2010-2011 allowed us to examine changes transport of dissolved nitrogen (N), phosphorus (P), and organic carbon (DOC) through each event and as a function of size and infrastructure. Although particulate nutrient forms dominated transport, concentrations of dissolved N and P species and DOC were often high. Among catchments, those with infrastructure designs that favored hydrological retention (i.e., dry retention basins) had higher concentrations than those that were highly connected (street drainage, or street-pipe infrastructure), likely because the latter flowed more often and nutrient accumulation between storms was consequently lower. Most sites showed clockwise hysteresis, indicating that nutrients were flushed from the catchments over the course of the events, but hydrologically retentive catchments exhibited counter-clockwise hysteresis, suggesting they were transport-limited rather than supply-limited. Changes in speciation of dissolved nitrogen through events hinted that nutrient processing in the catchment may have been stimulated by rainfall, leading to increases in nitrate (nitrification) or decreases in organic nitrogen (mineralization). Overall, infrastructure had minor but detectable influences on dissolved nutrient transport. Washes, the most recent design for handling stormwater in neighborhoods, were not discernibly different than street-pipe infrastructure. This suggests that these designed ecosystems have a limited capacity for nutrient retention, despite similarity in appearance to non-urban desert washes. Thus, we caution that design of urban stormwater infrastructure should be evaluated for its efficacy in nutrient retention as well as hydrologic modulation.

O7

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MACROINVERTEBRATE BIODIVERSITY IN SPAIN'S MOUNTAIN NATIONAL PARKS: PATTERNS AND SURROGATES

Introduction The study was conducted in 6 Mountain Parks (Cabañeros, Sierra Nevada, Monfragüe, Picos de Europa, Aigüestortes, Ordesa) belonging to the Spanish National Park Network. This study aims i) to inventory the macroinvertebrate families inhabiting the aquatic ecosystems of each National Park; ii) to determine what environmental variables shape the macroinvertebrate composition and richness patterns; iii) to identify the best taxonomic surrogate of aquatic biodiversity. Materials and methods Sampling were carried out in 81 sites, in summer (2008, 2009, 2010) and following a standardized protocol. Macroinvertebrates were identified at family level. Multivariate techniques (nMDS, DistLM, GLM) were applied to recognise what environmental factors address the macroinvertebrate composition and richness patterns. Then, the indicator value of each macroinvertebrate Order was investigated by examining the degree to which their family richness patterns was correlated with other groups (using Spearman's correlation). Results The 6 Parks together are able to contain 93 taxa. The National Parks showing the highest richness were Picos de Europa and Cabañeros (both with 73 taxa) while the lowest richness was observed in Aigüestortes (44 taxa). Results showed that maximum altitude and the presence of lotic against lentic habitats were the most important factors shaping community. In addition, the best richness models included the presence of lotic habitat and the percentage of dryland in the basin area of each sampling station. Coleoptera family richness showed the highest correlation with the other taxonomic groups. Conclusions The 6 Parks together embraced 68% of the taxa displayed in the checklist of the IBMWP biological index despite of not consider macroinvertebrate within the current criteria for National Parks design. The high diversity found in some Parks is probably results from the wider aquatic habitat heterogeneity of medium altitude mountains in comparison to high mountain zones. Finally, we suggest the use of Coleoptera families as aquatic biodiversity surrogate in the mountain National Parks.

O2

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NESTEDNESS PATTERNS IN AQUATIC MACROINVERTEBRATES UNDER ANTHROPOGENIC AND NATURAL STRESSORS

Streams are subjected to a wide range of natural and anthropogenic stressors that affect their richness and community composition. In some cases, marked nesting develops along disturbance gradients in which communities are reduced to nested subsets of those at richer sites. Here, we test the hypothesis that natural (altitude and salinity) and anthropogenic stressors (pH and metals) have similar effects on taxon richness and nestedness at different taxonomic levels. We investigated four datasets respectively from different altitudes (350 to 4695 m), salinity (16 to 315,200 uS cm-1), pH (4.9 to 7.8) and metal concentration (Copper 0.0007 to 0.8384 mg L-1) along which macroinvertebrates were collected using a multi-habitat protocol and identified to the lowest taxonomic level possible. Generalised linear models were then used assess variations in richness along each putative stressor. Nestedness in species composition was assessed using a metric based in species presence/absence (NODFc) for the maximally packed and stressor-ordered matrices. Richness at different taxonomic levels decreased in similar ways with increasing stressor intensity and on both natural and anthropogenic stressors. However, there were contrasts in nestedness. A high degree of species nestedness for the maximal packed matrices occurred along pH (NODFc=62.3) and metal gradients (63.3), but nesting effects were less for salinity (15.2). When sites were ordered by the stressor, lower values of nestedness were observed for pH (NODFc=45.9), metals (38.1) and salinity (9.9). These data suggest that anthropogenic stressors reduce richness and cause nesting by affecting non-tolerant species. In contrast, gradients in salinity appear to cause a higher species turnover due to the occurrence of habitat specialists which reduce nesting. We suggest that natural stressed ecosystems contribute to global biodiversity, while anthropogenic stressors might reduce it through risks to sensitive species.

O7

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LONG DISTANCES DISPERSAL IN MACROINVERTEBRATES AS A PREREQUISITE OF CLIMATE CHANGE DRIVEN RANGE SHIFTS AND RECOLONIZATION OF RESTORED RIVERS

Climate change driven range shifts or the recolonization of restored habitats can only be realized by organisms with a sufficient dispersal capacity. Several studies consider short distance dispersal, whereas our knowledge about long distance dispersal of hololimnic and merolimnic macroinvertebrates is scarce. This is mainly due to a growing "dilution effect" with increasing distance. To overcome this dilution effect, we present the results from three complementary approaches: 1) data mining, 2) a literature review on macroinvertebrate dispersal, and 3) population genetics. Dispersal strategies were categorized in active and passive, and sub-classified in aquatic, aerial, and terrestrial. We further distinguished between within-stream and between-stream dispersal and also assessed the speed of dispersal by providing dispersal distances in kilometer per year. All three approaches provide relatively short distances for hololimnic taxa and aquatic larvae of merolimnic taxa. Even adults of winged merolimnic taxa usually only move short to intermediate distances, although there are a few reports of occasional historical or recent long-distance dispersal. The results thus support the idea that the spread of, and quick recolonization by, macroinvertebrates usually is limited by their dispersal capability in addition to potential habitat filters in restored sites. Dispersal limitations can be overcome by using aquatic, aerial, or terrestrial vectors (passive dispersal). Our results point to the need of advanced river restoration strategies that integrate and facilitate landscape-wide networks. Concerning climate change our data could be used in advanced species distribution modeling (SDM) to improve our knowledge on climate change driven macroinvertebrate range shifts.

O8

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PATTERNS OF AEROBIC RESPIRATION IN STREAMS QUANTIFIED USING THE SMART TRACER RESAZURIN

We have developed resazurin ('Raz') as a smart tracer for use in streams for the purpose of quantifying patterns of aerobic respiration. Raz is a metabolically active phenoxazine compound that undergoes an irreversible reaction to resorufin in the presence of cells that are respiring aerobically. Both Raz and resorufin are fluorescent and easily measured at concentrations well below 10 ug/L. The rate of the reaction is related to the rate of respiration, and therefore concentration measurements in streams can be used to quantify respiration patterns. Results to date indicate that Raz is feasible to use as a tracer in streams. We will provide several examples where Raz has been deployed in streams, and we will highlight findings of this work that would be difficult to obtain via other methods.

SS3

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LINKING HABITATS TO INVERTEBRATES IN RIVERS: BIOLOGICAL TRAITS, TAXONOMIC COMPOSITION AND DIVERSITY

River monitoring in Europe has a long tradition in assessing environmental quality with macroinvertebrates communities. This approach, however, generally lack in mechanistic understanding, predictive ability and geographic coverage. A promising alternative is the use of species life-history traits. Both perspectives however generally rely on the time consuming identification of taxa. It has long been suggested that river biotopes (habitats associated with species assemblages) may provide a link between the ecology of macroinvertebrates and river hydro-morphology. The species trait approach offers a new perspective on which to apply this concept across broad geographical areas. Here we used macroinvertebrate data collected in 512 patches from 13 river biotopes among seven least impacted lowland rivers in England and Wales to test whether river biotopes are better predictors of macroinvertebrate trait profiles than taxonomic composition (genera, families, Orders) among rivers, independently of the phylogenetic effects and catchment scale characteristics (i.e. hydrology, geography and land cover). We also tested whether species richness and diversity differ more among 'habitats' than among rivers. River biotopes explained 40% of the variance in macroinvertebrate trait profiles across the lowland rivers largely independently of catchment characteristics, although there was a strong phylogenetic signature. River biotopes had better predictive power (50%) in macroinvertebrate trait profiles than in taxonomic composition across rivers whatever the taxonomic resolution. River biotopes explained better species richness and diversity among 'habitats' (40%) than among rivers (10%). Detailed trait-biotope associations were also congruent with independent a priori predictions linking ecology to hydro-morphology. Hence species traits provided a much needed mechanistic understanding and predictive ability across a broad geographical area. We show that the integration of the multiple biological trait approach with river biotopes at the interface between ecology and hydro-morphology provides a wealth of new information and applications for river science and management.

SS3

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A LONGER-TERM VIEW OF STREAMBED DISTURBANCE CAUSED BY FLOODS

Flood characteristics control the frequency, spatial extent, and depth of streambed disturbance, defining the total amount of the channel that can potentially serve as refugia. This research quantifies streambed disturbance over an extended flood sequence that affects many generations of the stream community. Field observations come from Carnation Creek, a small gravel-bed river located on Vancouver Island, Canada, that supports several species of salmonids. Streambed disturbance was documented by monitoring the three-dimensional positions of magnetically tagged gravels over 200 floods and producing cellular maps of disturbance frequency, intensity, and depth within a GIS. The streambed exhibits a range of frequencies, intensities, and depths of disturbance as expected. The most frequently disturbed areas make up about 1% of the streambed and tend to be located near the channel thalweg. Undisturbed areas that persist over the flood sequence constitute about 30% of the bed, with their position corresponding with channel bars that make up the higher portions of the bed morphology. Within the active portion of the bed, disturbance is generally of low intensity over the vast majority of the bed, but maximum depths of disturbance still exceed 10 cm over most of the bed. Disturbance derives not only from scour but also from fill. Results suggest that the natural variability of floods may help structure stream communities over longer time scales.

O1

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IMPACT OF FISH PREDATION ON THE BEHAVIOUR OF INVERTEBRATES AND THE STRUCTURE OF A NATURAL BENTHIC COMMUNITY

The importance of fish predation for the structure of natural benthic communities is still discussed because results of predation experiments seem inconsistent. To enhance the transferability of the experiment results to natural ecosystems large scale experiments are needed. Therefore a paired ecosystem experiment using two 2nd order mountain streams following the BACI design (Before-After-Control-Impact)was performed. Both streams were stocked with two benthivorous fish species (Gobio gobio and Barbatula barbatula) for two years. To analyse the effect of fish predation, the differences between the two streams concerning benthic invertebrates and periphyton were measured and compared between the two phases. Benthivorous fish seemed to affect the structure of the benthic community by changing biomasses and behavioural aspects (e.g. drift activity, life cycle traits) of some invertberate species within different functional groups between the two experimental phases. In addition,, the periphyton biomass significantly increased in the presence of fish whereas total biomass of invertebrates did not change. Possible causes for the functional changes are discussed.

SS5

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CONTRASTING RESPONSES OF NANO AND PICOPLANKTON COMMUNITIES TO UVR AND P- INPUTS IN A MID-ALTITUDE LAGOONS OF MEDITARREANEAN REGION.

Because algae live at the interface between the abiotic and biotic compartments of ecosystems, changes in abiotic factors are the primary drivers of potential alterations in photosynthetic activity, PP, algal-specific composition, and total biomass. UVR and pollution by nutrients are the most important global change stressors. The net effect of these stressors might have non-additive impacts on algal community. Our aim was to evaluate how two stressors with "a priori" opposing effects (negative UVR and positive P-input) affect the competition between nanoplankton and autotrophic picoplankton (APP) communities in a clear mid-altitude aquatic ecosystem. We applied a full factorial 2x2 design using 12 mesocosms (600 L). Six enclosures received full solar radiation (UVR treatment) and the other six received only photosynthetically active radiation (PAR treatment); half of the mesoscosms (3 UVR-transparent and 3 screened) received a nutrient addition to achieve 30µg P l-1 concentration maintaining a molar N:P ratio of ∼30. The response of these two autotrophic assemblages against UVR and P-pulse was markedly different both short and mid-term scale although significant interactive UVRxP effects were only found at mid-term scale for both communities. UVRxP interaction was synergistic for nanoplankton, i.e P-enrichment unmasked UVR damaging effect; and antagonistic for APP, i.e. P-enrichment reduced negative UVR effect. Nanoplankton abundance was 2.7 times higher at PAR+P than at UVR+P, and two orders of magnitude higher at P-enriched treatments than control treatments. In contrast, for APP UVR exerted an inhibitory effect (APP abundance was three times lower at UVR) at control treatments, while inhibitory UVR effect disappeared at P-enriched treatments and APP abundance increased two orders of magnitude. We will discuss these contrasting responses of autotrophic communities on base of their different ability to store nutrients and their sensitivity to UVR. We propose a potential model of light-nutrient modulating competitive interaction and structuring algal community in the framework of global change.

SS10

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BENTHIC INVERTEBRATES IN ISLAND STREAMS — OF VALUE FOR ECOLOGY AND ECOLOGISTS?

Exploring stream invertebrates on ("real") islands offers a surprisingly vast number of ecological issues to be addressed, as the publications reviewed here show. However, no examples, trends or results are presented in this abstract. Of all a possible topics, an immediate interest of lotic invertebrates in streams would be to illustrate the classical island biogeography, primarily in the form where each stream is viewed as an island, and patterns are for several reasons certainly more pronounced if the streams are located on an island. A wider perspective within the same theme is to view a number of islands, each with its lotic species list. Considering the species-poor end of such a gradient, the faunal setup is frequently reported to be due to that islands exhibit more or less extreme environments. Such conditions might shape the often less complex food chains/webs in island streams, giving release of other and unexpected niche function and behavior patterns, revealing the supposed general mechanisms in the "normal" situation with a more saturated fauna web. It seems that tropical sites have been especially attractive for studies in this respect, and these phenomena can explain the strange distributional patterns shown by organisms occurring on islands. As islands are often susceptible to anthropogenic threats as high water usage and diversion, drought, deforestation and aliens, and if the island(s) are also remote and harbor endemic species, there is a clear need of a more worldwide focus on biodiversity and nature conservation problems regarding stream invertebrates on islands.

SS2

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EFFECTS OF DEWATERING / INUNDATION CYCLES OF SEDIMENTS FROM AN ARTIFICIAL TEMPORARY WETLAND ON MICROBIAL COMMUNITIES

Temporary wetlands are dynamic ecosystems exposed to drying/wetting cycles. These cycles induce biogeochemical hot moments in surface sediments characterized by variations of nutrients variability and hydrology (inundation / dewatering of sediments and variations of moisture content during dewatering). Microbial communities residing in sediments of temporary wetlands are thus exposed to extreme environmental changes. Here we explore the microbial responses to immersion, emersion and drying events. For this aim, superficial sediments (2 mm) from an artificial wetland were sampled daily over a ten-days period. Experiments were carried out in autumn 2009 and winter 2010. The microbial dynamics observed during the two campaigns were very similar. The total numbers of microbial cells were significantly influenced by the drying/wetting cycles. Systematically, bacterial numbers increased during inundation and decreased during dewatering events. Cyanobacterial and eukaryotic algae increased during dewatering periods, which is opposite to the trend observed for bacteria. During inundation, the algal numbers remained systematically stable whereas no clear trend was observed for cyanobacteria. In parallel, our results highlighted a significant relation between microbial cell numbers and concentrations of inorganic nutrients in sediments. Bacterial numbers were positively related to phosphate concentrations, suggesting that the response of bacteria to drying/wetting cycles could be explained both by a direct influence of hydrolic variations or by an indirect influence via the variations of phosphate concentrations. Algal and cyanobacterial numbers were related to ammonium concentrations. Systematically, a strong development of phototrophic microorganisms was observed during dewatering phases when ammonium concentrations decreased, suggesting that ammonium is potentially toxic at high concentrations. Contrary to microbial cell numbers, enzymatic activities were not significantly related to hydrologic variables. These variables appear more responsive to nutrient concentrations or microbial cell numbers. Hence, phosphatase activity was significantly correlated with phosphate concentrations whereas leucine aminopeptidase and urease were significantly correlated to bacterial cell numbers, suggesting that the drying/wetting cycles influence these enzymatic activities indirectly.

O10

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INFLUENCE OF TEMPERATURE ON FOOD WEBS IN TEMPERATE STREAMS: A STABLE ISOTOPE STUDY

Trophic interactions are essential to address functional biodiversity. Concerning stream ecosystems, three major non-exclusive hypotheses are put forward to explain variations of food web organisation and complexity; i.e. ecosystem size, energy supply and environmental stability. Recent studies have confirmed that environmental stability plays a key role in determining food web structure, addressing this issue in terms of discharge variation or river bed stability. Here, we report on how thermal conditions and stability influence food webs of temperate streams, a question poorly dealt with until now. Using nitrogen and carbon stable isotope analyses we studied food webs across a hydro-geological gradient (from spring-fed to runoff-dominated systems) in five sites located in five different streams of one small watershed (Bez River Basin, France, 275 km²). This ensured that the studied sites were quite homogenous concerning most environmental conditions (climate, land use, river morphology, composition of invertebrates and fish communities) while exhibiting large discrepancies in terms of thermal patterns (annual temperature range varied from 6 to 20 °C between sites). Our results suggested that despite these significant thermal differences the general structure of the food webs was very similar between sites. On the other hand, the food chain length (FCL) increased significantly from 3.4 (at a runoff-dominated site with high temperature variability) to 3.8 (at a spring-fed site with narrow temperature range). In addition to previous studies, which focus on discharge variations, this result provides a thermal evidence for the positive influence of environmental stability on FCL. Further work is still needed to understand the underlying mechanisms that explain the link between temperature stability and FCL increase. However, these results provide a first insight into the potential impact of global warming on ecosystem functioning, as climate change is likely to increase the temperature variability of numerous temperate streams.

SS10

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BJÖRN MALMQVIST - MASTER FRESHWATER ECOLOGIST

This will be a brief summing up of Björn Malmqvist's many contributions to freshwater ecology. I will try to reflect on themes presented by his collaborators earlier in the session, and present my own perspectives on Björn's work and its influence in the wider field. His contributions are many and I cannot be exhaustive, but I will try to pick out major works and highlights, and aspects (such as Björn's mastery of natural history) that made his work so distinctive.

O5

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SEASONAL VARIATION IN THE EFFECT OF RESUSPENSION AND DENITRIFICATION ON TN TO TP RATIO

Nitrogen (N) to phosphorus (P) ratio in water varies over the growth season especially in eutrophicated lakes. Low N to P ratio favors cyanobacteria since, unlike other algae, they are able to use also molecular N as a nutrient source. The variation of total nitrogen (TN) to total phosphorus (TP) ratio is regulated by internal and external loading as well as processes that remove nutrients. The effect of resuspension on TN to TP ratio as well as on concentrations of total and dissolved N and P were studied experimentally in May, August and November during the open water season in 2009 at Lake Kirkkojärvi. Resuspension was conducted in three open columns in situ and denitrification rate and potential were measured using Isotope Pairing Technique to reveal the role of N removal on the N to P ratio. Resuspension lowered the TN to TP ratio and the effect was independent of the season. Resuspension increased TN and TP concentrations in every experiment and increased also dissolved nutrient concentrations: NOx- (nitrite + nitrate) and soluble reactive phosphorus (SRP) in May and August, ammonium in August and November. Denitrification rate was at its highest in May. The denitrification potential, however, was at its highest in August, when denitrification was limited by the low availability of NOx- . Denitrification during the open water season was so intense that it affected the N to P ratio in the water also directly and not only by lowering the ratio in the sediment prone to resuspension.

SS15

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SPATIAL EXPANSION OF AN INVASIVE SPECIES BY WIND-DRIVEN CURRENTS.

Since its initial introduction in Washington State along the Columbia River in the late 1930s, the invasive freshwater bivalve Corbicula fluminea (Asian clam) has spread in the US rapidly and extensively. Its economic and ecologic effects makes it the most important aquatic non-indigenous aquatic animal in N. America. Nowadays, it has been found in water bodies of 38 states. It was first observed at Lake Tahoe in very low numbers in 2002, but its population has apparently increased to a level where it is now having apparent environmental impacts. Its current known distribution (area ~1 million m2) along the southeast shore is changing due to its rapid growth rate and ability to colonize in the abundant sandy bottom. Asian clam has both pelagic and benthic life stages, enabling it to spread long distances by boats and lake currents and locally by diffusive growth. Management concerns for Lake Tahoe and surrounding water bodies are focused on the effective in-lake control of Asian clam as well as the prevention of future introduction and establishment of invasive species (i.e. the zebra mussel). This information is intended to advance the scientific literature in invasion biology and to assist managers in developing a management plan for Asian clam in Lake Tahoe. Our ultimate goal is to develop a long-term risk assessment of Asian clam growth, spread and impact. In this work we focus on understanding the role of lake currents in the transport of larval/juvenile stages to other locations in the lake. A high-resolution transport model of Lake Tahoe is used to simulate the pathways of clam young life stages of from the existing beds to other near-shore areas, and the environmental conditions that larvae are subject to as they travel around the lake.

O5

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REGIME SHIFT IN A LARGE RIVER: TOP-DOWN VERSUS BOTTOM-UP EFFECTS

The lower Ebro River (Catalonia, Spain) has recently undergone a regime shift from a phytoplankton-dominated to a macrophyte-dominated system. This shift is well known in shallow lakes but apparently it has never been documented in rivers. Two initial hypotheses to explain the collapse of the phytoplankton and the spread of macrophytes were considered: a) the oligotrophication due to the diminution of phosphorus (bottom-up); b) the colonisation of the zebra mussel (top-down). Data on water quality, hydrology and biological communities (phytoplankton, macrophytes and zebra mussel) was obtained both from existing data sets and new surveys. Results clearly indicate that the decrease in phosphorus is the main cause of a dramatic decrease in chlorophyll and large increase in water transparency, triggering the subsequent colonisation of macrophytes in the river bed. A Generalized Linear Model analysis showed that the decrease in dissolved phosphorus had a relative importance 14 times higher than the increase in zebra mussel density to explain the variation of total chlorophyll. The present study is apparently the first documented case in a river of a regime shift from a phytoplankton-dominated to a macrophyte-dominated ecosystem. This regime shift is triggering remarkable changes in the biological communities beyond the decrease of phytoplankton and the proliferation of macrophytes, such as massive colonization of Simulidae (black fly) and other changes in the benthic invertebrate communities that are currently investigated.

SS3

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CHANNEL ADJUSTMENT RESPONSE TO HYDROPOWER STATIONS IN A MEANDERING RIVER, THE LOWER REACH OF ARAGON RIVER

In the last decades several hydropower stations have been established along the meandering planform of the lower reaches of Arga and Aragon rivers. Those hydropower plants cut the meanders by means of a weir and an artificial channel through their neck, damming the water and sediments upstream the weir, diverting water by the artificial channel and flowing all the water downstream in the natural channel. This supposes the change of the hydromorphological conditions in the three reaches, leading to imbalances in the morphogenetic processes with changes in water discharge, sediment transport and slope. Thus the channel shows different geomorphological adjustments according to the different conditions given upstream, within the short-circuited reach and downstream the hydropower station. In addition riparian vegetation communities have been adapted also to these new conditions. In order to analyse the responses of the channel a study of the evolution of the channel planform, and of the lateral and vertical dynamics has been done, using GIS tools, analysis of the hydropower station's construction projects and the ancient documentation, and direct topographical measurements in the field. In addition a study of the bedload transport has been done by means of granulometrical analyses. The results show the differences of the adjustments in each meander, depending on the time since the hydropower station was established and on the characteristics of the weir. Besides an accumulative impact has been noticed as the effects of each one is adding downstream.

SS6

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FISH RESPONSE TO NATURAL DISTURBANCE IN AN INTERMITTENT MEDITERRANEAN STREAM: THE IMPORTANCE OF SUMMER REFUGIA FOR FISH POPULATIONS PERSISTENCE

Natural disturbance is a well known structuring factor of freshwater fish communities. This factor is particularly important in intermittent streams where the water scarcity during the summer period causes the decay of environmental conditions, severely affecting fish assemblages. In order to evaluate the magnitude of these changes and identify the main drivers involved, fish assemblages and environmental conditions were monitored in a Portuguese intermittent Mediterranean stream, upstream a small mesotrophic reservoir, during four consecutive years (2007 to 2010) from late Spring to early Autumn. Throughout the study period, a significant variability was observed both in environmental conditions and in fish assemblage composition and structure, in response to different hydrological conditions; 2006/2007 and 2009/2010 were regular and wet years while 2007/2008 and 2008/2009 were dry. Stream bed dried up from 50% to 100%. Fish abundance was significantly lower in dry years, representing less than 10% of fish density in the other years. Data analysis point out the importance of variables such as longitudinal location, water depth and aquatic cover explaining fish spatial distribution on the dry-stream pools formed during the summer. General pattern of fish dynamics is determined by the flow regime along the year and the amount of available aquatic habitats within the stream reach. When the flow ceases and water availability recedes, there is a progressive fish deflating due to fish migration, particularly the larger specimens, to the downstream reservoir. As a consequence, the proportion of small specimens and tolerant species, namely non-native species, such as pumpkinseed sunfish and crayfish, increase within the stream-reach. Although fish assemblages changed dramatically in dry years, the stream connectivity with the downstream reservoir allowed the maintenance of native fish populations within this river network and minimized the effects of dry years, due to the role of the reservoir as a summer refugia.

O5

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CLADOCERA AND COPEPODA SPECIES DIVERSITY PATTERNS ACROSS CONNECTIVITY GRADIENT IN THE DANUBE FLOODPLAIN AREA (SLOVAK-HUNGARIAN STRETCH).

The relationship between hydrological connectivity and species diversity patterns of cladocerans and copepods was investigated in the by-passed Danube section and in the adjacent water bodies on the left-bank of the floodplain (r. km 1840.5 – 1804) in Slovakia. A great variety of human activities has led to the longitudinal and lateral fragmentation of Danube river system. The structure of Cladocera and Copepoda assemblages in the by-passed Danube section and in the adjacent floodplain water bodies has changed after the Gabèíkovo hydropower plant was put into operation. Great changes have been observed in the previous parapotamal side arm, artificially fed with water from the head-race canal. The dominance of tychoplanktonic (benthic and phytophilous) species has increased, while the typical euplanktonic species have disappeared. The species richness increased with the decrease of lateral connectivity of floodplain area. The Cladocera community was chosen to describe species associations representative of all types of floodplain water bodies along the gradient of hydrological connectivity. Although cladocerans are not listed as an indicator group in the WFD in Europe, this group was considered in approach because of its relevance for assessing the ecological integrity of river-floodplain system. Following the long term-ecological research we tried to describe the Cladocera species habitat preferences numerically: indication weights have been allocated to each species and consequently the valency point distributions were based on available data. Beside ecological survey, DNA barcoding for chosen Cladocera and Copepoda species, collected from the study area, was promoted. These data, together with future outputs from other molecular analyses, will be used for development of economic and reliable determination technology of animal species using DNA samples. This contribution/publication 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.

I09

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PHYTOPLANKTON GROWTH IN THREE RIVERS – THE ROLE OF MEROPLANKTON AND THE BENTHIC RETENTION HYPOTHESIS

We analyzed long-term (5 to 8 years) hourly time series of chlorophyll converted from fluorescence measurements (Chl) in relation to discharge and light in three medium- to large-size rivers, where planktonic diatoms dominated during the growing season. Overall, there was an inverse relationship between discharge and Chl. At fine temporal scales, flow pulses were typically accompanied by an increase in diatom-Chl. In contrast, chlorophytes were usually diluted. The increase in diatoms was likely due to resuspension of meroplanktonic species from the bottom. The benthic retention hypothesis proposes that rapidly sedimenting diatoms take advantage of a prolonged benthic residence provided that the enhanced retention is sufficient to compensate for slower light-supported growth at the bottom relative to water. This hypothesis was tested by simple growth models. Although the rivers were highly turbid and did not support net growth when flow exceeded a rather low threshold, benthic retention might have favored low-light adapted algae during more than half of the period when net growth was possible. Among the physical factors, the rate of resuspension might be the critical factor that determines the ultimate success of a meroplanktonic life cycle strategy. The three rivers of this study rarely supported persistent planktonic populations. We propose that self-sustaining populations of riverine algae are primarily based on meroplanktonic diatom species, while truly planktonic populations, mostly chlorophytes, depend on periodic inoculations from out-of-channel sources.

SS5

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WAVES OF INVADERS: COMMUNITY AND ECOSYSTEM LEVEL IMPACTS OF MULTIPLE INVASIVE SPECIES

Biological invasions are a significant component of human-induced global change, with major implications for ecosystem structure and processes. Many aquatic ecosystems sustain several invasive species and little attention has been paid to interactions among them. Crayfish are common and especially destructive invaders in freshwaters that can have impacts from the individual level through to the ecosystem level. There are six species of invasive crayfish in the United Kingdom, four of which are present in the Thames catchment. We use a combination of field surveys and controlled experimental work to investigate the impact of multiple crayfish invasions on ecosystem structure and processes and trophic interactions. We aimed to examine if interactions among synergistic invasive crayfish species led to amplification or moderation of their impact at the ecosystem level compared to their allopatric counterparts. All four species of invasive crayfish present in the Thames catchment significantly altered aspects of ecosystem structure and functioning. Invertebrate community structure was altered by all crayfish species in both allopatric and sympatric conditions but to different degrees. These changes in the invertebrate community subsequently impacted ecosystem processes, including algal standing stock and decomposition rates, via a number of trophic cascades. Crayfish are generalist omnivores but our results indicated that species differ in their preference for animal or plant material which resulted in major variation in their overall impact at the ecosystem level. Our results suggest that interactions between sympatric invaders can synergistically alter their impact at the community and ecosystem level. Invasive species ecology tends to focus on the impact of a single invader; however our results indicate that co-existing invaders need to be considered for their full impact to be appreciated.

SS13

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LONG TERM ECOLOGICAL RESEARCH IN A RIVER AND FLOODPLAIN ECOSYSTEM: THE RHINE-MAIN-OBSERVATORY

There is a growing awareness that long-term ecological research is one of the key issues in ecology. However, long-term data over a time period of 10 or more years are scarce. This is especially true regarding riverine ecosystems. The Rhine-Main-Observatory (RMO) in central Germany is one of the few long-term ecological research sites focusing on a river and floodplain ecosystem. It belongs to the international Long Term Ecological Research (LTER) network and is also member of the GEO BON (Group on Earth Observation Biodiversity Observation Network) working groups of freshwater ecosystem change and terrestrial species monitoring. The established monitoring design of the RMO allows studying river and floodplain changes separately but also their interaction. In a regular stratified monitoring scheme key organism groups like benthic invertebrates, carabids, spiders, birds and floodplain vegetation are investigated. Additionally, we gather information from other monitoring programs within the RMO from water and conservation authorities about aquatic macrophytes, fish and mammals. For abiotic parameters various physical and chemical parameters are permanently measured using data logger. Recently, a hydrological catchment and hydrodynamic reach model was set up to investigate the interactions of river and floodplain ecosystems. The comprehensive monitoring of different aquatic and terrestrial organism groups in the RMO, together with several abiotic parameters, including catchment based high resolution hydrological and hydrodynamic models allow for an exceptional possibility for assessing the impacts of global change and anthropogenic pressures on freshwater and floodplain ecosystems.

SS1

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EVALUATION OF THE EFFECT OF EXTREME EVENTS (DROUGHT AND / OR FLOOD) IN THE STRUCTURE OF BENTHIC MACROINVERTEBRATE COMMUNITY OF THE POÇO NEGRO CREEK (PORTUGAL)

The benthic macroinvertebrate community consisted of a group of organisms that have a wide variety of anatomical, physiological and ecological. This diversity allows them to colonize all types of aquatic ecosystems and makes them one of the most popular indicators of biological quality of water through the use of a large number of methodologies since the use of diversity indices and richness to methods based on the structure of the communities. One of the main factors that affect the structure of benthic macroinvertebrate communities are the changes on the flow patterns induced by climatic changes or by human action. Thus, the purpose of this study is to evaluate the effect of extreme events (droughts and / or filled) in the structure of benthic macroinvertebrate communities of a section of the Poço Negro creek, a small water course in the North of Portugal. The present study compared results of benthic macroinvertebrate samples collected conducted prior to the total dry of watercourse with samples taken after the first rainfall along two years.

O1

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THE EFFECT OF SMALL-SCALE TURBULENCE ON REFUGE USE OF CHAOBORUS FLAVICANS

Turbulence has been denoted as a key driver in increasing predator-prey encounter rates especially among planktonic organisms. Chaoborus larvae are known to conduct light- and predation-induced migration and spend the daytime in dark water layers. The effect of small-scale turbulence on refuge use of Chaoborus flavicans fourth instar larvae was tested in laboratory experiments. The experiments were conducted in a 200 L aquarium where 200 individuals of C. flavicans larvae were placed. Two different light treatments were tested: completely dark, and either end of the aquarium darkened as a refuge. Seven different root-mean-square turbulence levels ranging from 0.5 to 14.0 cm/s were generated by a computer-controlled submersible pump. The threshold level that prevented the chaoborids from using their refuge was found to be between RMS-turbulence levels 1.4-2.6 cm/s. When the RMS-velocities were lower than the swimming speed of Chaoborus larvae, the larvae could resist the flow. In RMS-velocities higher than 2.6 cm/s the dissipation rate of turbulent energy exceeded 0.008 W m^3. In nature high wind velocities can produce similar dissipation rates in the water column. Climate models predict increasing wind velocities which can lead to increasing turbulence levels. In such cases chaoborids would probably have to migrate deeper to benefit from their dark refuge.

SS10

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SPATIAL CONGRUENCY OF STREAM ASSEMBLAGES AND DISTURBANCE

Understanding patterns in taxonomic congruency and the importance of environmental variables as drivers of these patterns is a prerequisite for analyzing changes in regional species pools and, in particular, for determining how human-induced disturbance affects these changes. Here the spatial correspondence of benthic diatoms, invertebrates, macrophytes and fish assemblages in 35 lowland European streams was studied using multivariate (constrained ordination) and univariate (abundance, diversity) analyses to determine how environmental and biological variables related to these patterns. Partial redundancy analyses showed that composition of other taxonomic groups was generally a better predictor of assemblage diversity than interactions with environmental variables (c. 12- 34% of the variance in diversity was explained by one or more of the remaining three taxonomic groups. Abundance, taxon richness, Shannon diversity, evenness, taxonomic distinctness, and assemblage composition (1st and 2nd axes of NMDS) were related to groups with high and low resource levels. Macrophyte and benthic diatom assemblages showed the strongest response to resources (only evenness did not change), although the direction of change was asymmetrical (diatom richness decreased, macrophyte richness increased). Fish diversity was also related to resource level (only changes in abundance and evenness were not significant). By contrast, none of the invertebrate metrics showed a significant response. Ordination confirmed shifts in diversity with resource level; all four taxonomic groups differed (ANOSIM, $p < 0.05$).

O5

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INCREASES IN LAKE PHYTOPLANKTON BIOMASS CAUSED BY FUTURE CLIMATE-DRIVEN CHANGES TO SEASONAL RIVER FLOW

Brief Introduction For the many lakes world-wide with short residence times future changes in river flow could affect phytoplankton biomass. Understanding this process is particularly relevant as climate-driven changes to river flow are predicted to vary substantially around the globe. Materials and Methods We have studied an eutrophic lake in the north-west of England with an annual residence time averaging about 20 days. By taking 32 years of hydrological flow data for the lake and scaling this flow data both up and down for each year we have modelled the effects of changing river flow on phytoplankton biomass in the lake, using the phytoplankton model, PROTECH. We have performed a further suite of modelling using predictions of river flow change in the north-west of England derived from future climate change scenarios. Results The impact on biomass is shown to depend on the seasonal flow changes rather than the annual flow changes. Furthermore, there is a qualitative difference in impact depending on whether the nutrient loading to the lake comes principally from flow-independent sources, such as point or internal sources, or from flow-dependent sources such as diffuse pollution. Predicted summer increases in phytoplankton biomass may be as high as 70 %. Conclusions Phytoplankton biomass may increase substantially in short-residence time lakes as a result of climate-driven changes to river flow, in addition to any changes owing to warming effects or eutrophication. In areas of the world where river flow is predicted to decrease even more in the summer than in the UK these changes may be extremely large.

O10

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LARGE SCALE MANIPULATIONS OF A QUANTIFIED FOOD WEB

Food webs, illustrating who eats whom, are one of the central concepts in ecology. Several workers have suggested that the structure of un-weighted links alone tells little about the outcome of a perturbation of one species for the population dynamics of the other species within the food web. We measured the strength of interactions among the species of a small stream in a number of different ways through direct observation of gut contents (e.g. per capita consumption rate, proportion of production, biomass flux) and estimated the flux of nutrients (Nitrogen and Phosphorus) through the food web. We then undertook two large scale manipulations. The first manipulation involved doubling the density of top predators (by reintroducing Atlantic salmon) and following the consequences for one year. Six months after the salmon smolts had migrated to sea the rate of supply of autochthonous resources was doubled (by removing 75% of the tree canopy) and the consequences followed for a further year. The effects of these top-down and bottom-up manipulations are compared.

SS10

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EFFECTS OF LARGE-RIVER REGULATION ON EMERGENT AQUATIC INSECTS AND TERRESTRIAL CONSUMERS

Regulation of large rivers transforms free-flowing stretches, and in some cases entire river systems, into habitats without the structural complexity and natural dynamics that river organisms have adapted to. It has been shown that river regulation in general have negative effects on aquatic insects, but despite a growing number of studies showing that emergent aquatic insects are important for riparian consumers, few have considered potential large-scale impacts of river regulation also on terrestrial consumers. In this study, we used seven large rivers in Sweden and one in Finland. Four of these rivers are since a few decades strongly affected by dams and flow regulation and four are free flowing. At each river, three sites with similar vegetation structure and landscape characteristics were selected in the adjacent near-riparian upland forest. Sites along free-flowing rivers were adjacent to rapids, while sites at regulated rivers were adjacent to former rapids. At each site, emerged aquatic insects and terrestrial invertebrates were collected every two weeks over one summer, to compare quantitative differences in these between regulated and free-flowing rivers. We found significantly lower biomass of emergent aquatic insects along the regulated rivers than at the free-flowing rivers. Likewise, the biomass of several terrestrial invertebrate groups, and of total terrestrial invertebrate biomass, was lower along regulated rivers. Emergent aquatic insect biomass explained significant amounts of the variance in several terrestrial invertebrate groups, indicating some aquatic-insect dependence in these. However, also ant biomass influenced terrestrial invertebrates - presumably through both positive and negative interactions. Thus, our results suggest that river regulation have persisting impacts on invertebrate communities also in the near-riparian upland forest, through effects on both emergent aquatic insects and terrestrial species interactions, and thereby highlight the need to consider effects on terrestrial systems beyond the riparian zone when assessing impacts of river regulation.

SS3

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SCALE MATTERS – THE INFLUENCE OF LOCAL HYDROMORPHOLOGICAL ALTERATIONS AND ANTHROPOGENIC STRESSORS AT LARGER SPATIAL SCALES ON THE ECOLOGICAL STATUS OF CENTRAL EUROPEAN RIVERS

In the last decades, water quality has substantially been improved but many Central European rivers are still affected by hydromorphological alterations. Therefore, many restoration measures were implemented to improve river hydromorphology. However, monitoring results show that many reach-scale restoration projects only had a minor effect on biota. It has been widely stated that this may be due to stressors at larger spatial scales which limit the effect of local restoration measures. The objectives of the two studies that will be presented were: to (i) identify the local hydromorphological features which most strongly influence biota at the reach scale, (ii) assess the importance of reach-scale hydromorphology compared to stressors at larger spatial scales, and (iii) identify limiting factors and thresholds for invertebrate colonization. The results indicate that: (i) At the reach scale, fish are most strongly influenced by channel-bank conditions and invertebrates by the naturalness of channel-planform. (ii) The river network just up to the next dam or weir has a larger influence on fish and the upstream river network including impounded reaches on macroinvertebrates. (iii) Fish respond equally to anthropogenic stressors at the reach and larger scales, whereas anthropogenic stressors at larger spatial scales have an overriding effect on the ecological status of macroinvertebrates. (iv) Besides water pollution, urban land use in the upstream catchment limits invertebrate colonization, although samples affected by saprobic pollution were excluded in this second data set. The thresholds derived using quantile regression and Threshold Indicator Taxa Analysis (TITAN) differ, which is attributed to the different focus of the methods on (i) the threshold for a single, aggregated response variable (metric), which includes both, the negative response of sensitive taxa and the positive response of tolerant taxa, and hence, rather reflects ecosystem functioning, and (ii) the community threshold of sensitive taxa based on taxon-specific responses, which seems to be best suited for species conservation issues.

O10

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CAN DIETARY FATTY ACIDS PREDICT FATTY ACID PROFILES IN AQUATIC CONSUMERS? – SCRUTINIZING FATTY ACID RETENTION OF ORGANISMS AT VARIOUS TROPHIC LEVELS

Trophic transfer of lipids, in particular their polyunsaturated fatty acids (PUFA), has crucial implications for somatic growth, reproduction, and overall health of aquatic consumers. Animals depend on dietary supply of omega-3 or -6 PUFA as they cannot synthesize them de novo. We examined results from freshwater field and lab studies that identified predator-prey relationships and the flow of PUFA from lower to higher trophic levels. Dietary PUFA flow across the plant-animal interface was most efficient in both lake and fluvial systems, whereas fish (cyprinids and salmonids) retained the omega-3 PUFA docosahexaenoic acid (DHA) most efficiently, even if dietary DHA supply was minimal. We show lab evidence that the herbivorous consumer Daphnia switches its PUFA profile when exposed to changing dietary supply, yet retains the PUFA eicosapentaenoic (EPA) and arachidonic (ARA) acid very efficiently even if those were not provided by food. Moreover, when feeding on PUFA-poor food, cyprinids showed enzymatic conversion of PUFA via enhanced hepatocytic desaturase and elongase activities. These results suggest that freshwater zooplankton and fish have a strong innate ability to convert dietary precursors into target PUFA that are required for their somatic needs. We conclude that freshwater consumers depend on dietary PUFA supply, yet are able to selectively retain specific PUFA. Thus, our results suggest that single dietary PUFA are poor predictors for their retention in many freshwater consumers.

SS6

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COMPETITIVE INTERACTIONS FOR LIMITED FOOD RESOURCES BETWEEN ALIEN RACER GOBY NEOGOBIUS GYMNOTRACHELUS AND NATIVE BULLHEAD COTTUS GOBIO UNDER LABORATORY CONDITIONS

Racer goby is one of the Ponto-Caspian gobiids that have been dispersing in European rivers in recent decades. The invasion of these fish may threaten a native, ecologically similar species, the bullhead. The declines of bullhead in Europe have been reported recently, coinciding with Gobiidae invasions, but no studies have demonstrated any particular adverse impacts of invading gobiids on the cottid species. We have examined behavioural interactions between racer goby and bullhead in a shared space with a limited food resource to determine whether the invading species is a stronger competitor and could displace the native species from their feeding grounds. Before the tests, the fish were habituated to eat from tray feeders in aquaria. Trials were conducted with single specimens of both species, exposed in the presence of two shelters and a single feeder, under 12:12 photoperiod. Food (living Chironomidae larvae), was applied below the satiation level to the feeder every 12 hours during 24 hours of exposure, in lighted conditions and in darkness. Interactions between fish were recorded using video cameras under infrared illumination. We have been noted the results of aggression events and the time spent in the feeder by foraging specimens. We can conclude tentatively that the invasive racer goby had negative effect on the native bullhead. Overall, they exhibited aggressive behaviour towards the bullhead, forced them from the feeders and outcompeted them for food. This suggests that in the field racer goby could displace bullhead from their optimum habitats to the areas that are less suitable with regard to food conditions.

O3

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INFLUENCE OF HYDROLOGIC VARIATION TO THE ECOLOGICAL STATUS OF MEDITERRANEAN STREAMS RECEIVING ORGANIC WASTEWATERS

Introduction Olive mill wastewater (OMW) is one of the major and most challenging organic pollutants in olive oil production countries and may cause severe adverse effects when discharged in receiving waterways. The influence of hydrologic variability (i.e. permanent vs. intermittent) to the ecological status of streams receiving OMW and its interaction with the self-purification capacity of such streams was evaluated. Methods and Materials Eight sampling sites of different typological character (i.e. mountainous vs. lowland; permanent vs. intermittent) were selected upstream and downstream the outflow of olive oil mills and biotic (macroinvertebrates) and abiotic (physicochemical, hydromorphological) data were monitored for two years. Results The results of this study revealed the spatial and temporal structural deterioration of the aquatic community due to OMW pollution with consequent reduction of the river capacity for reducing the effects of polluting substances through internal mechanisms of self-purification. Streams receiving OMW varied from moderate to bad ecological status according to stream typology. Effects were more pronounced at lowland intermittent streams, while the typology (i.e. slope, altitude) and hydrology of the stream site (i.e. perennial or intermittent) and the intensity and volume of the wastewater were the most important determinants of self-purification processes as showed by multivariate analysis. Conclusions As OMW are usually being discharged in small size streams that are not considered in the Water Framework Directive 2000/60/EC, there is a need for including of such systems into monitoring and assessment schemes as they may significantly contribute to the pollution load of the river basin. Since intermittent streams are highly vulnerable to pollution, special attention is required for their protection and management.

SS6

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FISH ASSEMBLAGES TRIENNIAL RESPONSE TO A SEVERE HYDROLOGICAL STRESS ON A MEDITERRANEAN RIVER (EVROTAS)

Introduction The Evrotas, once a perennial river, has changed in recent decades into intermittent due to unsustainable rates of water extraction. We examined the severity and spatial extent of summer drought and the associated impacts on fish communities, and we studied critical processes of the community recovery process. Materials and Methods The wetted and desiccated segments of the river during low-flow conditions were mapped through the use of GPS coordinates. Fish were sampled by electrofishing in 30 sites visited regularly over a three-year period (2007-2009). Fish abundance (areal densities) and relative species composition were compared along spatial and temporal axes to determine drought and post-drought impacts of droughts. The velocity and completeness of the recovery process was studied through comparisons of four fish community/population attributes in preselected intermitted and perennial reaches or with pre-drought periods. Results Severe discharge reduction in 2007 and 2008 due to reduced precipitation and extensive water abstraction led to the complete desiccation of the main river stem in about 80 % of its length. The spatial pattern of desiccation was similar in the two years and led to massive fish kills and altered abundance and fish community structure. Post-drought recovery began through recolonisation from unaffected reaches and was slow in winter but became increasingly rapid in summer following fish reproduction in spring. Different community attributes (species richness, abundance, etc.) were restored at different rates. Full recovery was not attained by the end of the investigation period. Conclusions The fish fauna of the Evrotas River appears to be fairly resilient to drought, provided that recolonization opportunities from refugial populations exist and there are no barriers to impede migration or larval drift. Both conditions hold for the main river stem but not for the tributaries that have almost entirely lost their fish fauna a few decades ago.

I09

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CAN WE PREDICT NITROGEN LIMITATION IN STREAMS AND RIVERS?

Over the last decades, human activities have greatly altered global nitrogen fluxes. Because nitrogen is an essential nutrient, increases in its availability may have important consequences for ecosystems. Until recently, the ecological role of anthropogenic nitrogen in freshwaters has been underestimated by the scientific community because of the long-standing paradigm that phosphorus is the primary limiting nutrient in these ecosystems. However, recent studies have shown that nitrogen can be important in limiting productivity in lakes and rivers, and suggest the need for a new framework of nutrient limitation that considers both nitrogen and phosphorus. We reviewed experiments assessing nutrient limitation of periphyton in streams and rivers to understand how frequent is N-limitation, and what circumstances may promote it. We used a meta-analysis and a vote-counting approach to test the hypotheses that N limitation occurs where (1) the concentration of dissolved inorganic nitrogen (DIN) in the water is below a saturation threshold, and (2) the water nitrogen-to-phosphorus ratio (N:P) is below an optimal value for algal growth. Our results show that nitrogen frequently limits periphyton biomass (potentially 39% of the streams studied, at least seasonally). N-limitation is predicted by both DIN concentration and N:P molar ratio, with N:P ratio playing a major role. With N pollution expected to increase globally, models developed in our analysis can help predicting some of the potential effects on running-water ecosystems.

SS5

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NITROGEN AND CARBON INTERACTIONS BETWEEN BOREAL SOILS AND LAKES

We used a large data set on nitrogen (N) and carbon (C) from Swedish boreal soils and lake waters to investigate N and C interactions between soils and lake waters. We found a significant relation between gridded C:N ratios of the organic soil layer and the ones of lake waters. We also found evidence of N deposition having depressed the C:N ratios of lake waters more than the ones of organic soil layers. In lake waters N strongly increased toward southern Sweden, mainly in the form of nitrate]nitrogen (NO3−]N) which we primarily attribute to an increased NO3−]N input from the boreal soils into the lakes. In contrast to N we found a much weaker direct relationship for C between soils and lake waters over Sweden. Instead, lake C was strongly related to lake morphometry and catchment characteristics. Our results indicate that large]scale variations in soil C content are not directly linked to C concentrations in lake waters, whereas soil N seems to leach in small amounts from the soils directly into the lakes in form of NO3−]N. Such differences in N and C interactions between soils and lake waters give important insights into the global biogeochemical cycling of N and C.

O4

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PONTO-CASPIAN GAMMARIDS INDUCE BEHAVIOURAL CHANGES IN ZEBRA MUSSEL DREISENA POLYMORPHA

Several gammarid species, co-occurring with zebra mussels in the Ponto-Caspian region and in areas invaded by these taxa, exhibit active preferences for habitats formed by this bivalve. No information has been available so far on the potential reverse relationship between them, i.e. whether mussels are affected by gammarids crawling among their shells. To check this, we studied the impact of a gammarid Dikerogammarus villosus on zebra mussel behaviour in laboratory. We exposed mussels in three treatments: (1) gammarids moving freely among the mussels, (2) gammarids separated from the mussels by mesh and (3) no gammarids. We measured mussel attachment strength, vertical displacement and aggregation level. In the direct presence of gammarids, mussels attached more strongly to substratum and reduced their upward movement. Their aggregation level remained unchanged. Mussels separated from gammarids by mesh did not change their behaviour. This suggests that mussels responded to mechanical irritation by gammarids. To confirm this hypothesis, we ran another experiment following the same protocol, but with gammarids replaced by a single Corydoras paleatus, a non-predatory South American catfish. As mussels have never contacted this species in nature, we assumed that their responses would be related to mechanical irritation only. Mussel responses to fish were similar to those induced by gammarids, though somewhat stronger, probably due to the larger fish size. In addition to changes in attachment and locomotion, mussels were also more aggregated. Mechanically irritated mussels modified their behaviour accordingly. Similar behavioural changes were previously observed in mussels exposed to molluscivorous roach. Stronger attachment and reduction of upward movement seem to be defence responses, increasing mussel safety by strengthening their connection with substratum and keeping them near the bottom, less exposed to various environmental dangers. This study was supported by Polish Ministry of Science and Higher Education Grant N N304 3930 38.

SS8

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GENETIC STRUCTURE OF BROWN TROUT IN CENTRAL EUROPE IS STRONGLY AFFECTED BY STOCKING WITH HATCHERY-REARED FISH

The genetic structure of 25 wild populations and five hatchery stocks of the brown trout Salmo trutta L. from Czech Republic and Slovakia were analysed based on mitochondrial (control region) and nuclear DNA (microsatellites, LDH-C1*) markers. The results were compared with those of previous studies from neighbouring countries. An extensive introgression of the Atlantic brown trout into the Danube basin was detected. Introgression in the opposite direction was also detected. Stocking practices have caused a massive replacement of Danube-basin populations in the eastern part of Czech Republic. Populations in Slovakia are result of strong hybridisation between the Atlantic and Danubian brown trout. Substantial differences in haplotype, allele frequencies, and genetic diversity were found across the Central Europe. Differences in stocking management and origin of breeding stocks appear to be crucial factors for the spatial variability of the genetic structure of brown trout in the Central Europe. This contribution was supported by the Biodiversity Research Center (LC06073), the Academy of Sciences of the Czech Republic (project No. 1QS500450513) and the Research & Development Operational Programme funded by the ERDF (ITMS: 26240220049).

SS13

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EVALUATION OF HISTORICAL ANTHROPOGENIC PRESSURE ON LAKE ECOSYSTEMS BY USING SEDIMENT CORE ANALYSIS

Lake sediments can be regarded as archives where past information on ecosystem conditions and processes are stored. Analysis of sediment cores can give additional information about long-term changes of aquatic ecosystem, water quality and when the major disturbances have been started. The aim of this study is to evaluate changes in lake ecosystem and possible anthropogenic pressures during the last 200 years. 53-60 cm long sediment cores were taken from the middle part of the Lakes Sventes, Râznas and Engures by using ordinary gravity corer with Plexiglas tube. The cores were sliced into 1 cm thick layers. Content of moisture, organic matter, carbonates, nutrients, heavy metals, diatom composition was determined in each layer. Every second layer was dated using 210Pb. Additionally water samples were taken from depth of 0.5m and hypolimnion for general water chemistry. The studied lakes are considered as mesotrophic lakes. There have been observed variation of organic matter content and phosphorus concentrations in sediment cores. Hypoxic conditions are observed in the deepest places of the Lake Sventes during the summer and winter as well as in shallow lagoon type Lake Engures during winter. These conditions can favour phosphorous release from sediments to water column. Concentrations of heavy metals in general are very low or low. In general, higher content of heavy metals is detected in upper layers of sediments indicating on anthropogenic impact. In the Lake Svente, for some elements such as Zn, Pb or Fe, concentrations have been doubled in the upper part of sediments till depth of 13 cm.

SS15

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TESTING THE TAXONOMIC COMPOSITION MACROPHYTE METRICS FOR ASSESSMENT OF EUTROPHICATION – SEARCHING FOR AN INTERCALIBRATION COMMON METRIC

Introduction According to the requirements of WFD Annex V, taxonomic composition of macrophytes should be considered, supplementary to abundance, in ecological state assessment. Due to variability of geographical conditions the use of indices elaborated at a national level for any international comparisons may be very limited. Thus, a need for a more universal metric appeared. In this study different macrophyte metrics on taxonomic composition were tested against water quality gradient to determine their usefulness for detecting eutrophication in different GIGs, countries and lake types and to indicate the best responding metrics to be further used for intercalibration of existing national methods. Materials and methods Based on biological data from over 1500 lake-years from 12 countries three groups of macrophyte metrics on taxonomic composition (indices based on trophic scores, on species richness and on proportion of functional groups) were tested against mean seasonal concentration of total phosphorus (pressure proxy). The values of Pearson's correlation coefficient $R>0.55$ and Spearman's correlation coefficient $RSp>0.60$ were assumed as a threshold to accept a metric as a well performing one. Results and conclusions The best performing were two metrics based on trophic scores (in a pool of all the lakes the correlation coefficient $R=0.72$ and $R=0.68$). Additionally, these metrics met the threshold value $R>0.55$ in a majority of countries and lake types. Therefore, they can be recommended in many countries and lakes types as common metrics for intercalibration purposes. The metrics based on taxa richness or proportion of functional groups responded much weaker to eutrophication and did not fulfilled the criterion set for well performing metrics ($RSp<0.60$ in all the analysed countries and lake types). Thereby, their use for the intercalibration process is very limited.

O3

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DETERMINANTS FOR ACCESS TO IRRIGATION WATER IN GUADALQUIVIR RIVER BASIN, SPAIN.

Water scarcity in arid river basins, such as Guadalquivir in Spain, presents challenges on achieving equitable sharing of available water resources and avoiding social tensions among water users, sectors and regions. The major water user in the basin is irrigation (87%) and management principles are given by the water law and in the hydrological basin plans. Irrigation water rights are linked to the ownership of land. Historically, the transfer of rights is done through land sale or inheritance. In the 1985 Water Law water resources are defined public domain (with some exceptions for groundwater rights). The amendment of this law in 1999 opened up for regulated exchange of water rights in banks set up by the basin authorities, however, little water has been traded so far. This paper aims to look beyond cropping pattern, and use descriptive statistics and regression analysis to determine what are the other main factors defining water consume per hectare. The data covers the entire basin (845.000 ha) and were taken from the new irrigation inventory for Guadalquivir (2008). This inventory contains data on reported water rights status (formal and informal access) and the seniority in use (the year the unit initiated irrigation). The units that are allocated more irrigation water belong to units with older formal water rights and usually they also belong to public irrigation initiatives and water intensive cropping patterns. The historically irrigated areas (older than 1946) use almost twice as much water per hectare than areas that started to irrigate after the law of 1985. Furthermore, 20% of the water use of traditionally irrigated areas stem from ground water against more than 50% for areas irrigated after the 1985 law. Finally, those that receive less water have significantly higher water use economic efficiency (â,¬ m3) and pay more for the water (â,¬ m3).

O2

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EFFECTS OF AERATION ON LAKE'S THERMAL STRATIFICATION AND STABILITY IN CHANGING ENVIRONMENTAL CONDITIONS

In many eutrophicated lakes internal loading extends substantially higher amounts than external loading and is able to maintain algal blooming. Oxygen depletion in bottom water, which is a consequence of elevated lake production, has been traditionally considered to be the most important factor sustaining internal loading. Thus, aeration and oxidation are one of the most common methods used in restoration of lakes. Latterly the meaning of oxygen depletion in the hypolimnetic water as the main mechanism of maintaining internal loading has been brought into question. In consequence, the significance of aeration in lake restoration is regarded with suspicion. The study was conducted at Lake Vesijärvi, Finland. In the year 2010, large scale aeration project was started in the lake, consisting of nine Mixox circulation oxygenators. Water temperature was measured with stable thermistors. In addition, data from previous years before aeration and from comparison area were also collected. Thermal stability was estimated by using the information of the lake's thermal conditions during the summer. Aeration breaks the thermal stratification by transmitting warm epilimnetic water to the hypolimnion, thus affecting the thermal conditions of the lake. Warming of the hypolimnetic water decreases differences in water density between different water layers, weakens the stability of the water column and assists mixing process. Moreover, warmer and homogenous water column affects the ecology of the lake in many different ways.

O3

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RESPONSES OF PERIPHYTON AND BENTHIC MACROINVERTEBRATES TO THERMAL POLLUTION IN THE NEDVEDICKA RIVER

The temperature regime in streams can be considerably altered due to anthropogenic influence, often caused by discharge of heated effluents from power stations. The main objective of this study is to analyse the stream at four representative localities with the emphasis on thermal variability (due to heated water in a tributary); to observe its effects on herbivore species, and to relate variation in phytobenthic assemblages to the temperature. Quantitative samples of macroinvertebrates and algae were taken once a month by a Hess sampler from March 2008 to May 2009 in the stream Nedvedicka (Czech Republic). During that period, temperature of water was monitored every 15 minutes. Conductivity, pH, dissolved oxygen, and physico-chemical parameters were recorded on each sampling day. The warm tributary warmed the water in the stream below the tributary, and thus the maximum temperature below the tributary was recorded about one month earlier and was about 1.66 °C higher than above the tributary. The abundance of diatoms, green algae, red algae, cyanophytes, charophyta and bacteria increased significantly with temperature and the numbers of species were significantly higher below the tributary. The higher temperature and greater abundance of algal food in the warm-water tributary favoured different herbivores (Trichoptera) and increased the abundance of some taxa (caddisfly Sillo pallipes, Coleoptera). The warm tributary supported large numbers of other grazers such as snails and caddisflies, but temperatures exceeding 20 °C may have excluded mayflies. The invasive species Potamopyrgus antipodarum, which wasn't found above the tributary, was found in the warm tributary and had a great invasion below the tributary. The larvae of Chironomidae, Ephemeroptera, and Diptera were significantly less abundant below the tributary. The effect of an increase in water temperature of 1–3 °C throughout the year increased the periphyton assemblage in the watercourse and changed the distribution and abundance of herbivorous species.

O1

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THE COMPOSITION OF DIPTERA ASSEMBLAGES ALONG THE GRADIENT OF MINERAL RICHNESS IN THE SPRING FENS

The aim of this study was to evaluate the effects of water chemistry, substrate, and discharge on taxonomic composition of Diptera larvae in small, treeless spring fen sites throughout the whole range of mineral-richness gradient. The sampling of Diptera larvae was carried out at seventeen sites at the borderland between the Czech Republic and Slovakia in May, July, and September in 2006. At each site, we sampled two clearly distinguishable mesohabitats, i.e. the most flowing part of the spring fen (habitat A) and a part with very slow-flowing or standing water (habitat B). In total, 9547 individuals of 163 taxa belonging to 26 families were found. Chironomidae (62 taxa) was the most taxa-rich family followed by Psychodidae (22 taxa) and Limoniidae (19 taxa). Principal component analysis (PCA) performed on the environmental data revealed that the gradient of basicity (including water pH, conductivity, the content of Ca, Mg, SO4, and the proportion of total organic carbon (TOC) and Sphagna) was the most important environmental gradient in our data set. Using the permutation multivariate analysis of variance (PERMANOVA), the gradient of basicity, median diameter of inorganic particle size (Q50) and water temperature were the most significant factors for Diptera assemblages in habitat A, whereas the gradient of basicity together with the content of Fe determined the Diptera assemblages in habitat B. However, basicity had no influence on the number of taxa or the number of individuals which were rather stable along this gradient. In contrast to the gradient of basicity that determined the taxonomic composition of Diptera larvae at the study sites, flow regime contributed to the variation of Diptera assemblages at the mesohabitat scale affecting the physical conditions at mesohabitats.

SS13

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RECENT TRENDS IN DIAGNOSTICS OF THE GREAT RUSSIAN LAKES

Fundamentally new direction in controlling aquatic ecosystems condition based on the analysis of quantitative indices of anthropogenic destructive successions (ADS) and their spatial-temporal analogy is developed. To develop a universal system, it is necessary to rely upon the global, not special, regularities, holistic approach should be applied. This direction provided sufficient prospects in development of early diagnostics methods, reliable control, and forecast regardless of climatic zone and a water body type. Comprehensive study of biocenosis dynamics getting closer to pollutant source, in the areas corresponding to different parts of ADS spatial curve, gives an opportunity to approximate biocenosis conditions during accumulation of the similar pollution concentrations in the entire water body at different stages of temporal ADS. On the analogy of polluted zones and anthropogenic eutrophy stages, early diagnostics is made, eutrophy stages are determined, and anthropogenic load according to the given ecosystem state is standardized. Individual approach to aquatic ecosystems lets simplify solution of problems when forecasting variants of associated influence of different pollutants on these ecosystems. Accumulation of knowledge on ADS regularities and different deformation features of the entire ecosystem status, with long-term accumulation of pollutant complexes, takes place. This approach allowed us to be the first to register the specific features of Ladoga Lake transformation from the olygotrophic to mezotrophic lake class in the 1970s. The experience of ADS study of Ladoga and Onega Lakes helped us to determine a series of significant signs of changes in the Southern Baikal biocenosis structure. Accumulation of ADS quantitative features can lead to unexpected qualitative increase as it happened to Ladoga Lake. Such specific features should serve as a warning of irreversible shifts in aquatic ecosystems. Data for the last four decades of control over the pollutants' influences on Baikal Lake prove the anxiety for its further fate.

O1

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HYDROMORPHOLOGICAL CONSTRAINTS ON MACROINVERTEBRATE COMMUNITIES STRUCTURE ALONG A LOWLAND REGULATED RIVER (OGLIO RIVER, NORTHERN ITALY)

Introduction Lowland reaches of regulated rivers suffer loss of habitat heterogeneity and alteration of the flow regimes. Furthermore, these stretches often lie in heavily impacted areas where anthropogenic activities are relevant. The way macroinvertebrates respond to hydromorphological and hydrochemical alterations is still poorly known. The aims of this work were 1) to investigate macroinvertebrate communities in a lowland reach of a regulated river and 2) to identify physical and chemical constraints governing the community structure. Materials and methods From summer 2009 to spring 2010 macroinvertebrates were sampled seasonally from 18 sites in the lowland reach of Oglio River (Northern Italy). The investigated reach (156 km) hosts 6 hydroelectric power plants and a number of channels for water abstraction. Quantitative sampling (0.5 m2) was carried out by using surber net (wadable sites) and artificial substrates (non-wadable sites). Abundance data were analyzed with non-metric multidimensional scaling (nMDS) to identify the factors addressing macroinvetebrate distribution and an IndVal analysis was performed to find indicators taxa of different river stretches. Results More than 47,000 individuals were collected and identified at the family level. The nMDS revealed the presence of 3 groups associated with different water velocity and depth conditions. Groups were representative of 3 distinct sections of the river: upstream of the dams, downstream of the dams (with reduced but persistent flow) and potamal sections. IndVal analysis identified 3, 7 and 5 indicators taxa for dammed, downstrem of the dam and potamal sections, respectively. Conclusions Hydromorphological features play a key role in governing macroinvertebrate communities in the Oglio River. The presence of a series of dams determines the alteration of the community structure towards lentic (dammed) and rhithral (downstream of the dams) communities. Detailed studies of ecological and biological traits of indicator taxa could support this hypothesis.

SS13

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DATASET QUALITY FOR A CONSISTENT ASSESSMENT OF WATER QUALITY: EXAMPLE OF IBGN DATASETS SAONE CATCHMENT IN FRANCE

BioIndicators are usually score-based indices built from a tricky protocol. Indicators datasets are often incomplete and heterogeneous time series. Nevertheless, they are necessary tools in order to assess water quality, and to help decision makers. To highlight a water quality evolution, a first operation consists in detecting trends and breaking points on datasets. So, we have chosen to use four different statistical tests specifically adapted to incomplete small-size datasets. We have focused on a biological indicator, IBGN, because of its robustness and its wide use. It is based on the abundance and the diversity of the benthic invertebrates. The work is applied on 56 datasets located on the Saône catchment (30000 km2 - East of France). Tests results are not always in accordance. Then, we try to find explicative factors that could help us to understand the observed trend and tests disagreements. Several kind of factors can be explored: (i) metrological aspects in relationship with the complex implementation of the protocol and the evolution of monitoring networks; (ii) environmental aspects such as hydrological regime and extreme events (flood, drought); (iii) human pressures aspects (presence of wastewater treatment plant, evolution of land uses at different scales -watershed, riparian area- , restoration actions…). On one hand, we discuss tests results according to the three aspects on some specific cases (i.e. when we can access easily to information). On the second hand, we discuss the importance to conserve and to structure information that usually exists but is located at various operators under different forms (expert knowledge, reports, database…).

O6

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DO MUCUS-DWELLING MICROBIOTA REFLECT WHAT FISH EAT? AN OBSERVATIONAL AND EXPERIMENTAL APPROACH WITH ATLANTIC SALMON

Fish mucus is composed by a series of glycoproteins and proteoglycans that mainly originate in the diet and are known to be partially metabolized by a group of microorganisms that live associated with the skin mucus. In this sense, it would be expected that a switch in fish diet might cause changes in the microbiota abundance and composition of their mucus. To test this hypothesis we conducted a short-term experiment with hatchery reared Atlantic salmon (Salmo salar L.) alevins that were fed on different diets (artificial pellets -common food at the hatcheries-, macroinvertebrates -natural food in the wild-, starvation and antibiotic enriched pellets). Mucus and water samples were taken in three occasions for microbiological analysis. At each time, we counted all different types of colonies of bacteria, yeasts and fungui following standard procedures. Wild salmons of similar sizes (13-15 cms) were also collected and sampled for comparison. At the end of the experiment, there were differences in the abundance of the mucus-dwelling microbiota among treatments. As expected, the bacterial counts were significantly lower on the fish fed on antibiotic enriched pellets compared with the numbers obtained in salmons fed on macroinvertebrates or conventional pellets. However, there were no differences in the densities of bacteria between the antibiotic treated fish and non-feeding fish. Numbers of fungui and yeast were relatively low and there were only slight differences among treatments. The variation in the densities of mucus-dwelling bacteria among treatments was also reflected in the bacterial community composition. The results showed in this study indicate that mucus may provide a rapid turnover tissue of diet switching by fish and that these changes may be reflected in the associated microbial communities.

O3

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DECISION ANALYSIS MEETS RIVER MANAGEMENT: A NEW APPROACH TO ECOLOGICAL RIVER ASSESSMENT

River assessment and management are challenges to scientists and practitioners alike. Rivers, being highly complex ecosystems, are difficult to characterize with adequate indicators. Predicting outcomes of river management actions are sophisticated and affected by large uncertainty. Moreover, many stakeholders with potentially diverging interests are involved or affected by river management decisions. Although different approaches to river assessment and management exist, there is a need for a concept that accounts for these difficulties. Decision analysis theory provides appropriate techniques for developing an integral river management concept. Decision analysis can be used as a basis for environmental decision support, which intends to integrate the best available knowledge to help decision makers find management options that achieve societal objectives to the highest degree possible. We combine four elements to a river management concept: objectives, results of river state assessment, potential management actions, and predictions of system response to management actions. We discuss how decision analysis theory can be employed to design a river assessment procedure that can easily be integrated as an element of the overarching river management concept. Key parts of the procedure are (i) the construction of value functions by converting state evaluations of traditional assessment methods, (ii) the hierarchical aggregation of sub-objectives' value functions, and (iii) flexibility in terms of considered indicators. Details of the procedure are illustrated with the examples of (1) hydro-morphological stream assessment, merging assessment methods from different countries to an integral hydro-morphological assessment approach, and (2) integral ecological stream assessment for Switzerland, which is traditionally based on separate methods for physical, chemical, and biological state evaluation. The further development of the procedure will lead to the described river management concept. This can be applied to river state assessment and to predictions of state development to support the prioritization of river management actions.

O10

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STABLE ISOTOPE FINGERPRINTING OF AMINO ACIDS IN AQUATIC ECOSYSTEMS

Identifying the biosynthetic origin of biomolecules in aquatic ecosystems is often challenging due to methodological constraints. Amino acids are among the quantitatively most important biomolecules carrying the majority of nitrogen and up to half of the carbon in living organisms. Recently, a study demonstrated that terrestrial primary producers generate unique AA d13C patterns during biosynthesis (Larsen et al. 2009, Ecology 90, 3526-3526), which can be used to track their origin in food webs. In this study we explored whether amino acid d13C patterns are different between aquatic and terrestrial photoautotrophs, and how much they differ from terrestrial bacteria and fungi. Amino acid d13C were analyzed on a GC-C-IRMS after derivatization of amino acids into N-acetyl-methyl esters. Fungi, bacteria and eukaryotic photoautotrophs could be distinguished on basis of amino acids with long and complex pathways such as isoleucine, leucine and threonine. In contrast, the photoautotrophs (microalgae, macroalge and terrestrial plants) were identified based on amino acids with short biosynthetic pathways such as glutamate, aspartate and glycine. To evaluate amino acids as a tool for food web analyses, we compared the d13C patterns from freshwater and terrestrial organisms with those of crustaceans and seston from five Alaskan tundra lakes affected by varying degrees of thermokarst. d13C patterns of seston (5-80 µm) in all five lakes mostly resembled microalgae and to a lesser degree terrestrial plants. Both Daphnia and fairy shrimps had d13C patterns resembling lake seston indicating that most amino acids assimilated were obtained from eukaryotic algae and not from bacteria, fungi or terrestrial plants in spite of the influence of thermokarsting in some of the lakes. In a more general context, we show that amino acid d13C is a powerful in situ assay for evaluating diet sources and tracing their biosynthetic origin.

O5

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DRYING AND WARMING – EFFECTS ON ORGANIC MATTER BREAKDOWN AND DETRITIVORE LIFE CYCLES

Drought and increased temperature are expected effects of climate change on freshwater ecosystems in large parts of the world. In two laboratory experiments, we assessed the effects of drying and warming on the ecosystem function leaf litter breakdown mediated by invertebrate detritivores (caddisfly larvae and isopods). We hypothesized that drying would decrease leaf litter breakdown rate while warming would increase breakdown rate and larval development (earlier emergence). The drought experiment had three treatments; control (high water level), medium drought with water level decreasing to 1 cm above the sediment surface, and high drought with water level decreasing to below the sediment surface. We measured leaf litter mass loss and day of pupation. The warming experiment had also three treatments; normal, following the ambient outdoor air temperature, a +3°C-treatment, and a +6°C-treatment. Leaf litter mass loss, day of pupation, and day of emergence were measured. Drought significantly decreased the leaf litter breakdown rate, which was 5 and 11 times slower in the medium drought and high drought treatments, respectively, compared to the control treatment. In contrast, warming significantly increased the breakdown rate (corrected for microbial breakdown). Additionally, both drying and warming had an effect on the development time of the caddisfly detritivores. Drought induced an earlier pupation and increased temperature resulted in earlier emergence due to a shorter pupal stage. The induced shift in the timing of emergence of aquatic insects may, besides the direct effects on breakdown rate in freshwaters, also propagate across ecosystems, since aquatic insects constitute important subsidies to terrestrial ecosystems. In conclusion, these two laboratory experiments show that both drying and warming will affect breakdown rates of organic matter in freshwaters in a climate-warming scenario. In addition, life history traits of detritivore insects will be modified. However, to understand the combined effects more elaborate studies are needed.

SS10

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PREDATOR-DETRITIVORE INTERACTIONS IN STREAM DEPOSITIONAL ZONES: CONSEQUENCES FOR LITTER DECOMPOSITION AND SEDIMENT BIOTURBATION

Predator-prey interactions have been an important area of research in stream ecology but knowledge of their consequences for ecosystem functioning is largely restricted to autotrophic production. In small streams shaded by forest vegetation, decomposition of terrestrial litter is the dominant pathway of energy flow. As shown by B. Malmqvist (1993)*, predators can reduce litter decomposition rate through lethal and non-lethal effects on detritivores. Such "brown" trophic cascade may be particularly apparent in depositional zones where weak hydraulic constraints may result in enhanced biotic interactions. Moreover, behavioral responses of predators to prey and prey to predators, by altering each other's movements and distribution, may modulate the deposition and reworking of soft sediments. We experimentally examined predator-detritivore interactions and their effects on litter decomposition and sediment bioturbation. We developed methods to disentangle consumptive and non-consumptive predator effects and to determine bioturbation rate. We focused on the odonata larvae Cordulegaster boltonii, a large and widespread predator in small forested streams. C. boltonii is a typical sit-and-wait predator, burying into soft sediments and waiting for prey. Field experiments revealed a decelerating effect of the predator on litter decomposition, largely due to antipredator responses of detritivores. Laboratory experiments showed that the density and behavior of two common detritivores, Gammarus sp. and Potamophylax sp., were affected by C. boltonii. A tough case did not protect the caddisfly larvae Potamophylax from predation and Gammarus was found to spend more time in predator-free refugia in response to predator aggression. C. boltonii were also found to cause substantial sediment reworking due to burying behavior and frequent changes of hunting location. Two important messages emerge from our studies 1) predator effects on ecosystem functioning could be largely mediated by prey antipredator responses and 2) predator can affect nontrophic ecosystem processes such as bioturbation. * Malmqvist B., 1993. Oikos 66:454-462

SS5

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IMPACT OF SIMULATED DROUGHT ON ECOSYSTEM BIOMASS PRODUCTION: AN EXPERIMENTAL TEST IN STREAM MESOCOSMS

Climate models predict widespread shifts in precipitation patterns and increases in the frequency of extreme events such as droughts, but consequences for key processes in affected ecosystems remains poorly understood. A two-year manipulative experiment used a series of stream mesocosms to test the effect of recurrent drought disturbance on the composition and secondary production of macroinvertebrate consumer assemblages and functional groups. On average, secondary production in drought disturbed communities was less than half of that that in controls. The effects of the drought differed among functional feeding groups, with substantial declines for detritivore shredders (by 69 %) and engulfing predators (by 94 %) that skewed the distribution of production in favour of algal grazers and herbivore-detritivore collector-gatherers. Contrasting responses were evident among taxa within most functional feeding groups, ranging from extirpation to irruptions in the case of several small midge larvae, but production of most species was suppressed. Taxon-specific responses were related to body mass and voltinism. The ratio of production to biomass (community P/B) increased under drought, reflecting a shift in production from large long-lived taxa to smaller taxa with faster life histories. This research provides some of the first experimental evidence of the profound effects that droughts can have on both the structure and functioning of aquatic ecosystems.

SS8

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ECOLOGICAL GENOMICS: FIRST INSIGHTS INTO THE GENETIC BASIS OF INDUCIBLE DEFENSES IN DAPHNIA

The freshwater microcrustacean Daphnia pulex is among the best-studied animals in ecological, toxicological and evolutionary research. One aspect that has sustained interest in the study system is the ability of D. pulex to develop inducible defence structures when exposed to predators. Predation is a major selective force structuring biological communities and causing the evolution of defenses in many prey organisms. While permanent defenses evolve under constant predation pressure, inducible defenses are adaptations to heterogeneity in predation risk. Since defended and undefended phenotypes have the same genotype, phenotypic changes are mainly due to differential regulation of gene expression. So far, little is known about the genetic mechanisms underlying inducible defences. Recently, the genome of Daphnia pulex has been sequenced by the Daphnia Genomics Consortium (DGC) allowing detailed studies of genes that direct defended phenotypes. Using tiling microarray, qPCR and RNAseq data we could identify more than 100 differentially regulated genes in D. pulex under predation risk. These genes are involved in very different metabolic pathways and yield interesting first insights into the regulatory processes of genes that modulate phenotypes cued by environmental stimuli. In this talk, I highlight the potential of having the genome sequence of an ecological model species for studying the interaction of genes with the environment. With the increasing availability and capability of high-throughput genomic analyses paralleled by a drop in costs for these, the Daphnia genome project may become a model for studying other ecological model species. This is of particular importance to better understand the consequences global environmental change may have from genotype to ecosystem level.

O1

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BENTHIC FAUNA IN RELATION TO ANTHROPOGENIC DISTURBANCE OF TWO TROPICAL LOW ORDER STREAMS IN KENYA

Studies to quantify benthic macroinvertebrates in relation to physical anthropogenic disturbances were carried out during two years in two tropical low order streams in Kenya, the Njoro River and Ellegirini River. The rivers have similar climate, geology, riparian vegetation, altitude and land use, but differ in the frequency and intensity of human and animal disturbances on their bed sediment surfaces. The study involved quantitative collecting of bed sediments with benthic macroinvertebrates by Lunz-sampler (modified Hess-sampler) during low discharge regime (when anthropogenic physical disturbances are presumed to be high) and during high discharge regime (when the disturbances are thought to be low). Systematic and quantitative analysis was done in the laboratory. Macroinvertebrate abundance and diversity were high at the less disturbed stream than they were at the disturbed stream. Sites that experienced high disturbances were characterized by low abundance and diversity and were dominated by one taxon that tolerated pollution during both discharge regimes. The gradation observed in the distribution of macroinvertebrates with increasing level of disturbance was attributed to the physical disturbances that most likely redistributed them through migration or dispersal. Anthropogenic disturbances play an important role in functioning of stream ecosystems, documented here especially on the benthic invertebrate fauna.

O3

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DEVELOPING BETTER COMMUNITY USE OF THE RIVER CRANE, A TRIBUTARY OF THE RIVER THAMES

The aim of this study was to demonstrate the disparate uses of a river and the way that different communities have embraced the opportunity to utilise the facilities, while recognising the usefulness of EU legislation. The River Crane is one of several tributaries of the River Thames to the west of London. The river is over 30 kilometres in length and flows through numerous housing estates and industrial developments including Heathrow Airport. The Friends of the River Crane Environment (FORCE) is a charitable organisation, originally set up in 2003 to promote awareness and sustainable environmental developments through representation of the interests of local residents and visitors to the corridors of the River Crane and in January 2011 had approximately 400 members. The Richmond Environmental Trust provides volunteers to assist in the management of the river including clearance of invasive vegetation and adaption and of river banks. Due to partnership working between local people, environmental bodies and statutory authorities there have been numerous improvements, for example, the creation of a Nature Reserve in an area previously used for gun powder manufacture. EU legislation such as the Habitats and Birds Directives as well as the Water Framework Directive have been interpreted in a local context and examples of good environmental practice and future challenges will be demonstrated.

SS10

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ARE BIOTIC INTERACTIONS IMPORTANT IN STREAMS? A CLOSE LOOK AT THE CASE OF TROUT PREDATION ON BENTHIC INVERTEBRATES

The role of biotic interactions in structuring communities has sparked one of the most enduring debates in stream ecology. For example, despite a rich history of studies, evidence on the effects of trout predation on benthic invertebrates is still considered ambiguous or controversial. Here we try to explain why different studies have produced different results by assessing three hypotheses (concerning study design and scale, the adaptation to predation and the abundance of trout) using a vote-counting approach. As predicted, differences in scale and design (i.e. whether trout were added or removed from a stream) significantly influenced the results. At large scales (> 15 m), salmonid effects were more frequent in addition experiments and observational studies (which we considered as natural experiments of large-scale addition) than in removal experiments. At smaller scales, effects were common across removal and addition experiments, but apparently involved non-consumptive in addition to consumptive effects. In comparison, we found no evidence that prior coexistence with trout or trout abundance could explain variation in results. Theory indicates that experimental design and scale influence the mechanisms that mediate interactions between predators and prey. Therefore, we suggest that the perceived ambiguity of the results of studies on trout-invertebrate interactions has arisen, to some extent, because evidence from fundamentally different types of studies has been lumped together. Understanding the factors that alter the effect of predators on prey is useful to reconcile the results of past studies and assist the design of future studies.

I09

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AQUATIC CONSUMER GROWTH RATES AND GROWTH EFFICIENCIES ARE HIGHER AT HIGHER LATITUDES - BUT AT WHAT COST?

The primary goal of this project was to study growth rate adaptations of aquatic consumers (along latitudinal gradients and how changes in growth rate adaptations to different latitudes affect a consumer's nutritional constraints and requirements. The project's hypotheses are derived from three premises: (1) Time limited habitats favor the evolution of rapid growth rates. (2) Rapid growth rates increase organisms' nutrient demands. (3) Habitats at high latitudes have short growing seasons and are often nutrient poor. In a laboratory experiment with tadpoles of the common frog Rana temporaria from two different latitudes (middle and northern Sweden) raised under high and low food quality and high and low temperature conditions, we tested the following hypotheses. (I) Tadpole growth rates are higher in northern than in middle Sweden. (II) Growth rates are higher with P rich food and higher under higher temperatures (but northern tadpoles are better at maximizing their growth rates under poor food quality and low temperatures). (III) Phenotypic plasticity is lower in more northern tadpoles. Our Results support these hypotheses, showing that within species, northern populations of univoltine aquatic consumers have evolved to attain rapid growth rates even at low temperatures and poor quality food, possibly at the cost of reduced phenotypic plasticity. Results from this project will aid our understanding of high latitude aquatic food webs. It will also help clarify effects of eutrophication and climate change on these food webs.

SS5

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FROM FISHLESS TO STOCKED LAKES – ECOLOGICAL CONSEQUENCES OF FISH INTRODUCTIONS IN SUBARCTIC LAKE ECOSYSTEMS

Naturally fishless lakes represent a unique freshwater ecosystem enhancing regional aquatic species diversity. The absence of fish in lakes could be related to unsuitable physical conditions, but in many headwater lakes the lack of fish is the result of natural barriers that inhibit post-glacial colonization by fish. Historically, the ecological value of fishless lakes has been underestimated and therefore many naturally fishless lakes have been stocked successfully for recreational purpose with salmonid or other game fish species. Fish introductions and translocations are one of the most widespread anthropogenic threats to aquatic ecosystems and their ecological impact to the functioning of the aquatic ecosystems remains largely unknown. We have initiated a research project that studies effects of human fish introductions on northern fishless lake ecosystems using both neo- and paleolimnological approaches. Paleolimnological methods are used for reconstructing the ecosystem structure before and after the fish were introduced and neolimnological monitoring for comparing water quality and food web structure before and after the fish removal. Our study area in northeastern subarctic Finland includes Lake Kuutsjärvi and nearby fishless reference lakes located inside the Värriö Strict Nature reserve. Lake Kuutsjärvi provides a unique opportunity to study the impacts of introduced fish on subarctic fishless ecosystems because of the known date of fish introduction in 1970s and the possibility to remove the fish during this project. In this presentation, I will demonstrate the reconstructed food web structure of the lakes during the past 50 years and show the results of the modern water quality and expected changes in Lake Kuutsjärvi after the removal of fish.

O5

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EUTROPHICATION ALTERS NON-ADDITIVE EFFECTS OF PLANT-LITTER DIVERSITY IN STREAMS

Litter decomposition is a key process in low-order forested streams that is affected by nutrient concentration in the stream water and diversity of riparian vegetation. However, the interactive effects of anthropogenic activities, such as eutrophication and loss of riparian vegetation, on plant litter decomposition are poorly understood. Here, we tested if: i) plant litter decomposition depends on litter species diversity and/or quality; ii) putative diversity effects can be predicted by comparing decomposition of litter mixtures with that expected from the sum of individual litter species (additive model); iii) mixing low- and high-quality litter affects decomposition of individual species; and iv) eutrophication alters the observed patterns. We used leaves of five riparian tree species (Alnus glutinosa, Castanea sativa, Eucalyptus globulus, Platanus sp. and Quercus robur) either alone or in mixtures of 2, 3 and 5 species, in a total of 12 combinations. Leaves were weighed in 4g groups, placed in coarse-mesh bags, and immersed in low-order streams along a gradient of eutrophication for 38 days. In the most oligotrophic stream, litter decomposition was significantly higher than that expected based on decomposition of individual litter species, indicating synergistic effects of litter mixtures. Moreover, the presence of high quality leaf species in mixtures increased the decomposition of low quality species. This trend tended to disappear with increasing levels of inorganic nutrients in the stream water. Results suggest that eutrophication can alter non-additive effects of riparian vegetation diversity on litter decomposition in streams. Acknowledgements The Portuguese Foundation for the Science and Technology supported I. Fernandes (SFRH/BD/42215/2007).

O2

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INVESTIGATING USE OF CONSTRUCTED HABITAT TO PROTECT AN ENDANGERED MACQUARIE PERCH POPULATION IN AN ENLARGED RESERVOIR

Increasing demand for water and forecast changes to rainfall and runoff patterns under climate change has stimulated worldwide planning or construction of new dams. In response to ongoing drought and bushfire impacts, the construction of an expanded domestic water supply dam for Canberra has commenced. The new dam will be 50 m higher than the existing dam, and impound an additional 4.5 km of river. In the Australian Capital Territory, Cotter Reservoir contains the last viable population of the nationally endangered Macquarie perch (Macquaria australasica), and the enlarged dam poses a number of threats to this species. Previous research in the existing reservoir demonstrated adult Macquarie perch rely on fringing macrophytes as daytime refugia. These macrophytes will be drowned by the enlarged reservoir, and are unlikely to re-establish. The current project aimed to determine if Macquarie perch will use constructed habitats when emergent macrophytes are not available and which constructed habitat type this species preferred. Three types of constructed reef (rock, pipe, pipe with grills) and control (no structure) were trialled at six study sites within the reservoir. Natural habitats (fallen timber, rocky shore, bare shore) were also monitored to determine usage by adult Macquarie perch. Remote radiotelemetry and underwater video were used to examine constructed reef usage when existing macrophyte beds were made unavailable to fish by drawing down the water level. Radiotelemetry data showed that habitat use is quite complex and varies by season, site and individual. Data collected using this method showed no clear preference for any one type of constructed habitat, but constructed habitats were preferred over control sites. By contrast, video analysis demonstrated a clear preference for rock reefs across four size ranges of Macquarie perch. Based on the results of this study, constructed rock reefs will be installed during the construction program for the new dam.

O7

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FISH COMMUNITIES STRUCTURAL AND FUNCTIONAL ASPECTS – A ROMANIAN CARPATHIANS WATERSHED CASE STUDY

This work is based on fish communities (1120 individuas, 25 species, 23 sites) structure and trophic resources use in Târnava Basin, on fish species trophic specialization degree and on trophic resources common exploitation degree and allow, to highlight the quality of fish populations as control factor for benthic macroinvertebrate populations.
For each fish community we analyzed the fish diet of species with higher than 5% relative abundance (minimum 30 adult individuals for each species), assessed the trophic niche dimension and niches overlapping degree. The trophic demand was estimated through the food items transformation in terms of relative abundance. The trophic supply was estimated based on benthic macroinvertebrate groups average density values (based on macroinvertebrates quantitative samples), which was transformed in terms of relative abundances. The ichthyofauna specific diversity variation reflect the habitat diversity and pollution degree. The highest species diversity and abundance was recorded in Târnava River at 2 km upstream the confluence with Mureş River, there the habitats diversity, trophic supply and pollution degree induced this situation. Where the biotope conditions are extreme, typical mountainous zones and sectors with high pollution degree, the specific diversity is very low. From the fish trophic spectrum analyze point of view 64% of the analyzed species are secondary consumers or of superior orders, 28% consume invertebrates but plants too, and a single species (4%) consume exclusive peryphiton and plants. The majority of fish species (60%) use more accessible resources, being characterized by relative high trophic plasticity. 40% are feeding preferably with certain macroinvertebrates characterized by high abundances, these fish contributing to the macroinvertebrates decreasing abundances. The most efficient use of the trophic resources is realized by the fish communities formed of species with low trophic niches overlapping degree which consume easy accessible resources and that with low abundances in the environment.

O1

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MODELING ECOLOGICAL NICHE OF FISH SPECIES AT THE EUROPEAN SCALE: EFFECTS OF CLIMATIC CONDITION AND POTENTIAL CONSEQUENCES ON FUTURE LOCAL SPECIES RICHNESS."

To be able to estimate the effect of climate change on species occurrences is one of the major concerns in biology of conservation. To answer this question numerous Species Distribution Model (SDM) has been developed. These models related species occurrences to environmental conditions. The estimated relationships are then used to estimate the future distribution area of the species depending of the different gas emission scenarios. The main criticism address to this methodology is the spatial extent of the data set used to calibrate the models. Most often, the SDMs are computed with data covering only a fragment of the species distribution area, reflecting partially the realized niche of the species. The spatial extent of the calibration data set has great consequences on the evaluation of the effect of the climate change. Our objective was to estimate the niche of 23 fish species widespread and native of Europe and to use the SDMs to assess the effect of climate change on species occurrences and on local species richness. An additional objective was to estimate the uncertainty associated with the environment-occurrence relationships. To achieve these objectives we used a data set composed of 1 548 sites spread all over Europe (covering an area > 4.106 km²), characterized by a low level of local anthropogenic disturbance. The results showed that species have contrasted responses to the climatic factors. Even if the influence of climate was highly variable between species, temperatures and run-off were two key factors driving species spatial distribution. The shapes of responses, species optimums and species niche breadth were highly variable. These results clearly showed that European freshwater species will be differently affected by climate change and thus species richness, depending of the combination of environmental parameters

SS9

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A MULTI-PROXY STUDY AT LAGUNILLO DEL TEJO (SPAIN): RECONSTRUCTION OF LAKE LAVEL CHANGES AND ANTHROPOGENIC ACTIVITIES

Lagunillo del Tejo is a small doline situated in the Iberian Range (Spain) whose sediment has proved to be very sensitive to rainfall variability. On the othe hand, the signs of human activity are also stamped in the sediment because of its situation on a past crossroad region. In this study we present a review of a multidisciplinary work based on cladocera subfossils, plant macrofossils, isotopes and macroscopic charcoals. Cladocera subfossils, plant macrofossils and isotopes have been used to infer lake level changes and therefore, hydroclimatic variability for the last millennium. Anthropogenic activities and fire history were reconstructed using macroscopic charcoals. All these proxies, showed a high level of concordance. Medieval Warm Period is characterized by low lake level and high fire activity whereas during the Little Ice Age the lake level was higher and the fire activity less intense which indicate a climatic influence in water level and fire. Nevertheless, land uses changes induced by human such as "The Mesta" and other socio-economical activities also caused an important charcoal signal in Lagunillo del Tejo sediment. Our study shows how climate and human activities cen be reconstructed from this sedimentary sequence.

O3

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DISCRIMINATING KEY CHEMICAL POLLUTANTS IN A MEDITERRANEAN RIVER DURING LOW FLOW REGIME AND THEIR RELATIONSHIP WITH BENTHIC COMMUNITIES

Llobregat river is a Mediterranean river situated in NE of Iberian Peninsula. For a long time, it has been under high anthropic pressure, subjected to intensive water use and exposed to a wide range of pollutants. In addition, its hydrology is influenced by the Mediterranean climatology with dry summers and episodic increases of discharge in autumn and spring. In summer and autumn of 2005 and 2006, seven points were sampled. Biological (epilithic diatoms and invertebrates from soft sediment) and water quality parameters (nutrients, ions) as well as the concentration of chemical pollutants (pharmaceuticals, pesticides and alkylphenols) were analyzed. Using multivariate analysis, previous works highlighted relationships between pharmaceuticals and invertebrates (Muñoz et al. 2009) as well as pesticides and diatoms (Ricart et al. 2010). In this work we analyzed all the data from the summer period (2005 and 2006) when concentrations of these substances were usually higher than in other seasons. Both biological and environmental data were analyzed by a Redundancy Analysis in order to find patterns in the distributions of species related with the environmental variables. With diatom abundance the environmental data explained a 38% of the variance of the species distribution, from this variability a 10% was explained by the physicochemical parameters (NO3-), while a 25.5% was explained by the chemical pollutants, especially antibiotics and the alkylphenols ethoxycarboxylathes (APECs). On the contrary, environmental data explained a 66.5% of the variance of the macroinvertebrate abundance distribution. In this case only a 7% of the variance was explained by physicochemical factors (chloride concentration) and a 29% was by concentrations of APECs and some pharmaceuticals. These results confirm those obtained in previous investigations showing different sensitivity in biological communities to chemical pollutants and different seasonal responses. In addition, APECs seemed to be an important stressor both for diatoms and macroinvertebrates.

SS4

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NET HETEROTROPHY AND CO2 EVASION FROM A PRODUCTIVE CALCAREOUS RESERVOIR

The role of lacustrine systems in the global carbon cycle is a major topic in freshwater research. Most lakes release inorganic carbon to the atmosphere due to the imbalance of net metabolism towards respiration. However, research on this topic mostly relies on data collected in natural low-alkalinity lakes, and it therefore remains unclear what role human-made calcareous lakes play in the current paradigm. In this study, we reported inorganic carbon fluxes and net ecosystem production in a calcareous human-made reservoir in Spain, using mass balances of inorganic carbon and dissolved oxygen. The inorganic carbon loadings reported are among the largest found in the literature, and the inorganic carbon pool in the reservoir depends on the net hydrological balance. The reservoir was identified as a net emitter of carbon dioxide (CO2) and showed persistent net heterotrophy, although we could not find any clear dependence of CO2 emissions on the metabolic balance. The variability of inorganic carbon and the net ecosystem production were poorly correlated, suggesting that additional internal processes govern the transformation of the dissolved inorganic carbon in the water column. Considering the significant decrease in surface alkalinity occurring during the summer, carbonate precipitation may be the dominant process confounding the relationship between metabolism and inorganic carbon variability. These results indicate that the CO2 dynamics may be weakly coupled to net metabolism in calcareous systems and that net heterotrophy may occur simultaneously with eutrophic conditions and low DOC concentration in flushed systems such as reservoirs.

SS15

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INTEGRATION OF BIOLOGICAL ASSAY (ZEBRAFISH SCALE) AND PHYSICO-CHEMICAL ANALYSIS FOR DETECTION OF WATER QUALITY CHANGES

Introduction Nowadays legislation related to water quality is becoming more stringent both at national and international level. In the European context, the Water Framework Directive (2000/60/EU) (WFD) is an example of the new attitude adopted (risk-based) in terms of environmental impacts. The WFD requires both a good chemical and biological status of water bodies, but current methodologies do to not allow knowing the status of water quality at acceptable operational costs. This underscores the need for alternative monitoring platforms that can be run, processed, interpreted and that provide information of changes in water quality on short notice. We present here an integration and interpretation of several technologies as zebrafish scales to determine the presence of dioxin-like compounds, analysis of physico chemical parameters and micropollutants and passive sampling detection as a tool to detect changes in water quality. Methods and materials Water samples were collected in three different sites at 12 different days in the Llobregat River (Spain) at relevant sites for the water collection scheme of Barcelona's metropolitan area. Several analysis were carried out: • Ten Danio rerio were exposed during 24 h to the water sample. After that, three front dorsal scales were removed form the fish and changes in the expression levels of CYP1A mRNA were studied • General physico-chemical parameters (conductivity, total organic carbon, pH, NH4+, Cl-) were analysed • Presence of micropollutants (metals, endocrine disruptors, PAHs, PCBs, alkylphenols) were evaluated Results and conclusions The methods proposed exhibit clear temporal and spatial variations for the Llobregat water samples analysed in the same way for all the technologies evaluated, demonstrating its suitability for monitoring variations on water quality linked to both specific discharges or changes on the river flow. A substantial part of this variability seems linked to sudden increases on the river flow, mainly due to heavy raining episodes on headwaters.

O2

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DO CATCHMENT PARAMETERS CONTROL LOCAL RESTORATION SUCCESS?

Recent studies showed that many river restoration projects failed to increase the biological and ecological quality. It was suggested that missing source populations, fragmented landscapes or catchment constraints might have hampered a positive response by aquatic communities. Therefore we analysed the potential influence of catchment landuse and river physical habitat quality on the ecological response of macroinvertebrates, fish and macrophytes of more than 40 restoration measures. The investigated measures were located in German lowland and lower mountainous areas and comprised restored sites in streams as well as in rivers. The conducted measures ranged from weir removal and the placement of large wood up to large channel re-meandering actions at several hundred meters. The organism groups were sampled according to WFD-compliant standard sampling methods. The restoration measures were evaluated using the space-for-time approach, i.e. the restored sites were compared to upstream unrestored sites, which resemble the restored sites before the restoration was conducted. We used the Corine Landcover data in a GIS system to generate catchment landuse upstream of restored sites. Additionally, the mean river habitat quality upstream of restored sites was estimated using river habitat survey data. We will demonstrate the influence of different catchment landuses and river habitat quality on different restoration methods. Ecological response, i.e. the increase or decrease of biological and ecological metrics of three organisms groups was correlated to catchment landuse parameters and physical river habitat quality upstream of the sites. Thus, the success of types of restoration measures is rated against potential large-scale influences acting at the landscape and catchment level.

SS11

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RELATING NUTRIENT UPTAKE WITH TRANSIENT STORAGE ZONES: EVIDENCE FROM IN-CHANNEL OBSTRUCTERS MANIPULATION

River eutrophication and water toxicity may be a consequence of the excessive amount of nutrients that human activities add to streams. Recent studies have shown that stream hydrological properties are essential to mitigate these ecological problems. In particular, transient storage zones play an important role in stream depuration processes as they are potential regulators of nutrient uptake. However, their capacity to influence stream biogeochemical processes commonly (and significantly) depends on the stream morphology. The aim of this study is to analyze the effect of in-channel flow obstruction (impermeable inert-baffles and vegetated fiber-rolls) on transient storage zones and to determine how flow obstructers alter stream nutrient uptake capacity. We performed five short-term stream tracer experiments of ammonia and phosphorus under previous conditions in two channels (Montseny, Catalonia). The tracer additions were repeated after installing the flow obstructers. Hydraulic parameters, transient storage zones characteristics and nutrient uptake rates were estimated using a one-dimension solute transport model (OTIS). In our experiments, transient storage area varied according to channel morphology and permeability. We found that vegetated fiber-rolls reported an increment of 93%, while impermeable inert-baffles only gave a 27% increment. This difference can be explained by the vegetated fiber-roll permeability, which enhanced the water interchange between the stream flow and the interstitial zones (64%). Moreover, nutrient uptake rates were strongly correlated with transient storage parameters. The phosphorus uptake rate increased after installing impermeable inert-baffles (128%) or vegetated fiber-rolls (320%), due to the improvement of biofilm algal assimilation. Vegetated fiber-rolls also augmented the ammonia uptake rate (146%), this being associated with the heterotroph organisms that lay on the interstitial zones. These results suggest that water quality in streams with intense eutrophication can be improved by enlarging transient storage zones through measures like stream morphology restoration, especially when they use permeable and organic obstructers.

O3

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MELIA: WATER MANAGEMENT INDICATORS FOR THE MEDITERRANEAN REGION

In the Mediterranean region physical water scarcity is an important issue, and consequently the management of water resources is of great relevance to achieve sustainable development. Big challenges in water management and the perception that current water management models do have deficits in integrating the views of important key stakeholders have increased the (especially international) pressure for implementing actions towards Integrated Water Resources Management (IWRM). The EU-FP6 project MELIA (Mediterranean Dialogue on Integrated Water Management) aims at structuring a dialogue among key stakeholders concerned and affected by water use and management in the Mediterranean region, such as scientists, professionals, decision makers, policy makers, water providers, etc. In this view, there is a need for horizontal and vertical integration and dialogue. The achievement of this dialog and the dissemination and exploitations of the recommendations obtained shall create real added value at the European and Mediterranean scale. In recent years, an increasing interest in water resource assessment and water management indicators can be observed. Before the background of MELIA, this paper discusses existing water management indicators sets with respect to their applicability in the Mediterranean region. For this purpose, the authors first analyse the role of the resource water and the specific complexity of water resource management in the area. Then principles for the identification of adequate indicators and important areas to be addressed are defined. The following section analyses a selection of indicator sets. The authors' perceptions are complemented with the knowledge of a group of experts which contributed by means of expert interviews. One of the main results is that no indicator set elaborated so far is tailored for the Mediterranean region. Consequently, in the final conclusions recommendations are given on how to design an indicator set fitting in the Mediterranean context by using a participatory, integrative and iterative process.

O2

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AQUATIC COMMUNITIES OF MONGOLIA AND EXPECTED SCENARIOS DUE TO THE HUMAN CAUSED CLIMATE CHANGE

Human-caused climate change as a leading threat for biodiversity conservation of the aquatic biota has been the emergent discussion of the last two decades. Climate change scenarios forecast a global increase of temperatures, annual rainfall, atmospheric moisture and the shrinkage of permafrost. The plasticity and adaptation capacities of the stream communities to these changes are of major interest to understand the impact of the climate change on the functioning of the stream ecosystem. Local and regional factors structuring theses communities will have a major impact on the predicted scenarios. Therefore we designed a study around the major watersheds of Mongolia. Mongolia is one of the last countries where historical human impacts are irrelevant if compared to the industrialized countries. Beside ancestral transhumant herding no other human induced disturbance has impacted the freshwater ecosystems of Mongolia. Two watersheds covering 80% of the surface area of Mongolia were extensively sampled over a 7 years period. Major differences discriminate these watersheds regarding the rainfall amounts they receive, their permafrost content and their sub-basins connectivity. Stream macroinvertebrates communities were compared based on their structure, nestedness and their functional guilds. The data was analyzed in order to show the major differences between the communities of these watersheds in order to discuss the expected impacts of the climate change. Higher diversity was observed in the watershed having the lowest sub-basin connectivity. Nestedness temperatures confirmed a major difference between the communities of these watersheds, leading to different expected impacts of the climate change. Functional guilds structure helped understand how these communities would react to changes in the abiotic factors and predicts different functional restructuring of the biota.

O1

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SHORT-TERM EFFECTS OF WILD FIRE ON MACROINVERTEBRATE COMMUNITIES IN UPLAND ATLANTIC -MEDITERRANEAN STREAMS

Portugal is one of the European countries with largest area affected by wild fires. However, the effects of this disturbance on lotic ecosystems are poorly known. With climate change wild fires are predicted to increase in the Mediterranean Basin. It is therefore important to assess fire impact to improve fire-related management of river ecosystems. In summer 2009 we used the European Forest Fire Information System to identify a gradient of wildfire impacts ranging from 50 to 100% catchment burned on 10 upland streams. During the first post-fire year we conducted surveys in September, November, March, May and August. Separate macroinvertebrates samples were collect by kick-sampling different habitats: riffle, pool and wood and plant surfaces within the water column. Six reference areas (environmentally similar but with no wild fires in the last 20 years) were also surveyed using the same methodology and survey periodicity. Area burnt and other large-scale catchment characteristics were described using a GIS database. Stream habitat was described using a modified River Habitat Survey, including a detailed description of macroinvertebrate habitat at sampling locations. Water quality parameters such as pH, conductivity and temperature were also measured. Results show no evidence of impact immediately following the fire event. A decrease in taxa richness and abundance in burnt sites was recorded in November and March surveys with pool habitat suffering a proportionally greater negative impact. Nevertheless, both richness and abundance increased markedly in May, indicating a rapid recovery of macroinvertebrate communities. The autumn decline appeared to be explained by catchment erosion, caused by post-fire rainfall events, leading to ash/charcoal deposition in stream habitat, especially in pools. Impact severity was related to recorded habitat variables at both at local and catchment scale. These data contribute towards the identification of fire sensitive habitats, and management strategies for enhanced protection and post-fire restoration.

O5

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HETEROGENEITY OF SURFACE SEDIMENT IN SMALL LAKES: QUANTIFYING FOCUSING EFFECTS ON ORGANIC CARBON AND PHOSPHORUS BURIAL

Brief Introduction Understanding the burial rate of nutrients and organic matter in lake sediments is becoming increasingly important from the perspective of quantifying lake carbon and phosphorus budgets. Often the calculation of burial rates assumes that a single site is representative of the whole lake, when in fact, the distribution of these materials in sediments is highly heterogeneous. This heterogeneity is a consequence of the physical process of sediment focusing caused by downslope gravitational transport, wave action and wind-driven currents. Much of our understanding of these processes comes from the study of large and/ or shallow lakes. In this study, in contrast, we investigate this phenomenon in a small lake. Materials and Methods We collected sediment cores in Esthwaite Water (UK), to elucidate the heterogeneity of surface sediment distribution. We obtained high resolution meteorological data from a monitoring buoy on the lake and used a new high-resolution bathymetry to quantify the different focusing processes, which we used in the calculation of burial rates of organic carbon and total phosphorus. We also compared these burial rate results to those calculated using a low-resolution bathymetry. Results We found that the use of single sites in the deepest part of the lake led to large overestimates in the burial of organic carbon and total phosphorus (54% and 110% more, respectively). Based on the lake-wide annual flux of total phosphorus to the bed we calculated that approximately half of the phosphorus entering the lake is retained in the sediments, which balanced the lake phosphorus budget. Conclusions Incorporating the effects of sediment heterogeneity when calculating burial rates for organic carbon and total phosphorus significantly improves their accuracy. This has implications for burial rate and budget studies which are increasingly important for lake management and restoration.

SS6

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THE EFFECTS OF CATASTROPHIC HABITAT DESTRUCTION ON ENVIRONMENTAL FACTORS AND FISH FREQUENCY

The Hex River in the Western Cape Province of South Africa is bordered by wine farms and is home to an interesting endemic fish community which is still under investigation. The climate here is characterised by dry summers, and wet winters sometimes resulting in flooding. Wine farmers have responded to this by illegally bulldozing vast stretches of the river. We conducted seven surveys of the Hex over two years encompassing two bulldozing events. We recorded environmental variables: water velocity, depth, vegetation cover, substrate type and turbidity; and the frequency two of fish species: the newly discovered Galaxias 'nebula' and G. 'hex'. Our aims were to 1) find which environmental variables are most important for the fish species; 2) examine the effects of season and bulldozing on environmental variables and 3) investigate spatial and temporal changes in fish frequencies. G. 'nebula' was much more abundant than G. 'hex'. G. 'nebula' preferred a high percentage of vegetation cover and water velocities around 0-0.2 ms-1. G. 'hex' appeared more frequently in lower water velocities (0-0.1 ms-1), in deeper water (10-50 cm) and on a sand and/or mud substrate. Both species preferred clear over turbid water. The first bulldozing event significantly reduced vegetation cover and depth while the second reduced depth and homogenised the substrate to rock and sand. Depth was also significantly higher in autumn than spring and summer. Fish frequency was lowest immediately after bulldozing. G. 'hex' did not reappear after the first bulldozing event while G. 'nebula' frequency reduced progressively over bulldozing events. We conclude that this catastrophic destruction is extremely detrimental to both Galaxias spp., especially G. 'hex', through loss of suitable habitat. However, both species survive in a nearby tributary and are likely to re-colonise if bulldozing stops long enough for the Hex to recover.

SS1

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IMPACTS OF DRYING AND CRAYFISH INVASION ON STREAM ECOSYSTEM STRUCTURE AND FUNCTION

Drought and seasonal drying can be important disturbance events in many small streams leading to intermittent or isolated habitats. Many small streams contain crayfish populations that are often keystone or dominant species in these systems. We conducted an experiment in stream mesocosms to examine the effects of drying and potential ecological redundancy of a native and invasive crayfish species. We examined effects of drying (dry or wet) and crayfish presence (none, native crayfish Orconectes eupunctus or invasive crayfish Orconectes neglectus) on stream structure and function (leaf breakdown, stream metabolism, algal and insect densities) in a fully factorial design. Each mesocosm contained a deep and shallow section and dry treatments had surface water present (10 cm depth) in deep sections where tiles and leaf packs were placed. Dry and no crayfish treatments showed significantly reduced leaf breakdown than wet and crayfish treatments, respectively. However, the native and invasive crayfish species did not differ significantly in their effects on leaf breakdown. Periphyton AFDM was not affected by drying or crayfish presence. Inorganic sediment and insect density was not affected by drying, but both were significantly reduced by crayfish presence. In all cases, the native and invasive crayfish species had similar effects on ecosystem structure and function. Pools within dry portions of intermittent streams appear to function differently than pools in permanent streams. Further work is needed to determine ultimate effects of drying on trophic dynamics and ecosystem function. Given the abundance of intermittent streams and their likely increase due to global climate change, it is crucial to untangle impacts of drying.

SS12

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NATURAL FEEDING HABITS OF BIOFILM-DWELLING NEMATODES STUDIED WITH A MULTI-METHOD APPROACH

In running-waters, benthic epilithic biofilms can provide most of the riverine primary production. These biofilms shelter dense and diversified assemblages of microphytes and heterotrophs (e.g. bacteria, protozoans, invertebrates) living embedded in a close connection which could induce complex trophic interactions. Nematodes are among the most abundant biofilm-dwelling invertebrate group. However, their role within the biofilm food-web remains little studied. The aim of this study is to gather information on the natural feeding habits and positioning of nematodes within the biofilm food-web. Epilithic biofilm was sampled from September 2008 to March 2010 in the Garonne River, France. To examine the "natural" trophic resources of nematodes both an in situ study and an experimental approach were used. HPLC-analysis of nematode gut pigment contents and their natural stable isotope (SI) signature with that of their potential microbial food resources and predators were measured. These measurements were compared to results from an in situ 13C pulse-chase experiment in which biofilms colonizing a set of immerged tiles were labelled with NaH13O3. Tiles were resettled on the river bed, and biofilm subsamples were collected at 0, 24, 48 and 72 h after the labelling period for tracking excess 13C from microalgae to small consumers. Gut pigment content analysis by HPLC indicated that Chromadorid nematodes fed on diatoms, and that this feeding was prey density-dependent (non-selective). Natural SI signatures of nematodes and other invertebrates confirmed this finding, in bringing also an overview of the nematode position in the biofilm food-web. Excess 13C uptake increased consistently in most invertebrate groups but with different enrichment patterns among groups. This pointed to different ways of algal carbon assimilation by benthic organisms, but confirmed nematodes as primary consumers. By combining these approaches, consistent patterns appeared, giving an insight into the positioning of nematodes within the biofilm food-web.

SS13

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EL NIÑO SOUTHERN OSCILLATION AND CLIMATE TRENDS IMPACT RESERVOIR WATER QUALITY: EVIDENCES FROM A 44 YEARS LONG-TERM RESEARCH

Low dissolved oxygen concentration in bottom layers of lakes and reservoirs usually indicates low water quality. In lakes, empirical models predicting anoxia are almost entirely based on the decay of plankton biomass, while in reservoirs recent findings suggest a prominent role of streamflow and load of organic carbon. This suggests a potential link between water quality in reservoirs and climate processes affecting streamflow. Here we support this hypothesis presenting evidence that both interannual climate variability and recent climate change, mainly consisting in a significant increase in potential evapotranspiration in the upstream basin, affected the oxygen content in a Mediterranean reservoir (Sau Reservoir, Spain). Using a 44-year monthly record, we found strong and consistent signatures of El Niño Southern Oscillation in the inflow and reservoir oxygen content. Spectral and wavelet techniques showed that the El Niño, streamflow, and reservoir oxygen content series oscillated in common periods, which coincided with the main El Niño variability modes. An empirical model explaining the annual oxygen content in the reservoir suggested that a decreasing streamflow trend reduced the oxygen content of the reservoir by about 20%, counteracting remediation measures implemented at the basin upstream the reservoir. Our results provide the first quantitative evidence of climate change effects on reservoir water quality using long-term instrumental data, and indicate that streamflow should be considered as a key variable in assessing climate change impact on reservoir water quality. These results are especially relevant in regions of the world where reservoirs are abundant and most climate models predict a decrease in runoff during the next decades. Both the expected trends and the sensitivity of reservoir water quality to global interannual climate variability should be considered for a correct management of water resources in the present and to design adaptation policies in the future.

O3

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USING DIATOM TAXONOMIC DIVERSITY TO ASSESS PESTICIDE CONTAMINATION IN RIVERS

Increasing contamination by micro-pollutants in freshwater systems has become a major problem in modern societies, giving rise to toxicological, sanitary and economical concerns. In 2010 the French government adopted a plan for a 50% reduction over 10 years in the use of pesticides which promotes research on contamination monitoring. Diatom bio-indication tools in rivers have been standardized and normalized (AFNOR NFT 90 354 ; CEN – EN 13946 & EN 14407) and are adapted to assess nutrient and organic matter levels. However these indicators do not assess micropollutants contamination despite diatoms being known to be sensitive to pesticide pollution. The objective of this study is to assess whether bio-indicators based on diatom communities could be developed to assess the impact of pesticide contamination, especially herbicides, on freshwater ecosystems quality. The hypothesis that increasing herbicide concentration reduces diatom diversity was tested on a diatom data set from the French Water Framework Directive monitoring network. The data set includes more than 2000 samples from 14 ecoregions from eastern France over the period 2000 - 2008. To each sample corresponds a list of diatom taxa and 531 micropollutants (herbicides, insecticides, fungicides, heavy metals and organic micro-pollutants) concentration measurements. Diatom diversity was calculated by means of 2 classic indices: Shannon's H' (Shannon, 1948) and Simpson's D (Simpson, 1949) and 3 taxonomic distinctness indices: Δ, Δ* and Δ+ (Clarke and Warwick, 1998). This poster describes preliminary results which may lead to new bio-indication metrics adapted to pesticide contamination.

O7

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KNOWLEDGE, POSSIBILITY OF PREDICTION AND MANAGEMENT OF POTENTIALLY TOXIC CYANOBACTERIA BLOOMS IN THE SARDINIAN MAN-MADE LAKES (WESTERN MEDITERRANEAN).

The affirmation of toxic Cyanobacteria is considered the worst and most frequent typology of Harmful Algal Blooms (HABs) in freshwater environments, with serious consequences also for human health. For this, the development of useful tools in the early prediction of toxic Cyanobacteria blooms is considered very important. With this main objective, a research project, financed by Regione Autonoma della Sardegna (L.R. 7/2007), is carried out on four reservoirs in northern Sardinia since 2010: Bidighinzu, Monte Lerno, Sos Canales and Torrei, already investigated for many years, characterized by different trophic status and whose waters are used for drinking. The study includes the assessment of trends on an annual cycle of chemical and physical variables, nutrients and phytoplankton. Microcystin and nodularin concentrations are detected with the use of the Immunosorbent method ISS.BGA.044.REV00 (Reports ISTISAN 07/31). Preliminary results confirm the presence of potentially toxic species already found in these lakes, such as species of Planktothrix agardhii-rubescens group in the Monte Lerno Lake, and the new notification of species not yet reported in Sardinia, such as Anabaena macrospora (Klebahn), Anabena Viguieri (Denis & Fremy) and Aphanizomenon klebahnii (Elenkin) Pechar et Kalina in Bidighinzu Lake. Anabaena macrospora is not reported in the literature as potentially toxic, Anabaena Viguieri and Aphanizomenon klebahnii are listed as potentially harmful due to the production of microcystins. The highest cellular densities in Monte Lerno Lake in October (120 x 10^6 cell. l^-1) and in Bidighinzu Lake in September (293 x 10^6 cell. l^-1) corresponded to the major toxin peaks, respectively 3.92 ppb and 1.36 ppb. It is confirmed the relationship between trophic status (Bidighinzu and Monte Lerno are the most eutrophic among the four investigated reservoirs) and presence of toxic Cyanobacteria. Moreover the toxicity of Aphanizomenon klebahnii blooms represents a new information in the Sardinian and Mediterranean scenario.

O7

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FIRST MOLECULAR EVIDENCES FOR THE SYNONYMY OF FERRISSIA WAUTIERI AND THE CRYPTIC INVADER FERRISSIA FRAGILIS (MOLLUSCA: PULMONATA: ANCYLIDAE)

Although some fossil records attributed to the freshwater limpet genus Ferrissia testify for an ancient occurrence of the genus in Europe, its presence was completely overlooked till the twentieth century, when an increasing amount of records throughout the whole continent peaked out with the description of a new species, Ferrissia wautieri, based on specimens collected in northern Italy. In the last few years, an ever increasing number of records reporting the occurrence of Ferrissia species throughout Europe have been published, but an agreement on the taxonomical identity of the European populations is currently missing. Recent molecular studies aimed at investigating the identity of Palaearctic Ferrissia species proved the occurrence in Europe and Asia of a number of populations belonging to the allochthonous north American Ferrissia fragilis, while no evidences to support the presence of autochthonous species have been found; furthermore, the possibility that F. wautieri and F. clessiniana, originally described from Italy and Egypt, respectively, could be junior synonyms of F. fragilis have been raised. In order to test this hypothesis, some specimens from the locus typicus of Ferrissia wautieri (Lago Maggiore and Lago di Mergozzo) and from other localities in southern Italy and Sicily have been collected and studied with molecular tools. The 16S and COI haplotypes of all the analysed specimens proved to belong to the North American Ferrissia fragilis, thus casting severe doubts on the status of bona species for F. wautieri. It is desirable that future studies are carried out including samples from other Mediterranean countries, and especially from Egypt (i.e. the locus typicus of F. clessiniana), with the aim of testing the possible existence of autochthonous Ferrissia species in the Palaearctic region.

SS11

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PATTERNS OF TEMPORAL VARIATION IN NET AND GROSS IN-STREAM NUTRIENT UPTAKE

There is a broad body of knowledge highlighting the relevance of in-stream nutrient uptake in headwater streams, which mostly derives from measurements done across a wide variety of streams. However, knowledge on temporal variation of stream nutrient uptake is still scarce. Streams are highly dynamic ecosystems; and thus, within stream variability in nutrient uptake is expected to be high. Each stream is subjected to characteristic temporal regimes of gradual and abrupt changes in environmental factors that affect the biological compartments responsible for nutrient uptake. We expect in-stream nutrient uptake to respond to these changes; and thus, to exhibit a characteristic biogeochemical "heartbeat". The examination of this "heartbeat" can help elucidating when streams are most active and if they show regularities at different temporal scales. Most studies addressing temporal variation of in-stream nutrient uptake are based on measurements of gross nutrient uptake, and some have used measurements of net nutrient uptake (i.e., uptake minus release). However, comparisons of patterns for gross and net uptake are rare, although they may provide insights on the relevance of uptake in front of release processes and determine the moments when a stream acts as a sink or a source of nutrients to downstream ecosystems. In this presentation we will contribute to fill some of these knowledge gaps based on results from four years of monthly measurements of gross and net nutrient uptake rates conducted in two streams located in la Tordera catchment (NE Spain). Results showed that gross nutrient uptake rates are highly variable, but net nutrient uptake rates are mostly bracketed around 0, suggesting that gross uptake is commonly counterbalanced by release processes. Seasonal patterns of gross and net uptake rates do not overlap, but spring appears as a consistent hot uptake moment.

O8

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STUDY AND CLASSIFICATION OF SEMIARID WETLANDS BASED ON THEIR PLANT COMMUNITIES AND TOPOGRAPHY BY MEANS OF LIDAR AND SPECTRAL AIRBORNE REMOTE SENSORS.

Semiarid wetland are environments between steppes and standing water ecosystems where there is no surface water or it is only temporary, but the water table remains sufficiently close to the surface as to allow the development of a specific communities of plants. The flora of a wetland is differentiated according to the plants' individual tolerance of salinity, water table levels and anoxic substrate. Plant species and communities are therefore appropriate ecological indicators for these ecosystems. This study aims to test applicabilities of airborne remote sensors for ecological studies of semiarid wetlands. Characteristic plant communities of 11 semiarid wetlands in Murcia Region (SE Spain) were identified by means of multivariate analysis of a species abundance matrix obtained through fieldwork sampling of plant species in all study wetlands. Georreferenced sampling plots served also as training areas for supervised image classification of plant communities using an airborne spectral sensor image (2x2 m resolution), which consisted in four spectral bands, i.e. Red, Green, Blue and near Infra-red. On site validation of resulting wetland plant communities maps showed accurate results. A LiDAR (Laser Imaging Detection and Ranging) derived Digital Elevation Model (4x4 m resolution) of the study wetlands was used to obtain the topography of each wetland and multivariate analysis on the elevation data matrix was performed to obtain a relief based wetland classification. This methodology seems to be suitable for the mapping and future monitoring of wetland plant community changes over time, as well as for the classification of wetlands based on their topography. This study was funded by the project I+D Nr: CGL2006-08134.

SS6

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EFFECTS OF HYDROLOGICAL ALTERATION AND RIPARIAN HABITAT QUALITY IN CONDITION OF LUCIOBARBUS SCLATERI (GÜNTHER) FROM A SEMIARID RIVER BASIN (SE, IBERIAN PENINSULA)

Freshwater ecosystems have been profoundly altered by human activities, including alteration of natural flow regimes and modification of riparian habitat. The Segura river basin is an intensely regulated basin located in a semiarid climate region of the southeast of Iberian Peninsula. This basin receives external water resources by Tajo-Segura transfer (annual mean water transfer of 340 hm3) which flow into the Mundo river (the main tributary of the Segura river). This situation has lead to severe modification of the natural flow regimes of these rivers which could negatively affect native fish fauna. Fish condition indices are particularly useful for monitoring fish populations and to assessing the effects of environmental conditions on individual or population health. The objective of this study was to evaluate the possible differences in fish condition of southern Iberian barbel populations, assessed through morphometric (length-weight relationships with ANCOVA procedure) and biochemical (whole-body crude lipid and crude protein) approaches, inhabiting three river sectors with different flow and riparian habitat conditions in the Segura river basin. There were significant differences in morphometric condition indices (total weight, eviscerated weight and liver weight, adjusted for fish size with ANCOVA) and whole-body crude protein among study sectors. Condition values were significantly higher in the most altered river sectors, situation that is probably related to changes in the body-tissue composition of Luciobarbus sclateri, such as the increase of muscular tissue in populations subjected to higher water discharges.

O10

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FRESHWATER PREDATION AT ECOSYSTEM BOUNDARIES: A CASE STUDY OF THE INTRODUCED EUROPEAN CATFISH (SILURUS GLANIS) IN SOUTHWEST FRANCE.

When predators forage at the boundaries between ecosystems, they can interact with the fluxes of energy between aquatic- terrestrial and marine-freshwater ecosystems. Particularly interesting are the newly introduced predatory fish that can have strong implications on the recipient food webs. Among these introduced fish species, we have studied the potential impacts of European catfish (Silurus glanis), the largest-bodied freshwater fish in Europe, on river food webs in southwest France. Specifically, we studied the trophic interactions between introduced catfish and native biota at the terrestrial-aquatic and marine-freshwater interfaces using stable isotope analyses and gut contents. Our results highlighted that terrestrial prey such as birds and small mammals can significantly contribute to the diets of large bodied catfish. Similarly, anadromous fish can also be an important part of their diet, illustrating the broad and opportunistic trophic niche of the catfish. These results underline the importance of interactions at ecosystem boundaries and the potential role of non-native species on fluxes between ecosystems. However, functional consequences of such interactions remain to be studied.

SS15

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ECOLOGICAL ASSESSMENT OF RUNNING WATERS: DO MACROPHYTES, MACROINVERTEBRATES, DIATOMS AND FISH SHOW SIMILAR RESPONSES TO HUMAN PRESSURES?

This study aimed at comparing the intensity and the precocity of the responses of four river biological quality elements (BQEs): macrophytes, fish, diatoms and macro-invertebrates, to human pressures excluding natural variations of stream ecosystem functioning. As part of the European project WISER, biological, water quality and hydro-morphological data were compiled for 290 French stream sites. National and European indexes (e.g. EFI) and metrics based on assemblage structure (e.g. species richness) and ecological and biological traits (e.g. number of lithophilic fish species) were first transformed to acquire independance of natural environmental variability (80 undisturbed sites). In a second step, their responses to human pressures linked to global, water quality, hydrological and morphological alterations were tested and compared for an independent data set (188 impacted and 22 undisturbed sites). Out of the 93 tested, 52 metrics covering the four BQEs responded significantly to global degradations. The responses to specific pressures were consistent with the BQEs ecological and biological characteristics. Macrophytes, diatoms and macro-invertebrates metrics responded strongly to water quality degradations. As for fish, macro-invertebrates metrics were very sensitive to morphological degradations such as the presence of an impoundment while diatoms and macrophytes metrics did not show strong responses to these changes. Fish metrics responded strongly to hydrological perturbations. Also, the four groups did not appear to be very sensitive to the presence of a barrier downstream. Although most of the metrics showed late responses to human-induced degradations, traits-based metrics seemed to have the earliest responses. Finally, studying the effects of different types of pressure and global degradation brought new questions about the effects of pressure accumulation, links among pressures and between environment and pressure effects on biological communities.

O5

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EFFECTS OF FLOW INTERMITTENCY ON CONSUMERS' FITNESS AND FUNCTIONING: A BOTTOM-UP EFFECT THROUGH CHANGES IN RESOURCES' QUALITY.

In the current scenario of climate change, the intensity and frequency of droughts are likely to increase and, furthermore, effects may be worsened by increasing water demand. Therefore, understanding the effects of streambed drying on trophic resources and stream inhabiting biota is important for predicting the potential effects of increasing water scarcity. In this study, we aimed to relate how changes in food quality driven by flow intermittency would transfer to consumers' fitness and functioning. Therefore, we conditioned autotrophic (biofilm) and heterotrophic (Populus nigra leaves) resources, simulating permanent flow (PER, 9 weeks submerged), intermittent flow (INT, 5 weeks submerged + 3 weeks in the shore + 1 week submerged) and autumn leaf-fall (AUT, 8 weeks in the shore + 1 week submerged; only for leaves). Afterwards, we fed a shredder (Stenophylax sp.) and a scraper (Physella acuta) with the different conditioned material. Preliminary results show a reduction in N, P and lipid content in INT conditioned biofilm. Leaves conditioned under PER conditions also showed higher N and P content, while AUT ones had the highest C:N, C:P and N:P ratios. However, those changes were not reflected on consumers' biochemical composition. Alternatively, we found higher consumption rates for shredders fed with PER leaves while the lowest ones corresponded to those fed with AUT ones. Similar tendencies, although not statistically significant, were found for scrapers. Accordingly, we also found higher growth rates for shredders fed with PER leaves while scrapers feeding on INT biofilm also showed a tendency towards a lower growth. In conclusion, flow intermittency caused a reduction in both autochthonous and allochthnous resources quality. However, consumers showed a high homeostatic capacity, their stoichiometry and biochemistry being not affected. Instead, we observed alterations in their functional responses, as both, consumption and growth rates were reduced in non-permanent treatments.

O3

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MODELLING STREAM AND GROUNDWATER DYNAMICS TO EVALUATE HUMAN PRESSURES ON STREAM DISCHARGE AT THE LOWER ARBÚCIES RIVER BASIN (NE SPAIN)

Water resources demand in mountain areas relies on surface water diversion, usually through complicated channel networks, and groundwater withdrawal from alluvial aquifers. In both cases, human demand affects stream discharge and it may become a threat for in-stream flow maintenance and ecosystem preservation. The Arbúcies River basin, located in the Catalan Coastal Ranges, presents such scenario which dries up the river in its lower reach during the summer season. These effects are especially noticeable in its lower part, at its confluence with the Tordera River, where alluvial deposits constitute an unconfined aquifer. Whereas flow diversion constitutes the main supply for urban and agricultural demand in the upper and middle part of the basin, groundwater withdrawal satisfies urban and industrial demand in its lower reach. Flow recession curve analysis, considering the effect of channel diversion, and numerical groundwater flow modeling are applied to estimate the effect of both pressures upon the river discharge. Hydrographs from a gauging station situated at upstream from the lower basin indicate the influence of diversion, which has been evaluated using a modified expression for the flow recession curve equation. Moreover, monitoring discharge along the lower reach indicates that infiltration from the streambed recharges the unconfined aquifers. Historical records of hydraulic head data corroborate this loosing stream behavior, and they represent a record of the groundwater withdrawal effect upon river discharge. Numerical flow modeling, including the relationship between stream and aquifer, allow simulating the capture due to groundwater resources exploitation. Both approaches, flow recession curve analysis and numerical flow modeling, evaluate the magnitude of human pressures and permit setting specific exploitation thresholds that will insure the accomplishment of in-stream flow requirements, and the completion of good hydrological status in this reach. This study is funded by the Catalan Water Agency, and it also benefits from project CGL2008-06373-C03-03/BTE (Spanish Government).

O3

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IDENTIFICATION OF STREAM FLOW SOURCES BY MEANS OF HYDROCHEMICAL END-MEMBER MIXING ANALYSIS (TORDERA RIVER, NE SPAIN)

Alluvial aquifers have been traditionally exploited to fulfill water needs for any demand. Such management practices did not recognize the stream-aquifer interaction. Minor streams are heavily affected as stream flow is captured by groundwater withdrawal. Analyzing stream discharge and hydrochemistry permits identifying the contribution of distinct end-members to the existing water resources in the stream and the overexploited alluvial reach. In this contribution, we investigate the origin of water resources in an intensively exploited stream-connected alluvial aquifer to provide potential strategies to locally ease the above mentioned human impacts. This research was conducted in the Tordera River basin along a 5 km reach. Discharge measurements and water samples for hydrochemical analyses were taken at different points to track discharge and chemical variations along the river. Active wells located in the alluvial aquifer were also sampled. End-member mixing analysis pointed out that surface water originates from distinct sources, namely, the upstream contribution of the Tordera River, that of its tributaries, the effluents from the waste water treatment plant, and additionally, groundwater contribution. Conversely, groundwater hydrochemistry also showed the influence of surface water infiltration, as expected because of the loosing stream behavior. The main outcome from this survey indicates that surface water gets a contribution from groundwater at the beginning of the investigated reach. It is attributed to the occurrence of preferential large-scale groundwater flows through regional fault lines. Mixing analysis shows that this specific contribution was up to a 20% of the total discharge. From a management perspective, groundwater appears as an alternative to water supply. Wise exploitation of such resources will ease the pressures upon the alluvial aquifers, and hence to the stream discharge allowing a more frequent achievement of the recommended in-stream discharge and, therefore, enhancing ecological preservation. This study is funded by project CGL2008-06373-C03-03/BTE (Spanish Government), and participates in 'Observatori de la Tordera' project.

O10

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HOW DO YOUNG, ARTIFICIAL LAKES AFFECT FOOD QUALITY AND FATTY ACID COMPOSITION IN ZOOPLANKTON?

In aquatic ecosystems, zooplankton obtains their dietary fatty acids (FA) mainly from fine particulate organic matter (<30µm). Previous studies revealed that FA of zooplankton reflect those of their dietary supply. We studied 5 gravel pit lakes that differ in age (1-28 years), size (4-16 ha) and depth (5-10 m) during spring, summer, fall, and winter (ice-free). These systems are mainly supplied by groundwater and provide a unique environment to investigate how food quality (FA composition of edible seston) varies with seasonal nutrient input and lake age, and affects the fatty acid composition of mostly herbivorous zooplankton. We hypothesized that changes in nutrient and/or food quality (as measured by essential FA) do not affect zooplankton FA composition because it is expected that zooplankton (cladocerans and copepods) will regulate their FA profiles in order to meet their physiological requirements, independent of the system or season. Our preliminary results indicate that the FA composition of edible seston differs seasonally, but does not predict the retention of fatty acids in either cladocerans or copepods, indicating that zooplankton seem to have a strong, innate ability to regulate their FA in these young lakes.

I09

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MULTIPLE AGRICULTURAL STRESSORS IN STREAMS: LESSONS FROM EXPERIMENTS AT TWO SPATIAL SCALES

Agricultural land use influences aquatic ecosystems in numerous ways, mostly with multiple stressors having simultaneous impacts. For example, many streams and rivers worldwide are affected by elevated levels of dissolved nutrients and deposited fine sediment, raised water temperatures and/or reduced discharges due to abstraction for farmland irrigation. While all these stressors are known to exert individual effects on community composition and ecosystem functioning, their combined consequences are poorly understood. In a series of experiments in 50-m reaches of farmland streams in the South Island of New Zealand and in 2.5-m longitudinal streamside channels fed by a farmland river, we have investigated key stressors in pairs and triplets, to determine their individual and combined effects on stream invertebrates. Manipulated stressors included elevated levels of dissolved nutrients, deposited fine sediment, reduced flow (to simulate water abstraction) and raised water temperature (to simulate replacement of tall tussock grass in stream margins by grazed exotic grasses). Each stressor had significant individual effects on invertebrate response variables, including community-level variables commonly used in biomonitoring. Increased nutrients had positive effects at low levels (subsidy) but became a stressor at higher levels in several cases. Increased fine sediment had mainly negative effects and was a more pervasive stressor overall than nutrients. Water abstraction had mainly negative effects on its own while raised water temperature had mixed effects. In combination, stressors often produced complex outcomes. Thus, elevated nutrient concentrations had positive effects at low sediment levels but negative effects at high sediment levels, and both water abstraction and raised water temperature exacerbated effects of elevated fine sediment. Because ecological consequences of multiple stressors are often unpredictable based on knowledge of single effects, resource managers need to know how stressors interact.

SS10

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ECOSYSTEM FUNCTIONING WITHIN SPRING AND AUTUMN COMMUNITIES OF STREAM SUSPENSION FEEDERS: THE ROLE OF SPECIES EVENNESS

Communities of benthic stream invertebrates are notably dynamic, with extensive spatio-temporal variation in species diversity and composition, and hence also in species traits of potential importance for ecosystem functioning. Indeed, in a landmark paper published in Ecology Letters during 2004, Prof. Björn Malmqvist together with his colleague Olivier Dangles presented field evidence that shifts in species relative abundances and seasonal shifts in species traits could have as strong effects on ecosystem functioning as shifts in species richness. To investigate further these "important but less obvious aspects of the biodiversity–ecosystem functioning relationship" we studied the effects of species evenness on feeding rates of suspension feeders, within two seasonal assemblages of lotic blackfly (Diptera: Simuliidae) larvae. Blackfly larvae are predominant processors of suspended organic matter in streams, with important roles in the retention of energy and nutrients at the stream reach scale, and were a key organism group in Prof. Malmqvist's research. We conducted two laboratory microcosm experiments using spring and autumn blackfly assemblages within which species richness and evenness were manipulated, and quantified individual consumption rates of yeast particles as an ecosystem process. Species richness had no effects on particle capture rates, whereas both evenness and species composition had marked effects. However, the effects of evenness varied not only according to the particular characteristics (traits) of the dominant species, but also with changes in species interactions in the different assemblage configurations, and at the different times of year. These results highlight the importance of species evenness for biodiversity-ecosystem functioning relationships in stream suspension feeder assemblages, and demonstrate how variation at the patch scale in not only species trait composition but also the relative strengths of intra- versus interspecific interactions might strongly influence spatio-temporal fluctuations in ecosystem functioning.

SS3

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ASSESSING THE IMPACT OF EXOTIC TREES LEAF LITTER ON THE MACROINVERTEBRATE COMMUNITY FROM AN UPPER REACH OF HENARES RIVER (GUADALAJARA, SPAIN)

In temperate streams leaves fallen from riparian trees represent the main source of energy for aquatic macroinvertebrates. Leaves fall into the river undergo a decomposition process driven by microorganisms and macroinvertebrates. Among macroinvertebrates, leaf consumers (shredders) select the leaves to ingest on basis of several characteristics, such as toughness, nutrient content, presence of chemical defenses, and the degree of conditioning by microorganisms. The invasion of riparian zones by exotic trees involves that leaves differing in physical-chemical properties from native leaves are entering the river. These exotic materials can modify the macroinvertebrate diversity and abundance. Our aim is the assessment of the potential effects of two common exotic trees, Ailanthus altissima (from China) and Robinia pseudoacacia (from United States), on macroinvertebrate community, by comparing the animals which colonized the leaf litter of these exotic species with those colonizing the leaf litter of two common native trees (Populus alba and Fraxinus angustifolia). We conducted a field experiment in a low order stream of the upper reach of the Henares River (Central Spain). Litter bags (mesh size of 0.5x0.5cm) were made with senescent leaves of the different tree species collected in autumn. Bags were left in riffles and four replicates of each species were collected after 2, 20, 39, 62 and 82 days. Leaf litter bags and their macroinvertebrates were collected by means of a hand net. Once in the laboratory, macroinvertebrates were counted and indentified to family level by means of taxonomic keys. Additionally macroinvertebrates were assigned to different functional feeding groups. The results would allow us to assess the impact of these common exotic trees on the macroinvertebrate community.

SS8

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GENETIC POPULATION STRUCTURE OF SYMPATRIC AND ALLOPATRIC POPULATIONS OF BALTIC CISCOES (COREGONUS ALBULA COMPLEX, TELEOSTEI, COREGONIDAE)

Teleost fishes of the Coregonidae are good model systems for studying postglacial evolution, adaptive radiation and ecological speciation. Of particular interest is whether the repeated occurrence of sympatric species pairs results from in-situ divergence from a single lineage or from multiple invasions of one or more different lineages. We analysed the genetic structure of Baltic ciscoes (Coregonus albula complex), examining 271 individuals from 8 lakes in northern Germany using 1244 polymorphic AFLP loci. Six lakes had only one population of C. albula while the remaining two lakes had C. albula as well as a sympatric species (C. lucinensis or C. fontanae). AFLP demonstrated a significant population structure (Bayesian ?B =0.22). Lower differentiation between allopatric (?B = 0.028) than sympatric (0.063-0.083) populations contradicts the hypothesis of a sympatric origin of taxa. Genome scans found only three loci that appeared to be under selection in both sympatric population pairs, suggesting a low probability of similar mechanisms of ecological segregation. However, removal of all non-neutral loci decreased the genetic distance between sympatric pairs, suggesting recent adaptive divergence at a few loci. Sympatric pairs in the two lakes were genetically distinct from the six other C. albula populations, suggesting introgression from another lineage may have influenced these two lakes. This was supported by an analysis of isolation-by-distance, where the drift-gene flow equilibrium observed among allopatric populations was disrupted when the sympatric pairs were included. While the population genetic data alone can not unambiguously uncover the mode of speciation, our data indicate that multiple lineages may be responsible for the complex patterns observed in Coregonus. Relative differences within and among lakes raises the possibility that multiple lineages may be present in northern Germany, thus understanding the postglacial evolution and speciation in the C. albula complex requires a large-scale phylogenetic analysis of several potential founder lineages.

SS11

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ANALYZING THE NITROGEN CYCLE IN A RIVER-AQUIFER CONTEXT. THE ONYAR RIVER CASE (NE SPAIN).

Streams in Mediterranean areas are characterized by a variable discharge regime with annual floods and droughts. Human pressures, such as wastewater discharge or agriculture and livestock pollution, may severely impact on these streams, since their possible dilution depend on river flow. In this context, a river-aquifer analysis has been conducted in 15 km of the Onyar River system (NE Spain), located in a siliceous watershed (mean discharge of 1.77 m3/s). To determine how natural or human changes in its flow may affect the nitrogen cycle in this stream, 6 field surveys were carried out measuring stream discharge and water table depth in wells and in 7 piezometers drilled in the river bed. Furthermore, 2 hydrochemical campaigns have been conducted analyzing surface waters, ground waters and subsurface waters collected in the piezometers. A hydrochemical survey was conducted after a dry period, and a second one, after a storm event. Results indicate that nitrogen in the alluvial aquifer is mainly composed by nitrate, ranging from 7–62 mg NO3--N/L. Nitrogen in waste waters ranges between 20–30 mg N/L and is mainly composed by organic-N or NH4+-N. In both sampling periods, stream flow was maintained or increased not only by surface runoff and treated and non-treated waste water discharges, but also due to groundwater contributions. In this stream, picks of nitrogen were detected after waste waters discharges, and also when important groundwater contributions were measured. In both cases surface water reached 7.5-10.5 mg N/L. Although nitrogen assimilation and natural attenuation is produced, its concentration in surface waters is maintained downstream, due to the groundwater loadings. As a conclusion, an integrated management of this river-aquifer system is needed in order to preserve and improve its ecological quality. This study is funded by project CGL2008-06373-C03-03/BTE.

O3

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CADMIUN TOXICITY IN SPIKED-SEDIMENT WITH THE AQUATIC OLIGOCAHETE TUBIFEX TUBIFEX: AN APPROACH TO ASSES CRITICAL BODY RESIDUE

Introduction In aquatic ecosystems, organisms are exposed to heavy metals via waterbone and dietary routes, including ingested sediment. In toxicity tests biological adverse effects due to specific sediment metal concentration could be related to metal accumulation in exposed organisms. Metal concentration in body tissues can be studied through the concept of critical body residue (CBR). In this study, the relationship between cadmium (Cd) exposure, accumulation, and toxicity was investigated using the oligochaete worm Tubifex tubifex. Materials and Methods Laboratory cultured T. tubifex were exposed to a natural sediment spiked with Cd in a 28d chronic toxicity test. Measured endpoints were survival, reproduction and growth. To determine Cd effect, median effective concentrations were estimated for reproduction on sediment, overlaying and interstitial water (EC50) and median critical body residue for tissue (CBR50). Also 96h acute toxicity test was conducted with the aim to determine the 96h-Cd LC50 (median Lethal Concentration) and 96h-Cd LBR50 (median Lethal Body Residue). Results T. tubifex accumulated Cd in a concentration-dependant manner. After reaching a threshold of Cd exposure, the tissue residue concentration was significantly related with a decline in reproductive output ($p<0.05$), but not a significant mortality was observed ($p>0.05$). The EC50 values in reproduction ranged for sediment 0.96-1.07 (µmol Cd g-1 dw); 0.16-0.24 and 0.24-1.4 (µmol Cd l-1) for overlaying water and interstitial water, respectively; CBR50 for reproduction ranged 27.45-40.14 (µmol Cd g-1 dw). The number of young per adult was the most sensitive endpoint. In the acute toxicity test, the LC50 was 11.58 ± 1.75 (µmol Cd l-1) and the LBR50 was 10.1 ± 1.61 (µmol Cd g-1 dw). Conclusions T. tubifex exhibited both acute and chronic toxicological effects depending upon the exposure concentration. The results also showed that cadmium had a very narrow range of action which could cause toxicity, and that once cadmium body concentration threshold was overloaded toxicity effect occurred dramatically.

O5

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MICROBIAL ACTIVITY AND SEDIMENT DISTURBANCE: DYNAMIC CONTROL OF VERTICAL WATER FLUX IN SAND BED FLUMES

The spatiotemporal patterns of Vertical Water Flux (VWF) in streams and its control are poorly understood. The aim of this study was to determine the effect of algal and microbial activity and posterior sediment disturbance on VWF under semi-natural conditions. The experiment was conducted during 30 days (June-July 2010) in 16 outdoor flumes (0.12 x 0.08 x 4 m) filled with clean silica sand (0.2-0.8 mm). One set of eight flumes had a level bed, and the other eight had a rippled bed. Half of each set was exposed to daylight, and the other half was kept under no-light conditions, to separate the effects of algae and bacteria. After 22 days, the sediments upper 2 cm were manually disturbed. VWF was measured by tracing uranine (day 1, 13, 20 and 30) while flumes were operating in re-circulating mode. At day 20, algae and bacterial abundance, biomass and CaO3 content in sediments were determined. Sediment associated respiration (SAR) was measured (day 20 and 30) in flow through respiration chambers. VWF in daylight exposed flumes was reduced faster than in those kept under no-light. After 3 weeks, the upper 2 cm of daylight flumes showed higher abundance of algae, sediment biomass, and SAR than no-light flumes, while no-light ones had higher bacterial abundance. All flumes showed a high precipitation of CaO3 in the upper sediments. Disturbance restored VWF to initial rates only in the daylight exposed flumes. SAR and sediment biomass were also not affected. Activity of benthic algal and bacteria can disrupt VWF. The interplay of sediment colonization by microorganisms and sediment disturbance due to flow dynamics can control VWF likely resulting in a complex spatiotemporal VWF pattern, which has yet to be appropriately considered.

O7

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ASSESSING ECOLOGICAL INTEGRITY OF TROPICAL RIVERS: A STUDY USING INVERTEBRATE COMMUNITIES IN A VOLCANIC ISLAND

As a French department, the Reunion Island (Indian Ocean) has to meet the Water Framework Directive requirements for 2015 (e.g. develop appropriate bio-assessment tools). This is a real challenge because 1) the geographic and historic context is different compared to temperate hydro-ecoregions (i.e. using common bio-assessment tools is impossible) and 2) ecological knowledge on Reunion invertebrates is poor. Therefore, we started a research program in 2008 to improve knowledge on invertebrate systematic, community structure, spatial distribution, ecological preferences and on river anthropogenic impacts. From 2008 to 2010, 42 reaches in the 20 permanent rivers of the island were randomly sampled (at least 12 microhabitats in each reach, using a Surber net) during dry season. At each sample location, current velocity, shear stress, substrate composition and depth were measured. With these data, ecological preferences of each taxa were computed. At the reach scale, water quality and discharge were regularly assessed. In 2008-2009, we collected 74 taxa and many of them were endemic of the Mascarene area. More than 80% of the taxa present in a given reach were collected with 12 samples. Taxa richness was different among rivers, but was not always related to catchment area. Longitudinal richness patterns also differed among rivers but, in general, there were more taxa in headwaters. The 2008-2009 data showed temporal variability in taxa richness highlighting for instance, annual hydrological variations or hurricane effects. Some taxa were restricted to certain areas (e.g. headwaters or mouth), whereas others were largely distributed. These later taxa are particularly interesting in a bio-assessment context: their absence or low abundance might reflect anthropogenic impacts. Finally, hydraulic disturbances are the most important anthropogenic impacts in Reunion rivers and thus, the many taxa showing marked hydraulic preferences could be very relevant to assess ecological integrity of these ecosystems.

O3

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HEAVY METALS IN AQUATIC ECOSISTEMS LOCATED IN RESTORED OPEN COAL MINES

Open coal mining involves important environmental impacts, especially if any restoration activity has not been carried out. The impact of this activity and the efficacy of restoration measures have been studied in landscapes, soils, vegetation and rivers, but there is little information about the aquatic ecosystems created in restored areas. We have analyzed the presence of heavy metals in ponds created in restored coal mines with the aim of knowing if there is metal contamination and also if there is metal accumulation in plants colonizing these ecosystems. We have studied 19 ponds located in tree restored coal mines and 1 in an unrestored mine located on the Martín River basin, in Teruel (Spain). We collected samples of water, sediment and littoral vegetation (Typha sp.) in each pond, analyzing their heavy metal content (Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn) upon inductively coupled plasma optical emission spectrometry (ICP-OES). Restoration measures resulted in heavy metal concentrations under toxic levels, in both water and sediments. Furthermore, concentration of heavy metals in Typha sp (especially those considered as essential trace elements) was similar to those observed in similar plants growing in unpolluted sites. Comparing data of ponds of restored and unrestored mines we observed that in unrestored pond, metals sediment concentration is lower and metals water concentration is higher due to metal solubilization. Littoral plants are unable of colonizing and growing in unrestored ponds mainly because of inadequate environmental condition (e.g. water pH ≈3,5). Our results show that restoration in open coal mines are necessary and efficient to control the contamination by heavy metals in the aquatic ecosystems created in these areas.

SS2

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NUTRIENTS AND PRIMARY PRODUCERS IN MEDITERRANEAN PONDS

The limnology of ponds is still poorly known, even more if we take into account the different types of ponds that exist. A major characteristic of Mediterranean ponds is their great heterogeneity mainly related to sources of water. Mediterranean climate promotes unstable habitats when ponds mainly depend on rainfall. The aim of this study was to understand the limnological characteristics of Mediterranean ponds, mainly focusing on nutrients and primary producers responses. We collected limnological data from 140 ponds distributed along the Eastern Spain. Ponds covered a broad environmental gradient from temporary rain ponds to permanent ponds fed by groundwaters. Water mineral contents was related to water sources; rain ponds had low conductivity but high turbidity and ponds fed by ground waters showed higher conductivities and clearer waters. Water nutrients (TP, TN) reflect land uses. Ponds fed by springs had higher TN, increasing in lowland areas due to intensive agriculture. Rain ponds had in average, a higher TP but showed high variability and increases with cattle trampling. The response of primary producers (measured as planktonic chlorophyll and plant coverage) was shaped by the effect of hydroperiod. Temporary ponds presented low TN/TP mass ratios, usually below 14, value considered to indicate N limitation, suggesting denitrification processes are important in temporary aquatic habitats, also turbidity in temporary ponds with short hydroperiods reach concentrations that can limit light penetration and thus algal and plant growth.

SS12

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NEMATODES AND ECOSYSTEM FUNCTIONING: DOES (CRYPTIC) SPECIES DIVERSITY MATTER?

Nematode assemblages comprise multiple trophic groups and substantial within-trophic-level diversity. Nematodes potentially contribute to a diversity of ecosystem functions, yet their importance in any of these remains largely unquantified. The co-occurrence of multiple supposedly confunctional species at local scales raises the question as to whether and how horizontal diversity contributes to ecosystem functioning. We review recent studies using bacterivorous nematodes as models and organic matter decomposition as a target function. We illustrate that nematode species diversity matters to ecosystem process rates, yet according to unpredictable patterns. In search for the underlying mechanisms, it has become clear that facilitative and inhibitory interactions among closely related species prominently feature and are key to a proper understanding of the role of nematode diversity and of assemblage structure. In view of the discovery that several of our model 'morphospecies' are complexes of several cryptic species which often occur sympatrically, the questions as to (a) what drives nematode species assembly and coexistence of closely related species, and (b) whether and how these closely related species exhibit functional differences, become even more challenging. Here we provide evidence of resource partitioning among sympatric species of the Rhabditis (Pellioditis) marina species complex. We further demonstrate that the nature of the competitive interactions between them can shift from contest competition to scramble competition depending on environmental factors. We have also performed microcosm experiments into the roles of different cryptic species of R. marina in macroalgal detritus decomposition. Decomposition rate did not differ between different cryptic species treatments, but microbial exoenzymatic activities did, albeit not consistently over time. These results highlight the importance of interspecific interactions in determining sympatric occurrences of cryptic species. They also suggest that small functional differences exist between cryptic species, but that these have limited consequences for ecosystem functioning.

O3

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PHYTOPLANKTON DYNAMICS BASED ON FUNCTIONAL GROUPS AND ECOLOGICAL STATUS ASSESSMENT ACCORDING TO WATER FRAMEWORK DIRECTIVE IN A MEDITERRANEAN LIMNO-RESERVOIR.

The "limno-reservoirs" are a new kind of reservoirs constructed in the edge of bigger ones in order to create a small body of water with a constant level. Pareja Limno-reservoir is one of the first limno-reservoirs in Spain and all over the world. It has environmental and recreational function, and this research group has set up an environmental observatory studying, among other variables, the limnological behaviour. In lakes and reservoirs, phytoplankton is one of the compulsory limnological indicators to be analysed under the EU Water Framework Directive. Its dynamics has been studied at the Pareja Limno-reservoir under the functional groups approach in the dam and the edge zones of the limno-reservoir. Groups X2 (Plagioselmis nannoplanctica, dam zone) and Y (Cryptomonas spp., edge zone) dominated the phytoplankton community when the studies started, and were rapidly replaced by diatoms from group B (Cyclotella spp.), which dominated in most of the samplings. They were replaced in summer by species of groups T (Planctonema lauterbornii, dam zone) and MP (Campylodiscus sp., edge zone). Groups MP and X2 were also abundant in winter, and also group P (Fragilaria sp., edge zone). The key factors involved in the phytoplankton dynamics seemed to be the ending of the filling process, the stratification pattern, the nutrients and light availability and the turbidity and inorganic compounds concentration incoming from the Ompólveda River. The Q index (assemblage index), which is based on the Directive requirements, was applying afterwards. An excellent ecological status was obtained for most of the samplings, which indicates that the objectives of the Water Framework Directive for phytoplankton have being achieved at Pareja Limno-reservoir.

SS3

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CHANGES IN CHANNEL FORM AND STREAM FUNCTIONING INDUCED BY WOOD RESTORATION IN MOUNTAIN STREAMS

Dead wood is a key element in forested streams, but its abundance has decreased worldwide as a result of clearing of riparian forests, resulting in changes in channel form and ecosystem functioning. We studied the effects of restoring the natural loading of large wood (LW) in 4 streams of the Aiako Harria Natural Park (Basque Country, Spain). These streams transport large amounts of sediments and leaf litter into a downstream reservoir, threatening the amount and quality of water stored there. Following a BACI design, we selected a control reach (upstream) and an experimental reach (downstream) in each of 4 streams ranging in width from 3 to 15 m. All reaches were studied for one year, then 30-240 m3/ha of large wood was added into experimental reaches mimicking natural structures, and all reaches studied for two additional years. Variables measured were: wood stability, channnel form, sediment type and storage, and organic matter storage. In the small streams most wood structures remained stable, whereas in the largest one most were scoured by floods and rearranged in a single massive jam. In all experimental reaches wood jams induced the formation of new geomorphic features, changes in physical habitat, and large accumulations of sediments and organic matter. Sediment stored at all reaches increased, but especially in the experimental reaches, were the increase was 6 to 58 times higher than in the control reaches. The amount of organic matter stored also increased up to 70 times more than in their respective controls. Increased pool number and depth were the main changes produced by wood addition into the experimental reaches. Our results are helpful for establishing rules to use of wood as a tool in stream restoration. In places where flood hazard can be ruled out, restoring the natural abundance of LW can result in fast geomorphic adjustments and in improved habitat diversity and stream functioning.

SS5

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SPECIES TRAITS AND HABITAT STRUCTURE MEDIATE THE IMPACT OF WILDFIRE ON FISH IN UPLAND PORTUGUESE STREAMS

In Mediterranean regions human actions have transformed the natural regime of wildfire and modified river habitats. These trends of increasing fire-risk and water exploitation are expected to intensify with climate change. Fishes may be particular vulnerable to the potential synergistic effects of these compounded (fire-habitat) impacts. We studied fish assemblages from an 18-year chronosequence of streams impacted by catchment-wide wildfire (N=14). Data were interpreted with reference to a previous survey (conducted 4 years earlier) of environmentally similar, non-impacted streams (N=18). These data also provided two contrasting cases of before – after impact assessment. We tested the hypotheses that recovery (taxonomic richness and abundance) was related to time since the wildfire event and that overall impact was explained in terms of species traits and habitat character. The impact of wildfire differed between species: as resource specialists, Salmo trutta were most vulnerable; Iberian endemic cyprinids, characterized by generalist traits, demonstrated ecological resistance. Recovery appeared to be explained in terms of mobility traits (migration behavior) although overall ecological recovery was not related to time since fire. Habitat architecture was a key determinant of wildfire-impact: increasing with channel slope and the degree of channelization. Downstream channel damming was considered to have impeded fish recovery in several fire-impacted streams. Presenting versatile, broadly applicable tools for fire-related assessment this contextual, habitat - traits perspective facilitates the prioritization of fire-related landscape management and the identification of clear targets for associated river restoration aimed at impact mitigation and enhanced ecological recovery.

O3

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LAND USE AND RIVER EUTROPHICATION: INFLUENCE OF SPATIAL SCALE

The main objective of this study was to demonstrate that spatial scale may affect the interpretation of results when relating land uses to nutrient enrichment of surface waters. Eutrophication impact of some land uses such as agriculture (irrigated cropland, dry cropland and low impact agriculture), urban and forest was assessed at four different spatial scales. Nitrate, ammonium and ortophosphate concentrations and the percentage of occupation by land uses were measured at 130 river reaches located in south-central Spain. Results suggested that different spatial scales may lead to different conclusions about causes of river eutrophication. At large scales, nested-overlapping subcatchments produced spatial autocorrelation between sites, and some land uses did not show a complete range of occupation. The most local scale analysed (1km radius buffers) was the most appropriate to detect river eutrophication, arising irrigated cropland as the main land use that caused river eutrophication by nitrate.

SS13

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THE FRENCH ALPINE LAKES OBSERVATORY (ALO): A TOOL FOR ASSESSING THE EFFECTS OF THE GLOBAL CHANGE ON LAKE ECOLOGY.

This Observatory involves 3 French alpine lakes (Léman, Annecy and Bourget), corresponding to different situations with regard to the water quality and ecosystems status. The main goal of the Observatory is to understand and to model the ecological status changes (structure, biodiversity, fluxes) of the lacustrine systems submitted to changes (in terms of nature and intensity) of the external drivers (anthropization, climate). Limnological surveys are organized since 1957 (Léman), 1980 (Annecy) and 1990 (Bourget) and concerned several environmental variables: physico-chemistry (water, meteo), Phyto-, Zoo-, Bacterio- and Virioplankton, fishes (stocks and dynamics). Collections of biological elements are also organized (Fish scales; phytoplankton; algae) and the data are gathered and organized in a database. The initial question of ALO was about phosphorus loads increase and eutrophication risk. But since 1960-1970 and the improvement of wastewater treatment, the main scientific questions are about the consequences of re–oligotrophication and about the consequences of global change (temperature, new pollutants, ..) on the lakes ecology. Three main results will illustrate the contribution of ALO these questions: - the links between the organization of planktonic communities and lacustrine ecosystem functioning, in response to local or global environmental changes, including a "retro observation" approach using paleolimnological data.

- The responses of communities and populations to habitat disturbances by developing a functional bioindication linked to risk assessment (including ecotoxicology approach) and by contributing to the management and bioconservation of fish stocks.

- The use of models describing the mechanisms and regulation process of suspensions, nutrients (dissolved, particulates) and contaminants of the rural catchment flowing into lakes.

SS1

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MICROBIAL DECOMPOSITION OF LEAF LITTER IN A MEDITERRANEAN STREAM

Streams in the Mediterranean region are subject to strong seasonality, with large floods in autumn and spring, followed by drought and high temperatures in summer. These seasonal differences may influence ecosystem functioning including the decomposition of organic matter. In this study we try to understand the response of microbial decomposition to strong seasonality in a forested Mediterranean stream. We performed five decomposition experiments throughout the year (autumn 2009-summer 2010). Leaves of black poplar (Populus nigra) were enclosed in coarse (10 mm mesh) and fine (0.2 mm mesh) bags and incubated in Fuirosos stream (NE Spain) for periods of 35 to 96 days. Bags were retrieved regularly, and we measured leaf mass loss, microbial biomass (fungi and bacteria), and activity of extracellular enzymes (B-glucosidase, B-xylosidase, cellobiohydrolase and phenoloxidase). Breakdown rates averaged 0.013 +- 0.0035 day-1 in coarse mesh and 0.0082 +- 0.0025 day-1 in fine mesh bags. Rates increased from winter to spring suggesting a direct relationship with rising temperature, but in summer, as the stream started to dry out, breakdown rates decreased. The summer decrease in breakdown rate was correlated to oxygen concentration and low flow velocity. Enzimatic activities of B-xylosidase and cellobiohydrolase showed a strong seasonality that paralleled breakdown rate, whereas phenoloxidase and B-glucosidase showed no relationship. The difference in breakdown rate between coarse and fine mesh bags increased in summer, thus suggesting inhibition of microbial decomposition. The harsh conditions before drought exert an inhibition effect on leaf microbial decomposition, which seems to counteract the expected positive effect of increasing temperature. Therefore, the duration of this progressive drought period could affect the annual stream carbon budget.

O7

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NEW RECORDS OF RARE MACROALGAE IN SOUTH-CENTRAL SPAIN

New records of rare macroalgae in south-central Spain Few studies on macroalgae have been addressed in south-central Spain rivers. However, the application of the Water Framework Directive during the last decade has increased the knowledge on the distribution of river plants especially macroalgae. Thus, some species considered as rare regarding geographical distribution and hardly cited in Spain have been recently recorded. In this work it is presented the distribution and environmental preferences of the following species: Tetrasporidium javanicum Möbius, Tetrasporidium cf. fotii Couté et Traccana, Batrachospermum atrum (Huds.) F. L. Harvey, and Nostochopsis lobata Wood ex Bornet et Flahault. Finally, morphological and biogeographical aspects are discussed in order to interpret the present distribution of the selected taxa.

O3

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COMBINING DIATOMS, MACROPHYTES, MACROINVERTEBRATES AND FISH TO ASSESS THE EFFECTS OF INDUSTRIAL WASTES: WHEN BIOLOGY TEACHES MORE THAN CHEMICAL MONITORING.

A 4-season survey was conducted along a stream located in south-western France subjected to industrial release. Simultaneously to chemical analyses of water, sediments, and plant bioaccumulation, diatoms, macrophytes, macroinvertebrates and fish were collected according to French standards (NF T 90-354, NF T 90-395 and NF T 90-350) or following De Lury (1947) catch-effort method for fish. While upstream sites were globally characterized by flora and fauna typical from the Landes area (e.g. acidobiontic diatom species, brook lamprey), directly downstream the industrial complex was observed i) a dramatic decrease of biological diversity and biomass for all biological compartments, ii) an increase in the occurrence of taxa or biological forms resistant to toxic pollution (e.g. pioneer diatoms, Sphaerotilus sp., Chironomideae). Although chemical analyses performed on a large set of metals and pesticides did not reveal any strong contamination, the effects on biological elements were characteristic of toxic impacts. Further investigations pointed out that aniline was occasionally produced by the factory, and released at high concentrations that may explain the deleterious effects observed on the biota. This study confirms the need to use a battery of biological indicators that can be combined to bring to light toxic events that can not be seen using classical analyses of chemicals in the medium, or may be missed in case of spot contaminations.

O1

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ENVIRONMENTAL FACTORS INFLUENCE PHYTOPLANKTON FUNCTIONAL GROUPS IN TWO RESERVOIRS LINKED BRAZILIAN

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 functional groups (FG) sensu Reynolds in a system of two connected, but contrasting, reservoirs, recognizing the driving main forces (physical and chemical variables), based in three days of superficial sampling. The reservoirs studied were Billings (Taquacetuba branch; 6 sampling spots) and Guarapiranga (Parelheiros branch; 7 sampling spots), located in São Paulo (Brazil). Billings is used for electric power generation, water supply, leisure, fishery and navigation. Guarapiranga's main use is water supply. Since 2000, Billings' water is transferred to Guarapiranga to regulate the water level of the last during the dry season. The main problem of both reservoirs is the excess of organic matter from clandestine domestic sewage input. We identify 122 phytoplankton species, grouped into 16 FG. The mean total biomass was 7.4±1.1 mm3L-1 in Billings and 8.1±5.1 mm3L-1 in Guarapiranga. Besides the FG's biomass and composition in both reservoirs were similar (only FG N, represented by some desmids, were found exclusively in Guarapiranga), their abundances and dominances varied: in Billings, the class Dinophyceae were dominant (67% of the total biomass), represented by the groups LM (Ceratium furcoides) and Y (Peridinium spp. and Gymnodinium spp.); in Guarapiranga, Y was abundant (45% of the total biomass), along with colonial and filamentous cyanobacteria from the group M (Sphaerocavum brasiliensis) and SN (Anabaena spp. and Cylindrospermopsis raciborskii) (28% of the total biomass). According to the PCA analysis (15 abiotic variables), the most important variables to explain the data variability were pH, dissolved oxygen, nitrate and nitrite in Billings and Zeu/Zmax and ammonium in Guarapiranga, indicating that environmental differences between both sites are influencing the FG composition in each reservoir. Acknowledgments This research was supported by FAPESP (Proc. n. 2008/00784-3 and CNPq (Proc. n. 471404/2010-1).

O10

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TROPHIC PATTERNS OF BENTHIC INVERTEBRATES ALONG TROPICAL ISLAND RIVERS (RÉUNION, INDIAN OCEAN)

The River Continuum Concept (RCC) predicts that from headwaters to the mouth, changes of physical parameters in rivers modify the relative avaibility of food resources (proportion of allochthonous versus autochthonous items) that, in turn influence invertebrate community composition. The RCC has been long debated and its applicability to zones other than temperate ones (e.g. tropical areas) has been particularly criticized. In tropical rivers such as in Reunion Island, physical parameters change from headwaters to mouth but the way it is modifying food resources and then invertebrate structure is not known. We studied longitudinal patterns of invertebrate community in two Reunion Island rivers, that differed in their hydroclimatic conditions (one localised on the dry side of the island, running through stream order 1-3 and the other, on the wet side running through stream order 1-4). Macroinvertebrates were sampled in October-November 2009 at one site in each of the stream order. In the laboratory, we assessed gut contents of 1500 organisms of 16 taxa being representative for 80% of the individuals of the whole community. Each macroinvertebrate was placed in a test tube filled of Hertwig's liquid (which digests muscles) and then put it in an oven for 20h at 65°C. Under a microscope, we determined diet composition of each individual, which was then assigned to a trophic group (predator, herbivor or detritivor). Supporting the RCC, our results showed that allochthonous resources decreased towards the river mouth, whereas sediment feeding increased and prey amount was constant. These patterns differed slightly between the rivers. However, in contrast to RCC predictions feeders of microphytes and FPOM showed no general pattern. Moreover, many taxa were generalists and only few were specialized feeders.

O2

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EFFECTS OF MEDITERRANEAN CLIMATE ANNUAL VARIABILITY ON STREAM BIOLOGICAL QUALITY ASSESSMENT USING MACROINVERTEBRATE COMMUNITIES

Data on macroinvertebrates of selected reference sites were compiled from a long-term monitoring programme carried out in the Mediterranean Catalan Basins (NE Spain) that permitted analysis for nine years, from 1996 to 2004, using a homogeneous data collection procedure. This study aims to analyse the differences in composition and structure of macroinvertebrate communities at family level in five Mediterranean river types, and the values of biological quality metrics (IBMWP and IASPT indices, taxon richness and EPT) in reference conditions. Also differences between seasons (spring vs. summer) and between dry and wet periods were analysed. The dry and wet periods were determined using the Standardised Precipitation Index (SPI). Differences on community composition at family level were appreciated, clustering the rivers in three different groups: 1) rivers with a continuous flow regime located in siliceous zones; 2) rivers with a continuous flow regime located in calcareous zones; and 3) temporary rivers regardless of geology. Moreover, our results explain that the characteristics of hydrological periods (dry and wet) characterize the differences between communities better than just the season. The analysis of four biological quality metrics reveals clear differences between values obtained from dry and wet periods concerning taxon richness, EPT values and IBMWP biological indices, whereas the IASPT index does not show significant differences. Hydrological specific conditions should additionally be considered in order to better calculate biological reference conditions, and to properly apply biological quality metrics used to establish the ecological status in Mediterranean rivers, especially in temporary ones.

O1

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DISCRIMINANT ANALYSIS BASED MODELS TO PREDICT OCCURRENCE AND ABUNDANCE OF ZEBRA MUSSEL IN LOTIC SYSTEMS OF THE LOWER EBRO RIVER

The zebra mussel, Dreissena polymorpha (Pallas, 1771), is a successful invasive bivalve native to the Ponto-Caspian region that has been introduced throughout Europe and North America. In the Iberian Peninsula it was first introduced in the Ebro River basin in 2001. Most studies on the zebra mussel were conducted in lentic environments, such as reservoirs or lakes were its populations reach higher densities. However, habitat preferences of this species in lotic systems are poorly known. We assessed the relationship of environmental and water physicochemical parameters with the abundance and distribution of the zebra mussel in the lower Ebro River, from the Flix reservoir to the limit of the salt wedge. Ten sampling stations were established and sampled every meter deep by means of scuba diving. In each depth layer zebra mussels fixed to substrate were collected manually using a 625 cm2 grid and physicochemical and habitat parameters were recorded. We developed statistical models to predict the occurrence and abundance of the zebra mussel in the lower Ebro River based on multidimensional correlations between the zebra mussel density classes and the limnological features, by means of forward stepwise discriminant function analysis (DFA). The obtained DFA models showed that the main four variables that determine the occurrence and abundance of the zebra mussel are: distance to Flix reservoir, depth, dissolved oxygen and water velocity. The relative weights of these variables are different in each of the built models. Other variables, such as substrate composition and temperature, have a certain importance to predict the zebra mussel occurrence.

SS10

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RESTORATION OF FENNOSCANDIAN STREAMS: MUCH ADO ABOUT NOTHING?

The primary focus of most in-stream restoration projects in Fennoscandia is to enhance habitat diversity for salmonid fishes, yet the lack of properly designed monitoring studies, particularly ones with pre-restoration data, limits any attempts to assess whether restoration has achieved its goals or not. I used a combination of physical habitat modeling (River 2D) and monitoring of fish and invertebrate densities based on a Before-After-Control-Impact (BACI) design to examine how restoration affects juvenile brown trout and benthic invertebrates. For invertebrates, I also used a space-time substitution design with a 20-yr perspective to community recovery. In each case, restoration increased habitat heterogeneity, yet biological responses were weak or non-existent. In the BACI monitoring study, a post-restoration drought reduced trout densities in all streams, overriding any local restoration effects. However, trout densities started to increase eight years after restoration, particularly in reaches with added wood. Benthic communities showed no response, irrespective of time since restoration. A key explanation for the weak responses of stream biota may be historical: when Fennoscandian streams were channelized, loss of habitat heterogeneity was only partial and habitat availability may not have limited biological communities even before restoration. Our results suggest that post-restoration monitoring must be sufficiently long to detect any restoration-induced changes to trout populations, and restoration measures need to be reinforced by strict fishing regulations. Finally, assessment of stream restoration has been strongly biased towards benthic invertebrates and fish, and more emphasis should be given to multiple organism groups, in both stream and riparian environments.

O3

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CAN AGRI-ENVIRONMENT SCHEMES PROTECT AND ENHANCE FRESHWATER ECOSYSTEMS?

Agri-environment schemes (AES) are designed to encourage farmers to protect and enhance the environment by paying them for provision of environmental services. Across Europe, €2.5 billion is paid each year to create a better rural environment. At the request of the Welsh Assembly Government, we have developed an extensive monitoring programme to provide robust evidence of whether streams and ponds are in better ecological condition when their catchments are within rather than outside of AES land. We sampled the macroinvertebrate and aquatic plant communities of 80 streams and 80 ponds. We also collated associated site and catchment environmental data and modelled catchment parameters. These data allowed us to attribute causes to the quantified biological differences we recorded between the AES treatments. Such information is critical for the continued improvement of AES design and implementation, and will also form a baseline against which any future changes in stream and pond condition can be assessed and attributed to AES uptake and other environmental factors.

SS6

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NEW DATA ON THE MORPHOLOGY AND BIOLOGY OF AN IBERIAN POPULATION OF TWAITE SHAD ALOSA FALLAX (RIVER ULLA, NW SPAIN)

Populations of twaite shad (Alosa fallax) have severely declined across Europe. The protection of this species requires a detailed knowledge of its biology and ecology, as well as an assessment of its abundance. Twaite shad populations in Spain have been poorly studied in comparison with populations of the rest of Europe, and no data are available on populations of the NW area of the Iberian Peninsula. We attempt to fill up this knowledge gap by offering for the first time data on individuals captured in the Ulla River. Surveys for spawning events or suitable areas allowed us to confirm the existence of an important spawning ground at about 24 km to the sea, as well as to identify other potential grounds in nearby sections. These are resting areas for the species, and they are also the main angling locations. Adult specimens (76) were provided by sport fishermen during fishing seasons of years 2007, 2008 and 2009. Each individual was measured (fork length ± 1 cm), weighted (± 1 g), sexed, and a sample of scales was obtained for age reading. Heads were frozen until dissection for extracting the first gill arch. Mean length, weight and condition factor were 37.03 cm ± 0.05 (range: 29-47.62 cm), 712.45 g ± 30.67 (range: 280-1370 g) and 1.34 ± 0.02 (range: 1.02-1.90) respectively. The average number of gill rakers was 51.59 ± 0.205 (range: 46-60), and age ranged from 3 to 6 years. About 85% of the individuals were 4 to 5 years old and 26 % of them had already reproduced once. Males were 3.11 years old when they first reproduced, while females were older (4.11 years). These characteristics agreed with those reported for other European populations except for the number of gill rakers, which are among the highest recorded in all stocks.

SS7

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INFLUENCE OF CLIMATE ON PHYTOPLANKTON DYNAMICS IN MEDITERRANEAN WATER BODIES

Climate is among the factors that influence the hydrology of water bodies and their mixing/stratification patterns. As a consequence, it may affect the eco-morphological selection of phytoplankton. Global climatic patterns, driven by Sun's magnetic field, were shown to promote cyclic cyanobacteria bloom during the years of drought caused by El Niño. Cyclic droughts, with a periodicity of about 11 years, also occur in the Mediterranean Basin where they produce analogous responses in phytoplankton composition. Some evidences exist that climate change can promote pseudo-eutrophication events and, by altering the hydraulic balance in shallow lakes, cause a shift between a clear macrophyte-dominated state and a turbid algae-dominated one. This is likely to occur in Mediterranean shallow lakes. A phytoplankton survey, carried out monthly in two shallow Sicilian lakes, in 2005–2007, revealed a transformation in the structure of their phytoplankton assemblages as compared with similar data collected in 1987–1988, which cannot be explained by any increase in nutrient loading. An analysis of the trends followed by precipitation and temperature over the last 40 years, showed reduced water inflows in both the lakes, due to increased air temperature and evapotranspiration rather than to a decrease in the amount of precipitation. This reduction in water level disrupted the littoral zone of the lakes and transformed them from clear, macrophyte-dominated environments to turbid ones characterized by huge summer blooms of cyanobacteria. The research carried out on climate change effects have shown that small changes in the physical characteristics of a lake can have a disproportionate effect on its chemistry (e.g. an intensified recycling of phosphorus, alteration in the ratio between mixing depth and euphotic depth) and biology (e.g. disruption of the littoral zone, enhanced cyanobacterial blooms). Thus, they need to be taken into consideration by lake managers when setting restoration targets and/or limits for nutrient loading.

SS6

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INTERPOPULATION DIFFERENTIATION OF THE EXTERNAL AND INTERNAL MORPHOLOGY OF NON-NATIVE PUMPKINSEED IN THE IBERIAN PENINSULA: LOTIC VS LENTIC POPULATIONS

Pumpkinseed Lepomis gibbosus show morphological differences in their native range distribution (North America) that are linked to feeding regime, competition with other species, hydrodynamic forces and habitat. Our objective was to test if these differences were also found among stream- and lake or reservoir-dwelling Iberian systems, where the species has been introduced, expanding its range, and presumably well adapted to freshwater Iberian Peninsula ecosystems. Our results showed a consistent pattern for lateral fin size, with pumpkinseed inhabiting streams in the Iberian Peninsula having longer lateral fins than those inhabiting reservoirs or lakes. However, differences between lotic and lentic pumpkinseeds in fin placement, body depth and caudal peduncle dimensions did not differentiate populations from lentic and lotic water bodies, and therefore were not consistent with functional expectations. Lotic and lentic pumpkinseeds also did not show a consistent pattern of internal morphological differentiation, probably due to the lack of lotic-lentic differences in prey type. Overall, our univariate and multivariate analyses showed that most of the external and internal morphological variation among populations did not differentiate lotic and lentic systems. The low degree of morphological differentiation between stream and lake/reservoir-dwelling pumpkinseeds may be a consequence of high seasonal flow variation in Mediterranean streams, and the resultant low or no flow conditions during periods of summer drought.

SS14

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MODELING LARVAL DYNAMICS IN RIBARROJA RESERVOIR: AN ENVIRONMENTALLY-FRIENDLY TOOL FOR CONTROLLING ZEBRA MUSSEL (DREISSENA POLYMORPHA) COLONIZATION OF AQUATIC INFRASTRUCTURES

Since spring of 2007 a intensive monitoring program of zebra mussel larvae populations (Dreissena polymorpha) is being performed in Riba-roja Reservoir (Ebro River, NE Spain). Data acquired from this intensive (monthly or biweekly) and extensive (8 sampling stations located along the 28 km of Riba-Roja Reservoir), were used to model the zebra mussel larval dynamics during the annual cycle. This work presents the first model runs, based on a combination of hydrological conditions and environmental variables, relevant from mussel's physiological point of view. Even if obtained larval density values are still far from real ones, model predictions about larval appearance and dynamics (time and conditions under which zebra mussel larvae appears and reached maximum densities), are robust. The maximum density of larvae is predicted to happen during June just at the end of the period presenting most favorable conditions (oxygen, temperature) for gamete fecundation (from April to June). This model may be useful for predicting effects on mussel's larvae populations caused by different reservoir management practices, thus being a promising tool for controlling zebra mussel populations.

O7

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BENTHIC MATS IN LAKES ON JAMES ROSS ISLAND (ANTARCTICA): CHARACTERIZATION AND KEY FACTORS INFLUENCING THEIR STRUCTURE

There is a growing interest in unravelling the influence of global change on aquatic ecosystems. The study of Antarctic lakes currently receives considerable attention due to their vulnerability and biogeographically interesting location. Lakes on James Ross Island (64°S 58°W, NW Weddell Sea) form a unique set of ecosystems on the transition between the maritime and continental Antarctic and therefore play an important major role in the comparison with other major lacustrine sites. The aim of our study was to characterize the taxonomic composition of benthic autotrophic assemblages in James Ross Island lakes and to determine the key factors that influence their composition. A representative set of lakes belonging to various types were sampled, and their physical, chemical and biological characteristics were examined. Massive autotrophic mats in the littoral zone of lakes were formed by filamentous cyanobacteria (e.g., genera Phormidium, Leptolyngbya, Calothrix, Dichothrix), which were accompanied by coccal and filamentous green algae and more than 100 species of pennate diatoms, most frequently from the genera Luticola and Nitzchia. The recent description of several new diatom and cyanobacterial species from benthic habitats on James Ross Island confirmed the highly specific nature of the Antarctic microflora. The analysis of abundance data revealed several groups of samples and this separation was supported by lake water chemical characteristics. However, the diverse character of benthic assemblages (especially in the oldest lakes) is probably also the result of long-term local adaptation to extreme conditions.

O5

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THE RIVER THE LA PLATA BASIN (BRAZIL, BOLIVIA, ARGENTINA, PARAGUAY AND URUGUAY): LATITUDINAL LIMNOLOGICAL PATTERNS AND EFFECTS OF LARGE RESERVOIRS CONSTRUCTION

A limnological study of the main rivers of the La Plata Basin, with emphasis on large reservoirs, was carried out. This is the second largest basin (3.17 x 106 km2; 22,000 m3 s-1) of South America, after the Amazonian, and drains part of Brazil, Bolivia, Argentina, Paraguay and Uruguay. A major regional impact in this basin is the construction of dams for electric production. In Brazil about 90% of the electricity (ca. 70.000MW) is provided by hydroelectric plants. Fifteen reservoirs (riverine and dam zones) and 11 free river stretches were sampled during summer (January/February 2010) and autumn/winter (June/July 2011). The Secchi transparency and detailed vertical profiles (Eureka probe) of temperature, turbidity, dissolved solids, oxygen, pH, conductivity and redox potential were measured. In each sampling point four to five water samples were obtained for determination of chlorophyll-a, organic and inorganic suspended solids, total nitrogen and phosphorus and silicate. Plankton (treplicates) samples were also collected for plankton (phyto and zoo) analyses. The results (PCA analyses) showed the influence of historical (geological differences among the sub-basins) as well human induced processes. The main forces acting on the analyzed systems are the hydrodynamics, especially the changes caused by the reservoirs construction (e.g. water velocity and retention time; stratification development); interaction with wetlands (floodplains) and eutrophication processes. Effects of conurbation areas (São Paulo, Curitiba and Buenos Aires) and intensive soil use for agriculture were clearly identified (e.g. P, N and Chl).

O8

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MOBICOS – A NEW SCIENTIFIC PLATFORM FOR EXPERIMENTAL WATER RESEARCH

Designing controllable, manipulable and replicable experiments has been challenging ecologists for decades. While laboratory studies generally provide rather simple reproductions of nature, field studies are generally difficult to control and virtually non-reproducible. Because of their specific experimental advantages, field mesocosms have a long tradition in aquatic ecology, especially in lake research; they can partly bridge the gap between laboratory and field studies. Stream mesocosms extend the principle of mesocosms by substituting stagnant (non-exchanged) water with bypasses to stream water. This allows conduction of experiments as controllable and manipulable as laboratory studies, while field-relatedness with regards to the hydrochemical and ecological background can be maintained. Field water bypasses may be used to supply different experimental facilities with either unchanged or manipulated field water, thus allowing to test the influences of specific environmental factors on ecosystems. MOBICOS is a new, modular and mobile experimental facility in freshwater research at the Helmholtz Centre of Environmental Research (UFZ). They are realized as container-based modules of running water laboratories. These laboratories can be equipped with flow channels, sediment-water columns and plankton chambers fed by river water bypasses. The containers are completed by a set of hydrological control devices, environmental probes, data storage and transmission facilities. The laboratory modules can be operated either in parallel or in series. The exact dimension of MOBICOS can be adapted on both the experimental requirements and the available room in the field. This adds a high degree of mobility and flexibility to the concept of stream mesocosms and extends the experimental horizon for comparative experiments within and between river catchments. Besides in-house utilization by members of the UFZ, we aim to offer MOBICOS to cooperating institutions as a platform for research. More detailed information may be provided on request via email or directly at the congress.

O1

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BENTHIC COMMUNITIES OF TATRA MOUNTAIN LAKES: SINGLE OR MULTIPLE TEMPERATURE GRADIENTS?

Individual response of mountain lakes to climate variability and change can vary considerably depending on geographical position, catchment characteristics and lake morphology that have a strong effect on lake thermal cycles. Macroinvertebrate fauna of the Tatra Mountains glacial lakes mostly consists of very typical taxa of high mountain lakes and its recent distribution is a residuum of the past periods when it inhabited all the Tatra lakes. The occurrence of relict glacial period communities in lakes located at much lower altitude could indicate extreme temperature conditions that differ from the scheme of linear changes along altitudinal gradient. We tested the differences in lake surface water temperature and littoral benthic communities within the set of the Tatra Mountain lakes of various altitudes consisting of two groups: i) “unshaded” lakes (U-lakes) of open watersheds, generally faced south, and ii) “shaded” lakes (S-lakes) faced north or shaded by surrounding crests. Paired U- and S-lakes were selected on the basis of morphology, altitude, chemistry global radiation (Wh.m-2) and the total duration of direct solar radiation (hours). We assumed that the changes in benthic communities would follow different altitudinal-temperature gradient in the both lake types. We expected occurrence of “azonal” assemblages in S-lakes. Lake surface water temperature depended on position of lakes in altitudinal gradient, but it was also influenced by solar energy inputs. S-lakes have considerable lower average temperatures and/or faster ice-cover formation than U-lakes. Distribution of littoral benthic invertebrates was not strongly correlated to extent of insolation. Some cold-stenothermic species were distributed irrespective of lake insolation type. It suggests that benthic communities of studied lakes do not follow single dominant altitudinal or temperature gradient. Study was founded by the Scientific Grant Agency of the Ministry of Education of Slovak Republic and the Academy of Sciences, Grants No. 1/0464/10 and 1/0529/09.

O3

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A TIPOLOGY OF SOME IBERIAN MOUNTAIN LAKES USING THE MACROPHYTE COMMUNITY COMPOSITION

This study attempts to explore if the most recent classification of mountain lakes carried out in Spain (CEDEX, 2004) has a biological meaning (it correspond to differences in biological communities), as de WFD requires. For this purpose we used the macrophyte community composition and environmental variables not affected by human activities in 39 reference or minimally impaired lakes. The floristic survey was undertaken during June and July of 2007, 2008 and 2010. The macrophytes were determined to specific level and their % cover was scaled into a range from 1 to 5 (1: < 1%; 2: 1-2%; 3: 2-5%; 4: 5-30%; 5: >30%). The sampling was complemented with an estimation of the percentage of cover of different macrophyte growth forms (emergent, floating-leaved, submerged, bryophytes and charophytes). Data treatment consisted, firstly, in the construction of the similarity matrices among samples, using the Bray-Curtis similarity coefficient. Then, dendrograms were represented using a hierarchical cluster analysis (whit group average linking) and a non-metric multidimensional scaling (NMDS) analysis was used to examine the distributional pattern of samples. The relationships between the multivariate community structure and environmental variables were examined using the BIOENV procedure. Finally, differences among the groups determined by the most important environmental variables were analyzed by Analysis of Similarities (ANOSIM). Taking into account the individual species, mineralization variables (alkalinity, conductivity and pH) were the most important in the determination of the groups of lakes. However, unlike CEDEX classification, altitude did not allow to differentiate groups. Calcareous lakes, characterized by species such as Groenlandia densa, Equisetum arvense, Chara fragilis or Potamogeton natans, were clearly separated from the siliceous ones. Regarding the macrophyte growth forms, the combination of alkalinity, chlorophyll a and total phosphorus showed the best correlation with the biotic structure. This analysis allowed to differenciate clearly tree groups of lakes with high percentages of helophytes, charophytes or bryophytes.

O7

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TEMPERATURE AND BIODIVERSITY EFFECTS ON FRESHWATER ALGAE FATTY ACIDS

Algae synthesize and subsequently supply polyunsaturated fatty acids (PUFA) to herbivorous consumers. Most of our current knowledge on fatty acid transfer at the base of the aquatic food chain results from feeding experiments using algal monocultures. Although specific effects of algae in conveying fatty acids to their consumers can be tested, such tests do not assess the effect of mixed algae in supplying dietary fatty acids as the case in natural systems. We conducted a series of lab experiments (20 days each) using mono- and mixed algal cultures (two green algae: Scenedesmus obliquus, Chlamydomonas reinhardtii, two diatoms: Navicula pelliculosa, Cyclotella meneghiniana, and the crytophyte Cryptomonas ozolinii) to test the effects of five mono- versus two mixed cultures (S. obliquus x C. meneghiniana x C. ozolinii and C. reinhardtii x N. pelliculosa x C. ozolinii) and different temperatures (12, 18, and 24°C) on bulk growth rates, biomass accrual, and fatty acid composition per unit biomass. We hypothesized that bulk growth rates and biomass accrual are highest at 24°C, whereas PUFA concentrations per unit biomass are highest at 12°C because cells require higher PUFA-mediated membrane fluidity at lower temperatures. Furthermore, we expect that monocultures will synthesize more PUFA than mixed culture under the same growth condition due to less competition for nutrients. Preliminary results show that bulk growth rates and biomass accrual were highest at the highest temperature and green algae provided the highest biomass among all cultures. The results will further our understanding of how dietary access to algal-derived fatty acids is affected by mono- vs. mixed culture, the latter naturally occurring in aquatic systems.

SS4

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ALKALINITY AND THE INORGANIC CARBON EQUILIBRIUM SHAPE THE METABOLISM-CO2 SATURATION RELATIONSHIP IN LENTIC FRESHWATERS

Since the observation that surface waters from most lentic ecosystems are supersaturated in CO2 researchers have focused on the factors explaining the high CO2 concentrations found in lakes and reservoirs. Among these, the aquatic metabolic balance and its relationship with allochthonous inputs of dissolved organic carbon are widely accepted as main drivers of CO2 supersaturation. However, most of the effort devoted to understanding CO2 variability has been performed in lakes covering a small range of geochemical variability, namely systems showing low alkalinity. Therefore, it is not clear how high alkalinity systems will fit in the current paradigm. In this work we evaluated CO2 saturation in surface waters of 100 Spanish reservoirs using data collected during an extensive survey performed in the 1990s. Each system was sampled during summer and autumn, and the survey covered a wide range of geological settings, land use typologies, and trophic states. Our results showed that most of the reservoirs had CO2 concentrations above atmospheric equilibrium (mean pCO2 = 859 ± 693 µatm), and in 52% of them such supersaturation was not restricted to autumn. In contrast, oxygen subsaturation was not as prevalent as CO2 supersaturation, and a significant number of reservoirs were supersaturated in CO2 despite having oxygen concentrations above equilibrium. Such discrepancy was observed in medium to high alkaline waters. From a theoretical approach based on the basic equations governing the inorganic carbon system, we show that the carbonate reactions can significantly contribute to the CO2 supersaturation, and also determine dramatic changes in the relationship between metabolism and CO2 saturation. Given the representativeness of medium to high alkalinity waters in the world lakes budget, it is likely that the paradigm linking CO2 supersaturation to net heterotrophy should be revised on a global perspective, especially with regard to budget carbon emissions from inland waters.

SS6

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SENSITIVITY OF NATIVE FISH RICHNESS TO ENVIRONMENTAL VARIABLES IN THREE MEDITERRANEAN STREAMS USING ARTIFICIAL NEURAL NETWORKS

Fishes are an indicator of the health of aquatic ecosystems, and they have become a key quality element to assess the ecological status of water bodies. In this context, a predictive model of native fish richness is a management tool that can be used by environmental managers to accomplish the requirements of the European Water Framework Directive. Artificial neural networks (ANN) are considered a powerful tool for solving environmental problems and they are an alternative to traditional methods of modelling in ecology. This work presents a multilayer feed-forward artificial neural network to predict the richness of native fishes in three Mediterranean-climate rivers and it is examined the contribution of ten environmental variables to estimate the richness at Júcar, Cabriel and Turia river basins (East region of Spain). The ten environmental descriptors were: riparian habitat quality -QBR index-, dissolved oxygen, annual mean water temperature, drainage surface in each site, annual mean water flow, river length without barriers, suspended solids, altitude and percentage of pools and riffles. The importance of ANN's input variables was determined using the Garson's algorithm and the sensitivity analysis proposed by Lek's method. According to the results, we found that the correlation coefficients between observed and predicted values both in training and in the validation were significant ($r = 0.91$, $P < 0.05$ and $r = 0.87$, $P < 0.05$, respectively). The most significant variables that described the native fish species richness in these three rivers were: annual mean water temperature, dissolved oxygen, % of pools, % of riffles, riparian habitat quality, drainage area and river length without barriers. In this work, we tested the capability of ANNs to represent nonlinearities and can thus be recommended for modelling ecological interactions.

O1

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HATCHING PATTERNS OF ZOOPLANKTON IN A RESTORED POND: AN EX SITU EXPERIMENT

Colonization of the water column in temporary ponds after flooding depends mostly on the egg bank characteristics (abundance and diversity of resting forms). In restored ponds these characteristics will be influenced by the different drying seasons along which the egg bank increases. To study the hatching patterns, an ex situ experiment was performed selecting one temporary pond restored in 2007. The restoration process consisted in an extensive dredging of the ground which was used to silt (in the sixties) the antique water basin. Previously, in the dry season (September 2010), sediment slices (1 cm depth) were collected from six different sites of the pond and later were homogenized in laboratory. After autumn flooding, we started a weekly sampling of zooplankton in the pond and simultaneously we placed outdoors four aquaria filled with dechlorinated tap water. Aquaria contained three plates harboring 60 g of the sediment previously collected. During one month, every two or three days, we filtered all the water from each aquarium separately (5 L) through a 20 m mesh size. Our aim was to monitor the hatching patterns at the begining of the wet period and to compare these results with the community of zooplankton developed in the ponds. For this purpose we identify all zooplankton taxa and compared changes in specific richness and abundance for each filtering. Rotifers were always the more abundant group (Cephalodella spp., Colurella adriatica, Hexarthra fennica …), some cladocerans were also found but copepods were absent from the aquaria. Hatching started in the first week but the largest number of hatchings occurred after the third week. Benthic organisms were quite frequent and hampered the hatching output.

O2

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APLICATION OF THE NEW ICF INDEX AND FISH PASS ASSESSMENT IN THE RIVERS OF CATALONIA, NORTH-EAST OF IBERIAN PENINSULA.

This study evaluates the effectiveness of fish passes in Catalan rivers (NE Iberian Peninsula). The aim is to test current functionality to enhance the structures in order to optimize their management. Until the year 2010, a quick evaluation of the locations and effectiveness of fish pass facilities in Catalonia was carried out through direct inspection of 94 fishways. Most of them were retro-fitted solutions using broad-spectrum technical structures, mainly pool fishway or pool pass facilities. An analysis of the effectiveness of 9 of the new passes (4, 2, 2 and 1 in the Ter, Llobregat, Ebro and Tordera river basin, respectively) was carried out between 2006 and 2010. These were located in weirs associated with hydropower plants and gauging stations. The preliminary assessment of fish connectivity was based on a field visit and collection of information to populate a database of existing obstacles and associated fishways, and calculation the new version of the ICF index (River Connectivity Index) (Solà et al., 2011) for all of them. Several methodologies were used to check the effectiveness of a selection of fish pass solutions. Direct estimation techniques involved the installation of fish traps at the exit of the fish pass and visual counts. Indirect estimation techniques compared fish population structure on each side of the obstacle using electric fishing or trapping systems, group mark-recapture methods and individual mark-recapture methods (PIT tags). The results have shown that: (1) Fish passes are generally inadequate or insufficient for the whole of the native fish fauna from each water body. (2) Fish passage rates are, with few exceptions, too low and, in most cases, only fish with high capacity to overcome obstacles, or the largest individuals succeed on migrating. (2) Fish pass efficiency agrees with the results of the new version of the ICF index.

O2

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RIVER RESTORATION AND ECOLOGICAL STATUS AND BIODIVERSITY ASSESSMENT IN MEDITERRANEAN RIVERS. EXPERIENCE IN THE TER RIVER, CATALONIA, NORTH-EAST OF IBERIAN PENINSULA.

Riberes del Ter (www.mitmanlleu.org/riberesdelter) and RICOVER (www.ricover.eu) combined projects are focused on the realization of previous and subsequent studies of biological indicators (flora, aquatic macroinvertebrates, fishes, birds, bats, small mammals, carnivorous, etc.) and hidromorphological indicators (IHF, QBR, RHS and ICF indexes, forestry inventories, etc.), and the realization of plans for river management in private and public forest land - pilot. Especially forestry tools combined with land stewardship agreements were used. At stretch level, about 26 km of the river Ter, between the towns of Manlleu and Orís (Osona area), 62 sectors were sampled. In some of these sections, during 2009, 2010 and 2011, winter activities have been carried out restoration and habitat improvement. Six forest land - pilots were chosen to carry out restoration projects in the riparian forest (2009-2011). In order to agree on the goals and development work, land-stewardship agreements between the owners of the land, three town councils (Torelló, les Masies de Voltregà and Manlleu), the CTFC and the CERM institutions were signed. Some of the restoration tasks involved the application of forestry methods for sustainable management, management of pasture and plantation of autochthonous tree species (combining cuttings and seedlings). Results show that riparian forests of the Ter river are relatively well conserved but they have not attained their potential due to loss of width (urbanization, agriculture), especially in the second line of the forest; a mixture of exotic species; and artificial water dynamics: low volume of water / water flow. Sectors with major structural heterogeneity coincide with higher values of ecological quality and biodiversity.

O3

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ENVIRONMENTAL RESULTS OF SEVERAL EXPERIENCES OF RECLAIMED WATER INTAKES IN COASTAL MEDITERRANEAN STREAMS OF CATALONIA, NE OF THE IBERIAN PENINSULA.

From 2003 to 2008 many ecological status and biodiversity monitorings in Tossa stream (Tossa de Mar, la Selva) were done focused on the assessment of regenerated water intake to the environment. Similar projects followed in Rubiés (Port de la Selva), Colera and Llançà streams (Alt Empordà area) from 2006 to 2010. The assessment methods were essentially hydromorphological, physicochemical and biological: IHF index (river habitat) (Pardo et al., 2002), QBR index (riparian vegetation) (Munné et al., 1998), IBMWP index (aquatic macroinvertebrates) (Alba-Tercedor et al., 2002), IBICAT index (fishes), etc. Regenerated water inputs guaranteed water column into these streams over the year. Reclaimed water eliminated some sensitive macroinvertebrates taxa, but the loss of richness was not significant and decreased the degree of flow temporality. Estuarine fish species, like eels and mullets, recovered the lower parts of these streams. Vegetation, like reeds, cattails and also alders, progressively recovered the riparian areas as well.

SS7

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IMPORTANCE OF RESERVOIR MANAGEMENT TO IMPROVE THE WATER QUALITY THEY SUPPLY: EXAMPLE OF SOME CATALAN RESERVOIRS

Drinking water from reservoirs is used for many large cities in Spain. In a few cases these reservoirs were specifically built for this purpose and in others it has been giving priority to this use over others for which they were specially designed. Although in all dams the issue of quantity is important, the stored water quality increasingly gets more attention. This paper reviews the techniques of reservoir management to improve the water quality they supply, applied to the Sau – Susqueda system in the Ter River and to La Baells, La Llosa del Cavall and Sant Ponç reservoirs. All this reservoirs are used to supply water to Barcelona city. Management of the Ter river system reservoirs during "normal" or "wet" hydrological periods is done favoring water self-purification through planktonic communities and through the election of best water quality of the water column using towers with multiple water outlets. By contrast, during the "dry" years with little volume of stored water and when the water quality worsens ostensibly, water transfer is necessary from levels where the water quality is better toward the downriver reservoirs. In this case, the input of cooler water, and therefore with higher density, causes an injection of water with higher concentration of oxygen to the deep zone of the reservoir while increasing the level of the reservoir. This kind of management allows us to improve the water quality using the outlets placed at different depths. On the contrary, in the reservoirs of the Llobregat river, which are mesotrophic, and thus of better quality, the criteria followed is to withdraw water from the deep zone. This operation facilitates the renewal of water of the hypolimnion and contributes to avoid the depletion of oxygen and the formation of reduced compounds or the dissolution of metals from the sediment.

SS15

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AN INVESTIGATION ON THE SPRINGS OF GOKOVA BAY (TURKEY, SOUTHERN AEGEAN)

Gokova Bay is located in the southern Aegean Area of Turkey. Gokova Bay which Ä°S included in Special Environment Conservation Area is very important as the ecological significiance. The bay which is fed by many rivers has various endemic species of the Mediterranean, cosmopolite, lessepsian of flora and fauna. KadÄ±n Creek, AkÃ§apÄ±nar Creek and GÃ¶kÃ§e Creek flowing into the bay are the important water resources. In this study, data on water quality and zoobenthos from relevant references 1995, 2008,2009 and 2010 about the three streams and their marine outlets have been collected. Also our study which field work in March 2011 and at the end of all literatures (1995, 2008, 2009 and 2010) some physicochemical factors (water temperature, air temperature, conductivity, pH, dissolved oxygen, calcium, magnesium, total hardness, choloride, salinite, nitrate, nitrite, phosphate, sulphate, suspended solid material, chlorophyll-a) and composition of bentic macro invertebrate discussed. A contribution to studies of determination of ecological quality of the Gokova Bay and its rivers was aimed. Key Words: Gokova Bay, spring, water quality, benthos, southern Aegean

SS13

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CHANGES ON MACROINVERTEBRATE ASSEMBLAGE (EPHEMEROPTERA, PLECOPTERA AND TRICHOPTERA) OVER A 15 YEAR PERIOD IN TWO DIFFERENT STREAMS: EFFECTS OF FLOODS AND CLIMATE.

Long-term datasets offer a great opportunity to analyse temporal ecological changes and to make future predictions. However, temporal biodiversity changes have been much less studied than spatial ones, most likely because long-term ecological datasets are not common. We analyzed long-term changes (i.e. for a 15 years time span) in EPT species (Ephemeroptera, Plecoptera and Trichoptera) in two contrasted reference streams of the Llobregat river basin (Barcelona, Spain): one mediterranean-like site and another more temperate-like site. Annual long-term changes were related to changes in temperature, precipitation and floods events. Our goals were to 1) study the influence of floods and climate on EPT communities along time 2) test if the response differed between the mediterranean-like and temperate-like streams. Mean annual EPT richness showed an upward trend in both stream types during the first four-year period in response to a high flow event happened in 1994, indicating the recovery of both communities. After this initial period, the temperate-like stream showed a gradual increase of EPT richness (maximum = 33 EPT taxa in 2007), while in the mediterranean-like stream, EPT richness was similar since 2000 with some inter-annual variation. Although communities were very different in both streams, they presented a similar trend in the accumulated species changes along time, with the mediterranean-like stream having a faster stabilization that the temperate-like stream. In both cases, community composition changed sequentially along years. Concerning annual mean temperature and precipitation changes, no clear trend was found in the mediterranean-like stream, whereas in the temperate-like stream the temperature at the end of the period was higher than at the beginning. The acquisition of mediterranean-like species in the temperate-like stream is investigated as a signal of long-term changes related to climate change.

SS15

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INTERCALIBRATION OF PHYTOPLANKTON-BASED ECOLOGICAL QUALITY EVALUATION METHODS DEVELOPED WITHIN THE MEDITERRANEAN GEOGRAPHICAL INTERCALIBRATION GROUP (GIG).

The Water Framework Directive (EC/2000/60) demands an intercalibration (IC) process to ensure that the quality thresholds set between categories are comparable between countries and methods. Here we report the progress made in the Second IC phase within the phytoplankton L-M GIG. All countries involved (Cyprus, France, Greece, Italy, Spain, Portugal and Romania) contributed with pressure, morphological, physicochemical and biological data. A database including 179 reservoirs, 18,115 physicochemical records and 954 phytoplankton samples was compiled. An array of statistical tests confirmed the need to categorise the Mediterranean reservoirs into four types based on lithology and climate (siliceous arid, siliceous wet, calcareous arid, calcareous wet). A sequence of filters based on pressures (CORINE land cover variables, total phosphorus and population density) and biological data (chlorophyll-a and phytoplankton biovolume) were applied to select sites of maximum ecological potential sites. The identified set of reference reservoirs was confirmed with participating countries. After the calculation of all the quality parameters included in the four currently available methods (MASRP used in Cyprus, Portugal and Spain, IPLAC used in France, ITMET used in Italy and ROMET used in Romania), they were related between them and with parameters developed and suggested as potential "Common Metrics (CM)" in the EU project WISER (Water bodies in Europe: Integrative Systems to assess Ecological status and Recovery). Two WISER parameters (FTI and PTI) resulted in overall high relatedness with Med-GIG parameters and were tested as CM. The "Pseudo Common Metric Approach" suggested in the intercalibration procedure was also tested. The pseudo-common metric consists of a mean value of all other methods applied per data unit. Preliminary correlation analysis between the national methods and the common metrics and pseudo-common metrics show better correlations with the latter, and therefore the second approach appears to be more suitable.

O4

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THERMAL SENSITIVITY OF METABOLISM AND GROWTH IN LAKE AND POND SPECIES OF DAPHNIA

Increasing concern about the effects of climate change has intensified research into the thermal sensitivity of organisms. Daphnia are one of the key elements of zooplankton communities of temperate freshwater lakes and ponds. We compared the thermal sensitivity of two pairs of closely related species (D. rosea/D. hyalina and D. pulex/D. pulicaria), which have different habitat preferences; D. pulicaria and D. hyalina originate from oligotrophic lakes, whereas D. pulex and D. rosea originate from a lowland pond. The metabolism and growth of field collected Daphnia were measured at different temperatures in the laboratory (5-30°C) at two different times during the season. Experimental temperature and body mass of Daphnia explained over 90% of variability in metabolic rates. Nevertheless, there were significant differences between species and seasons even after correction for body mass. The thermal optimum for electron transport system (ETS) activity was higher in D. pulex than in D. pulicaria, and intermediate in the other two species. Optimum temperatures for juvenile growth were similar in all tested species. 30°C was outside the temperature tolerance range. Clutch sizes decreased with temperature. Better reproductive performance of lake species at higher temperatures was related to higher haemoglobin content and the ability to increase respiration rates (R) at higher temperatures. The temperature of maximum ETS/R ratio, indicating maximum metabolic scope, was around 20°C for most groups, but was lower in cold acclimatized and cold adapted Daphnia. D. hyalina acclimatized successfully to 4°C due to the ability to compensate the temperature driven decrease in metabolic rate. Development at extremely low or high temperatures (4°C and 28°C) decreased the juvenile growth rate in D. rosea and D. pulex, due to reduced basal metabolism and activity. These results indicate that the thermal sensitivity of Daphnia is related to metabolic adaptations to habitat conditions.

O7

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EFFECT OF WATER SOURCE ON MACRO-INVERTEBRATES BIODIVERSITY IN L'ALBUFERA'S LAGOON (EAST SPAIN)

Albufera Natural Park is a mediterranean coastal lagoon near Valencia which is surrounded by rice fields traditionally irrigated from rivers Turia and Jucar. These fields are flooded during winter in order to favour hunting practice, increase biodiversity and provide food for migratory and wintering waterbirds . Over the last years, new water resources have been used to irrigate the fields such us reclaimed wastewater which could affect the presence and biodiversity of macro-invertebrate (principal source of food for birds). In this study, the effect on biodiversity in rice fields has been investigated with different source of water: i) from river Jucar, ii) from the waste-water plant of Pinedo mixed with water from Turia River or iii) directly from the lagoon. The preliminary results show that the worse scenario is the third(iii) and there are not clear differences in fields irrigated with waste water(ii) or directly from the river(i).

O3

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IMPACT OF WATER LEVEL FLUCTUATIONS ON MACROPHYTES IN LAKE PEIPSI

Water level fluctuations can result in changes to macrophyte communities. The total area of Lake Peipsi is 3555 km2, mean depth 7.1 m, maximum depth 15.3. Water level is unregulated and its mean is 30 m a.s.l.. Based on annual studies from 1997 to 2010 we hypothesized a correlation between species richness and abundance of macrophytes and water level fluctuations. Water level from May to July and 15 characteristics of macrophytes in 9 stations were studied every year in 2004-2010. Maximum fluctuation during the study period was 1.2 m. Generalized linear model procedure with Poisson distribution revealed the statistically significant changes: at the rise of water level 1 m the number of submergent vascular plant species (NSS) decreased on an average 2.1 times (P=0.0001) and the number of emergent species (NSE) decreased 1.7 times (P=0.0062). It is shown by several authors that direct impact of the temperature on the germination and productivity exists. The higher number of submerged species with lower water level periods can be explained by high temperature in low-water summers. Low water summers are also favourable for emergent and amphibious species due to the abundance of new habitats.

O6

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EFFECTS OF ETHANOL AND PHENANTHRENE ON LITTER DECOMPOSITION BY AQUATIC FUNGAL ASSEMBLAGES

Fungi, particularly aquatic hyphomycetes, have been recognized as playing a dominant role in microbial decomposition of plant litter in streams. In this study, we used a microcosm experiment with monocultures and combinations of mixed cultures with up to five aquatic hyphomycete species (Articulospora tetracladia, Tricladium splendens, Heliscus submersus, Tetrachaetum elegans and Flagellospora curta) to assess the potential effect of ethanol, phenanthrene and fungal diversity (species number and identity) on three functional measures: litter decomposition, fungal biomass accrual and sporulation. Alder leaf disks were conditioned by fungi for 7 days and then were exposed to ethanol (0,07%) and/or phenanthrene (1 mg/L) for further 24 days. Exposure to ethanol or phenanthrene decreased both leaf mass loss and fungal sporulation, but increased fungal biomass. All aspects of fungal activity increased with increasing number of fungal species. Fungal activity in mixed cultures was generally higher than expected from the weighted performances of participating species in monoculture, suggesting complementarity between species. However, the activity of fungi in mixed cultures did not exceed the activity of the most productive species in the absence or presence of ethanol and/or phenanthrene. Acknowledgment The Portuguese Foundation for the Science and Technology supported this work (POCI/MAR/56964/2004)

O2

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STUDY OF BARRIERS AND SPAWNING AREAS FOR RHEOPHILOUS SPECIES FROM RESERVOIRS IN EXTREMADURA REGION (SOUTHWESTERN SPAIN)

Introduction In Extremadura exist many reservoirs, 300 over 5ha, and many of them populated by non-native fish species that are displacing autoctonous fishes to head waters and less disturbed tributaries. The main defense of the Iberian cyprinids is a high recruitment that natural environment managers must promote giving them access along the waterways. Methods and Materials 10 reservoirs and 1 river in Extremadura were selected taking into account the presence of native rheophilous species populations in their waters, mainly straight-mouth nases and barbels: Valdecañas, Cedillo, Borbollón, Santa Lucia, Guadiloba, Valdeobispo, Torrejón-Tajo and the river Esperaban in the Tajo basin and the reservoirs of La Serena, Peña del Águila and Los Molinos in Guadiana basin. The main tributaries of these reservoirs were walked along for localization and characterization of barriers and possible spawning areas. Results 300 barriers with different order of importance have been reported to disrupt fish passage: 46 in Valdecañas, 60 in Cedillo, 50 in Borbollón, 3 in Santa Lucia, 1 for Guadiloba, 12 in Torrejón-Tajo and about 90 in Valdeobispo (in progress), 8 obstacles in the river Esperabán, 16 in La Serena and 14 for Peña del águila (in progress). As a result of these studies 9 barriers were eliminated, 5 constructing fishpassages, 1 by means of an artificial river and 2 by partial demolition of dams, releasing each between 10-60km of river. There are still 10 more actions currently being drafted. Conclusions Once evaluated just under 10% of the rivers longer than 10km in Extremadura, more than a thousand barriers are estimated to exist in the region. Attending to the available data on barriers and the abundance and quality of spawning areas, between 10 and 15% of them (200-300) are foreseen as priorities. More than 50 actions to facilitate fishpassages have been carried out by local and state administration, but much work remains to be done.

SS8

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ASSESSING THE IMPACT OF HABITAT FRAGMENTATION ON THE DEMOGRAPHIC HISTORIES OF POPULATIONS EXPERIENCING ASYMMETRIC GENE FLOW.

Anthropogenic habitat fragmentation by dams or weirs is a major threat for freshwater organisms. Such fragmentation might strongly reduce riverine populations' effective sizes. Indirect methods aiming at inferring the demographic history of wild populations through the analysis of neutral genetic data permit to identify such population declines, and hence to indirectly assess the impacts of fragmentation on such populations. However, inferring demographic histories through genetic data may be tricky. Indeed, it is well-known that population structure or gene flow reductions might generate false signals of demographic changes. In riverine freshwater habitats, populations suffer from an inherent downstream-biased asymmetric gene flow that could impede correct inferences. Yet, it still unknown how gene flow asymmetries might affect inferences made from genetic data. We conducted a multi-specific comparative analysis between two rivers (continuous/fragmented) to determine the impacts of fragmentation by dams and weirs on the demographic history of four fish species (L. cephalus, L. leuciscus, G. gobio, P. phoxinus). In addition, we tested through the analysis of simulated genetic data the potential effects of gene flow asymmetry on the inference of demographic histories. Our results show that habitat fragmentation did not affect the demographic histories of these species, even if their genetic diversity has previously been shown to be affected. We found evidences for ancient signals (i.e. 2000-7000 years BP) of strong bottlenecks for all species across the two landscapes. Simulations' analyses shown that gene flow asymmetry bias past demography inferences, by generating "false" expansion signals, but our empirical results were robust against this type of bias. Overall, our results suggest that river fragmentation by weirs and dams might affect gene flow without affecting the demographic history of populations.

O5

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15 N SIGNATURES REVEAL IN-STREAM NITROGEN UPTAKE BY AQUATIC MACROPHYTES

Aquatic macrophytes are conspicuous in lowland streams and may contribute to stream nutrient uptake. However, their role on nutrient stream dynamics has often been omitted. Most macrophytes are rooted in the streambed sediment; and thus, it is unclear whether they can use nutrients from the water column. In this study, we explored the relationship between ¹⁵N signatures of different species of aquatic macrophytes and those of dissolved inorganic nitrogen (DIN, as ammonium and nitrate), as well as how this relationship varies across space and over time. We selected four macrophyte species differing in their ratio of water vs. sediment interactions; from floating macrophyte Callitriche stagnalis, to aquatic emergents Apium nodiflorum and Veronica beccabunga, to riverine Carex pendula. We measured the ¹⁵N signatures of these macrophytes and of DIN forms along reaches downstream of five waste water treatment plant effluents, which previous results have indicated that generate remarkable gradients of ¹⁵N-DIN signatures. In addition, one of these streams was sampled on five dates to examine the temporal variation of the ¹⁵N signatures. Results showed a high spatial variability in ¹⁵N signatures of both aquatic macrophytes and DIN. When data from all the streams were compiled we observed positive relationships between ¹⁵N signatures of aquatic macrophytes and ¹⁵N-DIN except for Carex pendula. Moreover, results also showed a N uptake preference for ammonium or nitrate, which varied among species. Overall, these results indicate that stream water DIN is a N source for macrophytes, suggesting that they can contribute to in-stream N uptake. However, their influence on nitrate or ammonium dynamics will depend on the relative abundance of different macrophytic species.

O1

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MODELLING THE OCCURRENCE OF DOMINANT FISH SPECIES IN INSHORE SHALLOW HABITATS OF LOWLAND RIVERS

The diel fish species dynamics of lowland rivers was demonstrated by high variability in number of species or individuals. However, the particular fish species dynamics within the diel period is still unknown. We presented analyses that model the species distribution (number of individuals or relative abundance) in lowland rivers of Slovakia (Morava, Váh, Latorica, Bodrog and Tisa Rivers). Fishes were sampled every two hours during the 24 hour cycle using the small beach seine net (2x5m, mesh size 5 mm). We applied mixed linear and additive modelling in R statistical software for the model construction and selection. Mixed model were constructed using both random factor or autocorrelative structure. Moreover, we applied the model improvement to deal with data heterogeneity. The occurrence of dominant species Abramis sapa, Alburnus alburnus, Aspius aspius, Blicca bjoerkna, Chondrostoma nasus, Gymnocephalus baloni, Gymnocephalus schraetser, Leuciscus idus, Leuciscus leuciscus, Perca fluviatilis, Romanogobio vladykovi, Rutilus rutilus, Sabanejewia balcanica, Sander lucioperca and Zingel zingel were modelled using the appropriative model. On the basis of the analyses, several species show clear diel pattern, clearly visible especially in the case of the members of percids and some cyprinids. The next step that could help to understand the diel patterns in fish species occurrence is to assess the motivation of particular fish species to use the shallow inshore area of lowland rivers. This contribution/publication 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 and by the VEGA project no. 2/0080/11.

SS6

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THE EFFECT OF SMALL-SCALE TURBULENCE ON FEEDING EFFICIENCY OF PERCH (PERCA FLUVIATILIS)

Climate change models predict increase in storm activity which could consequently affect turbulence in aquatic ecosystems. Increase in turbulence levels can play an important role in the competition between different predators. As part of a project investigating the effects of turbulence on top-down regulation in aquatic systems, we conducted experiments investigating the effects of different levels of turbulence on fish feeding. Experiments included perch (Perca fluviatilis) (5-6 cm) as predator and fourth instar phantom midge larvae (Chaoborus flavicans) as prey. Perch were placed in aquarium with 200 L of water and 200 Chaoborus larvae. Different levels of root-mean-square turbulence levels ranging from 0.5 to 14.0 cm/s, both in dark and in illuminated conditions, were used as treatments. Results from preliminary experiments suggest that there is a threshold turbulence level at which fish feeding is benefited due to increase in predator-prey contact rates. However, high turbulence levels caused by strong winds can have detrimental effects on perch feeding since it can disperse prey patches lowering prey concentrations. Investigating how fish cope with increased turbulence will help us understand how changing climate might modify the role of fish in the top-down regulations in lakes.

O3

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COMPARISON OF NATURAL FLOW REGIME CLASSIFICATIONS BASED ON DIFFERENT STRATEGIES.

Hydrologic variability is a primary factor influencing the structure and function of ecological communities. Thus, information concerning flow regime is essential for sustainable management of rivers. River classifications based on key hydrological attributes allow the identification of rivers with different flow regimes. Inductive classifications apply statistical methods to flow records and environmental data and are considered more accurate methods than deductive methods. However, choice of statistical methods is subjective and classifications may be sensitive to these decisions. In this study we compare the performance of two inductive classifications defined for Atlantic (Cantabrian sea) and Mediterranean (Ebro) catchments in the northern third of Spain. 71 hydrologic metrics characterizing mean tendency and dispersion of flow regime attributes were calculated from daily mean flow measured in 164 unmodified gauge stations for which at least ten years of record were available. For each section of a digital river network variables describing the characteristics of the upstream catchment were derived. Two classifications were defined using opposite strategies: classify-then-predict and predict-then-classify. The first strategy clusters gauges based on flow indices and then uses an empirical model based on the catchment characteristics to deduce class membership for all sections of the network. The second approach first models the flow indices based on catchment characteristics and then clusters all the network sections. In both cases Partitioning Around Medoids algorithm was used for the cluster analysis and Random Forest was used to model and predict the classes and indices. We used the Rand Index to compare the spatial correspondence between the classification and the Classification Strength to compare their performance. Rand index was low indicating large differences in spatial patterns defined by the classifications. However, the performance of the two classifications was similar. This indicates that there is more than one credible flow regime classification within a region.

O5

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EFFECTS OF NUTRIENT ENRICHMENT AND RIPARIAN VEGETATION ON LITTER DECOMPOSITION IN STREAMS

Anthropogenic impacts, such as nutrient enrichment and changes in riparian vegetation, are raising concern about their impacts on biotic communities and key ecosystem processes in streams. In this work, we examined how eutrophication and changes in riparian vegetation affect litter decomposition and the associated aquatic decomposers. Leaves of five plant species, namely Alnus glutinosa, Castanea sativa, Eucalyptus globulus, Platanus sp. and Quercus robur, were placed in coarse-mesh bags and immersed in seven low-order streams along a gradient of eutrophication (from 0.16 to 3.37 mg L-1 of N-NO3 and 0.003 to 0.27 mg L-1 of P-PO4) during 38 days. Leaf mass loss, diversity of benthic invertebrates, and diversity and reproduction of aquatic fungi were assessed. Litter decomposition increased along the gradient of eutrophication defined by increasing levels of nitrates, particularly in fast decomposing plant species. Decomposition was faster for A. glutinosa (from 31.5 to 86.2%) and slower for Platanus sp. (from 20.0 to 44.0%). Both invertebrate and fungal assemblages discriminated litter species and streams according to the level of eutrophication. Moreover, aquatic fungal reproduction decreased with eutrophication. Overall, decomposition of leaf litter and the associated fungi and invertebrates gave reliable measures for assessing anthropogenic impacts in streams. Acknowledgement The Portuguese Foundation for the Science and Technology supported I Fernandes (SFRH/BD/42215/2007).

SS5

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CHANGES IN THE ORIGINS OF CARBON SUSTAINING THE PELAGIC FOOD CHAIN DURING A CENTURY OF HUMAN PERTURBATIONS ON TWO DEEP SUB-ALPINE LAKES.

Any perturbation of aquatic ecosystems that affects the quantity and quality of the phytoplankton, and thus the food resource available for primary consumers, might drive subsequent changes in carbon cycling within the food webs. For instance, lake eutrophication and subsequent re-oligotrophication within a context of global warming have caused long-term responses of the abundance and taxonomic composition of lake primary producers. Such changes at the first level of the food chain are expected to result in modified contributions of the autochtonous- versus terrestrial-derived organic matter in sustaining the lake secondary production, although such an hypothesis cannot be straighforwardly investigated with current tools in stable isotope analyses over long time scales. Through a paleolimnological approch combining stable isotope analyses on sub-fossil zooplankton remains and specific lipids, this study attempts to document multi-decennial changes in the origins of C fuelling the pelagic food web of two french sub-alpine lakes (Lake Annecy and Lake Bourget) under concurrent human perturbations over the last 100 years.

SS10

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ANTICIPATING THE EFFECTS OF GLOBAL WARMING ON BIODIVERSITY-ECOSYSTEM FUNCTIONING RELATIONSHIPS IN BENTHIC STREAM ASSEMBLAGES: EXAMPLES FROM MICROCOSM EXPERIMENTS

We performed two microcosm experiments which addressed some of the potential effects of global warming on biodiversity-ecosystem functioning (B-EF) relationships in benthic stream systems. Firstly, we investigated the capacity for assemblages of three shredder species from temperate (southern England) and boreal (northern Sweden) regions to respond to shifts in temperature and basal resources by quantifying rates of a key ecosystem process, leaf decomposition. Approximately 40% of the variance in decomposition rates was attributed to assemblage metabolism (predictions derived from allometric body size and temperature scaling relationships). Beyond this, regional differences were evident in decomposition rates across temperature and resource manipulations and in terms of the processing efficiency of temperate and boreal consumers of the same species (i.e. after correcting for body size and metabolic capacity). This suggested that intraspecific variation among local populations could modulate B-EF effects and responses to environmental warming. Overall ecosystem functioning is maintained by multiple ecosystem processes acting simultaneously. In a second experiment we quantified multiple ecosystem processes (including leaf litter decomposition, FPOM production, nutrient flux, algal grazing) using four species of primary consumers (both grazers and shredders) exposed to different thermal regimes. We tested how the perceived effects of species loss might change if more than one process is considered at the same time in a combined metric. Results highlight that although the performance of individual processes can often be explained by the presence of one or a few functionally dominant species and is relatively insensitive to initial species loss, joint functioning is more susceptible to the loss of species. This has important implications for extrapolating results from B-EF studies to natural systems because if redundancy declines, as an increasing portion of total functioning is captured, then the consequences of species loss could be far more serious than previously demonstrated by B-EF studies to date.

O4

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ENVIRONMENTAL CONTROL OF CRUCIAL PHYSIOLOGICAL ACTIVITIES IN FLUVIAL BENTHIC CYANOBACTERIA

Phosphorus and Nitrogen are among the most important limiting nutrients in aquatic ecosystems. Variation on their concentrations can produce changes on growth and development of primary producers such as cyanobacteria. Physiological processes as phosphatase or nitrogenase activities are often good indicators of these limitations and their study can indicate different adaptations of the organisms to different environmental conditions. Cyanobacteria are present in rivers where they may become dominant. In order to characterize how cyanobacteria can use or obtain P and N (from organic P or atmospheric N2) and the relation with environmental conditions, a study of both physiological processes (phosphatase and nitrogenase activities) in benthic cyanobacteria from rivers has been carried out. Some temperate rivers from Spain and tropical rivers from Mexico were selected in order to compare the effect of different environmental conditions on benthic cyanobacterial populations. Physiological assays were measured "in situ" on some heterocystous cyanobacteria (dominated by Tolypothrix, Rivularia, Nostoc), and other non heterocystous cyanobacteria (like Chamaesiphon or Phormidium). Each cyanobacterial population showed different activities depending on the nutrient concentration, but also on the community type and on their physiological condition. However, similar environmental conditions triggered similar phosphatase and nitrogenase patterns independently of the community or the location. These results suggest that phosphatase and nitrogenase activities could be used to detect changes in nutrient dynamics in rivers. This work was supported by grants from MICINN- CGL2008-02397/BOS; AECID: A/010529/07- A/016414/08, CAM- MICROAMBIE

O3

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STREAM MACROINVERTEBRATE COMMUNITY RESPONSE TO TREATED WASTEWATER IN A MESOCOSM EXPERIMENT

The discharge of treated water from sewage treatment plants is one of the most common forms of point source pollution to river ecosystems, yet its effects on aquatic macroinvertebrate communities have not been investigated in a controlled experimental setting. Here, we use a series of 12 artificial stream channels in a mesocosm experiment to test whether exposure to varying concentrations of wastewater treatment plant effluent influences macroinvertebrates at the community level. Stream invertebrates were exposed to a continuous supply of treated wastewater mixed with river water at 0% (control), 5%, 15%, and 30% concentrations for a two-week period. Multivariate analysis using Principal Response Curves and Monte Carlo permutation tests indicated a clear, dose-effect response to the treatment, with significant changes in macroinvertebrate assemblages by week 1 in the 30% treatment group and in the 15% and 30% treatment groups by week 2. Coleopterans and Ephemeropterans showed a strong concentration-dependent decrease in abundance and by week 2 were completely eradicated from the 30% treatment group. Trichoptera and Diptera taxa also decreased in abundance, with the exception of the pollution-tolerant Diptera Psychodidae, which colonized channels receiving 15% and 30% effluent by the end of the experiment. Analyses of physical-chemical parameters suggest that treatment effects on macroinvertebrates were largely explained by increases in nutrient concentrations (ammonium, sulfate, and phosphate) and decreases in dissolved oxygen. These findings demonstrate that effluent from wastewater treatment plants cause significant changes in abundance and composition of macrionvertebrate taxa and that effluent concentrations as low as 15% still have important effects on stream invertebrate communities.

SS15

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ASSESSING THE STATUS OF PHYTOPLANKTON FOR THE WATER FRAMEWORK DIRECTIVE USING A COMMON METRIC APPLICABLE TO A VARIETY OF LAKE TYPES IN EUROPE

Many European lakes suffer the effects of nutrient enrichment. The recent introduction of the EU Water Framework Directive provides an opportunity to assess and then improve the status of these lakes. Phytoplankton is a key indicator of eutrophication and simple metrics such as the concentration of chlorophyll a have been used for many years to assess status. However, the WFD requires a more comprehensive assessment including, biomass, taxonomic composition and the frequency and intensity of cyanobacteria blooms. This paper describes the development of a taxonomic metric that in combination with other metrics can be used to assess the status of lakes and compare methods developed by other countries. Methods Data describing the summer phytoplankton populations from over 1600 lakes from 19 countries, together with a range of environmental parameters were collated as part of an EU funded project (WISER). Ordination techniques were used to describe the phytoplankton communities and a number of potential metrics were developed that could be used to describe the status of the phytoplankton community. Results A plankton trophic index (PTI) was derived from a CCA ordination constrained by a single environmental variable, total phosphorus. Linear mixed models were used to identify the most important factors influencing the metric. Alkalinity and country were found to be the most important. Lakes were divided into types and data from a combination of minimally impacted lakes and models were used to determine reference conditions for the metric so that it could be expressed as an Environmental Quality Ratio which can indicate status as a change from reference status. Conclusions The analysis provided a series of metrics which after standardisation can be used to assess the status of phytoplankton in lakes

O7

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DO BIOLOGICAL TRAITS OF FRESHWATER BEETLES MATCH THEIR ECOLOGICAL PREFERENCES?

Coleoptera are the most widely distributed invertebrate group in freshwater habitats, showing a great diversity in life histories and ecological requirements. A central question is to explain this diversity and understand how particular combinations of traits allow species to colonise certain types of habitat. Our study aims at: (i) describing life-strategies for water beetles in Mediterranean environments and their ecological requirements; (ii) identifying functional groups of water beetles having common combination of traits; and (iii) assessing the degree of concordance between these combinations of traits and the water beetle ecological requirements. Taxonomic lists obtained from samplings in 212 sites within the southeast of the Iberian Peninsula were assembled, consisting of 272 species and 68 genera. For each genus, fuzzy coded affinities to selected biological and ecological traits were obtained from literature and expertise. Fuzzy correspondence analysis (FCA) was performed on each abundance-weighted trait matrix generated from biological and ecological information, respectively, and co-inertia analysis further enabled matching the two matrices. The first FCA axis separated genera according to food, feeding habits, respiration, reproduction and locomotion for biological traits, and longitudinal distribution, current velocity and transversal distribution for ecological traits. Sharp functional groups occurred at high taxonomic levels (suborder or family), Elmidae genera only showing a certain functional homogeneity. Co-inertia analysis demonstrated a significant correlation between trait matrices (Rv-correlation = 0.35, $P<0.001$). Elmidae was the family which genera displayed the highest concordance between biological and ecological traits whereas Hydraenidae showed the opposite pattern. The significant relationship between biological traits and ecological requirements demonstrate that those freshwater beetles showing a particular combination of biological traits (primarily concerning respiration, dispersal and food) should use particular habitats (mainly in terms of substrate preferendum, longitudinal distribution and current velocity). The lack of consistency detected in some taxa calls for further collection on trait information.

O8

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CYTOMETRIC IDENTIFICATION AND DISCRIMINATION OF PHOTOSYNTHETIC ORGANISMS IN THE VERTICAL PROFILE OF A HIGHLY STRATIFIED MEROMICTIC LAKE. MONITORING OF SEASONAL COMMUNITY DYNAMICS.

During last years, flow cytometry has been recognized as a powerful tool for the study of the spatial and seasonal trends of phytoplankton in aquatic environments. The aim of this work is to know the capacity of the flow cytometry for the identification and discrimination of the main photosynthetic groups observed in the meromictic Lake La Cruz. For the cytometric identification of the main photosynthetic groups, a Coulter CYTOMICS FC500 flow cytometer equipped with an argon laser (488 excitation), a red emitting diode (635 excitation), and five filters for fluorescent emission, was used. Autotrophic picoplankton counts were performed by epifluorescence microscopy, larger phytoplankton was counted by Utermöhl sedimentation method and photosynthetic sulfur bacteria were counted by the erythrosine method. The meromictic 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. The main organisms observed and identified by flow cytometry were autotrophic picoplankton (PE-Rich, PC-Rich and picoeukariotes), larger phytoplankton (Peridinium, Cyclotella, Scenedesmus, Tetraedron, Cosmarium,…) and photosynthetic sulfur bacteria (Lamprocystis purpurea and Chlorobium clathratiforme). We were able of doing an easy identification of these populations by flow cytometry, that was tested with pure cultures of the main organisms isolated from Lake La Cruz. The correlation between the different clusters observed in the cytograms and the microscopic counts show a good discrimination of the main phototrophic populations found in the lake. We also tested the use the red diode for phycocyanin rich population identification. Our results show how this methodology also allows for the identification, in most cases, even of species, thus taking advantage of the cytometry benefits like faster results and the possibility of extend the number of samples and the resolution of the sampling. This also would allow to deal with a more complex design of experiments in the lake.

SS5

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IMPACTS OF ENVIRONMENTAL WARMING ON ECOLOGICAL NETWORKS

Climate change is one of the major global threats facing freshwater ecosystems, especially at high latitudes, where warming is predicted to be particularly rapid. However, many aspects of how climate change and rising temperatures impact on fresh waters remain unknown, especially at higher levels of organisation (communities, food webs, ecosystems). Many studies to date have used space-for-time substitution across large ranges of latitude to assess likely impacts of warming, but these are often confounded with biogeographical effects. The other dominant approach has been to employ laboratory microcosm experiments (usually using protist assemblages), but these tend to lack realism. Our study aimed to minimise these shortcomings by using a "natural experiment" in a set of 15 geothermally heated streams in Iceland (4°C to 43°C mean summer temperature). Given these systems are isolated from potential low-latitude colonists, we would expect a decline in species richness with rising stream temperatures. Temperature should also affect allometric scaling relations between body-mass and abundance, with increased abundances of small organisms within trophic levels at warmer temperatures. We present results that demonstrate clear responses at each trophic level, and within guilds and the food web as a whole. The biodiversity of those cold-adapted systems declined with increasing temperatures, there was a clear shift in the composition of intermediate trophic levels and also in the abundance, size and trophic status of the top predator in this system, the brown trout, Salmo trutta, indicative of an increase in the "trophic height" of the food web.

SS15

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EFFECTS OF EUTROPHICATION, MORPHOLOGICAL ALTERATION AND HABITAT CHARACTERISTICS ON THE SPATIAL DISTRIBUTION OF LITTORAL MACROINVERTEBRATE COMMUNITIES IN NATURAL MEDITERRANEAN LAKES

Introduction. The relative strength of different factors in shaping the spatial distribution of lake littoral invertebrate assemblages in Mediterranean lakes are largely unknown. In this paper we quantified the effects of habitat heterogeneity and 2 of the major anthropogenic pressures (eutrophication and morphological alterations) on littoral invertebrates. Materials and methods. Within the framework of the EU funded WISER project, we collected macroinvertebrate samples in 15 natural Mediterranean lakes, characterized by diverse degree of anthropogenic pressures. We selected 9 sites per lake according to different levels of alteration of the shores and kick sampled macroinvertebrates with a 500 µm hand net in all the mesohabitats present at each site for an amount of time proportional to their areal extent. We used spatial analysis techniques along with variable selection procedures to partition the variance among environmental variables at different scales and the pure spatial components. Results. About half of the explained community variance (49%) was due to the pure spatial component. Of the remaining community variance, a large fraction was explained by morphological alterations (27%), while eutrophication explained 3%, and habitat characteristics less than 1% of variance. The remaining variance fraction was explained by interactions among variable groups. Among the eutrophication related stressors, TP was the most significant explanatory variable, while site land use (natural/seminatural, agricultural, urban), percentage of modified shoreline, percentage of natural/seminatural, urban and agricultural land use in the 200 m belt around the lake were significant stressors related to morphological alteration. Finally percentage of site macrophyte cover, number of littoral mesohabitats, substrate texture groups resulted significant habitat habitat-related factors. Conclusion. The spatial structure of littoral invertebrate communities of Mediterranean lakes are mostly constrained by morphological alteration while eutrophication and habitat characteristics seem to have only marginal effects.

SS14

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PHYSIOLOGICAL DIFFERENCES OF SPANISH ZEBRA MUSSEL (DREISSENA POLYMORPHA) POPULATIONS USING TRANSCRIPTOME ANALYSES.

Despite that zebra mussel is one of the most damaging pest species in the word, little is known about its physiology. DNA microarray technology in conjunction with functional genomics offers a powerful tool to study whole organism physiological responses to environmental factors. We developed a zebra mussel microarray including approximately 3,500 existing coding sequences and use it to study transcriptome variations in 4 experimental setups. Stress responses were analysed in different adult tissues and larvae exposed to TBT and Hg. In addition, geographical variations were explored compared natural population residing in different sites in Spain, including some 300km of the Ebro River (6 populations) and the Sitjar reservoir in the Jucar River. Finally, seasonal variations (spring versus autumn) were followed in the Riba-Roja reservoir population (Ebro River). In all cases we found significant expression variations of a limited number of genes. For example, TBT exposition induced changes on mRNA abundance of 38 genes, including the multixenobiotic resistance protein, whereas Hg exposition induced changes of only 13 genes. Ebro River populations showed transcriptome profiles more similar than any one of them relative to the Sitjar populations, whereas the population from the most polluted site (Flix reservoir) showed an increase of proliferation-related genes. Finally, data suggest that seasonal differences are more important than geographical (or even treatment-induced) ones, a result probably linked to the different stages in the life cycle (pre spamming in spring, gonad regression in autumn). The very incomplete annotation of zebra mussel genes prevents a through analysis of the genes implicated in the observed transcriptome variability; nevertheless, functional analyses based on gene sequence homologies are currently underway. We consider that the microarray methodology can be a very useful tool to study the physiology (including critical parameters for growth and reproduction) of even ill-characterised species, like zebra mussel.

O5

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HOW MIGRATORY BEHAVIOR AFFECTS BIOMAGNIFICATION OF METHYL-MERCURY BY THE PHANTOM MIDGE CHAOBORUS SP.

The phantom midge Chaoborus (Insecta, Diptera), a well known invertebrate predator of plankton, has been described as a poor conveyor of methylmercury (MeHg) to upper trophic levels. We investigated the bioaccumulation and biomagnification capacity of three different Chaoborus species through their ontogenic development in an ecological context. We hypothesized that bioaccumulation and biomagnification of those larvae are related to the concentration of ingested prey. Chaoborus respond to fish predator by vertically migrating in the water column which affects their feeding activities. We thus expected that spatial segregation between habitat refuge and habitat resource would alter their capacity to biomagnify MeHg. All Chaoborus species bioaccumulated MeHg through their ontogenic development, and MeHg concentrations were related to aqueous concentrations of the lake. However, in the lake inhabited by fish, all instars of C. punctipennis which were migrating in food-depleted deep waters or sediment were not able to biomagnify MeHg whereas in the fishless lake C. americanus and C. trivittatus showing less migratory downward behaviour biomagnified MeHg. Dietary and growth dilution effect could not explain such pattern of biomagnification, nor the trophic position according to ä15N stable isotope analysis which were equivalent among species. Moreover, reduced biomagnification capacity of C. trivittatus, the species coexisting with C. americanus in the fishless lake can also be explained by a progressive spatial segregation in deeper waters during larval development. Our findings demonstrate that migrating behavior patterns affect the biomagnification capacity of the most common invertebrate predator of lake planktonic food webs.

O3

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WATER QUALITY ASSESSMENT IN THE EBRO BASIN (2000-2010) AS A BASIS TO EVALUATE THE IMPACT OF THE DEPURATION AND CLEANING PLAN (PASD) OF THE ARAGON GOVERNMENT

The Water Depuration and Cleaning Plan of the Aragon Government (PASD) has led to the construction of 148 wastewater treatment plants in Aragon. Although the PASD could have improved water quality in the river Ebro basin, there is little knowledge regarding the extent of these changes. The objective of this study was to assess the changes of water quality in three areas of the Ebro basin upon implementation of the wastewater treatment plants. The selected areas were: Alcanadre river in OntiÃ±ena (Huesca); Huerva river in Fuente de la Junquera (Zaragoza) and Jiloca river in Luco de Jiloca (Teruel). The methods included a historical (2000-2010) assessment of biological water quality through biotic indexes (IBMWP and IASPT) and a physicochemical study, together with water sampling in these three areas during 2010. Biological and physicochemical data showed improved water quality in all three areas where the wastewater treatment plants were built. IBMWP increased from â€œgrossly polluted waterâ€ (7) to â€œpolluted waterâ€ (54) status in Huerva river. This indicator increased to â€œvery clean waterâ€ (75 to 115) status in Alcanadre river and from â€œpolluted waterâ€ (34) to â€œvery clean waterâ€ (106) status in Jiloca river. Similarly, physicochemical indicators, including phosphorus, phosphates, ammonium and nitrates levels, Kjeldahl nitrogen index, dissolved oxygen, COD, BOD5 and suspended solids, also improved. The improvement was greater in Huerva river and Jiloca river than Alcanadre river because of their lower initial IBMWP scores due to severe anthropics impact. Further research to confirm the sustained water quality improvement upon implementation of the PASD program is recommended, and may include: assessment of the seasonal variations of the physicochemical indicators; the evaluation of the water mass environmental health, and to increase the number of water quality sampling areas to monitor the whole diversity of the water mass in the Ebro basin.

O5

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CLIMATE CHANGE, INTERNAL LOADING AND HARMFUL ALGAE DEVELOPMENT IN LAKES WITH LOW EXTERNAL NUTRIENT INPUT

Climate change, particularly global warming may alter the intensity and duration of potentially harmful cyanobacteria (CYAH) blooms. It is already known that high water temperatures and water column stability increase cyanobacteria (CYA) buoyancy and favour vertical migration of large-sized and/or CYAH species like Microcystis, and that recent summer heat waves have boosted its development in a eutrophic lake. Less is known about the effect of global warming on CYAH-bloom formation in lakes with low external nutrient loading. Global warming strengthens the vertical stratification in intensity and duration, and increases sediment temperature. This may amplify bottom oxygen deficiency and extend the anoxia period, leading to higher phosphorus (PHOS) release. In northern environments, climate change increases precipitation, and especially the frequency of extreme rainfall events and storms, that could play an interactive role with temperature in CYA bloom formation. The objective of this study was to determine the relationship of temperature, ice-free season stratification length, PHOS-internal loading (a legacy of past external loads) and metalimnetic CYAH biomass, in small summer stratified lakes with low PHOS concentration in the epilimnion. We hypothesized that: (i) PHOS-internal loading supports metalimnetic CYA growth; and (ii) extreme rainfall events and storms, associated with climate change, will boost wind intensity and frequency, that promote turbulent vertical instabilities in the metalimnion and entrain PHOS and algae across the thermal boundary. The study was done in a Canadian dimictic lake, in which physical, chemical and phytoplankton community characteristics have been followed since 2007. During the four year study, the lake has presented extreme weather events, consequently, the stratification and hypolimnion anoxia length, varied by one and three month, respectively. The relationship between summer PHO-internal and total loading, CYA biomass, thermocline stability, will be presented during two years of contrasting climatic conditions.

I09

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GRADIENTS IN PHYLOGENY AND PUPAL CASE ARCHITECTURE OF NINE HYDROPSYCHE SPECIES (TRICHOPTERA) ALONG THE LOIRE RIVER

Considering the concept of the longitudinal zonation of lotic invertebrates, spatial distribution can be related with phylogeny and trait adaptation to environmental conditions prevailing along rivers. Previous phylogenetic studies of nine Hydropsyche species (Trichoptera) from the Loire illustrated that the ancestor of that clade colonized headwaters and that subsequent speciation occurred stepwise toward large-river mouths (presumably in systems of Western Europe), leading to the contemporary longitudinal distribution of species. Furthermore, several ecophysiological traits changed during speciation, indicating meaningful adaptations to environmental gradients along rivers. To expand these studies, we assessed potential trait adaptation of pupal cases (made from sand and small gravel) to environmental constrains prevailing on a gradient along the Loire (i.e. a steeper slope and a coarser bottom material in the headwaters than near the river mouth). We hypothesized that the pupal case architecture of headwater species should differ from that of large-river species. Supporting this hypothesis, several characteristics of case architecture (e.g. case height, area and perimeter, grain size and form, silk amount) and case resistance against crushing forces changed along the Loire. Furthermore, we compared these parameters among species from a headwater site and a large-river site. The pupal cases at the headwater site had fewer total but more large grains than those at the large-river site. These differences in grain size composition of cases had consequences for other grain characteristics and silk use at the two sites (i.e. cases higher and more resistant to crushing forces at the headwater site). Given that the difference in grain availability along the river influenced physical properties of Hydropsyche pupal cases at the headwater and large-river sites, this should generate potential 1) costs for fixing grains by silk and 2) benefits related to case resistance. Ultimately, the fitness of species from headwaters may differ from that of large-river sites.

SS15

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ECOLOGICAL ASSESSMENT OF LAKES IN EUROPE: LESSONS LEARNED AND CHALLENGES AHEAD

Ten years ago the European Water Framework Directive (WFD) created a new paradigm in the understanding of ecological status of water bodies in Europe. The implementation has involved hundreds of the freshwater scientists across Europe and has resulted in improved and harmonised assessment systems which were recently formulated in the EC Decision (EC, 2009). Future challenges still remain, including some biological quality elements (benthic and fish fauna for lakes, phytoplankton, macrophytes and fish fauna for rivers), some regions (Mediterranean and Eastern Continental), water bodies (shallow lakes and estuaries) and issues (uncertainty of assessment results, rules in combining the results from different communities). My presentation will address the following questions: *f*{ How lake ecological assessment systems are built and used across Europe? Which metrics are included in the assessment systems of different biological quality elements ? *f*{ Are the methods validated against pressure-response relationships ? *f*{ How lake reference conditions and ecological quality targets are set ? *f*{ What are the main lessons and challenges of the methods` development and harmonization process?

SS13

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MAYFLIES OF THE FAMILY HEPTAGENIIDAE (INSECTA, EPHEMEROPTERA) OF THE CZECH REPUBLIC: RARE, PROTECTED AND PROBLEMATIC SPECIES

Mayflies (Ephemeroptera) represent an important order of insects for a fluvial ecosystem biodiversity as well as for the assessment of running waters ecological status. The group has a significant potential for detection of long-term changes of freshwater ecosystems, which can be caused, among others, by the impact of climate changes. For this purpose, the knowledge of distribution of sensitive species and their biology and ecology is crucial. It should be supported by the knowledge of the taxonomic position and status of species. Five genera of Heptageniidae occur in the Czech Republic: Epeorus, Heptagenia, Ecdyonurus, Electrogena, and Rhithrogena. The species with uncertain taxonomic status (species inquirenda) belong to the last two genera (e.g. Electrogena samalorum and Rhithrogena zelinkai). Combined analyses of molecular and morphological data are optimal approach to solve these taxonomic problems. From the protection point of view, the family includes 2 critically endangered species, 3 endangered species, 6 vulnerable species and 5 near threatened species according to IUCN classification. For these species, the knowledge of their distribution and ecology is still incomplete. There were also several species which are difficult to distinguish in the larval stage (esp. Ecdyonurus gr. helveticus), and one recently described species (Ecdyonurus silvaegabretae Soldán & Godunko 2006). Their ecological requirements are insufficiently known due to lack of reliable data on their distribution and life histories. The preliminary results of taxonomic analyses, evaluation of ecological requirements and long-term distribution changes of selected species are presented.

O1

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LIGHT AND LITTORAL SLOPE ARE EXPLANATIONS FOR THE ABUNDANCE AND ZONATION OF EGERIA DENSA (HYDROCHARITACEAE) IN A EUTROPHIC URBAN RESERVOIR? (SÃO PAULO STATE, BRAZIL)

Egeria densa, a species of submerged aquatic macrophyte, can cause some environmental problems, principally resulting from his intense growth, as observed in Brazil and the other parts the world. Knowledge of limiting factors is important for monitoring and management of this species. The aim of this study was to test the hypothesis that morphometric characteristics of the coast, such as the littoral slope and water transparency determine the zonation and abundance of E. densa in an urban reservoir (Guarapiranga reservoir, Brazil - São Paulo). The presence and maximum depth of colonization of E. densa were recorded using a rake and the abundance recorded based on an index value of rake teeth filled. Multiple linear regressions were used to describe which variables can explain the width of the stands, the maximum depth of colonization and the abundance of E. densa. The width of the stands of E. dense ranged from 2 to 155 m, maximum abundance was recorded at depths of up to 5.41 m. The abundance and width of the stands were negatively correlated with the littoral slope ($p > 0.001$). The highest values of width of the stands were found on slopes below 5% and the highest abundance in slopes below 15%. The photic zone (1% of incident light) was calculated at 2.68 m and the maximum depth of colonization was 5.61 m. No correlation was obtained between water transparency and variables measured. The littoral slope can affect the processes of erosion, stabilization and sediment accumulation. The low slope of the coast favors the accumulation of particles rich in nutrients thus explaining the high abundance of E. dense in low slopes. The tolerance to low light intensity, elongation of internodes and the canopy formation may explain the abundance of E. densa in deep regions and below the photic zone. Acknowledgments This research was supported by FAPESP (Proc. procs. 09/16652-1, 06/51705-0) and CNPq (Proc. 471184/2006-3).

O3

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BIOFILM STRUCTURE AND FUNCTIONING AS FUNCTION OF POLLUTION GRADIENTS IN MEDITERRANEAN WATERSHEDS.

The structure and functioning of epilithic and episammic biofilms were characterized in four Mediterranean river basins (Llobregat, Ebro, Júcar & Guadalquivir). Five sites were selected in the main course of each river along a chemical pollution gradient. The chemical gradient was defined from the concentrations of emerging and priority compounds in water and sediments. Regarding the algal component of the biofilm, the community composition as well as the algal biomass, and photosynthetic efficiency were analysed. The heterotrophic relevance was estimated through the bacterial density and the extracellular enzymatic activities. The electron transport system analysis was used as a general estimation of biofilm community respiration. The environmental factors determined a natural gradient of nutrients and light in the river, from headwater to downstream. While biomass increased along the river, functional parameters like photosynthetic efficiency decreased. The chemical inputs and environmental stressors affected specifically the biofilms of the different river basins. The relative contribution of environmental factors and pollutants in the variability of biofilms was determined by means of a Variance Partition Analysis. The gradient of water quality decreased from the Ebro, Júcar, and Guadalquivir to the Llobregat, and it corresponded to a lower community diversity as well as to a lower efficiency in organic matter processing.

SS6

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DEMOGRAPHIC ECOLOGY OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) IN LAKE BANYOLES.

Lake Banyoles at present contains a deeply modified fish community. Largemouth bass (Micropterus salmoides), introduced during the 1960s, is today one of the dominant species. Between 1997 and 1999, 19 intensive electrofishing campaigns were carried out, applying several mark-recapture methods. The results show, above all, a high interannual stability of all the studied aspects: condition, growth, population size, recruiting and mortality. That, along with an ontogenetic increase in survival, accounts for the high maximum longevity registered, which equals the maximum value described for the species (11 years). All this is related to the ambient stability which characterises this lake. The medium condition of the population is low as compared with other populations. Similarly, growth is slow in comparison with other populations, but both the maximum lengths observed and the estimated values for asymptotic length are among the highest values in literature. Moreover, the seasonal oscillations observed in the lake's ambient conditions cause a clear seasonal variation in condition, growth and mortality. Condition and growth have their peaks around the Summer solstice, whereas the peak in mortality occurs in mid-summer, when the medium temperature of water reaches its maximum value too. All these oscillations are very stable interannually. Therefore, the species is fully established in Lake Banyoles, a process that seems to have been facilitated by the occupation of a very stable effective ecological niche. On the other hand, a project for the recovery of the original biodiversity of the lake has presently been initiated ("Projecte Estany" LIFE+ 08/NAT/E/000072) which includes, among other actions, an intensive and continued culling operation of largemouth bass and other exotic fish species. The first results obtained with this population control are presented.

SS14

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PRESENT SITUATION OF UNIONIDS IN THE LOWER TER

In the Ter river basin, 5 unionid species have been cited: Potomida littoralis (Cuvier, 1798), Unio mancus (Lamarck, 1819), Unio ravoisieri (Deshayes, 1847), Anodonta anatina (L, 1758), and Anodonta woodiana (Lea, 1834). The latter is a recent introduction. Between 1995 and 2010, several specific surveys were carried out, always below the Pasteral dam, both in the Ter river and in several of its tributaries, including Lake Banyoles. Moreover, during 2010 a thorough freshwater bivalves prospection campaign was performed in the alluvial plain of lower Ter, including the river and secondary water masses, mainly irrigation channels associated with the traditional system of agricultural irrigation. The prospections were done by manually on the river bed bottom. Evidence shows that all native species in the basin are still present, though their general conservation status is precarious, with populations intensely fragmented, and densities often low and heavily aged for lack of recruitment. The most endangered species in the basin is P. littoralis; it was only detected in 4 locations, always in extremely low densities. U. mancus and A. anatina appear in fragmentary form in some tributaries of the Ter river, Lake Banyoles, as well as the alluvial plane area. U. ravoisieri was only located in Lake Banyoles, where nowadays presents a very low density. By contrast, the exotic A. woodiana is expanding and occupies already the whole alluvial plain and the lower course of the Ter river, where it is very abundant. The present distribution of all these species is presented here, together with an analysis of the causes of the native species' regression. On the other hand, a project for the recovery of the original biodiversity of the lake has presently been initiated ("Projecte Estany" LIFE+ 08/NAT/E/000072), which includes, among other actions, the reproduction in captivity of P. littoralis, U. mancus, and U. ravoisieri. The first results obtained in this project are presented.

SS1

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EFFECT OF SUBSTRATUM DRYING ON THE SURVIVAL AND MIGRATIONS OF NATIVE AND PONTO-CASPIAN GAMMARIDS

Water level fluctuations may strongly affect organisms inhabiting near-shore areas of water bodies. Gammarids are mobile animals, which can respond to such events by following the decreasing water level or burying into substratum. Alternatively, they can survive air exposure for some time. We checked whether these adaptations are exhibited by shallow-water European gammarids: Pontogammarus robustoides, Dikerogammarus haemobaphes, D. villosus (Ponto-Caspian aliens) and Gammarus fossarum (native). Three experiments were conducted in tanks with sandy substratum, filled with a few cm of water above substratum. Water gradually evaporated resulting in water level decrease and substratum drying. (1) Horizontal migrations were investigated in tanks with bottoms inclined at 10º to imitate shore inclination. When the water level dropped, gammarids were counted in three substratum zones: (i) the lower, submerged zone, (ii) the middle zone with infiltration water below surface, (iii) the upper, dry zone. (2) Burying was checked in tanks filled with 15-cm layer of sand, when the substratum became exposed to air. (3) Survival was monitored daily in shallow trays until all individuals had died. P. robustoides was most resistant to substratum drying. LC90 water content for this species was only 1.8%. It was the only species that buried into sediments, though only just below surface, but did not migrate horizontally. Other species were less resistant to air exposure (LC90 7-10%). G. fossarum and D. haemobaphes followed the decreasing water level moving to the submerged zone of the inclined tank. Surprisingly, D. villosus grouped in the middle, infiltration water zone. The tested gammarids are well-adapted to water level changes, though their defensive mechanisms vary among species. These adaptations can facilitate the establishment of aliens in anthopogenically modified environments, experiencing high water level fluctuations. This research was supported by Nicolaus Copernicus University grant 308-B and by National Science Centre grant N N304 306840.

SS10

Prat, Narcís [1] ; García-Roger, Eduardo [2] ; Sánchez-Montoya, María del Mar [3] ; Cid Puey, Nuria [1] ; Verkaik, Iraima [1] ; Erba, Stefania [4] ; Karaouzas, Ioannis [5] ; Vardakas, Leonidas [5] ; Sokoulidos, Nikos [5] ; De Martini, Daniele [4] ; Buffagni, Andrea [4] ; Gómez, Rosa [3] ; Suárez, María Luisa [3] ; Vidal-Abarca, María Rosario [3] ; Rieradevall, Maria

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DECONSTRUCTING SPATIAL AND SEASONAL PATTERNS IN AQUATIC MACROINVERTEBRATE ASSEMBLAGES FROM MEDITERRANEAN STREAMS: A HYDROLOGICAL COMPARISON.

We examined the importance of seasonal changes in habitat features at multiple spatial scales and their effects on aquatic macroinvertebrate assemblages of temporary and permanent streams in reference conditions from six catchments across the whole range of the northern part of the Mediterranean basin (i.e. from Portugal to Greece). We followed a spatially nested hierarchical design where microhabitats (substrate type) within mesohabitats (pools vs riffles) within streams (temporary vs permanent) were sampled at two key phases during the hydrological cycle: 1) during the flowing period, when pool-riffle sequences were well-established, and 2) the dry phase, when only pools were expected to occur in the temporary streams. During the dry season, both a reduction in total available habitat (due to riffle disappearing or reduction) and in microhabitat diversity was observed in all streams. Similarly, taxa richness decreased in all streams, but more significantly in the temporary ones. Macroinvertebrate assemblages differed among catchments (i.e. geographical identity) and were also influenced by meso- and microhabitat type; the latter being revealed from this study to be specific and of prime importance to aquatic macroinvertebrate structure and diversity.

SS15

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LONGITUDINAL PATTERNS OF WATER TEMPERATURE ALTERATION AT THE DAILY TIMESCALE: THE EBRO RIVER CASE

Water temperature is one of the principal regulators of freshwater organisms' biology. Reservoirs and thermal discharges are common causes of water temperature alteration. At the daily timescale, great attention has been paid to water temperature extremes alteration by such infrastructures, but there has been less interest in the diel temperature cycle or longitudinal variability of the alterations. In this communication, we study the lower Ebro River (Spain), subject to the thermal and hydrological alterations caused by the system of reservoirs of Mequinenza, Riba-roja and Flix and to the thermal effluent of the nuclear power plant of Ascó. Water temperature was measured downstream from the reservoirs and a modelling approach was used to determine the equilibrium temperature and water temperature recuperation distance in the study reach for different seasons and hydrological years (wet vs. dry year). The intensity of the alteration caused by the reservoirs and nuclear power plant effluent was studied in reference to the equilibrium temperature and discharge rate. Water temperature range showed a progressively fading longitudinal pattern of nodes (minimum water temperature range) and antinodes (maximum water temperature range). Mean daily water temperature downstream from the reservoirs was higher than mean daily equilibrium temperature in the fall and was lower in the rest of the year. The intensity of the alteration decreased downstream. Depending on initial alteration intensity, discharge and meteorology, calculated recuperation distance ranged between some 200 km and more than 1000 km. Thermal alteration induced changes in the thermal behaviour of the river by producing important variations in evaporation and conduction with the atmosphere. Also, complex interactions were observed between the alterations caused by the different reservoirs and the nuclear power plant of Ascó, located 5 km downstream.

SS5

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DROUGHT EPISODE MODULATES THE RESPONSE OF FLUVIAL BIOFILMS TO TRICLOSAN EXPOSURE.

Consequences of global change on rivers are, among others, alterations of flow regime and entrance of compounds potentially toxic for the biota. Indeed, in water scarcity situations, reduced dilution capacity may amplify the effects of chemical pollution. Therefore, studying the response of natural communities to both flow reduction and toxicants is a key issue in the assessment of global change impacts on river ecosystems. This work aims to investigate the influence that an episode of drastic flow reduction may have on the response of biofilms to pulses of Triclosan (TCS). Specific objectives were: i) the assessment of the separated effects of flow and TCS and, ii) determine the potential interactions between the two factors. Three-week old biofilms were subsequently exposed to flow reduction (1 week), flow interruption (2 days) and TCS pulses under restored flow conditions (2 days). Biofilms were later left for two weeks under steady flow conditions to describe late responses and recovery. Several descriptors of biofilms were analyzed previously and after every manipulation. Biofilms responded to flow interruption with a slight increase of phosphatase activity (+25.3% above controls) and a marked increase in the biomass of green algae (+118.5%). Pulses of TCS severely affected biofilms, leading to a significant decrease in photosynthetic efficiency (-17.4%), live/dead bacteria ratio (-28.6%) and phosphate uptake rate (-32.8%) in exposed biofilms respect to controls. Late effects evidenced significant interaction between the two stressors. In particular, one week after the end of exposure, phosphate uptake capacity and diatoms fluorescence of biofilms submitted to both flow reduction and toxicant exposure resulted significantly lower than controls indicating an enhancement of TCS toxicity by flow reduction. Finally, two weeks after TCS exposure, biofilms in general recovered. In conclusion, our study demonstrated how the negative effects of TCS on biofilms can be worsened under water scarcity situation.

SS13

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LONG-TERM STUDIES IN SPANISH PYRENEES: THE STREAM MACROINVERTEBRATE COMMUNITIES OF AIGÜESTORTES AND ESTANY DE SANT MAURICI NATIONAL PARK.

High mountain areas have experienced steep increases in average annual temperatures during the last 30 years. These changes might have affected the altitudinal distribution of mountain organisms, especially stenotherm species such as some aquatic insects. For this purpose we have combined available data from the last 15 years of stream macroinvertebrates of Aigüestortes National Park (Central Pyrenees). Two extensive studies of stream macroinvertebrate communities took place in July 1994 and summer 2008-2010 comprising a range of altitudes from 1400 to 2550 m a.s.l., and covering the different basins of the National Park with the objective to know the changes occurred since 1994 associated with global change, and to select good bioindicators for the assessment of global change in Pyrenean high altitude streams. These studies were complemented from 2005 onwards with a seasonal sampling of four sites at the Sant Nicolau river basin; two being regulated and two undisturbed reaches with an altitudinal range of 1400-2100m. Changes in altitudinal distribution were observed from 1994: Upstream movements partially associated with water temperature were found for cold stenotherm species as Arcynopteryx compacta, Perla grandis, and Habroleptoides berthelemyi. We also found a recovery of colonizers from downstream populations such as Caenis species, and some Baetidae species. A decrease in the altitudinal distribution were also observed for the most reophile species (Rhithrogena loyolaea, Rhithrogena semicolorata group), partially associated with fluvial processes (e.g. flow changes). The increase of flow variability observed in the last decade, with extreme floods and droughts, and associated with cold and warm years affected the resilience of macroinvertebrate communities in Pyrenean high streams. Some metrics were selected for stream community assessment associated to global change, as stonefly biodiversity, Rhrithrogena altitudinal distributions and parasite impact, caddis fly species richness, and Blephariceridae densities. This research was supported by MAYSTONS, GRACCIE, and BIODAT proyects.

SS8

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HEMOCYANIN GENE EXPRESSION IN STONEFLIES UNDER DISSOLVED OXYGEN DEFICITS IN STREAM ECOSYSTEMS.

The recent discover of a respiratory hemocyanin from stoneflies (Hagner-Holler et al. 2004; Fochetti et al. 2006), has raised the hypothesis of an advantage for this insect order to survival in front of the Climate Change in aquatic ecosystems. The search for hemocyanin in stonefly species has showed that this respiratory protein is present only in few species from the carnivore families Perlidae and Perlodidae (Amore et al. 2009). We confirmed this situation in stonefly populations in Spanish Pyrenean high mountain streams (Puig et al. 2010). Now the question is: hemocyanin transcription is associated to changes in dissolved oxygen concentrations? We have used an experimental approach to answer this question, using oxygen meters with closed chambers for respirometry measures (Strathkelvin Inst., model 782). Three groups of experiments were realised with 5-8 individuals of Perla marginata at temperature of 16±0.5°C, and oxygen concentrations of 5.0, 2.4 and 0.0 mg*L-1. Hemocyanin transcription was measured by qRT-PCR techniques, using a fragment sequence of 100bp, and actin transcription as standard reference. The results show two types of answers, hemocyanin transcription at 5.0 and 0.0 mg*L-1, and absence of transcription or minimum levels of transcription at 2.4 mg*L-1. This pattern is consistent with previous studies on Perla marginata behaviour, when the experiment films showed that the aquatic larvae increase their respiratory activity (push-up movements) while decreasing the dissolved oxygen concentrations, but at concentrations of 2-3 mg*L-1 stop the larval activity (pseudo diapause or lethargy), to increase finally near anoxic conditions. Our results support the role of hemocyanin as respiratory protein, and its presence is an advantage to face up to water quality changes (temperature increase, dissolved oxygen decrease) associated to Climate and Global changes. This research was founded by MAYSTONS and GRACCIE projects.

SS15

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PRELIMINARY VERSION OF A FISH INTEGRATED BIOMARKER RESPONSE INDEX (IBR) FOR THE ASSESSMENT OF THE ECOLOGICAL HEALTH OF RIVERS

The IBR, based on a suite of biomarkers at different levels of biological response at the individual level, provides an integrated relative measure of the general health of freshwater fishes. Using the IBR, the health of barbel (Luciobarbus guiraonis) and carp (Cyprinus carpio) from four rivers (Mijares, Magro, Cáñoles and Júcar) of Valencia (East of Spain) was compared. The fishes were collected in each river site using electrofishing procedures. The biomarkers measured were: Acetylcholinesterase (AChE) activity in muscle, Metallothionein (MT) concentration in kidney and TBARS concentration and Catalasa activity in liver. This preliminary version of IBR index reports a series of comparisons between the results of these four biomarkers in the two species from the four sites. IBR results indicate that Mijares's river was healthier than the other three rivers. The highest values of IBR were detected in barbel from Cáñoles's river and carp from Magro's river, which showed high levels of four biomarkers. Results indicate that the IBR offers a potential measure than can be used in monitoring under the Water Framework Directive for the assessment of the ecological health of rivers.

O2

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STOCKING THE IBERIAN ARCHED-MOUTH NASE FOR ITS CONSERVATION AND AS SUBSTITUTE OF EXOTIC FISHES IN PONDS.

Introduction In the basin of Guadiana river in Extremadura (SW Spain) there are more than 12,000 small ponds, many of them containing exotic species. These ponds are potential sources for distribution of fishes to other water bodies, especially in years with high rainfall. The Iberian arched-mouth nase (Iberochondrostoma lemmingii) is a cyprinid found in Extremadura that is able to complete its cycle in still water, being ideal as substitute for exotic fish in ponds. Thus, the possibility of using this specie is evaluated in this study. Material and methods Six ponds of two disparate climate zones were selected in the Guadiana basin of Extremadura. Three of them are located in the lower basin of Ardila river (Zone 1) and three in the basin of Guadarranque river (Zone 2). Ponds were analyzed by electrofishing to check they did not contain any fish, and then they were stocked with I. lemmingii obtained by captive breeding. Fishes 1+ were stocked in Zone 1 in 2008 and fishes 0+ in Zone 2 in 2009. Later on we returned to check by electrofishing the status of new populations. Results In Zone 1 some fishes were recaptured in two ponds in 2009, finding effective reproduction one year later only in one pond. In Zone 2 I. lemmingii was captured in the 3 ponds in 2010. Sampling in 2011 should be done to check if effective reproduction takes place there too. Conclusions The results showed a suitable stocking and the stability of populations of I. lemmingii in ponds. It would provide ponds with sport fishing value, preventing them from illegal and uncontrolled exotic fish translocations. Furthermore, it would provide a natural enhance, since any transfer of fish populations out of the ponds due to heavy rains will restock the Iberian arched-mouth nase in the basin.

O1

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IMPROVED PREDICTION OF VEGETATION COMPOSITION IN NW EUROPEAN SOFTWATER LAKES BY COMBINING LOCATION, WATER AND SEDIMENT CHEMISTRY

Isoetids, as indicators of pristine softwater lakes, have a high priority in national and international (European Water Directive Framework) assessments of ecological lake quality. Our main goal was to identify the most important environmental factors that influence the composition of plant communities and specifically determine the presence and abundance of the isoetid Lobelia dortmanna in NW European softwater lakes. Geographical position and composition of surface water, porewater, sediment and plant communities were examined in 39 lakes in four regions (The Netherlands, Denmark, West Norway and East Norway) distributed over a 1200 km long distance. We confirmed that lake location was accompanied by significant changes in environmental variables between NW European lakes. Lake location was the single most important determinant of vegetation composition and it had significant individual contributions independent of the coupling to environmental variables. This influence of location was supported by a significant decline of community similarity with geographical distance between pairs of lakes at regional, inter-regional and international scales. Combining the geographical position with environmental variables for surface water, porewater and sediment significantly improved prediction of vegetation composition. Specifically, the combination of latitude, surface water alkalinity, porewater phosphate and redox potential offered the highest correlation (BIO ENV correlation 0.66) to vegetation composition. This complex analysis can also account for high sediment variability in the littoral zone of individual lakes and offer better predictions of vegetation composition when lake water chemistry is relatively homogeneous among lakes within regions.

SS11

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EFFECTS OF TERTIARY-TREATED WASTEWATER DISCHARGE ON ECOSYSTEM FUNCTIONING AND FOOD WEB STRUCTURE IN AN URBAN STREAM

Tertiary wastewater treatment is common in developed countries, but little is known about the effects of best-practice wastewater treatment plant (WWTP) on the biological structure and function of urban stream ecosystems. Hence, we studied the effects of a tertiary WWTP and concomitant urbanization of a stream on its biological structure, as benthic invertebrate assemblages and resource utilization within their food web, as well as on its ecological functioning, as invertebrate biomass production, whole-stream metabolism, nutrient retention. We found that discharge of treated wastewater resulted in increased concentrations of total organic C, total N, and total P in the sediments, as well as in enhanced whole-stream community respiration, gross primary production and areal nitrate retention rates. As a consequence, the trophic basis of invertebrate production shifted from upstream natural and agricultural resources to urban resources; i.e., wastewater-derived organic matter as well as autochthonous primary production based on wastewater-derived nutrients. Urbanization, including homogenisation of habitats, resulted in a partial turnover of species. However, invertebrate production at urban sites exceeded that at agricultural sites. Our results suggest that contemporary urban stressors in developed countries affect secondary producers less severely than historically recorded, but still significantly impact urban streams by loss of sensitive invertebrate species, eutrophication, and reduced nutrient-retention efficiency.

O3

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CYANOBACTERIA IN RECREATIONAL WATERS. THE NEW EUROPEAN LEGISLATION

The new European Directive for Bathing Waters considers for the first time cyanobacteria as one of the health risks for the users. In this context every country is obliged to prepare a profile set in which a number of variables should be considered to qualify every bathing site. Every country has followed different strategy, some of them based on historical data, others on the actual presence of cyanobacterial blooms and other s on probabilistic bloom modeling. In this communication we will present the strategy followed in Spain as, an example, and the data obtained regarding cyanobacteria and cyanotoxins, as probably the most extensive dataset in the country monitoring 212 waterbodies during two summer seasons. In this study about 20% of the official bathing sites appeared as highly prone to develop potentially toxic cyanobacterial blooms. 50 percent of the bathing sites in the country were moderately prone to develop cyanobacterial blooms. In this extensive work, on a remarkable proportion of the Spanish waterbodies, planktonic cyanobacteria were dominated by Microcystis spp. and at lower scale by Anabaena, Aphanizomenon and Woronichinia, all of them considered potentially toxic. Microcystins, cylindrospermosis and anatoxin-a were also found in some waterbodies but at moderate concentrations.

O6

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NITROGEN UPTAKE AND DISSIMILATIVE REDUCTION IN VEGETATED SEDIMENTS (V. SPIRALIS) ALONG AN EUTROPHICATION GRADIENT

In organic-rich sediments the survival of submerged rooted macrophytes depends on their ability to transport variable amounts of oxygen from leaves to roots and to detoxify pore-waters. In this study we have analyzed how Vallisneria spiralis stimulates inorganic nitrogen dissipation by denitrification coupled to nitrification (Dn) and how it competes with nitrifiers and denitrifiers in two segments of the Mincio River (Northern Italy) with different trophic status (water nitrate and sediment organic matter content). During three periods of plant life (maximum growth, biomass peak and senescence) microcosms containing transplanted V. spiralis individuals and bare sediments were deployed on the riverbed for three weeks. In the laboratory standard light and dark incubations were performed in order to measure gas, inorganic nitrogen fluxes and nitrification coupled denitrification rates after 15NH4+ injection into the pore-water. Measured Dn rates were highest in organic-rich, vegetated microcosms incubated in the light. Dn rates measured in vegetated microcosms were similar to rates measured in the rhizosphere of other submerged macrophytes: they ranged from 657.8±79.8 to 1709.9±268.1 µmol N m-2d-1 (pooled data). Plant nitrogen demand (500 to 7000 µmol N m-2h-1) was estimated to be one order of magnitude higher than N removal via denitrification, but nutrient availability at both riverine sites was elevated, in particular in spring and autumn periods. Relatively low Dn rates were measured during summer, likely due to the combined effect of elevated plant uptake and oxygen consumption within sediments by heterotrophic bacteria communities. V. spiralis seems to adapt to reducing conditions typical of sediments with high organic matter and its plasticity is probably determined by its ability to transport oxygen to sediments.

O1

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MACROINVERTEBRATE ASSEMBLAGES OF FEN STREAMLETS IN THE OUTER WESTERN CARPATHIAN MTS

The borderland between the Czech Republic and Slovakia is a suitable model area for studying aquatic macroinvertebrate of spring fens due a frequent occurrence of ecologically various fen habitats along the entire gradient of mineral richness. The aims were (i) to study species richness and composition of macroinvertebrate assemblages in springbrooks of ecologically different types of fens, (ii) to isolate environmental factors controlling assemblage compositions and (iii) to describe habitat preferences of dominant species. Altogether, 11 and 15 sites were sampled in 2006 and 2010, respectively. The samples were taken in spring and autumn at each study site. Proportions of substratum fractions and several environmental variables (e.g. water temperature, conductivity, pH, discharge and depth) were recorded. In total, 134,203 individuals of 293 taxa were found. The most diverse group of macroinvertebrates was Diptera (161 taxa), especially Chironomidae (53 taxa). Based on species composition, we distinguished four types of sites varying in mineral richness and substratum characteristics. There were differences in both species richness and abundance among these types of sites, but the compositions of macroinvertebrate assemblages were rather similar. Non-insect fauna, especially Gammarus fossarum and Mollusca, was dominant in all groups of sites. Using redundancy analysis (RDA) with Monte Carlo permutation test, the water conductivity, depth, content of NO3-, water temperature and proportion of sand were most significant factors controlling variation of macroinvertebrate assemblages of the Western Carpathian fen streamlets. These results present the first quantitative data on springbrook taxocoenoses of the study area.

O1

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PRELIMINARY RESULTS ON THE DISTRIBUTION AND COMPOSITION OF WEED-BED FAUNA IN REPRESENTATIVE AQUATIC ECOSYSTEMS IN THE SMALL ISLAND OF BRAILA

Eutrophication is well known as an important process contributing to the deterioration of the aquatic ecosystems. In the Lower Danube River System (LDRS), as a result of structural changes registered in the last half of the twentieth century, the remnants of the natural aquatic ecosystems showed a pregnant tendency of transition to hypertrophy. As a consequence, the density of the energy input into ecosystems increased through excessive development of either phytoplankton, a process correlated with the reduction or extinction of the aquatic macrophytes and weed-bed fauna (e.g. deeper lakes in costal Danube Delta) or macrophytes - epiphytic complex (a typical case in the shallow lakes in the Small Island of Braila-SIB). The impact of those changes on the composition and structure of the weed-bed invertebrate fauna is poorly documented and represents the main aim of this paper that is part of a broader research, continued in 2010. During June-August 2009 samples were taken on a longitudinal hydrological gradient in eight aquatic ecosystems, representative for the SIB (the largest area of LDRS remained in the natural hydrological flooding regime and important long-term research site). Main taxonomic groups of invertebrates were identified and the data were processed using Biodiversity Pro software. The spatio-temporal heterogeneity of the structure and composition of the weed-bed fauna communities revealed that among a total of 27 identified taxonomic groups only one to three groups (usually Chironomidae, Oligochaeta, Isopoda) are dominant in each community. Distribution, species richness and species identity of the macrophyte beds as well as physical, chemical and hydrologic conditions are important drivers of the structure and dynamics of the weed-bed invertebrates.

O6

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CHANGES IN THE BACTERIAL PHENOL-DEGRADING COMMUNITY ALONG THE DECOMPOSITION OF PLATANUS ACERIFOLIA LEAVES IN A FORESTED STREAM

Microbes are the main responsible for the decomposition of plant litter due to their enzyme capabilities. Among the extracellular enzymes, those involved in lignin decomposition might be especially relevant in leaf degradation due to the high recalcitrance of this molecule. While the role of fungi in plant decomposition is quite well described little is known about bacteria and their potential contribution to lignin decomposition. This is investigated here by using the large subunit of the multicomponent phenol hydroxylase gene (LmPH) as a molecular marker to reveal changes in the phenol degrading bacterial community during the decomposition of Platanus acerifolia leaves. Leaves were incubated for 112 days in a forested stream and samples were collected at regular intervals. Bacterial biomass progressively increased and positively correlated with the phenol oxidase activity for the entire period. A PCR-cloning approach was applied to samples corresponding to the onset of the bacterial growth (day 7), the point of maximum phenol oxidase activity (58), and the end of the incubation period (112). On the basis of LmPH gene similarities, significant differences in the bacterial community were found. According to the amino acid deduced sequences and the corresponding theoretical kinetic parameters of phenol hydroxylases, the initial community showed a low specialization, presumably as a result of random colonization of leaves or low nutrient bioavailability. On the contrary, at the end of the incubation period the community was exclusively composed of members of the low Ks type, such as Comamonas testosterioni and Burkholderia cepacia, indicating the presence of highly specialized bacteria. The use of key functional genes may significantly enhance the characterization of relevant bacterial phylotypes and provide with a more realistic picture of the induced changes in a time scale. The observed changes in the bacterial community highlight the contribution of bacteria to the degradation of leaf material in aquatic environments.

SS15

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MODELLING TRANSPORT AND MIXING PROCESSES AT THE CONFLUENCE OF TWO RIVERS ENTERING A MEANDERING RESERVOIR

The growth of zebra mussel individuals at Ribarroja reservoir is suggested to be related to stratification due to density. With low residence time of less than 30 days, stratification at the dam is most probably the result of the interaction between two masses of water (Ebro and Segre rivers), with distinct physical-chemical characteristics, which meet at the tail of the lake. Hence, the first step to propose strategies to eradicate the zebra mussel at this lake is to understand the processes of transport and mixing between both rivers. Our goal is to understand how Ebro and Segre interact, dispose and mix, and evaluate how these phenomena vary at seasonal and daily scales. Based on inflow rates and temperatures from Ebro and Segre rivers, three scenarios are proposed to describe their behavior at their confluence. Experimental data collected during February and July in 2009 (scenarios I and II) are used as inputs for a three dimensional hydrodynamic model (Smith, 2006) and estimations are validated against measured data. Tracer releases at simulations let us evaluate how Segre and Ebro interact and deviations from complete mixing and standard deviations of tracer concentrations allow us to quantify mixing between both sources. Complete mixing is not achieved at neither of two scenarios at the far end of our computational domain. At February, inertial forces dominate, both rivers flow side by side, the interface is mainly vertical and mixing is enhanced when temperature differences (and so density differences) between rivers exist. At July, buoyancy forces dominate, Segre river (with less density) flows on top of Ebro river (and even flows upstream into the Ebro channel) and the interface is mainly horizontal. Phenomena such as the inclination of the isotherms at the Ebro channel could be favoring horizontal mixing and so could enhance mixing during scenario II.

O3

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ECOLOGICAL CHANGES OF CENTRAL EUROPEAN LAKES WITHIN THE EU PROJECT EULAKES: NUISANCE CYANOBACTERIA AND IMPACT ON THE AQUATIC ECOSYSTEMS

The project EULAKES (European Lakes under Environmental Stressors) started in 2010 within the Central Europe Programme. Its main objective is to support the sustainable management of Central European lakes by fostering a combination of vulnerability and risk assessment, monitoring and participative planning to face climate change and other environmental stressors. The international partnership comprises four lakes of different characteristics: Garda (I), Neusiedler (A), Balaton (HU), and Charzykowskie (PL). One of the main topics in our research includes the study of the impact of nuisance cyanobacteria on the trophic webs and human health in Lake Garda. Phytoplankton and cyanobacterial communities, and basic limnological variables, were recorded every month in the trophogenic layers. Determination of cyanotoxins by LC-MS and evaluation of the presence of mcyE genes coding for microcystins begun only recently. In addition, the study of resistant cells of cyanobaceria of the order Nostocales (akinetes) will be investigated to reconstruct the colonisation history by potentially toxic filamentous taxa, such as Anabaena. Despite its trophic status – which oscillated, during the last 30 years, between oligotrophy and oligo-mesotrophy – Lake Garda hosts an abundant cyanobacterial community. Since the beginning of the 1970s, the Lake showed a slight but continuous increase of TP, up to present concentrations of 18 µg P/L. These changes were followed by a parallel increase in the abundances of potentially toxic cyanobacteria, including Planktothrix rubescens and Anabaena lemmermannii. The latter species was observed, for the first time, at the beginning of the 1990s, in the form of extensive water blooms. A few first results showed a strict connection between the abundances of cyanobacteria (mainly Planktothrix) and the concentrations of microcystins. When integrated with genetic, these results will contribute to define a reliable assessment of the threats posed by cyanobacteria based on a combination of biological, metabolomic and genetic analysis.

SS4

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DYNAMICS OF CO2 CONCENTRATION IN A SOIL-LAKE-BROOK CONTINUUM OF A BOREAL FORESTED CATCHMENT

The numerous waterbodies are an important part of the boreal zone landscape and their riparian zones act as an interface between terrestrial and aquatic ecosystems. Up to 30% of the terrestrially fixed carbon is exported by runoff and thus, the role of fresh waters is crucial to the carbon cycle. Yet, the transport of dissolved inorganic carbon (DIC) is still unclear and the terrestrial-aquatic connection little studied. Therefore, we installed automatic measurement systems with Vaisala CARBOCAP® CO2 probes (Vaisala Oyj, Vantaa, Finland) in the riparian zone soil matrix around a small headwater lake, in the lake itself, and in the out flowing brook and followed the seasonal and diurnal variation in CO2 concentration as well as rain event-driven changes in this natural-state soil-lake-brook continuum. Seasonal variation was greatest and concentrations highest deep in the soil and in the lake, but also in the brook, especially at a distance of app. 135 m from the lake. On the other hand, diurnal variation was highest in shallow soil layers and in the lake surface. The clear spatial variation in CO2 concentrations in the riparian zone reflected the heterogeneity of the soil. After a rain event, the normal diurnal pattern in the CO2 concentration was changed, the concentration in the soil increasing as water filled the soil pores and slowed down the diffusion. The water from the lake with lower CO2 concentration diluted the CO2 concentration in the brook and the CO2 coming from the soil. However, the influence of the lake faded away at less than 150 m distance from the lake. On an annual basis, a considerable amount of CO2 of terrestrial origin entered the lake.

SS15

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IMPROVEMENTS IN THE FINNISH FISH-BASED LAKE CLASSIFICATION METHOD

In the first ecological classification of surface waters according to the Water Framework, an index of four parameters (EQR4) was developed for the fish-based assessment of ecological status in Finnish lakes. Data for calculating the EQR4 values were obtained from the standard gillnet test fishing and the four parameters included were total biomass, total number of individuals, biomass proportion of cyprinid fishes and the occurrence of indicator species. EQR4 was targeted in the first hand to detect the effects of eutrophication pressure and it seemed to work well when responses of lake fish communities to agriculture-induced nutrient load were considered. Further, the fish classification results were quite well in line with those obtained from other biological quality elements. In this presentation, the effects of recent improvements of EQR4 are presented. Access to more representative reference data has enabled us to update lake type specific reference values and class boundaries. Consequently, the accuracy of classification has increased and uncertainty decreased. Finally, the classification results calculated from a common set of lakes using national lake fish assessment tools of the northern European countries are compared with emphasis on the differences of fish community characteristics and environmental pressures in the countries.

SS3

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LONG-TERM CHANGES IN VEGETATION PATTERN AND CHANNEL MORPHOLOGY IN A BY-PASSED SECTION OF A BRAIDED GRAVEL BED RIVER – THE ROLE OF RESIDUAL FLOWS, PEAK FLOODS AND GRAVEL EXTRACTION.

Long-term changes in vegetation pattern and channel morphology in a by-passed section of a braided gravel bed river – the role of residual flows, peak floods and gravel extraction. Michael Reich, Damian Bargiel, Hilke Rühmkorf Institute of Environmental Planning, Leibniz University Hannover, Germany The upper Isar (Bavaria, Germany) is one of the few remaining braided gravel bed rivers in the Alps. Discharge is reduced significantly by diversion at the Krün weir since 1924, and a residual flow was established only in 1990. However, during major floods the weir is opened during peak flow to flush gravel downstream. This gravel was usually extracted downstream the weir. To assess the effects on biodiversity in the floodplain, we studied changes in vegetation pattern and channel morphology by time series of aerial photographs and historic maps (1858- 2006), and cross-profiles (1965-2005). With the reduction of discharge, significant changes in vegetation pattern took place, characterized by a loss of pioneer communities. The establishment of a residual flow in 1990 did not solve this problem but supported the succession of dense willow thickets in large parts of the floodplain. Two hundred-year floods, occurring in 1999 and 2005, could not stop this process. Cross profiles demonstrate that, despite the gravel extraction downstream the weir, there was no incision of the channel since 1965. Instead, an aggradation of fine sediments on the gravel bars occurred, which still accelerates succession. Until now, the modification of the minimum flow, the extension of flushing time during floods and the reduction of gravel extraction at the weir are discussed as the most relevant factors to improve ecosystem processes in future. Our results show that furthermore the management of the fine sediments plays a key role to protect especially the endangered pioneer communities in the floodplain.

O3

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THE PCP TRICLOSAN: AN EMERGING COMPOUND OF ENVIRONMENTAL CONCERN IN FLUVIAL ECOSYSTEMS

Fluvial systems are commonly affected by physical and chemical disturbances such as alterations in water flow or nutrient concentration. Numerous chemicals are continuously released into the environment as a result of their use in industry, agriculture or household activities. Among them, the personal care product (PCP) triclosan is a commonly added antiseptic agent in a variety of products of daily use, such as skin creams and toothpastes. It resists several degradation steps in wastewater treatment plants (WWTP) and can reach fluvial ecosystems. Water scarcity in Mediterranean systems causes lower dilution capacity and a potentially higher environmental risk of triclosan. A set of experimental channels was used to examine the short-term effects of triclosan on biofilm algae and bacteria. Environmental concentrations of triclosan caused an increase of bacterial mortality (EC10= 0.6 ug/L). The photosynthetic efficiency of algae was inhibited (EC10= 3.4 ug/L), as well as the non-photochemical quenching (EC10= 1.3 ug/L). Diatom cell viability was also affected with increasing triclosan concentrations (EC10= 3.7 ug/L). Triclosan toxicity was also evaluated when applied in binary mixtures with i) the phenylurea herbicide diuron and ii) the pharmaceutical product propranolol (β-blocker) on the green alga Scenedesmus obliquus. The toxicity of the first mixture was accurately predicted by the currently available models. However these models underestimated the joint toxicity when triclosan was mixed with propranolol. This mixture had a greater negative impact that the one predicted by the models, showing a synergistic effect. This study provides an example of emerging compound, the PCP triclosan, posing environmental concern. Although triclosan is present at low concentrations in fluvial systems, its capacity to survive through WWTP processes, the toxicity detected on the co-occurring non-target components (algae) of the biofilm community and the increase in toxicity when mixed with other substances demonstrates that triclosan may be toxic to fluvial communities.

SS10

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CONSUMER RESPONSES TO RESOURCE PATCH ARCHITECTURE: LEAF PACKS IN STREAMS

Resource patch size, spacing and configuration can affect consumer colonisation and use of patchy resources. Leaf packs represent resource patches in streams, and there is evidence that patchiness affects colonisation. However, little is known about how the architecture (size and composition) of these resource patches affect subsequent use of resources by consumers. We used experimental gradients of leaf pack size (0.5 to 5 g of beech leaves) and altered structure with inorganic materials (polyester "leaves" and plastic stir sticks) to examine consumer responses. The use of artificial leaves allows us to independently manipulate physical size of leaf packs and nutritional value. These leaf packs were submerged in a small stream in the Montagne Noire, east of Toulouse, France, during the winter of 2007. Increased leaf pack size resulted in significantly lower breakdown rate, although the slope of the linear relationship was not steep. We found no significant differences in the concentrations of ergosterol (a specific measure of fungal biomass) per unit mass of leaves between any of the treatments, indicating no limitations to colonisation by that group, and also no feedback from consumption. Small-bodied leaf detritivores showed no significant relationship with leaf pack size or composition per unit of leaf mass. However, numbers of large-bodied detritivores decreased strongly per unit mass as leaf pack size increased and these consumers could not gain access to most of the resources within the leaf pack. For these large-bodied consumers increasing leaf pack size using artificial leaves had the same impact as for real leaves, whereas small-bodied consumers were in proportion to the amount of real leaves in the resource patch. These results show that resource patch architecture can interact with consumer size structure within a community to differentially provide resources to subsets of consumers.

SS15

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SELECTIVE WITHDRAWAL SHORT-TERM EFFECTS ON PHYTOPLANKTON COMMUNITY COMPOSITION IN A MEDITERRANEAN RESERVOIR

A combination of different factors as light-nutrient availability, mixing regimes and biological interactions between species regulate phytoplankton composition and abundance in reservoirs. A correspondence between withdrawals events and changes in phytoplankton community composition was pointed out by few studies based on the analysis of field observations. In this work we want to examine the specific reaction of phytoplankton groups, aggregated depending on their particular response to environmental conditions, to withdrawals level variation. We start from the concept that changes in the environmental conditions generated by withdrawals operations may favor the development of certain species in detriment of others. Our analysis was conducted adopting a conceptual model in which the reservoir is conceived as a stack of horizontal homogeneous layers having the same volume, and the only forcing is associated to outflows. Short term experiments (15 days) were conducted taking as reference the bathymetry of a Mediterranean medium-size reservoir (El Gergal-Seville). The response of several phytoplankton groups, with different sensitivities to the environmental conditions (e.g. tolerance to light availability), was evaluated simulating several scenarios, extracting water at surface, intermediate or bottom level. The changes experienced by the phytoplankton groups are dependent on the bathymetry of the lake under study, the withdrawal rate and the relative position between the level of extraction and the depth of the phytoplankton group development. Experiments results show that the modification of the outflow level may induce a change of the dominant phytoplankton group. Our work, understanding how withdrawals affect phytoplankton behavior, is oriented to the developing of alternative strategies for reservoir water quality management.

O3

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TAXONOMIC RESOLUTION OF RIVER DIATOMS: STRUCTURING IMPACT OF ENVIRONMENTAL PARAMETERS AND IMPLICATIONS FOR BIOMONITORING

Benthic diatoms are routinely used to assess river pollution. Most of the tools based on these organisms exploit the differences of pollution sensitivity between species; therefore species identification is required. Determination of diatom species requires a lot of experience due to the extreme diversity of the group. The level of taxonomic resolution is rarely questioned in diatom bioassessment. The objective of this study was to test, using a database, the impact of taxonomic resolution on information loss. Our final datasets, comprising 1967 diatom samples carried out in the framework of biomonitoring rivers in the French basins, combined three kinds of data for each sample: (a) taxa abundance, resolved to the species, genus, family, order, class or subdivision resolution separately; (b) chemical characterization; (c) river typology. It appeared that all the arrays describing diatom assemblages at the different taxonomic resolutions were significantly correlated (except for subdivision). Other tests between chemical parameters and diatom communities show that there was an increase in correlation from subdivision to genera resolution. Species and genus resolution showed equivalent correlations with chemical parameters. Finally, based on corrected Rand indices, we observed that the more precise the taxonomic resolution, the better the correspondence with hydro-ecoregion classification. These results led us to wonder if very precise taxonomic resolution is necessary to assess classical pollution (nutrients, organic matter). Hypotheses to explain such results are that: (1) many species are too rare to establish their ecological requirements with certainty; (2) more environmental descriptors are necessary to explain the presence of some species; (3) the dataset is surely marred by identification errors, particularly at the species level. On the other hand, it seems important to keep a species level identification for biogeographical purposes and to know the ecoregional membership of the diatom community.

O1

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AQUATIC INSECTS SECONDARY PRODUCTION AND PHENOLOGY OF A PÁRAMO STREAM AT LATITUDE 0

High altitude Andean streams are one of the less studied ecosystems. These streams are very different from their lowland counterparts having low mean temperatures throughout the year, which would have direct effects on the phenology and developmental times of aquatic fauna. The grassland vegetation in these areas also provides different types of heterotrophic sources that can influence the secondary production of streams. Information on the phenology of Andean aquatic insects is scarce and secondary production has not been studied yet. Our objectives were: 1) to calculate the annual secondary production in a high altitude stream and 2) to analyze the relationship between phenology and d/or production with hydrology in this stream. To achieve these objectives we took monthly quantitative benthic and adult samples during a year at the Saltana stream (3800asl, Ecuador). Flow was measured continuously during the study year with a level logger located at a gauging station. Larval specimens were measured to calculate biomass of each taxon. Chironomids were the most abundant larva and adult insects during all samplings also with the highest biomass. Most larval taxa (e.g., Andesiops, Orthocladiinae) were present throughout the year, with varying sizes and instars in different hydrological periods. Several taxa (e.g.,Varipes) were rare and only present in a certain season. Density was related to flow, being higher at low flow months. Our results suggest that most species are multivoltine, except for the less abundant ones. As temperature does not change throughout the year, hydrology might be the key parameter to understand patterns of species phenology and life-history traits of aquatic insects in high-altitude Andean streams.

SS15

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LITTER DECOMPOSITION EXPERIMENTS IN AQUATIC SYSTEMS: DOES THE SHAPE OF LEAF LITTER BAGS MATTERS?

An increasing number of studies sustain the high potential of leaf litter breakdown in low order stream ecosystems as an important tool to be used in water quality assessment. Several requirements are needed for such a tool so that to allow comparability of the results across time and space while it is easily used on large scales. Experimental procedures designed for field assessment of the decomposition rates are different in many aspects - such as exposure technique: leaf bags vs. leaf packs; mesh size of nets; size and shape of bags etc - each of them representing a possible source of variability. Considering this, we set an experiment in which the differences between alder breakdown rates in bags with different shapes and mesh types have been investigated in the Carpathian Mountains, Romania. The rationale is that the breakdown rates are different in bags with different shapes placed in the same stream conditions as a result of differences in the effect of water physical forces and macroinvertebrate colonization. Five types of mesh bags (10 cm x 14 cm) were used: three types of coarse mesh bags (10 mm mesh size) - tetrahedral shape; flat (envelope) shape (both made by rigid polyethylene); flexible shape (made by textile net) - and two types of fine mesh bags (0.5 mm mesh size) - tetrahedral and flat. Five replicates of each bag type were retrieved at five sampling dates, according to RIVFUNCTION protocol. Results were tested for identifying significant differences among the decomposition rates in bags with different shapes in order to assist the end-users, which may decide to choose flat shape, and textile bags that are much easier to be manipulated.

O5

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ANCIENT DISSOLVED ORGANIC CARBON - A DRIVER FOR MICROBIAL ACTIVITY IN AN INITIAL SANDY CATCHMENT?

As in other man-made landscapes and recently deglaciated land surfaces, the substrate of the Chicken Creek Catchment (http://www.tu-cottbus.de/sfb_trr/index.htm) contains high amounts of fossil organic carbon. This old carbon appears to be mobilized in the initial phase of ecosystem development, as indicated by high concentrations of dissolved organic carbon (DOC) in upwelling groundwater. During transport from soils to aquatic ecosystems, both DOC quantity and quality can change as a result of sorption at mineral surfaces and biogeochemical transformations. In turn, DOC bioavailability and microbial community structure would be affected. In a microcosm experiment we assessed whether the quality and bioavailability of DOC differs along the hydrological flow path across the Chicken Creek Catchment: from soil solution to stream and pond water. In addition, we compared the potential of microbial communities in soil, stream sediment and pond water to mineralize the DOC present. In upwelling groundwater DOC had a mean 14C age of 2600-2800 years, indicating that it was indeed mobilized from old substrate. According to the solid-state CPMAS 13C NMR spectra, high concentrations of aromatic compounds and low concentrations of carbohydrates revealed the recalcitrant nature of the DOC. This idea was reinforced by low levels of microbial respiratory activity in all microcosms containing either soil solution, upwelling groundwater, hyporheic stream water, or pond water. Despite differences among microcosms in the dynamics of respiration during the 72-day incubation period, the microbial communities of soil, stream sediment and pond water revealed similar level of activity. Our results suggest that old organic carbon is an important source of DOC exported from newly created catchments. Due to its low bioavailability, the old DOC, however, is less significant in driving microbial activity in new landscapes.

O7

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INVASIVE TRENDS OF FRESHWATER SPECIES IN A TRANSBOUNDARY RIVER: THE CASE OF THE MIÑO RIVER (SPAIN-PORTUGAL).

Freshwater ecosystems have been the recipients of many alien species, both by unintentional or deliberate introductions. The Miño River, a transboundary river that serves as border between Spain and Northern Portugal, has not been immune to this problem, and for decades it has hosted populations of various Non-indigenous Invasive Freshwater Species (NIFS). For this reason, it is urgent to increase the knowledge about the populations of these species in order to reduce the ecological and economic impacts they may cause, as policies and management plans will have to bee agreed and approved by the two countries. In this paper we show an updated list of NIFS present in the International section of the Minho River and its main tributaries in the Spanish side. Additionally we present the current knowledge on the historical changes in the distribution of NIFS in the area. Most of the data used in this study have been gathered from scientific literature, but we have included also many references of grey literature and information obtained in the last years through extensive sampling campaigns of researchers working at the Hydrobiological Field Station of the University of Santiago de Compostela. The list of NIFS in this area includes 6 species of invertebrates, 11 of vertebrates and 2 macrophytes. The Asiatic clam, Corbicula fluminea, or the red swamp crayfish, Procambarus clarkii, are amongst the worst invasive species in the area, but we warn about the almost certain arrival of at least two new species, the mosquitofern Azolla filiculoides and the water hyacinth, Eichornia crassipes, already invasive in the upper and middle sections of the river. Coordination of policies and actions among agencies of Spain and Portugal will be indispensable to avoid or at least retard these new entries.

SS9

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DIATOMS DISTRIBUTION IN THE LAKES OF THE PYRENEES AND THEIR POTENTIAL FOR ENVIRONMENTAL RECONSTRUCTIONS

The regional variability of diatom distributions in alpine and temperate areas is usually mostly explained by pH or acid neutralising capacity gradients, and this property have been successfully applied for reconstructing pH changes in the past using sediment records. Nevertheless, there is still a lot of non explained variability in diatom assemblages when the effects of pH are taken into account. Here, we explore which other factors are statistically significant beyond pH and to what extent they can be used in environmental reconstruction. The study is based on a survey of 82 high mountain lakes in the Pyrenees. Diatom samples were collected of surface sediment and epilithic substrates. The environmental gradients surveyed included the main bedrock types, altitudinal range and lake morphologies. A broad range of variables representative from the proximal to the landscape environments were determined for each site. Multivariate analyses were applied to examine species-environment relationships and determine which variables were suitable for reconstruction. The predictive potential of the most explicative variables was checked developing transfer-functions. Beyond pH and related chemical variables, water transparency, temperature and total phosphorus showed high explicative potential. However, the latter showed little predictive capacity. Epilithic and deep sediment diatom assemblages differ in composition but their environmental indicative performance was quite similar.

SS12

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FRESHWATER MEIOFAUNA: NOT QUITE SO 'OUT OF SIGHT, OUT OF MIND'?

The freshwater landscape is a connected and complex one ranging from familiar streams and rivers on the surface of the land to less familiar hyporheic zones. Meiofauna, small benthic invertebrates passing through a 1mm sieve, occur in all these habitats. We explore how our understanding of meiofaunal abundance, persistence and productivity in surface waters and hyporhiec zones has changed over the last two decades and present a case study on meiofauna in Mediterranean streams. Here we show that species traits such as vermiform body shape and active locomotor structures confer higher resilience to meiofauna in the face of natural hydrological disturbances.

SS2

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HYDROGEOLOGICAL FEATURES OF WETLANDS DEVELOPED OVER PEDIMENTS IN THE ALBERA RANGE (NE SPAIN)

The Albera Range is a Paleozoic massif located in the eastern Pyrenees (NE Spain). In the southern part of this range, situated over a metamorphic and granitic pediment, a wetland area has been developed. This area includes 1 permanent and 23 temporary pools, and has been declared as a Natural Wildlife Reserve by the Catalan Government in 1996, for its floristic diversity and representativeness. The aim of this contribution is to analyze the participation of local and regional ground water fluxes in the origin and evolution of these wetlands, in order to evaluate whether current management strategies are adequately adapted to their characteristics and dynamics. Geophysical prospecting, jointly with hydrogeological and geomorphologic surveys, have been the methodologies used. Results indicate that the study area correspond to an etchplain, developed in a weathering front of granitic and metamorphic rocks. In fractured areas, the weathering has progressed deeply due to the thermal and non-thermal ground water fluxes, which have originated some of the basins that contain these small pools. Therefore, ascendant fluxes of thermal ground water have created vertical pipe-like structures and, as a result, small subcircular pools in surface. Regarding the dynamics of these wetlands, hydrogeological data allow to distinguish different kinds of water fluxes: 1) part of these wetlands is mainly influenced by thermal ground water fluxes; 2) another group of pools is influenced by non thermal regional ground water fluxes; 3) and also, surface runoff and surface ground water fluxes play an important role in their dynamics. Each of these fluxes present distinctive hydrochemical, isotopic and geophysical characteristics. In conclusion, the identification of these different behaviors arise the necessity of an integrated model for management and conservation strategies. This model should take into account these different hydrogeological behaviors, in order to avoid management incongruities.

O10

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STRONG TOP-DOWN EFFECTS OF BARBUS MERIDIONALIS IN A MEDITERRANEAN STREAM

Top predators may have powerful effects on community structure and ecosystem functions in freshwater systems. Scientific knowledge about top-down effects of benthic omnivorous cyprinids is relatively low compared to other fishes, such as predatory salmonids. We studied the potential top-down effects of Mediterranean barbel (Barbus meridionalis) by an enclosure/exclosure mesocosms experiment, in a fishless Mediterranean stream affected by a wildfire (Vall d'Horta stream, NE Spain). We used nine large boxes (1x1x0.7m) of 10 mm mesh size, allowing macroinvertebrate emigration/immigration. The experiment was carried out in late spring 2010 along 5 weeks: 3 weeks for substrate colonization before the addition of the top predator, and 2 for interaction. We tested 3 treatments: a) no fish; b) caged fish at low density (known pre-fire density), and c) caged fish at high density (double than pre-fire). The density of most predominant macroinvertebrate taxa decreased with fish presence, but vulnerability varied considerably among preys. The decline in abundance of some invertebrates was significant only at high fish density. Moreover, the predator impact differed between taxa. The analysis of biological traits confirmed the strong decrease of invertebrate predators in barbel presence due to competition and/or fish predation. Periphyton chlorophyll concentration was significantly higher in both fish treatments. This could be explained by the combination of two processes: a) a cascading trophic effect due to a decrease of scraper density, and b) an increase of light availability by a lower detritus deposition due to the action of barbel omnivorous feeding. In conclusion, Barbus meridionalis could be the major determinant of structure and processes in Mediterranean streams. Local extinction of this keystone species, due to human or natural impacts, could lead deep changes in food webs, increasing the relative importance of other trophic interaction forces, such as those exerted by predatory invertebrates, or abiotic factors.

O5

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CARBON DYNAMICS IN A SEMIARID WETLAND: NATURAL ORGANIC MATTER IN WATERS, PORE WATERS AND WETLAND SOILS IN LAS TABLAS DE DAIMIEL (SPAIN)

Wetlands represent important and active carbon reservoirs in the global carbon cycle. Most wetlands accumulate natural organic matter (NOM) because primary production exceeds mineralization rates, usually slow because of permanent or temporary anaerobiosis linked to waterlogged conditions. The characteristics and fate of NOM in wetlands have been comparatively less studied than in other ecosystems and, particularly, carbon dynamics in semiarid wetlands is poorly known. Las Tablas de Daimiel (La Mancha, Central Spain) is a good example of semiarid wetland. It is known to behave as a carbon sink when dried out, but the carbon fluxes in a flooded state have never been studied. In this study, we have measured NOM concentrations in flooded conditions outside the peak production period (February). Samples from two different compartments: waters and sediment pore waters have been studied in addition to humic acid samples from wetland soils. An aspect often ignored is that different types of NOM will behave differently vis à vis mineralization and that, therefore, will have a different weight in the carbon cycle. In this study we have measured, not only the dissolved organic carbon (DOC), but also the refractory fraction (refractory organic matter, ROM) in all samples by applying a novel quantification method. Water gets richer in DOC (from 3.0 to 7.4 mg/L) and in ROM (from 0.4 to 2.3 mg C/L) as it circulates through the wetland, with the proportion of ROM ranging from 12 to 35 % in free waters. In shallow waters close to the shore, ROM concentrations are higher and more variable, probably reflecting local release from the soils. Pore water data confirms the existence of a net flux of DOC and ROM from the wetland soils to the water column. Our results suggest that organic carbon accumulated in the wetland is exported downstream during flooding periods.

SS4

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ECOSYSTEM ASSESSMENT OF CARBON IN TROPICAL HYDROELECTRIC RESERVOIRS

The number of hydroelectric reservoirs has dramatically increased in recent times. There is a general idea that reservoirs in the world are burying carbon and accumulating it in their sediments. In contrast to the traditional view of inland waters as passive pipes linking the terrestrial environment to the oceans, freshwater systems, including reservoirs, have recently been pointed out as active components to the global C cycle. We estimated organic carbon burial in reservoir sediments based on an ecosystem mass balance approach. Seven tropical hydroelectric reservoirs varying in flooded area (27 to 1342 km2) and in age (2 to 40 years) were studied. Our estimates were based on the total carbon pool (TOC +DIC) variation at short time scales (months), based on measurements of terrestrial inputs and outputs, net ecosystem production, and changes in standing stock of carbon as a function of water level variability. The carbon burial rates varied from -400 to 900 gC m-2 per year, where positive values represent C retention in the sediment and negative values represent C source to the atmosphere. Reservoirs with positive values were sinking carbon because (i) they are enriched in phosphorus and nitrogen and, consequently, primary production rates overcame respiration or (ii) terrestrial inputs (as massic discharge) overcame downstream exportation. Reservoirs with negative values are exporting C to atmosphere because they are still mineralizing flooded terrestrial material including soils, plants and trees and so supporting heterotrophy (NEP). Our data suggest that ecosystem mass balance can be predicted from the combination of (i) morphometric and hydrological variables and (ii) nitrogen and phosphorus availability. Based on these findings we present a consistent approach using ecosystem mass balance to access retention of organic carbon in reservoirs.

SS7

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BIOFILM FORMATION AT WARMING TEMPERATURE: ENHANCED EFFECTS AT EUTROPHIC CONDITIONS

River biofilms that grow on wet benthic surface are mainly composed of bacteria, algae, cyanobacteria and protozoa embedded in a polymeric matrix. This structure is a highly dynamic biological layer which can change its metabolism, thickness, density and composition depending on its own evolution and/or physical-chemical conditions. In the context of global change, increasing river water temperature might co-occur with higher nutrient concentrations. In this study, the effects of increased temperature of river water on biofilm formation considering two extreme nutrient levels were investigated. A laboratory experiment was designed employing two temperatures (11.1-13.2 °C, night-day; 14.7-16.0 °C, night-day) and two nutrient levels (0.054 mg P L-1, 0.75 mg N L-1; 0.54 mg P L-1, 7.5 mg N L-1). Biofilm formation at the higher temperature was faster, while the biomass of the mature biofilm was mainly determined by nutrient availability. The specific response of the three microbial groups (algae, bacteria and ciliates) was modulated by interactions between them. The greater bacterial growth rate and earlier bacterial colonization at higher temperature and higher nutrient status was not translated into the accrual of higher bacterial biomass. This may result from ciliates grazing on bacteria, as shown by the earlier increase in peritrichia at higher temperatures, and especially at high nutrient conditions. Temperature and ciliate grazing might determine the growth of a distinctive bacterial community under warming conditions, which was detected by denaturing gradient gel electrophoresis (DGGE) analysis. Warming conditions also produced a thicker biofilm, while functional responses were much less evident (increases in the heterotrophic utilization of polysaccharides and peptides, but no increase in primary production and respiration). Increasing temperature of river water might lead to faster biofilm recolonization after disturbances, with a distinct biofilm community structure that might affect the trophic web. Warming effects would be expected to be more relevant under eutrophic conditions.

SS3

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INFLUENCE OF RIPARIAN CANOPY COVER ON STREAM WATER TEMPERATURE AND BENTHIC MACROINVERTEBRATE COMMUNITIES

Water temperature is considered an important factor affecting the structure and function of stream ecosystems. In its turn, water temperature and energy fluxes in streams are influenced by canopy cover. Moreover, benthic macroinvertebrates are sensitive to changes in water temperature as well as food resources. The objective of this study was to evaluate the influence of the riparian canopy cover on the water temperature and on benthic macroinvertebrate communities in streams. This study is part of the European project REFRESH, which aims to evaluate a series of specific adaptive measures to minimize the consequences of climate change on freshwater ecosystems. This study was conducted in eight Mediterranean streams located in NE of Spain. For each stream a 2-km section, including an open-canopy and a close-canopy contiguous reaches, was selected. Canopy cover was measured every 100 m along each reach. Within each section ten sampling stations were defined. At each station a water temperature logger was installed and data was measured at 20-min intervals for almost a year. Macroinvertebrate samples were collected once at every station under full canopy cover (summer). Additionally, water samples for nutrient analyses were collected and stream discharge was measured. No consistent patterns of water temperatures were found among the different sections. However, the influence of canopy cover on water temperature tended to be more evident for daily maximum temperature and daily temperature oscillation than for daily average temperature values. As expected, these parameters were higher in open than in close reaches. Macroinvertebrates showed more consistent patterns among sections, showing higher abundances in open than in close reaches. These results suggest that besides of water temperature differences, other factors (e.g. food resources) could drive the observed differences in macroinvertebrate community between reaches.

SS9

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HYDROGEN ISOTOPIC SIGNATURES IN BIOMARKERS AS A PROXY OF HYDROCLIMATIC VARIABILITY IN LAKE ISABEL, MEXICO.

Over the last years, the analysis of the D isotopic signature in organic molecules preserved in lake sediments has become a new tool in paleoclimate research because of the possibilities to infer hydroclimatic variability based on the observed linear relationships between the isotopic composition of the source water and the D of the biosynthesized compound. However additional factors potentially influence the isotopic signature of specific compounds such as metabolism of organisms, growth rate, salinity, and temperature. Many of these additional influences remain poorly understood. Lake Isabel is a small crater located on Isla Isabel, 30 km off the Pacific coast of central Mexico (21°52´N:105°54´W). The biological community of this hypersaline lake (70-115 mScm-1) has been shown to be sensitive to the seasonal rainfall variability and the associated dilution of the upper water layer during wetter conditions. In this study, we analyzed the D of the most abundant lipids by irm-MS preserved in a short sediment core of Lake Isabel; 1,15 C32 diol and tetrahymanol, specific biomarkers of the algal populations and bacterivorous ciliates, respectively. The hydrogen isotopic values of 1,15C32 diol in the uppermost 16 cm of the sediment (1938-2000 A.D.) showed a significant relationship with the record of rainfall amount over the last decades. However this relationship was in the opposite direction of the expected result because of the main driver effects of the algal growth on the hydrogen isotopic signature. Of our best knowledge, this study is the first calibration analysis between the hydrogen isotopic signatures in both biomarkers and the instrumental climatic record. This study shows the complexity but also the potential of hydrogen isotope analyses of lipids as proxy to reconstruct the hydroclimatic variability.

SS15

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THE RESPONSE OF BENTHIC ESTUARINE DIATOM ASSEMBLAGES TO NATURAL AND ANTHROPOGENIC STRESSORS: APPLICATION OF THE EXISTING DIATOM INDICES IN A MEDITERRANEAN SALT WEDGE ESTUARY: THE EBRO RIVER ESTUARY (CATALONIA, NE SPAIN).

The benthic diatom community of the highly stratified Ebro River Estuary is mainly characterized by the presence of two species assemblages; one characteristic of oligohaline waters, with minor conductivity fluctuations and very few sudden salt-wedge intrusions; and another one characterized by species under marine influence at both superficial and deep water layers. Both diatom assemblages are influenced by sudden natural floods and frequent flow fluctuations due to the high regulation of the Ebro River flow by dams. In the estuary, two main human pressures can be defined: a hydrological pressure due to flow changes that affects the salt-wedge dynamics both at spatial and temporal scales; and a water quality pressure resulting from industrial pollution and nutrient loading. The complex hydrodynamics of estuaries, with pronounced natural physicochemical gradients, would favour the presence of species with high tolerance to environmental fluctuations, difficulting the distinction between natural and anthropogenic stress. Diatom indices have been developed and successfully applied in freshwater systems, but no specific diatom indices exist for transitional waters like estuaries. In the present study we evaluated the application of the already existing freshwater diatom indices to a complex transitional system like the Ebro Estuary, and some proposals to develop biological indices for estuaries based on diatom responses to salt-wedge dynamics or eutrophication are considered.

SS2

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EPHEMERAL WETLAND VEGETATION IN MEDITERRANEAN HEATHLAND AND MAQUIS COMMUNITIES

Ephemeral wetland vegetation in shallow depressions in gaps of woody vegetation is less prominent than vernal pool vegetation and thus often disregarded despite its protection by EU habitat directive. Depending on the variability of precipitation in the Mediterranean zone, ephemeral species vary considerably from year to year. It is studied whether the occurrence of ephemeral wetland vegetation in Mediterranean heathland and maquis (shrubland) communities is associated with certain scrub types and also whether the cover of dwarf rush communities can be quantified by dependence on topographic parameters on a landscape scale. The study area, a typical heath-maquis example, lies in Southern Spain. The vegetation complexes were analyzed using classification by floristic similarity and indirect and direct ordination techniques. Habitat suitability modelling was made using generalized linear models. The results show that ephemeral wetland vegetation was associated with maquis communities dominated by Pistacia lentiscus. Atlantic heathlands did not co-occur with ephemeral wetlands. Ephemeral wetland species were rare in scrub communities on clayey soils. The cover of ephemeral wetland vegetation in shallow depressions could be well predicted with topographic variables at a 10 m × 10 m resolution. The inclusion of soil moisture, a variable only available for the sampling sites, enhanced model predictions remarkably. Modelling of the cover of ephemeral wetlands is crucial for the consideration of these communities in conservation planning.

SS2

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SEASONAL VARIABILITY AND PHENOLOGY OF DWARF RUSH COMMUNITIES IN SOUTHERN SPAIN

In the southwest of the Iberian Peninsula dwarf rush communities belong to the class Isoeto-Nanojuncetea and constitute the ephemeral wetland vegetation. The hydrological conditions are determined by the Mediterranean precipitation regime and therefore vary with the seasons. Previous studies found this vegetation type to be highly dynamic in time and space, but until now drivers of this dynamic are not well known. Nonetheless, this dynamic should be considered in evaluating the current state of dwarf rush communities protected by the EU Habitats Directive. For that reason we aim to describe and to clarify the influence of the temperature sums and soil water balance on the seasonal dynamic and the phenological development. We show that the variability of ephemeral dwarf rush communities was high and equally partitioned in time and space. Our findings suggest that soil moisture is an important driver of the temporal dynamics. Overlapping flowering phases of species of the Isoëto-Nanojuncetea and Helianthemetea (rock rose communities) support earlier findings that the temporal replacement of Isoëto-Nanojuncetea species by Helianthemetea species is marked by a gradual turnover rather than an abrupt shift.

O6

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ACTIVITY AND DISTRIBUTIONAL PATTERNS OF METHANOGENS AND METHANOTROPHS IN THE HYPORHEIC SEDIMENTS OF A SMALL LOWLAND STREAM

were studied in a small lowland stream Sitka in Czech Republic. The methanogens and methanotrophic bacteria were detected using FISH with 16S rRNA¡Vtargeted oligonucleotide probes. The highest microbial density was obtained in the upper sediment layer 0-25 cm; this zone corresponded also to that of highest metabolic activity, as indicated by the methanogenic potential, methanotrophic activity, INT and FDA profiles. Both methanogenic archaea and aerobic methanotrophs were found at all localities along the longitudinal stream profile. The proportion of these groups to the DAPI-stained cells was quite consistent and varied only slightly but a higher proportion to the DAPI-stained cells in deeper sediment layer 25-50 cm was observed. On average 28 % of DAPI-stained cells were detected by FISH with a probe for methanogens while type I methanotrophs reached *f*î 26 % and type II methanotrophs 14 %, respectively. The percentage of DAPI-stained cells hybridizing with methanotroph-specific probes was generally higher for type I than type II. Our data show that the methanogenic archaea and aerobic methanotrophs can be numerically dominant components of hyporheic biofilm community and affect CH4 cycling in river sediments.

O1

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ENVIRONMENTAL IMPACT OF HEATED MINING WATERS ON CLITELLATE ASSEMBLAGES (ANNELIDA: CLITELLATA): A CASE STUDY

Temperature is a key determinant of community composition in most environments. Thermal alteration due to the inflow of heated water might therefore have a serious impact (both direct and indirect, e.g. influencing the growth of algae) on the composition of freshwater invertebrate communities. Within this study we examined the effect of heated mining water on the taxonomic composition of the clitellate assemblages (Annelida: Clitellata). Clitellates represent a group of permanent fauna with a limited mobility, however, their species show a wide range of ecological valences including both eurythermic and stenothermic species. Their assemblage composition is therefore likely to show a clear response to thermal alterations. The study was conducted at the Nedvědička River, which is a recipient of heated decontaminated mining water discharging from the last operating underground uranium mine in the Czech Republic. One sampling site was selected at the mining tributary and three at the Nedvědička River (one upstream and two downstream from the tributary). Quantitative samples of macroinvertebrates were taken from each sampling site monthly from March 2008 till June 2009. Physical-chemical water parameters were recorded at each sampling occasion, while water temperature was recorded continuously. The water of the mining tributary differed not only in temperature, but also in pH, conductivity, and inorganic carbon (higher values) and oxygen and nutrients (lower values), from the water in the Nedvědička River. This rather complex environmental alteration was most probably responsible for a) a lower abundance and number of species of clitellates at the downstream sites compared to the upstream, and b) a shift in the assemblage composition as observed in the CA (Correspondence Analysis) diagram. To conclude, the impact of the mining water on the clitellate assemblages was evident. However, as the "polluted" water differed in more parameters from the "natural" one, we were unable to reveal the very effect of thermal pollution.

SS14

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FIRST GENETIC DATA ON ZEBRA MUSSEL (DREISSENA POLYMORPHA) POPULATIONS FROM RECENTLY INVADED SPANISH RIVERS.

The zebra mussel is a freshwater species native from the Caspian Sea and Black Sea basins, which spread in central European rivers in the XIX century and in North American lakes and rivers at the end of the XX century. During the last decade the species was detected in several localities along the Ebro and Júcar river basins in Spain. The species is therefore in the initial steps of the invasion process in the Iberian Peninsula, and provides a nice system to study the genetic population processes that take place after colonization of new habitats. We have carried out a genetic study of Iberian populations with mitochondrial DNA sequences (COI genes) and nuclear markers (microsatellites, intronic sequences). Iberian populations were compared with selected samples from other European and American freshwater masses. Our results suggest that the Iberian populations were founded by small numbers of individuals of non-Caspian origin.

O3

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STREAMES 1.0©, AN ENVIRONMENTAL DECISION SUPPORT SYSTEM FOR STREAM MANAGEMENT WITH EMPHASIS ON ECOSYSTEM FUNCTIONALITY AT REACH SCALE

Stream management involves harmonizing environmental flows and preserving good ecological status for fluvial conservation combined with multiple water uses within a catchment. This is a challenging task because stream water management needs to consider human pressures operating at different spatial scales and complex interactions among a broad variety of factors. This requires knowledge from multiple disciplines. Therefore, decision-making in water management can benefit from integrated and multidisciplinary tools that are rooted on empirical and heuristic knowledge. Here we present STREAMES 1.0, a new version of an Environmental Decision Support System (EDSS) prototype developed to support stream managers that can be freely downloaded at www.streames.net. A novel aspect of this EDSS is that it uses, in the form of fuzzy decision trees, the heuristic and empirical knowledge provided by scientists and managers. STREAMES 1.0 is a computer application to: (i) diagnose the stream ecological status based on nutrient concentrations, potential in-stream nutrient uptake efficiency, riparian nutrient buffer capacity, as well as the streambed and riparian morphological state; and (ii) provide a list of the main causes generating the problems considering that they can operate at different spatial scales (from catchment to streambed). Once the diagnosis and causes of problems is provided, the EDSS offers a list of potential solutions or management strategies, including land use practices, innovative ways of controlling point and non-point sources, and measures to increase in-stream nutrient retention and riparian buffer capacity. The solutions to improve ecological status are structured according to the scale of application (catchment, riparian zone, channel and streambed). For each proposed action, the EDSS also provides a cost-benefit evaluation, and bibliographic or web references, which can be updated with the experience gained by managers. We consider that STREAMES 1.0 may become a useful tool to aid decision-making processes in stream management and restoration.

SS7

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SPATIAL AND TEMPORAL PATTERNS OF PHOSPHORUS UTILIZATION BY PLANKTONIC COMMUNITIES IN A LARGE REGULATED MEDITERRANEAN RIVER

Regulation of large rivers for human purposes (e.g. hydroelectricity production, flood prevention, recreation activities) alter the longitudinal distribution and functioning of microbial planktonic communities. The present study analyses the phosphorus availability and transformation in the particulated and dissolved water fractions of the Ebro River (N Spain). Nutrient content and phosphatase activity were measured in the two water fractions in 6 sites upstream and 6 sites downstream of a system of reservoirs during three years. Algal and bacterial densities and phytoplankton community composition were analysed throughout the study. Results showed higher phosphatase activity in spring-summer than in autumn-winter, related to the larger plankton cell densities in the former. A strong correlation between dissolved reactive phosphorus (SRP) and phosphatase activity occurred during spring-summer in the two water fractions. However, during autumn-winter months the SRP-phosphatase correlations were only consistent in the dissolved fraction. Irrespective of the study period, the links between SRP-phosphatase in the upstream section were stronger in the particulated fraction, while the connection shifted to the dissolved fraction in the downstream section. These differences were related to the differences in microbial cell densities and phytoplankton species composition between the upstream and downstream sections. The phosphatase activity did not follow a progressive increase in a downstream direction. In this regulated system the uncoupling between SRP and phosphatase activity in the particulated (phytoplankton-dominated) fraction might derive on a decrease in authochthonous organic matter production in lower water courses.

SS3

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ASSESSMENT OF THE RHÔNE RIVER RESTORATION (FRANCE). METHODOLOGICAL APPROACH AND FIRST RESULTS.

An ambitious hydraulic and ecological restoration programme on the Rhone River (French part) was initiated in 2000. It addresses 8 priority by-passed reaches situated between Chautagne (Savoie region) and Donzère (Drôme-Ardèche region). The restoration programme consists in two main measures: (1) to increase the minimum discharge in the by-passed reaches of the hydroelectric schemes and (2) to restore the connectivity of selected former channels with the main river channel. Therefore, an interdisciplinary scientific survey intended to measure the effects of physical and biological changes induced by the river restoration was implemented since the beginning of the restoration programme. The objective is to develop methods and indicators designed to assess and to predict the effects of the restoration measures. In flowing by-passed reaches, predictive instream habitat models were developed to assess the effect of minimum flow increase on macroinvertebrate and fish communities (firstly developed in Pierre-Bénite reach). In former channels, hydraulic connectivity, sediment dynamics and associated community changes were measured before restoration to provide predictive models. Afterwards, this predictive approach was tested with the post restoration data of four restored reaches. The aim of this communication is to introduce the interdisciplinary approach, the predictive models implemented, the indicators selected and the first results drawn from the follow-up of 4 restored reaches. We show that the responses of populations in the by-passed sections after restoration are in accordance with the predictions made on Pierre-Bénite data.

O7

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INFLUENCE OF CLIMATE CHANGE ON THE TRICHOPTERA COMMUNITY FROM SIERRA NEVADA MOUNTAIN RANGE (SPAIN) OVER TWO DECADES

Many studies on climate change indicate that mountain and aquatic ecosystem will be the most affected due to the increase of temperature, especially those in southern Europe, but few address it directly. Furthermore those species with restricted distribution, narrow ecological niches and which inhabit river headwaters and mountain lakes will be significantly threatened. The National Park of Sierra Nevada represents the Mediterranean high mountain ecosystems, so it could be doubly endangered by climate change, for being a mountain ecosystem and because the south position, so therefore, doubly important to study and detect the effects of global change. Also, these aquatic ecosystems are especially harsh because of low winter and high summer temperatures, limiting water availability and constraining life histories. Trichoptera is a group of insects very rich in species that cover a wide range of ecological conditions, which make them ideal as bioindicators of impairment in aquatic ecosystems. However, the available information about south-eastern European species is still incomplete. The aim of the study was to evaluate how could affect the possible climate change on the Trichoptera population from Sierra Nevada over two decades and improve the knowledge of this order in this mountain range to assess its conservation status. We have identified caddisfly specimens from macroinvertebrate lab collection samples, collected more than 20 years ago, from 20 locations that were also seasonally sampled in 2008 and 2009. The comparative analysis of caddisfly assemblages of these two dataset is discussed in order to detect faunistic changes in relation to the global change. Study results indicated that water temperature increased more than 1 Â° C during the last twenty years in Sierra Nevada. Furthermore, the number of species has increased over the two decades, showing differences between localities and sampling seasons.

O5

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QUANTITATIVE AND QUALITATIVE DISSOLVED ORGANIC MATTER (DOM) CHANGES DURING SNOWMELT AND STORMFLOWS IN A HIGH MOUNTAIN CATCHMENT

Dissolved organic matter (DOM) dynamic in small streams is essentially modulated by discontinuous flushing of terrigenous soils and in-stream transformation mediated by microorganisms. In this study, DOM concentration fluxes (in terms of Dissolved Organic Carbon) and quality (in terms of UV absorbance and three-dimensional Excitation Emission fluorescence Matrices - EEM) were monitored intensively in stream water, snow and precipitation in a small high mountain catchment (Contraix catchment, Pyrenees) during snowmelt and abrupt storm events. Regression between DOC and stream discharge considering the whole data set is not significant, but yes it is considering individual hydrologic events. EEM analysis reveals an increase of fluorescence intensity during hydrologic events peaks, especially for humic-like fluorescence. DOC content in precipitation and snow cover were similar to that of stream waters, but their fluorescence properties and intensity differ. The results suggest a leaching of soil-derived DOC from the catchment during hydrologic events and a quick assimilation/retention of more labile DOC forms from atmospheric deposition.

I09

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MULTIPLE-STRESSOR EFFECTS OF THE AGRICULTURAL ANTIBIOTIC MONENSIN, DAIRY EFFLUENT AND RIPARIAN SHADE ON STREAM ALGAL COMMUNITIES

Streams draining agricultural land are subjected to many stressors including antibiotics and effluent in dairy farm runoff. However, little is known about the combined effects of these two stressors on stream algal communities. Furthermore, antibiotic effects may also differ between shaded and unshaded streams because many antibiotics decompose faster at high light levels. We studied effects of the antibiotic monensin (used to increase dairy cow feed efficiency and milk solids production), dairy farm effluent and light on stream algae using a factorial repeated-measures design in 60 circular channels supplied with water by a nearby river. Five antibiotic concentrations (0, 1, 55, 300, 550µg/L), two effluent levels (effluent, no effluent) and two light levels (ambient, reduced by 69%) were investigated. To simulate differences in stream shading (unshaded versus riparian vegetation), light was manipulated throughout the experiment, whereas antibiotic and effluent were applied during a 24-hour pulse, simulating a runoff event. Algae were sampled immediately before, eight and 16 days after this pulse. Increased light resulted in lower algal biomass and species richness, contrasting with previous studies. Antibiotic addition also reduced species richness at 300 and 550µg/L. Common algal taxa (11 diatoms, three greens and one blue-green) showed a range of responses. Some taxa were more prevalent at ambient light or when effluent was added; others showed the reverse patterns. The most common species, Cymbella kappii, responded negatively to antibiotics, whereas Fragilaria capucina responded positively. Many interactions between experimental factors occurred; for example, high antibiotic levels had stronger negative effects on species richness at reduced light, and effluent increased richness at ambient but not reduced light. Our findings indicate that stream algae respond sensitively, and mostly negatively, to monensin. Further, interactions with other environmental factors affected by agriculture can either strengthen or weaken the impact of monensin.

O6

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EFFICIENCY OF THE PHYTOCHELATIN METAL COMPLEXATION IN NITZSCHIA PALEA (KÜTZING) W. SMITH TOLERANCE TO CADMIUM

The focus of this study was to evaluate the effective role of phytochelatin cadmium complexation in the freshwater diatom Nitzschia palea. Diatom cultures were exposed under laboratory conditions, to three different Cd concentrations (0, 0.1, 0.2, and 0.3 mg Cd.l-1). PC-Cd complexes were isolated from four sequential buffer extractions through size exclusion chromatography. Cadmium and sulphide were quantified and thiol composition was determined by HPLC analysis. The majority of Cd was complexed with peptides, in 0.1 mg Cd.l-1 treatment only 49% of intracellular Cd was bound to PC molecules, while in 0.2 mg Cd.l-1 almost all Cd was complexed to PCs, and at the highest Cd concentration (0.3 mg Cd.l-1) the efficiency of phytochelatins started to decline, being 79% of the Cd complexed. The highest toxicity levels induced a decrease in total PCn amount, but the cadmium per SH group showed to be more efficient in this treatment. Contrarily to plant and yeast reports, sulphide ions are not included in PC complexes. The PC-Cd complexation seems to be essential for N. palea tolerance. As soon as this mechanism starts to decrease its efficiency and free Cd ions accumulate in the cytosol, toxicity symptoms worsen Cd toxicity, survival is seriously compromised.

O1

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THE ROLE OF PARASITES IN THE INVASION SUCCESS OF THE EXOTIC BRINE SHRIMP ARTEMIA FRANCISCANA IN THE MEDITERRANEAN REGION

Biological invasions are main threats to biodiversity at global scale and increasing numbers of studies suggest that parasites may have a role. However, the mechanism through which parasites may influence the outcome of the invasion is poorly understood. Here we provide evidence supporting the role of parasites as potential agents mediating the competitive exclusion of Mediterranean brine shrimps Artemia (A. parthenogenetica and A. salina) by the exotic American A. franciscana, using different native and invasive populations from South Spain and South France. Our results revealed high rates of infection by cestodes in native brine shrimps, sometimes with extreme prevalences of up to 100%. In contrast, A. franciscana populations showed very low diversity, prevalence and burden of cestodes. The effect of parasites in native populations was multiple, ranging from reproduction and survival, to life history traits, microhabitat selection and diet. Infection strongly reduced host fitness by both, reducing fecundity (parasite castration) and indirectly increasing predation by birds final hosts as revealed by prey choice experiments. We found evidence that high rate of parasitism (particularly the castrating parasite Flamingolepis liguloides, the most prevalent cestode in natives but nearly absent in the exotic Artemia), indirectly affected the life-history strategy of non infected individuals, inducing for example earlier maturation. Moreover cestodes influenced spatial (vertical and horizontal) distribution of the host, altering the diet as revealed by isotopic analysis. Contrasting with the strong impact of parasites in native populations, we have never observed any pathology (castration, behavioural alteration, etc) associated with infection in the exotic species. Overall, the results of this study suggest that the large impact of cestode on the native, but not the invading species, is likely to confer a decisive competitive advantage to the invader, contributing to explain the demographic success of A. franciscana in the Mediterranean region.

O3

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WASTEWATER REUSE IN LAS TABLAS DE DAIMIEL NATIONAL PARK BY IMPROVING ITS QUALITY THROUGH CONSTRUCTED WETLANDS

The Tablas de Daimiel National Park (TDNP) is a floodplain wetland which covers 1,928 ha, located in the Upper Guadiana Basin (14,000 km2) over the West Mancha aquifer (5,500 km2) in Central Spain. This aquifer has been subject to intensive pumpage since the late 1970s, resulting in the decrease of the phreatic level. Therefore, wetlands have been disconnected from the regional aquifer, producing serious environmental damage on TDNP. In this work, the efficiency of the reuse of treated sewage effluents (TSE) from 8 Wastewater Treatment Plants in the surroundings of the wetland is analysed. The quality of the TSE would be increased through the formation of several Constructed Wetlands, which would act as transition between the sewage plants and the natural wetland. Management of a freshwater National Park like this, threatened by drought, may be controversial. Although research about environmental management has been wide, there is a lack in terms of knowledge transfer concerning this management practices. A mass balance model for predicting efficiency of water recharge in the TDNP has been developed, considering several scenarios of meteorology, inputs and outputs. The modelling of the water conditions into the Created Wetlands has been also realized, in order to evaluate the viability of this system. The TSE available for the recharge of the TDNP has an approximate volume of 10 Mm3. Regarding the biochemical characteristics of these effluents, it is necessary around 150 ha of Constructed Wetlands to guarantee an acceptable water quality for this purpose. The modelling results demonstrated that in this site, with the present volume of reclaimed water, it is difficult to obtain a great inundated surface a cause of the increase of infiltration and evaporation with the inundated area, but this solution allows maintaining a considerable inundated surface throughout the year, with a seasonal comportment.

SS6

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VARIABILITY IN FORAGING BEHAVIOUR OF BROWN TROUT IN ATLANTIC STREAMS: FOOD AVAILABILITY OR DENSITY DEPENDENCE?

Recently, special attention has been focused on the analysis of the interaction between biological and physical factors and fish populations. Among these factors, population density is one of the most influential, having negative effects on growth and survival rates in brown trout. Density effects can be mediated through either exploitation or interference competition mechanisms, and occur at the intraspecific level. Thus, the objective of this study was to analyse whether the foraging behaviour of brown trout varies depending only on food availability or also on the population density. Individuals were collected in three streams located in Galicia (NW Spain) during September 2007. At the moment of sampling, trout density at the three sites was 0.05 ind/m2 at River Anllóns, 0.22 ind/m2 at River Furelos and 0.56 ind/m2 at River Lengüelle. Benthos and drift were sampled in order to study prey availability, and foraging behaviour of brown trout was investigated by direct observation of stomach contents. For the description of the diet we used different indices, and data are offered as frequency of occurrence and relative abundance of preys. The analysis of the feeding strategy of the species using the Shannon diversity index suggests that brown trout has the largest niche breadth in the River Lengüelle (high density) ($p < 0.001$). Surprisingly, despite River Anllóns (low density) showed lower surface drift ratio (336.51 ind/m2*hour) than Rivers Furelos and Lengüelle (887.2 and 764.1 ind/m2*hour respectively), we found that trouts consumed more frequently terrestrial invertebrates in River Anllóns (37.01% ± 5.355 SE) than in the other two rivers (Furelos: 22.65% ± 3.620 SE; Lengüelle: 20% ± 3.409 SE) ($p = 0.025$). Thus, the effects of high population density on foraging behaviour seem to be related to the acquisition a benthic feeding behaviour, probably due to the need of territory defence.

SS1

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EFFECTS OF HYDROLOGICAL DROUGHT ON BOTH HABITAT AVAILABILITY AND MACROINVERTEBRATE COMMUNITY IN PERMANENT AND TEMPORARY MEDITERRANEAN STREAMS IN THE SOUTHEAST OF SPAIN.

The objective of this study was to compare habitat change during the dry period and its effect on macroinvertebrate communities in two undisturbed streams (a permanent and a temporary one). These streams were sampled in two different hydrological phases in 2009 and 2010: 1) at the end of spring with baseflow conditions, when pool-riffle sequence was patent and 2) in the dry period, when pools were only connected by reduced riffles (runs) in the temporary stream. Surber samples of macroinvertebrate (n=20; 15 x 15 cm, 250 µm) were taken proportionally to the relative occurrence of mesohabitats (pool and riffle) and microhabitats (different mineral or organic substrates). Both streams were more heterogeneous in 2010 than in 2009 regarding the microhabitat availability. In general, the dry period produced a loss of microhabitat diversity except for the temporary stream in 2009. The NMDS and ANOSIM analyses showed differences in macroinvertebrate communities between streams (permanent and temporary), years (2009 and 2010), mesohabitats (pool and riffle) and among microhabitats. In the permanent stream in both years, the reduction of flow in the dry period eliminated reophilous taxa (EPT) and increased lentic taxa (OCH), but the total number of families found in the two periods was very similar. In the temporary stream, the desiccation produced a reduction in the total number of families, EPT and OCH in 2009, but on the contrary in 2010 the number of families significantly increased during this period due mainly to the increase of EPT taxa, even when discharge in the two dry periods were very similar (0.08 l/s in 2009 and 0.07 l/s in 2010). These differences detected in the temporary stream could be explained by the significant and unexpected rainfall detected in 2010 during the dry period. These results point up the low degree of predictability on the macroinvertebrate communities in temporary streams during the dry period.

O5

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BIOFILM QUALITY CHANGES UNDER A NUTRIENT INPUT IN A MEDITERRANEAN STREAM: IMPORTANCE OF LIGHT AND HYDROLOGICAL REGIME

Light and nutrients are the main limiting factors in forested low-order streams. During most of the year these streams mainly have a heterotrophic metabolism, relying on allochthonous resources. However, in some moments higher light availability and warmer temperatures favour primary production and nutrients potentially become the most limiting factor. The objective of our study was to test the effect of an increase of nutrient concentration in the nutritional quality of the benthic biofilm in the stream. To achieve this goal, in spring 2008 we compared two contiguous analogous reaches of a Mediterranean stream, one in natural condition and the other receiving a long-term (2005-2008) moderate nutrient input (two times the basal nitrogen concentration and three times the phosphorous concentration). We analyzed the content of lipid, protein and polysaccharide and the specific composition of the amino acids, fatty acids and sterols of the epilithic biofilm. The microbial biomass content (algae and bacteria) was further analyzed. During the sampling period flow was highly variable. These changes and the decrease of light availability (due to the dynamics of the riparian vegetation) determined that lipid and polysaccharide content were higher in the enriched reach at the beginning of the sampling period. Amino acid relative abundance (% pmol) did not differ between the two reaches, though the two first dates were characterized by the presence of the essential amino acid arginine. Phytosterols were more abundant in the enriched reach in the first dates, indicating an accumulation of organic matter that was washed off with the flow increase. Overall, the nutritional quality of biofilms was highly influenced by the hydrology regime and light availability, overriding the long-term nutrient addition.

O4

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CADMIUM EFFECTS IN NITZSCHIA PALEA (KÜTZING) W. SMITH FRUSTULE PROTEINS

The ubiquity of diatom distribution, species richness, short generation time, and specific sensitivity to several environmental stressors such as metals, make these organisms particularly useful for scientific studies. Due to the toxicity of metals towards organisms, their biomagnification nature and persistence character, the effects of metals on organisms have been extensively studied. In this work, alterations in frustule proteins of Nitzschia palea cells exposed to cadmium were investigated. Diatoms were grown in the absence and presence (0.2 mg l-1) of cadmium in Chu 10 medium. Extracellular polysaccharides were extracted in 5 mM CaCl2 in an ultrasonic bath at 50°C during 30 min. Cells were centrifuged and subsamples of the supernatant used for polysaccharide and Cd determination. The pelleted frustules were broken by maceration in liquid nitrogen and frustule proteins sequentially extracted using 0.1 M EDTA pH 7.8, 1 M NaCl and 8M urea. Protein content was determined by the BCA method with BSA as standard. Proteins of each fraction were separated by gel electrophoresis (SDS-PAGE). The cadmium associated with each protein fraction was determined. Cadmium quantification was accomplished by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) analysis. Exposure of Nitzschia palea to cadmium globally increased 6 times the expression of frustule proteins. Particularly the EDTA extract, where frustulins were found, contained 50% of the total amount of proteins extracted, making these proteins the most abundant in the frustule. Cadmium was mostly retained extracellularly; 71% was bound to the frustulin fraction, 26% was bound to polysaccharides and 3% to other frustule proteins. This ability of the diatom Nitzschia palea to increase the production of frustulins and to retain cadmium is enhanced by the presence of Cd, suggesting a new cellular defense mechanism to metals unknown until now.

SS6

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EFFECTS OF FLOW REGIME ON FISH PASSAGE SUCCESS IN AN EXPERIMENTAL POOL-TYPE FISHWAY

The placement of instream structures in river channels is a common rehabilitation measure to offset the loss of habitat due to weir and dam construction. Therefore, it is not surprising that fishway literature has increasingly focused on these structures as a potential means for improving fish passage. Although they have been used in close-to-nature fishways, there is a lack of information on how they perform for assisting fish passage in conventional pool-type facilities. This study aims to assess the effects of two different flow regimes, defined according to the relative depth (d/h) of flow, where d is the water depth and h is the height of artificial bottom substrata, for assisting fish passage in an experimental full-scale pool-type fishway. Two sets of experiments consisting of twenty replicates and each representing a distinct flow regime– d/h>4 (regime 1) and 1.3<d/h<4 (regime 2) - were carried out by analyzing the number and timing of successful upstream movements of adult Iberian barbel (Luciobarbus bocagei) through the facility embedded with artificial boulder substrata. Water velocity and turbulence at different horizontal layers parallel to the flume bottom were measured by an ADV Vectrino to characterize the hydraulic environment and understand fish movement patterns. No significant differences in passage success was observed between both flow regimes, however fish transit time was lower in regime 2, characterized by the presence of surface waves and a recirculation region near the artificial boulders. The results of these experiments showed that lower relative depths may be more beneficial to fish passage as they reduce the transit time for successful negotiation, thus providing a sound indication on how to improve fish passage through pool-type fishways.

O7

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DISTRIBUTION AND HABITAT CHARACTERISTICS OF LACUSTRINE POPULATION OF THE PYRENEAN NEWT (CALOTRITON ASPER)

The distribution and characteristics of the Pyrenean newt (Calotriton asper) in high mountain lakes were investigated using published data and field surveys. Lacustrine populations are rare (found approximately in only the 3% of total Pyrenean lakes) and, represent a new and recent ecozone for this species. Altitude, lake area, longitude and perimeter are the most remarkable variables affecting the species presence. In two lakes, the populations we find newts with partial neoteny. Historical citations allowed us to detect the extinction of the species in some Pyrenean lakes. Fish introduction seems to be the most serious threat for the preservation of these interesting populations, deserving conservation management and future ecological studies.

SS6

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IDENTIFYING MANAGEMENT AND CONSERVATION UNITS IN THE ENDANGERED IBERIAN THREE-SPINED STICKLEBACK (GASTEROSTEUS ACULEATUS)

Despite the global distribution of the three-spined stickleback (Gasterosteus aculeatus), populations living at the southern edge of its distribution have suffered sharp declines and multiple local extinction events. In the Iberian Peninsula, the species has completely disappeared from most of its past distribution and survives only in isolated freshwater locations. The main threats of stickleback are, as in many other species, invasive fish introductions and habitat degradation. In Portugal and Spain this species has been listed as endangered following IUCN (International Union for Conservation of Nature) criteria. The scarce reported genetic data from Mediterranean-Adriatic stickleback indicated an ancient evolutionary history in this area, before Pleistocene, and deserved the status of evolutionary significant unit of highly divergent populations. Here, we present the first study about population structure of the Iberian three-spined stickleback. We investigated five streams (Muga, Onyar, Daró, Calonge and Tordera) from the Northeastern Iberian Peninsula, the most important area in the Mediterranean Iberian where this specie remains. We used microsatellite markers to estimate gene diversity and to study genetic differentiation among populations. Our results identified contrasting levels of gene diversity among populations with some extremely low genetic variation in some samples. Population structure and gene flow estimates indicated high isolation in most populations and identified an ancient translocation event from Daró as the most likely origin of the population in Calonge stream. Bayesian and phylogenetic analysis of genetic differentiation yielded a model of three genetic groups related to the geographical pattern. In the most depleted populations it would seem that invasive fish could prevent gene flow and hence isolate populations. Due to its threatened situation and because they could retain long evolutionary histories, Northeastern Iberian stickleback should be considered of high conservation priority and at least three conservation management units should be considered with this purpose.

O6

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BULK HETEROTROPHIC METABOLISM AND SINGLE-CELL PHYSIOLOGY OF BACTERIONEUSTON IN HIGH MOUNTAIN LAKES

The air-water interface constitutes a specific environment, i.e., the surface microlayer (SML) is different from the underlying surface water (UW), despite its close proximity. High mountain lakes are suitable ecosystems to study possible effects of hostile environmental factors in microbial processes because when the SML forms, the organisms living there (the neuston) are exposed to high levels of UV radiation. Our aim was to investigate how common is the formation of a SML (inferred from small temperature gradients in the first centimetres of the water column) in 17 high mountain lakes (all above 1600 m above sea level) and in which way the exposure to high UV radiation affects some microbial processes comparing to those occurring in the UW analyzing microbial bulk metabolism and several single cell physiological parameters by flow cytometry. In most of the 17 lakes studied bulk prokaryotic metabolism and single cell physiology were significantly different in the neuston than in the plankton. In most lakes, neustonic bacterial production (BP) was clearly lower than BP at deeper layers. Contrarily to the subsurface and deep chlorophyll maximum, BP on the SML was decoupled from chlorophyll a and, thus, presumably from primary production. Heterotrophic prokaryotes in the SML had lower percentage of living cells, lower BP and higher number of cells with high respiration rates (CTC positive), resulting in lower bacterial growth efficiencies. These differences were related to the environmental hostile conditions occurring in the SML which would result in an increase in the proportion of the total flux of energy that cells must dedicate to cell maintenance.

O2

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A COMPARATIVE STUDY OF THE EFFECTS OF EUCALYPT, PINE AND BROADLEAF FORESTS ON AMPHIBIAN COMMUNITIES ASSOCIATED WITH PORTUGUESE UPLAND STREAMS

Production forest monocultures have increased in recent years, leading to concern for biodiversity conservation. In Portugal, Pine and Eucalypt forests account for 23% and 21% of forest cover, respectively. These radical changes in landuse are of particular concern to amphibian fauna that characterize terrestrial-aquatic ecotones. As part of a multi-faceted study of the effects of production forests on biodiversity and the associated transfer and flow of energy within and across aquatic and riparian habitats, we studied amphibian communities associated with perennial and intermittent Portuguese streams. Terrestrial amphibians were quantified by visual, active search surveys conducted over 3m x 10m transects, perpendicular to the stream. Aquatic amphibians were surveyed using a dip-net. Amphibians were identified to species, recording life-stage and weight. General characterizations of the habitat were recorded using a modified version of the River Habitat Survey, including detailed information relevant to amphibians such as stony and woody refugia, leaf litter, shading, presence of walls (terracing) or isolated pools. Preliminary results revealed quantitative differences in amphibian communities between forest types with abundance higher in Broadleaf forest, compared to production forests of both Eucalypt and Pine. Organic litter was significantly more abundant in the former. Distribution patterns in relation to distance to the stream were complex and related to shade and cover. These results highlight the importance of broadleaf woodlands for amphibian communities. More generally, they illustrate the crucial role of understory vegetation and accumulated forest litter in maximizing the amphibian conservation value of production forests.

SS9

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APPLICATION OF REAL-TIME QUANTITATIVE PCR (QPCR) FOR ENUMERATION OF PLANKTOTHRIX POPULATION (CYANOBACTERIA) IN THE LAKE SEDIMENTS: COUPLING PALEOLIMNOLOGICAL AND MOLECULAR TOOLS

The recurrent presence of Planktothrix blooms has been observed in the subalpine Lake Bourget (the French Alps) since the 90s causing potential exposure of microcystins. Fossilised organic components represent an archive of ancient aquatic microbial communities, and hence lake or river sediments can be used to reconstruct temporal variations in past community assemblages and biodiversity. In this respect, the initial objective of this research was to analyse the DNA preserved in sediments to study the succession of historic phytoplanktonic communities in a deep lake (Bourget, France) and to reconstruct the presence of Planktothrix spp. in lake and to evaluate their quantitative distribution along lake sediment core by real-time quantitative PCR (qPCR). DNA was extracted successfully from a sediment core recording the last 100 years. Cloning-sequencing (16S rRNA-ITS genes) was used to compare distinct regions of the core, corresponding a priori to different trophic periods in the lake (oligotrophic to eutrophic). The quantitative distributions of total/toxic Planktothrix spp. (on phycocyanin (PC), 16S rDNA and mcyA genes) by real-time quantitative PCR (qPCR) were reconstructed. Designed qPCR assays were successfully applied for the analysis of the 30 first cm of Lake Bourget core and can be considered specific and robust enough to prevent false positive results. QPCR reactions were not inhibited by co-extracted impurities within the DNA extracts. Clear changes in the cyanobacterial communities were identified between the analysed time points. It was demonstrated that deep calcareous lakes are favorable environments for an efficient preservation of DNA (high quality sequences obtained), and that designed qPCR assays could be applied successfully to these laminated sediments. Therefore, the reconstruction of temporal variations in past community assemblages and biodiversity, using biomarkers, is a promising approach.

O7

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CLIMATE CHANGE IN WETLANDS: CAN BIODIVERSITY MITIGATE HEAT EVENTS IN PHYTOPLANKTON COMMUNITIES?

Loss of biodiversity has become a catchphrase over the past years, increasingly in connection with man-made stress factors including climate change. In this context, the global increase of temperature and resulting increase in water temperature and changes in the hydrological cycle predicted by climate experts may have major impacts on wetlands, which are known as highly diverse and dynamic systems. In general, a high level of biodiversity increases overall system stability. But can biodiversity be maintained and mitigate temperature effects under increased levels of temperature stress? In this study, biomass development, resource use efficiency, elemental composition (stoichiometry), and taxa composition of phytoplankton communities at three temperature levels were examined under controlled laboratory conditions. Cultures of 15 single algal species of the functional groups Chlorophyceae, Cyanophyceae and Bacillariophyceae as they typically occur in the Lobau floodplain near Vienna, Austria, were used. Besides monocultures, artificial phytoplankton communities of 5 species richness levels were created and exposed to three different temperature levels (12°C, 18°C, 24°C) for two weeks. Following this adaptation phase to constant temperatures, daily short-term (7 hours) temperature peaks (+4°C) were set during one week to simulate extreme heat events. Changes in growth, resource use efficiency, species and functional richness, as well as community composition were determined as a function of temperature. Effects of temperature, of species richness, as well as combined effects of temperature and species richness on phytoplankton growth and resource use efficiency were found. Additionally, a negative effect of temperature on phytoplankton diversity occurred and was most pronounced in cold-adapted communities after short-term temperature increases. These results shed some more light on the response of aquatic primary producers to global climate change and its implications for sustainable wetland management.

O1

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EFFECT OF SAMPLING EFFORT, TAXONOMICAL RESOLUTION AND ABUNDANCE WEIGHT ON THE REPRESENTATIVENESS AND SEPARATION OF ECOLOGICAL ASSEMBLAGES

We examined how sampling effort, taxonomical resolution and abundance weight influence the representativeness of a single assemblage and the separation of two assemblages. Caddisfies were collected from pool and riffle habitats of a natural submountain stream using a Surber sampling device. Using a computer algorithm, we simulated different sampling efforts (sampled area), taxonomical resolutions (species-, genus- and family-level resolutions) and abundance weights (presence/absence, log-transformed abundance and raw abundance). We found that these parameters strongly influenced the outcome of Sample Representativeness (expressing representativeness) and Mean Similarity Approach (expressing separation) both individually and when considered jointly. Our study calls the attention to the careful selection of sampling, laboratory and data processing related factors in the multivariate comparison of assemblages.

SS4

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CARBON FIXATION, FLUX AND BURIAL EFFICIENCY IN TWO CONTRASTING EUTROPHIC LAKES IN THE UK (ROSTHERNE MERE AND TATTON MERE).

Globally, lakes have been described as important carbon processors which has lead to increasing consideration of their role in regional and global carbon cycling. Carbon exchange occurs not only within a lake but also with the atmosphere, sediments and rivers. It is estimated that on average 80% of carbon processed within a lake is lost to the atmosphere through CO2 evasion, with the remainder being sequestered in sediments. Continuous monitoring can provide an excellent insight into the seasonal and yearly cycling of carbon within lakes through detailed observation of carbon fixation, respiration and burial. This study consists of continuous, high resolution O2 data collected every 15 minutes, monthly pCO2, water quality surveys and a spatial survey of organic carbon in surface sediments in an attempt to determine whether 2 eutrophic lakes in the UK are autotrophic or heterotrophic. It is hypothesised that both lakes are net autotrophic due to the high levels of production recorded during the summer months. Located on the Cheshire Plain in North West England, Rostherne Mere is a deep monomictic lake that is stratified for up to 8 months resulting in hypolimnetic anoxia with high levels of inorganic carbon accumulation, and Tatton Mere, a shallower monomictic lake with a shorter stratification cycle and different carbon dynamics. Results to date indicate that during the summer months net ecosystem production at Rostherne Mere is positive and imply the system at this time is autotrophic, however the trends in winter are less certain: although productivity is limited, the lake does not totally de-gas to the atmosphere during its mixed phase. Initial data from a few months in 2010 suggests potentially autotrophic systems, but the actual status of Cheshire's eutrophic meres will not become clear until 1 – 2 annual cycles have been observed.

O6

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AS-PCR AND PCR-RFLP AS POTENTIAL METHODS FOR MOLECULAR IDENTIFICATION OF AQUATIC ORGANISMS

DNA barcoding is an effective and rapidly expanding method, which has brought a new insight into the biodiversity research and became a useful tool for many applications. Nevertheless, sequencing itself seems to be not very convenient method for the routine faunistic research, considering its costingness. This project attempts to optimise cost-effective and time-saving methods for a rapid determination of aquatic organisms. For this purpose, we have chosen several model taxa among fishes and aquatic invertebrates, which are commonly found in central-European drainages. Allele-specific (AS) PCR and PCR-RFLP assays have been developed and they are tested for groups of relative and/or morphologically similar species. In the present, we test both methods, whether they are suitable or not for the determination of several species in large sample sets, including larval and juvenile individuals, which are often hardly distinguishable by morphological analyses. These techniques suppose to provide reliable tool for species determination with no need of sequencing and therefore they should be widely usable in local faunistic research or food analyses. 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.

O5

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PATTERNS OF VARIABILITY OF D13C AND D15N IN FRESHWATER AQUATIC MACROPHYTES FROM CATALONIA (NE SPAIN)

Abstract: The aim of this study was to assess the variability and the ranges of d13C and d15N signatures of aquatic macrophytes collected from different water bodies (N=82) in Catalonia (NE Spain). We also aimed to shed some light on whether isotopic signatures were species-specific or were mainly driven by the environment. We surveyed species of vascular macrophytes (N=49) and some species of algae (N=??) encompassing main freshwater habitats from Catalonia (alpine lakes, coastal lagoons, karstic lakes, meanders, ponds, reservoirs and temporary pools). Studied aquatic ecosystems covered a strong gradient of altitude, alkalinity and trophic state. The d13C ranged from -43.14‰ to -7.49‰ and averaged -23.20‰. The d15N ranged from -5.16‰ to 20.08‰ and averaged 4.54‰. In general, no clear patterns were found between stable isotopes signature and the studied environmental factors (system typology, location, altitude and trophic state). However, d15N values tended to be more positive with higher eutrophic levels. d15N values of macrophytes in alpine and other oligotrophic environments were close to 0‰, suggesting that the plants demand exceeded the available resource and the absorption was therefore not discriminatory. Nevertheless, we found that d13C and d15N in macrophytes varied within and among species, but no significant differences were found among different functional forms. Potamogeton pectinatus, Myriophyllum spicatum, Ranunculus aquatilis and Potamogeton trichoides were the most widespread species in Catalonian water bodies, and being present in different water body types showed broad signature ranges. Ruppia cirrhosa which typically grows in coastal lagoons, showed the highest d15N values (20.08‰). R. aquatilis, R. trichophyllus, P. trichoides, P. natans and P. densus showed different d13C and d15N values depending on where they were located. In conclusion, the high variability of d13C and d15N values was mostly species-specific although particular species also displayed a high variability related to the environment.

SS15

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DEVELOPMENT OF A DIGITAL TAXONOMIC KEY FOR PORTUGUESE MACROINVERTEBRATES IMPLEMENTATED IN THE AQUAWEB ONLINE PLATFORM

The basis for most freshwater ecological studies and bioassessment programs with macroinvertebrates is the identification of taxa. Their incorrect identification is the source of classification errors and misinterpretation of the ecological studies results. This can be the outcome of numerous reasons: 1) for some regions (as for Portugal) there is an insufficient knowledge about species distributions; 2) the available taxonomic keys are based on taxa collected elsewhere not in the study area; 3) the available keys are in foreigner languages (e.g. English, French, Italian, Spanish). Therefore, the present study aims to fill this gap and build an electronic taxonomic key for freshwater macroinbertebrates families. Invertebrates have been collected in different types of Portuguese streams over one year. Images are produced under a stereomicroscope (magnification of 7.5x-60x) and a digital camera with Full-HD live video output in a PC screen. The animals are kept alive for video recording of their morphological as well as behavioral aspects and will be used to illustrate the families diversity. Photographs of both alive and preserved animals are also produced to illustrate distinctive details, including mouthparts, all structures involved in food capture, type of respiration and gills morphology, locomotion, all body parts, including coloration, necessary to make species identification. This information is finally structured as a key and included in the AQUAWEB platform, an holistic online platform for the bioassessment of Portuguese streams that can be used by scientists, environment technicians and general public.

O2

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TRANSLOCATED SPECIES IN THE RIVER MIÑO: PRESENT STATUS OF GOBIO LOZANOI AND COBITIS PALUDICA (PISCES) IN THE SPANISH TRIBUTARIES OF THE BOUNDARY SECTION WITH PORTUGAL

River watersheds represent natural barriers for freshwater organisms, but human activities have already dispersed many species outside their native distributional range. Many of these introduced species get established in distant areas, sometimes becoming invasive and transforming their new habitats. However, translocated species (i.e. species moved inside the same biogeographical area) are normally paid little attention, because they are expected to have a low impact. The Pyrenean gudgeon, Gobio lozanoi, is autochthonous of certain areas of North East Spain and Southern France, but it has colonized other rivers throughout the Iberian Peninsula. Similarly, the Southern Iberian spined-loach, Cobitis paludica, is an endangered endemic species native to southern Spain and Portugal, but it has been locally introduced also in northern areas of the Peninsula. Both are thought to have been introduced as fishing bait, and they have been known to be present in the lower stretch of the river Miño for decades. In summer 2010 we undertook electrofishing sampling in fourteen Spanish tributaries of the lower Miño. Results showed the presence of both species in the lower stretches of tributaries closest to the mouth of the river, with a maximum density of 0.113 ind/m2 and biomass of 1.50 g/m2 for G. lozanoi, and a maximum density of 0.372 ind/m2 and biomass of 1.91 g/m2 for C. paludica. Both densities and biometric characteristics of the individuals are similar to those found in other rivers of the Iberian Peninsula, and no clear impacts were detected on other sympatric fish populations. However, these species may be considered as invasive in certain sections, as other authors have recently reported. Additionally, in this work we discuss the implications of the recent find of two individuals of C. paludica in a northern river of the same region.

O3

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CYANOTOXINS AND THEIR IMPACT ON WATER QUALITY IN CENTRAL EUROPE LAKES

Cyanobacteria have a fundamental role in aquatic ecosystems. However, the presence of toxic species can pose serious health risks for humans and animals, besides having negative impact on all water uses. Some cyanobacteria genera have the potential of producing toxic secondary metabolites: hepatotoxins (microcystins, nodularins), neurotoxins (saxitoxins, anatoxins, BMAA), cytotoxins (cylindrospermopsins). Many countries have introduced legislative measures for controlling and limiting human exposure to these toxic compounds. The EULAKES project is a cooperation project involving four countries (Italy, Austria, Hungary and Poland) which has, among others, the ultimate goal of develop a common approach to tackle cyanobacterial threats based on scientific basis. We have chosen Lake Garda (Northern Italy) as model system in which we carry on scientific work aimed at analyzing the ecology of toxic cyanobacteria with special focus on the temporal dynamics of toxins production. Planktrothrix rubescens and Anabaena lemmermannii are the most frequent potential toxic species in this water basin. Lake Garda was regularly investigated by monthly sampling. Cyanobacteria were identified and quantified; parallel to that, molecular diversity of toxins was also analyzed by using state of the art Liquid Chromatography/Mass spectrometry techniques. Microcystins (MCs) were mostly represented by desmethylated MC-RR (more than 90% of the total), which has a toxicity level of ca. 4 times lower than the most toxic microcystin (MC-LR, 50 µg kg-1 b.w.). Anyway, total microcystin concentrations never exceeded the World Health Organization proposed limit of 1 µg/liter. In the considered period, the highest concentrations of MCs were found in the summer months, in coincidence with the metalimnetic development of Planktothrix populations. The results obtained in this project will give the opportunity to contribute to homogenize the procedures for risk evaluation and implementation of management strategies in the participating countries.

O5

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SEASONAL VARIABILITY OF THE THALA HILLS LAKES ECOSYSTEMS (EASTERN ANTARCTIC)

The Thala Hills (67 40'S, 45 51'E) is a coastal ice-free area with above than 60 reservoirs in Enderby Land, East Antarctica. Lake Glubokoe is the biggest lake (more than 30 m depth; 0.3 km2) at this oasis. We investigated physical parameters (temperature, conductivity, and solar radiation), water chemistry, phytoplankton, zooplankton and bottom communities in several lakes of the Thala Hills during summer (19.12.2010-06.02.2011) in order to compare the dynamics of biological components related to changes in environmental conditions. The solar radiation penetrates through the ice cover (about 3 m) of the lakes and reaches the bottom. This phenomenon provides heating the deeper layers of water. The maximal intensity of light near the bottom (depth of 30 m) comprised 15% of the surface intensity of light. We found inverse stratification of water temperature in Lake Glubokoe, from 0 near the ice to 4.3 °C near the bottom. The mean conductivity of water increased (from 0.020 to 0.042 mSm/cm) with an increase of depth. The pH of water varied between 6.8 and 7.6. Significant changes in oxygen concentration were recorded: from temporary anoxia in water near the bottom during December to 80-95% of oxygen saturation in January. The physical conditions determine very low biological productivity of these ultraoligotrophic lakes. The phytoplankton was presented very poor in Lake Glubokoe and other lakes resulting in low chlorophyll A (0.1-0.2 mg/m3). Characteristic feature of lakes is development of phytobenthos where whole bottom are covered by algal / bacterial mats up to 25 cm of thickness. Cyanoprocaryotes (Chyanophyta) were dominating taxa in these mats. Invertebrates such as rotifers and targidrades were recorded in the epibenthic communities. The study was supported by grants from the Russian Foundation for Basic Research (grant 10-05-00963).

O6

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THE EFFECT OF INDUSTRIAL AND DOMESTIC EFFLUENTS ON BACTERIAL ANTIBIOTIC RESISTANCE IN A RIVER

Because of the widespread use of antibiotics in human and animal medicine, they massively reach the environment, causing the emergence of resistant bacteria, which are not usually taken into account as contaminants, but that can cause major problems in public and environmental health. This work aims to study the abundance and dynamics of resistant fecal bacteria (E. coli, Total Coliforms and Enterococcus) in an impacted stream that receives in less than one kilometer the discharges from an urban WWTP and from an antibiotic synthesis industry (AB). For this purpose, water and sediment samples were collected, membrane filtered and cultured to carry out susceptibility tests. Two methods were used: the agar dilution method (E. coli, TC and Enterococcus) [cephalexin, (25 µg/ml) and amoxicillin (50 µg/ml)] and the disc diffusion method (E. coli) [penicillin (10U), ampicillin (10µg), doxycycline (30µg), tetracycline (30µg), erythromycin (15µg), azithromycin (15µg) and streptomycin (10µg)]. Density values obtained ranged over 4 log units, increasing after spills, especially after the WWTP one the same trends were found in water and sediments. In regard to antibiotic resistance (agar dilution method), most E. coli and TC were found resistant to amoxicillin, with major values after the AB discharge. In the case of Enterococcus, higher resistance to cephalexin was found, but there was no resistance to amoxicillin among them. The percentage of resistance was higher in sediments closer to the AB sampling points, which may confirm that resistant bacteria are being accumulated in the sediments after the AB outflow. With the disc diffusion method, 100% of isolates were found resistant to P and E and generally high values of resistance to the rest of antibiotics were found. MAR (multiple antibiotic resistance) was greatly extended due to P and E resistance, and highly MAR (resistance to 4 or more antibiotics) reached values of 41% in water and 50% in sediments.

SS9

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INTRODUCTION OF BROWN TROUT (SALMO TRUTTA) INTO A FISHLESS LAKE – CAN THE RESPONSES OF ZOOPLANKTON BE SEEN IN THE SUBFOSSIL CLADOCERAN RECORD?

High latitude lakes are facing multiple environmental pressures acting on them simultaneously. These include increasing human disturbance, changing climate, invasion of non-native species and introductions of fish for recreational purposes. Fish introductions to naturally fishless lakes can change the species composition and size structure of freshwater zooplankton communities with potential trophic cascades. The impacts of invading fish on the food web structure and function of naturally fishless lakes has rarely been studied in subarctic Finland, where fish stocking has been a common practice. Unfortunately, very few data is available on the aquatic ecosystems before the introductions. Our project studies the response of northern aquatic ecosystems to fish introduction by comparing various limnological properties of lakes with and without introduced fish. Paleolimnological methods are used for reconstructing the ecosystem structure before the fish, and to gain perspective on long-term within lake response and development of the aquatic community after the introduced fish. The results will be compared with paleolimnological ecosystem reconstruction of a reference lake without fish to disentangle the possible climate induced dynamics. In this presentation I will compare the zooplankton community dynamics of two lakes during the past c. 100 years by using subfossil cladoceran assemblages derived from dated lake sediments. Naturally fishless Lake Kuutsjärvi has experienced documented fish introduction in the 1970's and Lake Tippakuru, situated close by, remains naturally fishless today. Preliminary results indicate differences in the subfossil cladoceran species assemblages, density of remains, and the size-structure of Bosmina spp. between the lakes. Both direct and indirect effects on the zooplanktonic community can be observed from the subfossil data of Lake Kuutsjärvi since the fish introduction took place.

SS6

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BIOMETRIC CHANGES FROM AMMOCOETE TO POSTMETAMORPHIC STAGE OF THE SEA LAMPREY (PETROMYZON MARINUS L.) IN THE ULLA RIVER (NW SPAIN)

Ammocoetes of the anadromous sea lamprey (Petromyzon marinus) spend several years in freshwater habitats before metamorphosing and migrating to sea. Metamorphosis involves the radical transformation from a substrate-dwelling filter-feeder into a free-swimming parasitic-feeder, and individuals undergo marked morphological and physiological changes. We studied the morphometric characteristics of ammocoetes, metamorphic larvae and postmetamorphic individuals in the Ulla River. Ammocoetes (n = 302) and metamorphic larvae (n = 75) were collected by electrofishing in September 2010 at distances of 25, 40 and 50 km to the sea. Metamorphic individuals were classified into two groups M- (early metamorphic stage) and M+ (late metamorphic stage). The big shoals of Liza aurata present in the estuary of this river provide an early and abundant food source for the postmetamorphics, and from December to almost May they can be found attached to mullets. Capture of Liza aurata shoals allowed us to measure 322 postmetamorphics between January and March 2009, 2010 and 2011. Registered data were total length (± 1 mm) and weight (± 1 g). Condition factor was calculated as [weight (g) x 106]/ length (mm)3. Significant differences were recorded between ammocoetes and metamorphic larvae of the same size for weight and condition factor, but only condition factor varied between M- and M+. Concerning metamorphic larvae and postmetamorphics, differences were found for total length, weigh and condition factor for most of the sampling dates. Additionally, significant differences were recorded for these three parameters between postmetamorphics collected at the beginning and at the end of the season. Our data reflect the profound changes that this species undergoes during the metamorphic process. Ammocoetes need to accumulate reserves just before the start of the transformation to withstand several months without food, but at the postmetamorphic phase the parasitic feeding allows individuals to present a very high growth rate.

O4

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CLIMATE WARMING AND RESPIRATORY POTENTIAL OF AQUATIC ORGANISMS FROM AN OLIGOTROPHIC LAKE

Global average surface temperatures are expected to rise by about 2.0 to 5.4 °C from the present until the year 2100. In order to estimate the influence of elevated temperature on the respiratory potential of aquatic organisms in an oligotrophic lake (Slovenia), the electron transport system (ETS) activity was measured in a microplankton community, two macrophytes species (Myriophyllum spicatum and Chara aspera), and sediments. Samples collected in winter, spring, summer and autumn were incubated at three different temperatures – at the temperature of the multiyear period (i.e. last fifty years), at the in situ temperature measured at the sampling site, and at temperatures higher than the latter by 3 or 4°C. The respiratory potential was, in average, greater at higher incubation temperatures for 117% in microplankton and for 30% in sediments, indicating that elevated temperature influenced the respiratory capacity of the microbial communities for mineralization of organic matter through respiration. The largest increases of respiratory potential in winter and spring microplankton community, and in spring sediment reveal that those communities are most susceptible to elevated temperatures during the coldest period of a year and at the beginning of lake warming. The respiratory activity of M. spicatum was independent of incubation temperature, indicating its wide physiological tolerance. The lower respiratory potential measured at higher temperatures in C. aspera optimized the use of energy in plants. It is concluded that the respiratory potential of major components from an oligotrophic lake was influenced by elevated temperatures, and the results of the present study support previous findings, reported for eutrophic lakes, that the lakes are most susceptible to climate warming during the coldest period of a year.

SS4

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STREAM NETWORK-SCALE PATTERNS OF DOC-PROCESSING AND CARBON DIOXIDE EVASION

Dissolved organic carbon (DOC) is the largest pool of organic carbon on Earth. Streams and rivers receive organic carbon from the terrestrial environment and not only transport this terrigenous OC to the oceans, but also transform large amounts into carbon dioxide that subsequently outgasses to the atmosphere at scales relevant for the global carbon cycle. Due to the intimate connection to the terrestrial surroundings and their high surface:volume ratio, headwater streams are disproportionately important with regard to receiving and transforming OC. Moreover, draining and integration of the landscape happens by means of a typically dendritic network where OC quantity and quality, as well as transport and transformation processes are dependent of location in the network rather than just along the fluvial continuum, and may also be a function of network topology. We sampled a stream network draining a catchment of appr. 250 km2 by 120 sites including all major streams from 1st to 5th order. We measured CO2 partial pressure and estimated gas exchange coefficients from stream hydromorphology and conservative tracer gas injections. DOC concentrations were measured along with optical properties (absorbance and fluorescence), and DOC molecular composition and diversity was assessed by high-resolution Fourier-transform-ion-cyclotron mass spectrometry on solid-phase extracted DOC. We will present and discuss network-scale patterns of carbon dioxide evasion, DOC concentration and composition.

SS13

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CREATED DESICCATION - ASSESSING THE UNDERLYING CAUSE OF DESICCATION IN TEMPORARY RIVERS AND THE ECOLOGICAL STATUS UNDER THE PERSPECTIVE OF MAN MADE DESICCATION

Introduction Seasonal desiccation can be attributed either to natural climate variability (meteorological droughts) or to direct (water resources exploitation) and indirect (climate change) anthropogenic pressures or a combination of both. When focusing on assessing the ecological quality of streams according with the demands of the Water Framework Directive, the distinction between natural and anthropogenic desiccation is essential. This article underlines the necessity and proposes methods for distinguishing natural from anthropogenic desiccation, and suggests a relevant ecological status assessment procedure. Methods and Materials The Evrotas (S. Greece), which is an intermittent river, was selected for the purposes of this article. To assess the underlying cause of desiccation, a "Leitbild" approach was applied. Faunal responses to desiccation were assessed through comparisons of fish and macroinvertebrate assemblages in perennial and desiccated reaches and in pre-drought and post-drought periods. Results It was revealed that during prolonged drought years, the vast majority of the river network was completely desiccated, primarily as a result of substantial water abstraction for irrigation. Repeated desiccations during the last decades resulted to the elimination of fish from the vast majority of the Evrotas tributaries. Along the Evrotas main stem, the effects of desiccation on fish populations were detrimental, even in reaches that retained flow, whereas upon flow resumption communities remained severely impacted and overall recovery was markedly slow. On the contrary, macroinvertebrate recruitment processes were relatively rapid upon flow resumption. Conclusions Since, (at least) fish are threatened by repeated artificial desiccation the status of artificially dry reaches during the period of complete desiccation should score "bad", as reference conditions presuppose perennially flowing conditions and associated biota. We, therefore, propose the introduction of an "artificially intermittent Mediterranean river" category within the context of the WFD assessment applications.

SS5

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ONE PRESSURE TOO MANY? DIET SHIFTS IN A DECLINING ARCTIC CHARR POPULATION AND THE IMPLICATIONS FOR THE LAKE FOOD WEB

Introduction Windermere, the largest natural lake in England, is one of the best studied lakes in the world, with sampling records covering more than 70 years. Within the past 20 years, the temperature of the lake has warmed by an average of 1.1 degrees Celsius, and there has been a rapid increase in the population of the non-native fish, roach. These pressures on the lake ecosystem have coincided with a dramatic decline in the population of Arctic charr, a protected fish species, and a decline in the abundance of zooplankton, which has been a primary food source of charr in Windermere. Methods Stable isotope analysis of archived samples of zooplankton, macroinvertebrates and fish spanning over 25 years was used in conjunction with a dietary mixing model to assess changes in the diet of Arctic charr in Windermere before, during and after the invasion of roach and the zooplankton decline. Results The dietary mixing model indicates a substantial shift in the diet of Arctic charr towards benthic organisms such as chironomids within the past 10 years. This coincides with a decline in the abundance of zooplankton in the lake. Conclusions The shift in Artic charr diet has implications for both higher and lower trophic levels due to its key role as the main pelagic planktivore and as a principal dietary component of pike in Windermere. Thus, the decrease in food availability that overlaps with increased water temperature and roach expansion has altered the feeding behaviour of Artic charr and contributed to the cascade of pressures on this threatened species.

O6

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ARE AEROBIC ANOXYGENIC PHOTOTROPHIC BACTERIA NUMERICALLY IMPORTANT IN TRANSPARENT ALPINE LAKES?

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Aerobic anoxygenic phototrophic (AAP) bacteria are able to use light and organic substrates for fulfilling their energy and carbon requirements. However, little is known about their importance in lakes, as well as on their temporal and vertical distribution. Here, we followed the temporal dynamics of AAP bacteria and of major bacterioplankton groups, in the water column of a very transparent alpine lake during the ice-free season. In contrast to phytoplankton which peaked in July, AAP bacteria stayed low until mid July and increased only in late summer. In mid September, AAP bacteria reached the maximum abundance of ~ 1.3 × 105 cells ml-1, which represented 29% of all prokaryotes. AAP cells were highly pigmented large rods (length range: 1.6-5.2 μm), which frequently formed clusters. Along the season, the abundance of AAP followed closely that of Alphaproteobacteria (r2= 0.79), suggesting that most AAP bacteria in the lake belong to this phylogenetic group. The dominance of Alphaproteobacteria, was also found in pufL-M gene clone libraries constructed from this lake. Based on the observed temporal and vertical distribution, we suggest that photoheterotrophic bacteria are not well adapted to the high light (and ultraviolet radiation) conditions found at the surface in transparent alpine lakes during summer.

SS15

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ECOLOGICAL STATUS ASSESSMENT OF LAKES IN POLAND: INTEGRATION OF BIOLOGICAL INDICATORS AND EVALUATION OF UNCERTAINTY

This presentation will focus on the challenges of integrating assessment results based on different biological indicators (phytoplankton, macrophytes, macroinvertebrates and fish). All biological and supporting physico-chemical elements required by EU's Water Framework Directive (WFD) were measured in ten lakes situated in Central Poland (Wel river catchment area) during full-season field sampling campaign carried out in 2009. The study was performed by a large Polish-Norwegian research team within the project deWELopment financed by Polish-Norwegian Research Fund. Classification based on particular biological quality elements (BQEs) was performed using methods officially adopted in national lake monitoring, if they existed (phytoplankton, macrophytes, phytobenthos). In case of BQEs for which Polish national methods are still missing, new metrics were developed and tested (benthic macroinvertebrates and fish). According to the WFD's one-out-all-out principle, all water bodies investigated should be classified as moderate or even worse, because at least one of the biological quality elements in each lake showed moderate or lower status, even if other BQEs showed good or high status.. Such an approach seems to downgrade some of the lakes unjustifiably, especially when uncertainty in the assessment of each BQE is taken into consideration.. In our presentation, besides the one-out-all-out principle, alternative approaches for intergrating assessments of different BQEs will be presented: weighted averaging of the BQEs, or omitting the most uncertain BQE.

SS6

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PATTERNS OF MOVEMENT AND ACTIVITY OF IBERIAN BARBELL, BARBUS BOCAGEI, IN AN INTERMITTENT MEDITERRANEAN STREAM

The hydrological variability is a well known structuring factor of freshwater fish communities. This factor is particularly important in intermittent streams where the fish ecological strategies are totally coupled with streamflow variations. In this study, thirteen individuals of Barbus bocagei were tagged with radio transmitters surgically implanted and tracked between March and August of 2009, in order to evaluate the patterns of fish movement and activity along the Spring-Summer seasons. The monitoring was conducted in an intermittent stream, upstream a small reservoir, located in Sado river basin, southern of Portugal. Fish were located daily and over several 24 hour cycles.

During the study period, B.bocagei home-range ranged from 2.4 to 3.2 km, occurring both on the stream sector and at the reservoir. Fish home-range in the stream was higher than those at the reservoir. Between March and early April, fish showed great mobility and used mainly the upstream sector of study area, where a higher amount of reophilic and suitable habitats for spawning was available. Barbel home-range and dispersal decreased with the decline of stream water depth and current velocity. In late May, when the streamflow ceased and water availability receded, all individuals migrated to the downstream reservoir, where they remained during the summer. In general, the higher activity of barbel was observed at dawn and dusk. During the resting periods, barbel tend to use shallower habitats but with a high percentages of refuges.

The results point out the importance of stream flow and water depth in the activity and dispersal behavior of barbel and highlight the role of fish migrations as an ecological strategy to ensure the individuals survival during the dry-season. The large home-ranges and high dispersal movements along the river network exhibited by B. bocagei, emphasize the need of a Fish Conservation Strategy at the river basin scale.

O1

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THE DYNAMICS AND IMPORTANCE OF AUTO-, MIXO- AND HETEROTROPHIC PELAGIC COMMUNITIES IN A HUMIC AND OLIGO-HUMIC LAKE IN THE WEST OF IRELAND

An increase in the transfer of organic carbon from long-term terrestrial stores (peat soils) to more labile dissolved forms has been observed in Northern Europe and America. Dissolved organic carbon (DOC) plays an important role in many aquatic ecosystems as it is a source of energy fuelling microbial metabolism. DOC also attenuates solar radiation. The abundance and biomass of picoplankton, phytoplankton (including potentially mixotrophic flagellates), ciliates and heterotrophic bacteria were enumerated fortnightly and monthly for one year in two oligotrophic lakes in the west of Ireland (Feeagh, Co. Mayo and Guitane, Co. Kerry). Feeagh is a humic brown-water lake (water colour 78 - 107 mg l-1 Pt/Co, DOC 6.2 – 11.4 mg l-1, TP 5 – 12 µg l-1, TN 200 – 870 µg l-1) and Guitane is an oligo-humic lake (water colour 16 - 26 mg l-1 Pt/Co, DOC 1.5 – 6.4 mg l-1, TP 2 – 25 µg l-1, TN 210 – 530 µg l-1). There was poor development of phytoplankton and picoplankton biomass in Feeagh compared to Guitane and this is presumed to be due to the unfavourable light climate, caused by a high concentration of humic substances. A summer peak of mixotrophic flagellates was evident in both lakes, however the abundance of heterotrophic bacteria was three times higher in the humic lake. The results confirm the importance of bacteria in driving production at higher trophic levels in humic lakes.

SS11

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AN ASSESSMENT OF REGIONAL PATTERNS AND DRIVERS OF DISSOLVED INORGANIC AND ORGANIC NITROGEN (N) LOSSES FROM BOREAL STREAMS AND RIVERS OF SWEDEN

Dramatic changes to the global nitrogen (N) cycle over the last century have prompted extensive research on the patterns and drivers of watershed losses of dissolved inorganic and organic N (DIN and DON). Relative to temperate and tropical counterparts, however, less is known about the controls over riverine N export from Boreal watersheds. We evaluated patterns of water chemistry from 132 streams and rivers sampled monthly from 2007 to 2010 as part of the Swedish National Monitoring Program. Sites were distributed throughout Sweden, and encompassed a broad range in drainage size, elevation, annual climate, dominant vegetation, land use, and atmospheric N deposition. Over annual time scales, variation in total N (TN) concentrations among sites was largely driven by exponential increases in nitrate, which varied from less than 10 ppb in forested catchments to over 2500 ppb for streams and rivers draining agricultural areas. Despite this, DON was the dominant form of N at over 80% of sites, and for many forested streams and rivers represented 75-95% of the TN pool. Annual average DON concentrations ranged from 45 to 1070 ppb, and varied among sites as a function of climate and elevation, but also increased with agricultural land use in the upstream catchment. Finally, compared to other N forms, there was a strong seasonal pattern for nitrate, which was on average more than five times lower during the growing compared to non-growing seasons, illustrating the role of plant demand as a driver of inorganic nutrient retention across Sweden. The magnitude of this seasonality varied regionally, and also drove large temporal changes in the ratio of DIN to total phosphorus (P) at most sites. Overall, results illustrate the interactive influences of regional climate, vegetation, and land use gradients on the spatial and temporal patterns of N losses from Boreal watersheds.

SS3

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MODELING BED-SEDIMENT ENGINEERING BY LOTIC FISH AND CRAYFISH

Recent developments in zoogeomorphology in combination with the increasing interest of ecologists in ecosystem engineering by organisms initiated considerable research on the impact of lotic animals (and other organisms) on fluvial bed sediments and the transport of solids. This research provided multiple evidence from field and laboratory observations and experiments that many species among mammals, amphibians, fish, insects, crustaceans, mollusks, and worms engineer bed sediments of running waters with diverse mechanistic "tools". Furthermore, many among these animals modify the bed-sediment engineering by plants (e.g. benthic algae). Based on data collected in 84 mesocosms over 8 experiments with fish (barbel and gudgeon) and crayfish, I assessed whether and how the bed-sediment engineering by these bioturbators can be quantitatively modeled. Relatively simple multiple regression models (no variable transformation, no interaction terms included) provided highly significant results (P-range: <10^-6–<10^-15) for nine sediment variables describing baseflow and flood-induced sediment transport as well as sediment surface modifications. For example, bioturbator biomass and/or algal abundance in combination with physical variables such as baseflow shear stress or gravel size explained between ~70–~90% of the variability in sediment responses such as the overall baseflow sediment transport and, as a result of the baseflow sediment-surface engineering by the animals, the flood-induced gravel or sand transport. Confronting these seemingly encouraging experimental results with real world conditions, however, illustrates considerable problems to unravel the complexity of biotic and physical factors that vary temporally and interfere/interact non-linearly in a patchy pattern in small parts of real river beds, where baseflow bed-sediment engineering by lotic animals prevents or fosters mass erosion during subsequent floods.

SS3

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INTEGRATING TREE-RING AND STABLE CARBON ISOTOPE ANALYSES TO MEASURE RIPARIAN ECOSYSTEM FUNCTION, INTEGRITY, AND MESO-SCALE HYDROGEOMORPHIC IMPACTS

In alluvial river ecosystems throughout the world, geomorphic and hydrologic change due to flow alteration, land use and climate change has stressed biotic communities and threaten further impairment in the future. In riparian zones, there is a need to develop tools to measure these impacts on the key biological and physical processes that sustain ecosystem health and potential recovery. We used dendroecology combined with carbon stable isotope analysis of ring wood in Populus nigra, a riparian tree that is vulnerable to changes in local hydrology, to analyze ecosystem response following gravel mining along the Drôme River, a Mediterranean-climate stream in southern France. We cored trees at seven floodplain sites, measured ring widths, analyzed ring-wood chemistry and calculated site-based indices of growth to compare the severity and timing of local growth decline along the river. Results indicate that tree growth has declined at some sites coincident with documented in-channel mining sites and associated channel incision and groundwater drop, and that patterns of low growth and crown dieback are consistent with stress due to reduced water supply. Recent radial growth varied 5-fold between sites, and this variation was not due to tree age, individual size at an early age, or stand density. Regime Shift Detection analysis of site chronologies showed significant sustained growth decline at four sites after 1980, following the period of intensive instream mining downstream. Site growth declines were initiated in years of meteorological droughts that occurred after (but never prior to) the mining period, and were spatially distributed to suggest local bedrock controls on soil depth. Results indicate that these semi-arid systems are vulnerable to multiple physical drivers, but that the severity of impacts is conditioned by interactions between drivers at different scales, including regional climate variability, reach-based hydrogeomorphic alteration, and local lithological controls.

SS13

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FRESHWATER BIODIVERSITY PATTERNS AND RESPONSES TO STRESSORS AND NATURAL DRIVERS ACROSS DIFFERENT ECOSYSTEMS AND SCALES – A REVIEW

Freshwater biodiversity is declining worldwide in an accelerating state. To improve our knowledge of the global spatiotemporal patterns of freshwater biodiversity and their drivers, we reviewed recent publications in order to collect the major hypotheses concerning the natural drivers and stressors affecting freshwater biodiversity of all ecosystems. A search with keywords covering biodiversity of all freshwater associated organism groups and ecosystems with focus on the last decade (2000-2010) was implemented in the Web of Science resulting in ultimately 368 literature records. Generally, short-term studies at ecoregion and catchment scale focusing on invertebrates, macrophytes and fish in Palaearctic and Nearctic regions dominated. The most frequent hypotheses tested were amongst others the landscape filter concept with 16% of total and mostly in running waters, the species-area-relationship (9%, more in lentic systems), and the metacommunity concept (6%).The dominating natural drivers identified were area, disturbance, energy, heterogeneity and a combination of these. Land use, eutrophication, habitat destruction and associated loss of connectivity between water bodies, hydrologic alteration as well as invasive species were identified as most important stressors. The most evident pattern is the decline in biodiversity of all organism groups in response to these stressors in contrast to increasing biodiversity determined by natural drivers across all ecosystems. The outcome of this literature survey showed that the main hypotheses ecologists are testing in freshwater ecosystems originate from the 20th century and that these and the drivers are relatively similar between ecosystems and organism groups. Moreover, it showed that here is still a need for comprehensive large-scale studies with a multiple-evidence approach to determine organism response to global threats like climate change. Protection of freshwater biodiversity is the ultimate challenge since it supports valuable ecosystems services ensuring perpetuation of mankind.

SS5

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IMPACTS OF WARMING ON FRESHWATER ECOSYSTEMS AT INTERGENERATIONAL SCALES: RESULTS FROM MODEL SYSTEMS OF PROTIST ASSEMBLAGES

The universal temperature dependence model of the metabolic theory of ecology (MTE) predicts that rates of population extinction will rise with temperature and mean individual body-mass. This has potentially far-reaching implications given the unprecedented rates of warming the planet is currently experiencing. MTE has been successful in predicting patterns at higher levels of organisation so we attempt to use it to predict patterns in the population dynamics of pure cultures of three ciliate species in experimental microcosms. We explore the potential connections between cell mass, temperature and rates of population decline as well as the rates of mass decline in these species, to test MTE predictions in a model system using statistical modelling. We found that our populations declined at faster rates at higher temperatures for all three species, but that the larger species showed far weaker responses to moderate warming than was the case for the smaller species. We discuss the application of metabolic theory and the potential for other temperature dependence theories to predict population-level responses of environmental warming.

O7

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PHYTOPLANKTON BIODIVERSITY PROMOTES ZOOPLANKTON GROWTH AND DIVERSITY

In this study we test whether diversity effects of phytoplankton extend to higher trophic levels (zooplankton). Based on theoretical considerations we expect differences in diversity of the phytoplankton community to have the following consequences for zooplankton consumers: Phytoplankton diversity is expected to have a dual control on zooplankton via affecting both resource quantity and stoichiometrically expressed resource quality. The relative importance of those two controls will depend on light and nutrient availability. Additionally, we expect increasing phytoplankton diversity to positively effect zooplankton growth by separate mechanisms acting on both trophic levels. This should result in higher zooplankton growth and diversity and in reduced variation of zooplankton growth among communities at high phytoplankton diversity. To test this we performed a mesocosm experiment using natural phytoplankton communities from lakes of different trophic states. We conducted complementary nutrient addition bioassays to investigate the effects of phytoplankton diversity, nutrients, and biomass on zooplankton growth. The effect of phytoplankton diversity on Daphnia growth was positive in low productive systems but negative in highly productive systems. Diversity effects were mediated by phytoplankton productivity which increased resource quantity but also diminished resource quality in terms of carbon to phosphorus ratios at higher productivity. Finally, we performed a laboratory experiment with a diverse zooplankton community under controlled food conditions where only phytoplankton biodiversity was manipulated while food quantity and food quality (biomass stoichiometry) were maintained constant. Here, phytoplankton diversity increased the mean but suppressed the variance of zooplankton growth and abundance, and sustained higher zooplankton diversity. Likely explanations include complementarity effects among resource (phytoplankton) entities affecting individual Daphnia specimens as well as to complementarity effects among Daphnia species. Thus, by affecting the productivity as well as the reliability of the next trophic level, biodiversity of primary producers may have far-reaching consequences within the whole aquatic food web.

SS1

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INVERTEBRATES IN THE HYPORHEIC ZONE REFUGIUM: IS COMPARING BENTHIC AND HYPORHEIC POPULATIONS VALID?

A key ecological role of the hyporheic zone is as a refugium that promotes survival of benthic invertebrates during adverse conditions in the benthic sediments. Several studies have inferred invertebrate migrations during both spate events and during the dry phase in temporary streams. In addition, our research has demonstrated vertical migrations of Gammarus pulex (Amphipoda) in response to biotic pressures during flow recession, an inevitable precursor of the dry phase. With ecological research in the hyporheic zone continuing to gain momentum, it is increasingly important to recognise and follow best practice in hyporheic sampling strategies, particularly given the inherent difficulties in accessing subsurface sediments. Here, we present data collected during a four month flow recession in a second-order temperate-zone temporary stream. Invertebrates were collected using a paired benthic-hyporheic sampling strategy, and we use our results to assess the advantages and limitations of such an approach. A conceptual model is presented outlining how comparison of the benthic abundance, hyporheic abundance and the hyporheic proportion of a taxon's total (benthic + hyporheic) population can facilitate understanding of invertebrate behaviour in general, and refugium use in particular. Using this model, we are able to infer a range of behavioural responses to changing hydrological conditions, including active use of the hyporheic zone refugium and passive vertical range extension of an increasing benthic population. We argue that, despite limitations, a paired approach permits comparison of populations for which sampling must be conducted using different techniques, and we call for its wider acceptance.

SS13

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LONG-TERM CHANGES OF MAYFLY TAXOCOENOSES: A CASE STUDY FROM THE CZECH REPUBLIC

Long-term studies of benthic macroinvertebrate assemblage composition can serve as a basis for fluvial ecosystem impact assessment on local, regional and even a global scale. However, the appropriate data are infrequent. One of the available datasets comprises information on Ephemeroptera of the Czech Republic, collected in the 1950's, 1990's and today. The 1st period of the investigation represents the time before intensive development of industry and agriculture in the 1970's and 1980's; the 2nd period can be characterised as the beginning of the phase of some mitigation of organic pollution and acidification. Reducing of organic pollution and acidification stressed the impacts of stream morphology degradation and changed hydrology in the 2nd period, which are further intensified by climate changes today (3rd period). Thirty localities situated on stretches of different stream types (from nearly pristine to variously impacted as well as from different stream order and altitude) were evaluated from the Morava (March) River basin (the Danube tributary) and the Odra (Oder) River basin. A comparable number of species (about 45) was identified in all periods, but the average number of species per locality varied with the lowest value in the 2nd period (ca 8). The significant species exchange was stated among periods. Some sensitive potamal species disappeared (e.g. Choroterpes picteti) and were substituted by generalists. The species with higher resistance to drought substituted those with lower resistance (e.g. Habrophlebia fusca and H. lauta), especially at coline headwaters. The functional composition of taxocoenoses (current preferences, fixation of life cycles etc.) was changed in medium size streams, which were frequently impacted by various impoundments. The organic pollution (especially in potamal zones), changes of hydrological regime (drying-out of small streams) and stream morphology (habitat degradation and/or impoundments of middle and large streams) led to rather irreversible changes in species composition of the localities investigated.

O1

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PLANT COMMUNITIES OF CREATED WETLANDS IN CENTRAL EUROPE: DIVERSITY AND SPECIES COMPOSITION AT LOCAL AND REGIONAL LEVEL

Half the area of global wetlands has already been lost, and degradation processes continue to be uncontrolled in many parts of Europe. There is an articulated need for studies targeting wetland biodiversity at the regional scale. The purpose of this study was to assess the relative importance of regional and local processes to wetland plant diversity in crated depressional wetlands in Central Europe (central Slovakia). The origin of these habitats is related to underground coal mining that resulted in changes to surface landforms and subsequent appearance of flooded terrain depressions called Ko'ské mokrade wetlands. Twelve wetlands were sampled for vegetation, water chemistry, morphological and hydrological data in 2008. A total of 39 plant species were found in the wetlands, dominated by Typha latifolia L. Wetland plant diversity was negatively related to electrical conductivity. Other local specific variables (e.g. water depth, pH, nutrients, wetland age) did not show any significant relationship with diversity measures. When analysing community composition, age, water depth and conductivity emerged as the most important factors. This supports the hypothesis that local environmental variables affect both species diversity and composition. Contrary, we did not find any significant linear relationships between plant communities and measures of connectivity among wetlands. Nevertheless, floristic data revealed a small-scale (0–500 m) positive autocorrelation, indicating that wetlands in near proximity are more similar in species composition than more distant wetlands. Our results suggest rapid development of wetlands within an agricultural landscape. The importance of site-specific factors appeared to be predominant. Similar plant species composition in nearby wetlands may suggest dispersal limitation or effect of shared local factor (e.g. age). This exposes potential difficulties in successional studies that use space-for-time substitution. This study was supported by the Scientific Grant Agency of the Ministry of Education and the Slovak Academy of Sciences (VEGA 2/0013/08 and 1/0529/09).

O7

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CLIMATE CHANGE AND EVOLUTION IN SPRINGS: RADIATION, SPECIATION AND HYBRIDIZATION OF AUTUMN CADDISFLIES ON THE WESTERN BALKAN

The caddisflies of the Chaetopterx rugulosa group are endemics to the western Balkan, and to a few nearby areas. All species and subspecies of the group have very restricted ranges, from the south-eastern Alps to the Southern Carpathians. Classic taxonomic studies suggested that the group is undergoing an accelerated speciation through rapid radiation into isolated habitats. The central area of the radiation is located on the western Balkan. This is a karstic region, where springs are rare but permanent and they are generally isolated by impenetrable dry areas. The survival and diversification of organisms was most probably driven by climate and geology-related changes in the availability of spring habitats. This unique setup makes the C. rugulosa group an ideal model system to study how climate and geology drives speciation through rapid radiations into new environments. We intend to validate the actual taxonomy, and to reconstruct the history of the group by comparing multilocus nucleotide sequence data (mtCOI, wingless, EF-1α) for all the 6 species, 4 subspecies and 2 hybridizing populations. Our results mostly confirmed the actual taxonomy of the group, but we also found additional, geographically confined cryptic diversity, and paraphyly of several subtaxa. Based on the depth of disjunctions we conclude that both geological and climatic changes contribute to the ongoing speciation of the species group.

O1

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RESPONSE OF ZOOPLANKTON TO IMPROVING WATER QUALITY IN THE FRESHWATER REACH OF THE SCHELDT ESTUARY (BELGIUM)

Introduction Freshwater reaches of estuaries represent interesting ecological settings, combining tidal influence and freshwater characteristics. Within the context of the follow – up of the ecology of a restoring estuary, the Scheldt (Belgium/The Netherlands), we had the opportunity to study the response of the various the crustacean plankton community to improving water quality. Methods and materials Data obtained from 14 years of monthly multidisciplinary samplings (1996–2009) were used. Zooplankton from sub-surface 50 µm net samples was determined and counted at species or genus level and analysed by redundancy analysis in relation to environmental variables. Results and conclusions A strong reduction of poor water quality indicators, such as NH4+ and BOD5, as well as an increase in oxygen and in chlorophyll a concentrations were observed during the study period. The inventory of the taxonomic composition of crustacean zooplankton at species or genus level revealed 27 taxa of copepods and 32 of cladocerans, with respectively 6 and 10 new reports for this estuary. During the study period, important changes were observed in the zooplankton community composition and spatial distribution. From 2007 onwards, calanoids, previously mainly found in the brackish water reach, moved the bulk of their population to the freshwater, where they reached higher abundances than previously observed. Simultaneously, cyclopoids populations strongly decreased in freshwater while cladocerans did not change their abundance, except during years with high chlorophyll a concentrations. The variability within the calanoid population responds positively to an improvement in water quality. Variability within the cyclopoids and cladoceran community is mainly explained by chlorinity and chlorophyll a concentrations. Their presence in the most polluted upstream area up till 2007 suggests they are more tolerant to poor water quality than calanoids. Apparently, they can only live in the freshwater reach when calanoids can not due to bad water quality.

SS10

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CONTRIBUTION OF EPILTHIC DIATOMS TO BENTHIC-PELAGIC COUPLING IN THE GARONNE RIVER (FRANCE)

The temporal dynamics of diatoms in the water column was compared to that in the epilithic biofilm of the Garonne River. The study station was located in the middle part of the Garonne River, 36 km upstream the city of Toulouse, France (near the town of Aouach). Phytoplankton cannot fully develop in this location of the Garonne because of the irregular water flow, and most of the primary production is mainly benthic. Previous studies showed that exchanges between the water column and epilithic biofilms were however possible. Therefore this study aimed, (1) to determine if algae from the water column colonized the biofilms or if the process was in an inverse direction and (2) what are the key factors that control the algal dynamics between the water column and the epilithic biofilm. These questions were approached by analysing the relationship in composition and pigments between the algae in the water column and in the biofilm. The data set collected from September 2008 to March 2010 shows that the algae mostly derived from the epilithic biofilm. The chlorophyll a concentration in the water column (algal biomass) followed the biomass pattern of the epilithic biofilm. Except in situations when the discharge was very high, algae in the water column increased with decreasing biofilm biomass. The community composition and cell counts indicate that most of the algal taxa determined in the water column were benthic. These were mostly pinnate diatoms. Previous studies have shown that the discharge is the main factor causing the biofilm detachment and drift, but also other factors are important, including the autogenous detachment, the algal death and grazing. All these possibilities could be at work in our study site.

SS7

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CHANGE IN THE PROVISION OF CURRENT FRESHWATER ECOSYSTEM SERVICES IN A MEDITERRANEAN BASIN UNDER WET AND DRY CONDITIONS

Landscapes differ in their capacity to provide ecosystem goods and services, which are the benefits humans obtain from nature. The rising human pressure together with climate change affect the structure and function of ecosystems needed to sustain the provision of ecosystem services. Mapping and valuing accurately services is essential for their preservation under stress. The Integrated-Valuation-of-Ecosystem-Services-and-Tradeoffs tool (InVEST) was applied to assess different ecosystem services in a Mediterranean basin (Llobregat River). Water provisioning, sediment retention, and water purification (retention of N and P) were quantified under current average conditions, and subsequently compared to their provision under wet and dry periods (taking average conditions for the 5 rainiest and the 5 driest years for period 1970-2000). Higher values of water provisioning were found in areas of important water yield production and low demand, coinciding with high altitudes. However, they were identified as locations experiencing the highest decrease (~75%) during dry periods. The center and south of the basin were the most resistant areas to drought, and were estimated to exceed 400% increase in supply during wet years. Despite the differential change between uplands and lowlands, the former continued being the water source in both periods. Nutrient export under wet and dry conditions was closely related to change in water yield. Total annual nutrient loads reaching the outlet were 11.5% lower in dry conditions and increased 2.5% in wet conditions. Soil erosion increased with rain aggressivity (higher for rainy years) and specially concentrated in areas close to the river channel. Higher values surrounding the hydrological network were also obtained for nutrient export, meaning that sediment and nutrient would have fewer chances to be retained and probably end up in the river. Although InVEST is proved a suitable tool for assessment and valuation of ecosystem services provided by river basins, preliminary results point out the need of incorporating in-stream processes for modeling purposes.

O5

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EFFECTS OF STREAM DEGRADATION ON THE SEDIMENT QUALITY OF AGRICULTURAL LOW-ORDER STREAMS

The north-east of Austria is characterized by intensive agricultural land use. Consequently, low order streams are heavily impacted there. Many stream channels have been straightened and natural riparian buffer zones have been reduced. Soil erosion and concurrent nutrient loading effect sediment and water quality negatively. The aim of the study was to investigate the effects of bank and channel degradation on the sediment quality of already nutrient-enriched agricultural headwater streams. We compared pristine and restored stream sections to morphologically altered sections of the same stream with respect to grain size, nutrient concentrations, and organic matter content. In addition, we determined the spatial and seasonal variability of sediment quality and the impact of morphologically improved sections on down-stream reaches in three case studies. The sediment samples were divided into an upper and a lower layer to identify the effects of flood events and increased riparian input after manure application. As sediment quality changes, a change in benthic respiration can be expected. Therefore we determined sediment microbial respiration via the change in dissolved oxygen within sealed incubation chambers in situ and in the lab. All types of stream sections showed a high spatial and temporal variability in nutrient concentrations. Broad, reed-vegetated channel sections featured the smallest grain sizes and high organic matter accumulations, indicating a distinct sedimentation of suspended material within the reed. Sediments in natural and restored forested channel sections generally showed the largest grain sizes. However, we did not detect any effects of such reaches on sediment improvement in degraded down-stream sections. This suggests that sediment quality is mainly affected by direct lateral input and bank management measures.

O1

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SHIFTING PHENOLOGY IN PLANKTON COMMUNITIES: AMONG-SPECIES DIFFERENCES IN RATES, PATTERNS AND DRIVERS OF CHANGE

Abstract Brief Introduction Changes in the seasonal timing, or phenology, of biological events are one of the most widely reported ecological responses to climate change. There is growing evidence that such changes have also been apparent in freshwater plankton communities. We need to understand the mechanisms behind phenological shifts as they have the potential to disrupt ecosystem functioning by de-synchronising species interactions. Materials and Methods In a series of published studies, we have used long-term data sets collected since the 1940s from the Cumbrian lakes, UK, to examine changes in the seasonal timing of phytoplankton and zooplankton population growth. Trends in the timing of plankton population growth have been statistically related to potential environmental drivers; particularly warming and nutrient enrichment. In order to make robust inferences about change, we have used a suite of phenological metrics to describe seasonal timing. Results In five lake basins we have found evidence of changes in the seasonal timing of plankton growth. Patterns of change (rates and directions) have been species-specific but the same species can show very similar long-term phenological trends in a number of adjacent lakes. Changes are related to water temperature, water column stability and resource availability. Conclusions In the Cumbrian lakes, phytoplankton and zooplankton have changed their seasonality but species differ with respect to patterns and drivers of change. In such systems localised processes, such as nutrient enrichment, may act in concert with regional changes in climate to affect phenology. Among species differences suggest that seasonal interactions might be affected.

O1

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SAME PLACE, DIFFERENT STORY: VARYING RECOLONIZATION PATTERNS IN TWO CO-DISTRIBUTED ARCTIC-ALPINE FRESHWATER INSECTS IN EUROPE

1. There is growing interest among biogeographers in distribution patterns of European arctic-alpine disjunct species. We used the co-distributed mayfly Ameletus inopinatus and stonefly Arcynopteryx compacta as model species to investigate the European Pleistocene and Holocene history of stream-inhabiting arctic-alpine aquatic insects. 2. We used last glacial maximum (LGM) species distribution models (SDM) to derive hypotheses on the glacial survival during the LGM and the recolonization of Fennoscandia: 1) both species potentially survived glacial cycles in periglacial, extra Mediterranean refugia, and 2) postglacial recolonization of Fennoscandia originated from these refugia. We tested these hypotheses using mitochondrial sequence (mtCOI) and species specific microsatellite data. 3. We observed old lineages, deep splits, and almost complete lineage sorting of mtCOI sequences between mountain ranges. The recolonization of Fennoscandia was very different between the two study species. For A. inopinatus we found strong differentiation between the Fennoscandian and all other populations in sequence and microsatellite data, indicating that Fennoscandia was recolonized from an extra European refugium. High mtCOI genetic structure within Fennoscandia supports a recolonization of multiple lineages from independent refugia. However, this structure was not apparent in the microsatellite data, consistent with secondary contact without sexual incompability. In contrast, A. compacta exhibited low genetic structure and shared mtCOI haplotypes among Fennoscandia and the Black Forest. Again, there is incongruence with the microsatellite data, which could be explained with ancestral polymorphism or female-biased dispersal. 4. Our genetic data support the hypothesis that both A. compacta and A. inopinatus persisted in multiple periglacial extra-Mediterranean refugia in Central Europe during the LGM. However, despite similar present day distributions we show that the underlying demographic histories of the study species are vastly different, which might be due to differing dispersal capabilities and niche plasticity. This study provides a next step in filling the knowledge gap regarding molecular studies of the arctic-alpine invertebrate fauna.

SS11

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AN ISOTOPE TRACER APPROACH TO ASSESSING TOP-DOWN AND BOTTOM-UP CONTROL OF NITROGEN CYCLING IN A NEOTROPICAL STREAM

Tracer applications of stable isotopes are widely used in nutrient cycling studies. Tracer approaches are particularly common in stream studies in temperate North America. Far fewer studies have been conducted tropical streams. We have conducted 10-day 15N-NH4 additions in adjacent streams for 4 consecutive years. Year 1 served as a control and had no experimental treatment. Following our first experiment, we removed the understory canopy in one stream to increase light (daily PAR flux increased 2-fold). Between year 2 and 3, guppies (Poecilia reticulata) were introduced into the lower reach of each stream. In each experiment, longitudinal samples of water column 15N-NH4+ and 15N-NO3- and several hydromorphological variables were used to quantify NH4+ uptake kinetics and whole stream nitrification rates. Spatially and temporally explicit sampling and donor-controlled models were used to estimate N flux into algal and microbial assemblages and consequent movement into benthic consumers, Rivulus hartii, and introduced guppies. In all experiments, detrital pools (fine and course benthic organic matter) accumulated the most 15N on an area-specific basis despite low mass specific uptake rates. Canopy manipulation increased NH4+ uptake rates while fish introduction did not. However, both light availability and fish introduction created differences in the fate of tracer 15N within these foodwebs. For example, canopy manipulation increased both algal standing stocks and NH4 uptake velocity. Tracer mass balance indicated that increased isotope accrual in epilithon in the high light streams accounted for between stream differences. All aquatic invertebrates and fish became enriched in 15N by day 10 and remained enriched in post-enrichment sampling. Donor controlled modeling of N fluxes between food resources, invertebrate consumers, Rivulus and guppies is currently underway but preliminary results indicate that guppy introduction influences both foodweb structure (invertebrate composition) and function (N flux) and increases the overall residence time of N in these foodwebs.

O2

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INFLUENCE OF SALINITY ON THE GROWTH OF TWO AQUATIC PLANT SPECIES.

The Brivet and Brière Marshes cover 20 000 ha and are located in Atlantic Coast of France. They are densely covered with reeds. The biodiversity of marshes has also declined due to the cumulative effects of hydrologic changes, human activities and exotic species. The built of estuarine dam has lead to decrease the salinity, because sea water intrusion was prevented. Exotic plants that alter marsh habitats and modify species diversity, such as water primrose Ludwigia grandiflora (Michaux) Greuter and Burdet and the parrot feather Myriophyllum aquaticum (Velloso) Verdcourt, are increasingly encountered in marshes. The aim of this study is to investigate the responses of these two invasive species to salt stress. Three experiments were carried out in spring, summer and autumn in laboratory conditions. Plants were placed in three salt concentrations (1, 3 and 6g/L) during one month. Then ten morphological traits were measured on each individual. Our results showed that the two species had a significantly different salt tolerance. Ludwigia grandiflora tolerates salt concentration no more than 3g/L, whereas Myriophyllum aquaticum tolerates salt concentration of 6 g/L. Moreover, both species were more tolerant to salt in autumn. The decrease of sea water in marshes due to management could explain the invasiveness of exotic species.

O8

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NETWORK THINKING IN RIVERSCAPE CONSERVATION – A GRAPH-BASED APPROACH

Graph theoretic approaches have received increased interest recently in landscape planning and conservation in the terrestrial realm, because these approaches facilitate the effective modelling of connectivity among habitats. We examined whether basic principles of graph theory can be extended to other ecosystems. Specifically, we demonstrate how a network-based context can be used for enhancing the more effective conservation of riverine systems. We first show how to use graph theoretic techniques to model riverscapes at the segment level. Then we use a real stream network (Zagyva river basin, Hungary) to examine the topological importance of segments in maintaining riverscape connectivity, using betweenness centrality, a commonly used network measure. Using the undirected graph model of this riverscape, we then prioritize segments for conservation purpose. We examine the value of each of the 93 segments present in the Zagyva river basin by considering the conservation value of local fish assemblages, connectivity and the size of the habitat patches. For this purpose we use the 'integral index of connectivity', a recently advocated habitat availability index. Based on the results the selection of the most valuable habitat segments can be optimized depending on conservation resources. Because of their inherent advantage in the consideration of connectivity relationships, we suggest that network analyses offer a simple, yet effective tool for searching for key segments (or junctions) in riverscapes for conservation and environmental management.

SS1

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INTERMITTENCY DIFFERENTIAL EFFECTS ON C:N:P USE BY ECTOENZIMES IN A MEDITERRANEAN STREAM.

Mediterranean regions are characterized by a long summer drought that usually involves intermittency in streams of low to mid order. This intermittency is increasing due to Global change and has relevant effects on stream ecosystems, affecting to all biofilm types, as well as both autotrophic and heterotrophic processes. The effects of intermittency on biofilms and ecosystem processes is not well understood, and might be of special interest because of the increasing relevance of intermittency on the biogeochemical cycles. Our goal was to characterize the effects of drying and rewetting on the different biofilm types (epilithic, epipsammic and hyporheic), as well as on their heterotrophic and autotrophic components. For this purpose a Mediterranean headwater stream was studied during a hydrological cycle, with special emphasis during the drought period. In each biofilm type the total nutrient content (C, N and P content) was analyzed together with the extracellular enzyme activities involved in the decomposition of cellulose, organic phosphorus compounds and peptides (â-glucosidase, phosphatase and leucine-aminopeptidase).The drying of the streambed had clear effects on the biofilm functioning. Enzymatic activities in the epilithic decreased by 80% from baseflow to non-flow conditions, but experienced a fast recovery with the flow resumption. Contrarily, epipsammic and hyporreic maintained their degradation capacities during non flow conditions, specifically for polysaccharides (â-glucosidase) and organic phosphorous (phosphatase) compounds. Nitrogen acquisition was limited under dry conditions but positively correlated to the water content of stream sediments; whereas C and P compounds were largely used throughout the entire hydrological cycle. Overall, results revealed that the specific substrate ability to retain water influenced the response of each biofilm type to the intermittency. Further, intermittency influenced the C:N and C:P ectoenzymatic ratios specifically during dry conditions, suggesting a change in the organic matter acquisition by the biofilm during this harsh period.

O7

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THE SILENT FRESHWATER BIODIVERSITY CRISIS

There is clear and growing scientific evidence that we are on the verge of a major biodiversity crisis. However, few are aware of the catastrophic decline in freshwater biodiversity at both local and global scale. While freshwaters cover only 0.8% of the earth's surface, they contain ~10% of all animals. Compared with terrestrial and marine systems, they exhibit a 4-6 times higher extinction rate. Threats to freshwater biodiversity are growing and now are global in scale. The implications to ecosystems and humans are immense because rivers, lakes, ground waters, and wetlands provide a diverse array of crucial natural functions and services; more than any other ecosystems. The goals of this presentation are (i) to raise awareness about the dramatic situation in freshwater biodiversity, and the ecosystem services that are being lost as this biodiversity declines, (ii) to present a comprehensive overview of the main pressures on European freshwater biodiversity, and define clear criteria for setting priorities for their sustainable management, (iii) to suggest research and management priority actions for supporting local and global biodiversity, and (iv) to discuss the formation, and the potential ecological and evolutionary consequences of novel communities, using large rivers as an example. Project BioFresh: Biodiversity of Freshwater Ecosystems: Status, Trends, Pressures, and Conservation Priorities. www.freshwaterbiodiversity.eu Project SMART: Science for the Management of Rivers and Tidal Systems. www.riverscience.eu.

O2

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FARM PONDS IN ANDALUSIA (SOUTH OF SPAIN): OPPORTUNITIES FOR SPECIES, LANDSCAPE AND PEOPLE

A large number of farm ponds were created in recent years in Andalusia (southern Spain) and other areas of Europe. These were usually made to maintain a reservoir of water for irrigation and / or for livestock watering and wildlife. Some of them have a certain naturalization of substrate, meanwhile others are practically artificial. But scientific interest has been recently raised. An extensive survey of 120 ponds was carried out in 2007. 30 of them were selected and visited in 5 occasions, to test their associated richness. Data from natural wetlands were also collected to be compared. Interviews with owners were frequent. Finally, a revision of related literature has been carried to test the degree of importance of studies concerning ecology, connectivity or biodiversity conservation associated to farm ponds in Europe. We are finding that the high density of these ponds (approx. 17 000 inventoried in Andalusia in 2007) is: 1. changing the landscape in certain areas; 2. creating alternative habitats for many species that have suffered a reduction caused by salinity or desiccation of natural wetlands; 3. facilitating transport and dispersal areas between wetlands (connectors). We note an important change in concepts associated to Rural Environment, so interesting initiatives are been created for keeping the naturalization of many ponds, compared to other aggressive techniques of construction and management, This fact seem to favor the diversity and richness of all the groups of studied organisms. Literature and projects revised and results obtained from our works show the potential of many of these systems to maintain local and regional biodiversity. Their role as connectors between natural wetlands is an emergent result, also. This project was funded by: Consejería de Medio Ambiente, Junta de Andalucía. Universities of Seville, Granada and Almeria are developing it since 2007. Keywords: farm ponds, landscape, amphibians, connectors.

O7

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DISTRIBUTION AND ECOLOGY OF SOME SPECIES OF RHODOPHYTA IN THE EBRO RIVER BASIN

The implantation of the Water Framework Directive (2000/60/CE) in the Ebro River Basin and the evaluation of the ecological state of rivers, lakes and wetlands are increasing the knowledge about the distribution and ecology of aquatic organisms, including the red algae (Rhodophyta). After selecting representative reaches of 100 m long we took 1200 macroalgae samples from 1450 sites during the period 2006-2010 and between May and October. The organisms were fixed in 4% formalin and were taken to the laboratory to be analyzed under the microscope. In addition to biological sampling, some physical and chemical parameters were measured in situ (pH, Tª, conductivity and dissolved oxygen) and additional water samples were taken to the laboratory for analysis of nitrates, nitrites, ammonia, phosphorous and dissolved reactive silica. In this work we show new data concerning the distribution and environmental ranges of five species of Rhodophyta in the Ebro River Basin. 1) Bangia atropurpurea was present in different types of rivers, from the high mountains of the Pyrenees to the middle reaches of some major tributaries of the river Ebro, preferring oligo-mesotrophic waters. 2) Chroodactylon ornatum was observed as an epiphyte on Cladophora sp, showing an eurioic behaviour. 3) Chroothece richteriana has a restricted distribution in the Ebro basin, and it was found in sections of limestone mountains in oligo-mesotrophic conditions. 4) Compsopogon coeruleus was found in the middle and lower reaches of the river Ebro in warm and eutrophic waters. 5) Thorea hispida was restricted to the main axis of river Ebro and the lower reaches of its main tributaries, showing wide ranges of conductivity and nitrate.

SS13

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REMOTE SENSING AND GIS TECHNIQUES FOR LARGE-SCALE ASSESSMENT OF THE RELATIVE IMPACTS OF LAND COVER PRESSURES ON MACROINVERTEBRATE COMMUNITIES

Restoring or preserving the ecological quality of aquatic ecosystems is a major objective of Water Framework Directive (WFD). A pending question deals with the relative influence of anthropic pressures from local to watershed scale on river ecological status in order to better orient restoration strategies. For this purpose, a regional approach studying the relationships between land cover (a driving force of the main anthropic pressures) and biological WFD standards is required. This study mobilizes three complementary fields of research: 1- the use of suitable land cover data at each functioning scale: the upstream watershed (UW), the upstream riparian (UR) and the local riparian scale (LR) ; 2- the quantification of synthetic spatialized indicators of land cover reflecting the impact mechanisms; 3- the development of pressure/state statistical spatialized models (PSM) that quantify the links between biological indicators assessed at station level and land cover spatial indicators over each scale. Several riparian buffers were tested in order to better localize the areas to be restored. The corresponding methods were developed and implemented over lower French Normandy river networks (6000 km long; 157 macroinvertebrate stations, a part of Tables Calcaires hydroecoregion). CLC database was used for quantifying land cover at UW scale and very high spatial resolution imagery over riparian scales (UR and LR). Results show for instance the significant riparian tree vegetation (over a 20m wide strip on both sides of the river) influence on macroinvertebrate indicator. Such results are very useful for decision-makers that can estimate the interest of investing in restoration strategies by anticipating their effects in terms of Water Framework Directive standards. In the near future, new spatial indicators at riparian scale and new biological indicators will be used in PSM models over different hydroecoregions with a particular attention to the spatial and temporal inaccuracies of data.

SS10

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EFFECT OF FLOOD EVENTS AT DIFFERENT SPATIAL SCALES ON DIATOM COMMUNITIES IN A SEMIARID RIVER NETWORK

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 is 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 km2) 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. Results showed that temporal variability in diatom community composition changed with spatial scale. Observed patterns in the Gila catchment suggest that climate variability interacts with hydrologic routing to influence spatial patterns of stream diatom communities' structure in arid catchments. Global climate change will have strong effects on the structure and function of stream communities. Steady changes in temperature or precipitation will influence stream biota but these effects can not be compared to the impact of extreme events.

SS14

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ECOPHYSIOLOGICAL CHARACTERIZATION OF ZEBRA MUSSEL POPULATIONS (DREISSENA POLYMORPHA) INVADING THE EBRO AND THE JÚCAR HYDROGRAPHIC BASINS.

The invasion of zebra mussel in the ecosystems involves a serious environmental risk, at both ecological and socioeconomic levels. In Spain, the first populations were detected in 2001 in the Flix reservoir. They expanded gradually to other reservoirs and ecological biotopes colonizing almost entirely the Ebro River Basin. The Hydrographic Basin of Júcar River has also been affected by the invasive species. The control of the zebra mussel invasion requires previous knowledge about the main colonization strategies and dispersal ability, as well as a comprehensive study of the mechanisms involved in coping with environmental factors. The aim of the CEBRAPOP project deals with the study of the ecological differentiation degree of the Spanish zebra mussel populations in response to the environmental and anthropogenic stress. The study includes six populations sampled at diverse locations, differing in their water quality, from the Ebro and Júcar basins. According to our results, osmoregulatory and ionoregulatory characters, defences against metal toxicity, and a general health status index are useful markers for the ecophysiological characterization of zebra mussel populations. This research was supported by the project CEBRAPOP (reference 042/RN08/03.4) funded by the Ministry of the Environment and Rural and Marine Affairs. Thanks to the Confederacion Hidrográfica del Jucar for allowing us the use of their facilities in the development of the present project.

SS13

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LONG TERM CHANGES IN MACROINVERTEBRATE SPECIES COMPOSITION AND ACTUAL ECOLOGICAL STATE ASSESSMENT OF BULGARIAN RIVER REFERENT SITES

Macroinvertebrates communities as a one of the basic biological quality elements were used to assess ecological state and taxonomic composition changes in observed referent sites. officially recognized in terms of normative definitions of the Annex V, Framework Water Directive 2000/60/EC. The first referent site is situated on Cherni Osam river (Danube river basin) in Balkan mountain, and corresponds to Bulgarian type Mountain rivers in the Pontic Province Ecoregion 12. The second referent site is placed on Demianica river (Aegean Sea basin). Studied site is located in the Pirin Mountain National Park, and falls in Bulgarian type Mountain rivers in the Ecoregion 7 Eastern Balkans. Based on macrosoobenthos and using cenotic, saprobic, biotic and trophic indices actual ecological state was assessed. Comparison between species composition of two free of any human impacts sites was done. Based on long range data collected - Demianica (twenty four period from 1986 to 2010) and Cherni Osam (forty two period from 1968 to 2009) - cluster analysis of similarity between species composition of macroinvertebrate fauna for different studied period was made. Ecological assessment shows very good state correspond to EQR scale. Changes in species diversity at an anthropogenic uninfluenced referent site during the twenty year period were observed. This processes could be described as regime shifts - re-organizations of communities from one relatively stable status to another one. In condition of lack of clear expressed impact some global processes, as gradual temperature increase and water discharge decreasing (sixty years observed period), that was established for Mesta River, may play an important role for occurrence of restructuring of the bottom invertebrate communities.

O2

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FACTORS DRIVING NONNATIVE TROUT INTRODUCTIONS IN PYRENEAN ALPINE LAKES: A BASIS FOR CONSERVATION PROGRAMS

High mountain lakes are naturally fishless, and many have suffered the introduction of nonnative fish species, predominantly trout. Predation on native fauna by introduced trout involves profound ecological changes. The objective of this study was to reconstruct the historical process of trout introduction in the 520 high mountain lakes >0.5 ha of the southern Pyrenees and to find out which particular factors either environmental or anthropogenic, mostly explained their present distribution. We found the first written evidences of trout introductions dating back to the year 1423. At the year 1900 there were 26.5% of lakes that had been introduced with trout during preceding centuries. First modern introductions using large stocks of juvenile trout grown in local fisheries did not occur until 1960 when most fish stockings were recorded (increasing the number of lakes with trout to 52.5%). Trout species introduced were Salmo trutta before 1950, and this species together with two North American species, Onchorhynchus mykiss and Salvelinus fontinalis after 1950. We used generalised additive models to find out which were the most important factors explaining the introduction of trout along the 20th century and the present distribution of the three species. From 1900-1950, walking distance from the most nearby location was the dominant factor explaining from 29 to 60 % of exclusive deviance indicating that the trout-introduced lakes where those closer to human settlements. In contrast, with the onset of modern fish management that took place during the period 1960-2000, the most significant factors were both the management practices and lake characteristics likely related with the probability of survival of the fish population. Remaining fishless lakes are those of highest altitudes, and shallowest and lowest surface area. Stronger regulations limiting further introductions are urgently required to protect the remaining fishless lakes, especially the few large fishless lakes.

SS15

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NEW TRENDS IN THE USE OF METHODOLOGY TO ESTABLISH THE EBRO WATER BODIES ECOLOGICAL QUALITY ACCORDING TO THE EUROPEAN WATER FRAMEWORK DIRECTIVE.

During the summer 2010, in 32 reservoirs of the Ebro watershed, it was conducted instrumental vertical profiles and water column samplings to perform analytical data to establish the ecological quality in the operational monitoring network of reservoirs according to the Water Framework Directive. In agreement with the methodology provided, the integrated sampling for the photic water column should be 2.5 x depth of Secchi Disk vision. However, the use of photometric PAR measures to determine the light extinction has shown different values in several situations, being the depth values of the real photic zone in 11 reservoirs rather different in relation to Secchi Disk estimations. These variations are due, in some cases -such as Yesa reservoir-, to the presence of suspended solids that give turbidity in shallow layers, giving lower deep photic zone values than expected. In other cases -such as Ortigosa reservoir-, the existence of a deep chlorophyll maximum, gives overestimated values, because a maximum of phytoplankton is located below Secchi Disk depth. Therefore, we conclude that the use of PAR measurements provide a much more accurate photic zone value than the Secchi Disk in those situations deviating from the regularity of the water column vertical profile. On the other hand, the use of chlorophyll fluorometers, turbidity probes, as well as Phycocyanin and Phycoerythrin fluorometers could help to locate metalimnetic deep algal or cyanobacteria maximums. Similarly, accurate oxygen profiles revealed maximums and depletions of oxygen related with the biota activities. The CDOM fluorometry probe indicates the amount and main type of organic matter in the water. These techniques, combined with laboratory instrumental analyses as HPLC of pigment extracts, flow fluorocytometry or spectrofluorometry, could be useful tools to go on in the methodology for a better assessment of the water body ecological quality.

SS4

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BACTERIAL METABOLISM IN THE AMAZON RIVER SYSTEM

Only few studies of bacterial metabolism have been conducted up to date in the aquatic Amazonian ecosystems. In the present study we addressed the spatial variability of both bacterial production (BP) and respiration (BR) in a set of aquatic systems of the central Amazonas area. The objectives were to evaluate the bacterial role in Carbon dynamics in different Amazonian sub-systems and to assess differences between floodplain lakes and rivers effects on in situ rates of bacterial carbon processing, during both high and low water periods. Bacterial production and respiration were measured in total samples through Leucine and Thymidine incorporation. Leucine and Thymidine uptake rates showed high variability but, on average, low values were found in high water period compared to the low water period for a given sub-sytem. In general, low Leucine/Thymidine incorporation ratios were registered at low water conditions, giving insights into a possible shift in bacterial metabolism and an enhance in cell production compared to biomass accumulation. Moreover, high respiration rates were measured at the high water period, together with consequently low bacterial growth efficiency (BGE) levels. From our results we could estimate that a higher proportion of carbon derived from phytoplankton was up taken by heterotrophic bacteria in the low water period, when BP was coupled to chlorophyll-a, PP and CO2 partial pressure. The present study will contribute to produce an accurate sub-model of microbial C turn over, to be incorporated into a general biochemical model of the Amazonian drainage basin.

O1

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LIFE HISTORY TRAITS OF ADULT SEA LAMPREY (PETROMYZON MARINUS L.) IN THE ULLA RIVER (NW SPAIN) DURING THE SPAWNING MIGRATION.

The sea lamprey (Petromyzon marinus) spends its adult life in the ocean, where individuals remain until the right conditions occur to start the spawning migration. Once this happens, lampreys move upstream in search of suitable areas for spawning, and during this migration they do not eat, so their reserves gradually diminish. We have studied the variation of the biometric characteristics during the spawning migration of individuals in the Ulla River (NW Spain). A total of 278 lampreys were captured at two sites, at 17 and 40 km from the sea, between January and April 2008, 2009 and 2010 (44 individuals in 2008, 98 in 2009 and 136 in 2010). Registered data were total length (± 1 mm) and weight (± 1 g). Condition factor was calculated as [weight (g) x 106]/ length (mm)3. The mean observed lengths, weight and condition factor were 834 mm ± 3.8 (range: 621-1005 mm), 1116 g ± 15.3 (range: 564-2055 g) and 1.91 ± 0.014 (range: 1.14-3.01) respectively. Sex ratio (F:M) varied significantly between months of sampling, with a mean value of 1.6:1. In addition, significant differences were recorded among months for weight and total length of the individuals, and among years for weight, total length and condition factor. Our data are consistent with the existence of a latitudinal gradient for the total weight and total length for this species in Europe, with larger individuals on the South. In our case, the largest specimens were found at the beginning and at the end of the migration period, and males arrived before females. Available data suggest a reduction in size of the individuals in the last decade.

SS8

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DIEL GENE EXPRESSION PROFILES IN A HIGH-ALTITUDE LAKE THROUGH METRANSCRIPTOMICS

We have used metatranscriptomic sequencing to analyze day and night gene expression profiles in the bacterial assemblages from the oligotrophic high altitude Lake Llebreta (1620 m above sea level, Central Pyrenees, 42° 33'3"N, 0° 53'25"E). The goal of the study was to obtain clues about the main biogeochemical processes carried out by planktonic bacteria and explore unique biogeochemical features of this freshwater system. An average of 37,871 unique reads were obtained per treatment after using 454 pyrosequencing technology to sequence the extracted and amplified messenger RNA (mRNA). Approximately 37% of the reads were assigned a protein function based on BLAST analysis against the NCBI RefSeq database. Bacteroidetes and Betaproteobacteria were the most actively transcribing phyla of the community and they showed different strategies to process limiting nutrients such as phosphorus. An overabundance of transcripts for energy acquisition (e.g. photosynthesis, oxidative phosphorylation) was observed in the day compared to the night including genes codifying for photoheterotrophic activities such as proteorhodopsines and bacteriochlorophylla. House-keeping activities (e.g. aminoacid synthesis) dominated night transcriptomes. Compared to diel studies in marine plankton, Lake Llebreta showed an overabundance of transcripts related to lipid metabolism and specifically, an overrepresentation of transcripts related to degradation of polycyclic aromatic hydrocarbons (PAHs), which was overrepresented at night. This study represents the first attempt to characterize the bacterial functionality of a freshwater system and potentials and limitations of the approach will be discussed.

SS5

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ASSESSING GLOBAL STRESSORS PROPAGATION THROUGH AN AQUATIC FOOD WEB: FROM SHORT TO LONG-TERM OBSERVATIONS

Ecosystems are being affected in multiple ways in response to current global change. However, while the direct effects of global stressors are relatively well established, the subtle indirect effects may outweigh the impacts of direct effects by, for example, affecting the nutrient imbalance in food webs via changes in food quantity and quality of primary producers. To date, important global stressors are atmospheric aerosols and UV radiation. The location of the study site in the high mountain lakes of Sierra Nevada in the southern Mediterranean has shown an increasing intensity and frequency of aerosol depositions over the past three decades (1973-2003), affecting as a consequence phytoplankton biochemical composition and biomass. A combination of short and mid-term experiments together with long-term observations strongly suggest that a combination of these larger atmospheric dust depositions with the high UV radiation levels might underlie the observed interannual increase in phytoplankton and, in turn, the strong decoupling between phytoplankton and zooplankton for the last decade. Future changes in UVR regimes and nutrients due to enhanced atmospheric deposition may, therefore, propagate in cascade and affect the growth of herbivore grazers by the simultaneous alteration in the quantity and quality of their food.

O4

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EFFECT OF LANTHANUM AND NEODYMIUM ON THE GROWTH, CHLOROPHYLL CONTENT AND PHOTOSYNTHETIC RATE OF THE GREEN ALGA SCENEDESMUS QUADRICAUDA

Introduction: Rare earth elements (REEs) promote at suitable concentrations physiological functions in plants. We have studied the effect of lanthanum (La) and neodymium (Nd) on the growth, chlorophyll content and photosynthetic rate of the green alga Scenedesmus quadricauda at different light intensities (50 - 750 µmol/m2/s). The toxicity tests of the extracts of REE-enriched algae were also done. Methods and Material: Scenedesmus quadricauda (Turpin) Brébisson was cultivated in a photobioreactor in liquid mineral media at 30°C aerated with 2 % CO2 (v/v) in air. The chlorophyll content was determined spectrophotometrically at 664, 647, 470 and 450nm after aceton extraction. The photosynthetic activity was measured as the light-saturated steady-state rate of oxygen evolution in cell suspensions using a Clark-type electrode. Toxicity of REEs was checked by determination of the index of acute toxicity EC50 by measurement of a movement inhibition of oligochaeta Tubifex tubifex. Results: Both lanthanum and neodymium enhanced the growth of Scenedesmus quadricauda at all light intensities except the lowest one (50 µmol/m2/s). The chlorophyll content in untreated culture was 13.8 µg/mg D.W., and increased in lanthanum treated culture to 16.2 µg/mg D.W. and in neodymium treated culture to 19.5 µg/mg D.W. At light intensities 238 – 750 µmol/m2/s the photosynthetic rate of untreated and La or Nd treated cultures was comparable. At a low light intensity 50 µmol/m2/s the photosynthetic rate of treated cultures is about 3 times higher than untreated culture. Acute toxicity of extracts from the alga containing Nd and La are not greater than extract from untreated culture. Conclusion: Neodymium and lanthanum enhanced the growth of Scenedesmus quadricauda at all light intensities used. REEs enhanced the photosynthetic rate only at the lowest light intensity. Lanthanum and neodymium treated cells have higher chlorophyll content. Extracts from alga containing neodymium and lanthanum are not toxic. Supported by the GACR 525/09/0102 and IRC AV0Z50200510.

O2

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CLASSIFYING NATURAL SPRING ECOSYSTEMS – A FAUNISTIC APPROACH

Natural springs are unique ecosystems that provide specific abiotic conditions. They are habitats for many freshwater organisms, which partly show a strong adaptation or even are restricted to springs. The limnological classification of these very heterogeneous habitats has been a focus of interest since spring research began. Traditional spring typologies concentrate on ecomorphological and hydrological features, often characterised a posteriori by key species. In a first survey of 25 natural springs in north-western Switzerland we developed a faunistic spring typology based on the dominant functional feeding groups of the macrozoobenthic species. Using multivariate ordination and analysis of similarities we significantly differentiated scraper dominated lotic springs, filtering collector dominated lentic springs and an intermediate type mostly inhabited by shredders and gathering collectors. In a second step we now applied this new approach to springs all over Switzerland ranging from alpine regions in the Bernese Alps to springs in the very southern part of the country and springs in the western Jura Mountains near the Lake of Neuchâtel. With this comprehensive data base of over 80 springs we were able to confirm our a priori faunistic spring typology. We now have a first spring typology primarily based on faunistic features for Switzerland, which is also applicable to other mountain areas in Europe.

SS1

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TERRESTRIAL INVERTEBRATE COMMUNITIES OF TEMPORARY MEDITERRANEAN STREAMS

Ecological research in temporary streams has focused on the aquatic biota that persists in refuges during periods of drought. Little attention has been paid to the terrestrial biota that inhabits the dry stream bed. The aim of this empirical study that was carried out within the frame of the EC-funded project MIRAGE was a) to investigate the potential presence of unique terrestrial invertebrate communities on the dry river beds of Mediterranean temporary streams, and b) to determine the diet and potential dependence of these communities on aquatic subsidies. We sampled three habitat types (stream bed, riparian zone, and upland) in temporary and permanent stream reaches of five Mediterranean catchments using pit fall traps. In one of the catchments, we used stable isotopes to determine the diet of terrestrial invertebrates. Overall, we found a distinctive terrestrial invertebrate community on the stream beds of temporary reaches when compared to stream beds of permanent reaches, and to the riparian and upland habitats. In addition, terrestrial invertebrates from the stream bed of the permanent reach showed a marked aquatic subsidy signal, whereas this signal was weakened in terrestrial invertebrates from the stream bed of the temporary reach. Results from this study emphasize the importance of temporary streams as habitats for unique terrestrial invertebrate communities and suggest a potential use of these communities for the ecological assessment of temporary streams. Furthermore, we discuss the role of dry streams as migration and dispersal corridors for terrestrial organisms, as accumulators for nutrients and organic matter, and as potential refuge for upland assemblages during very harsh conditions.

SS13

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LAKE RACHELSEE (1999–2010): A CASE OF PLANKTON RECOVERY FROM ACID STRESS DELAYED BY FOREST DIEBACK

Despite a rapid decrease in both sulphur and nitrogen atmospheric deposition in the Bohemian Forest in the 1990s, chemistry of Lake Rachelsee (NP Bavarian Forest, Germany) recovered slowly and water remained strongly acidified as late as in 1999, when a large-scale dieback of spruce forest peaked in its catchment. The resulting high terrestrial export of nitrate reversed the recovery process until 2005. In 2006–2009, nitrate export declined to the pre-disturbation level, a rapid chemical recovery of the lake from acidity has started, and many limnological parameters have shown more or less remarkable trends compared to 1999–2005. In 1999–2005 the lake water was clear; bacterial filaments dominated plankton biomass, whereas phytoplankton and rotifers were scarce in the epilimnion. In contrast, the decrease in nitrate concentrations since 2006 was accompanied by significant declines in concentrations of sodium, potassium, magnesium, and ionic aluminium forms, while pH and concentrations of dissolved organic carbon and alkalinity increased. These chemical changes resulted in a significant increase in phytoplankton biomass and rotifer abundance in 2006–2009. Moreover, Ceriodaphnia quadrangula (Cladocera) has newly occurred again in the lake since 2009. Though the zooplankton of the lake is still rather anomalous, the process of recovery proceeds.

I09

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MULTIPLE-STRESSOR EFFECTS ALONG GRADIENTS OF DEPOSITED FINE SEDIMENT AND DISSOLVED NUTRIENTS IN STREAMS

Agriculture introduces multiple stressors to streams, presenting a challenge for freshwater managers who must understand the relative strengths of each individual stressor and their combined multiple-stressor effects if they are to implement the most effective management actions and avoid 'ecological surprises' that arise from complex interactions between stressors. To investigate patterns of ecological response variables across broad gradients of two major stressors, we designed a streamside mesocosm experiment with eight levels each of dissolved inorganic nutrients (36-6900 ug/L of DIN plus 1.4-450 ug/L of DRP) and deposited fine sediment (0-100 % streambed cover). Multiple linear regression and an information-theoretic approach were used to select the best predictive models for a series of ecological response variables, including algal and invertebrate variables. We tested (1) the subsidy-stress hypothesis for each stressor (where at low stressor levels an ecological variable responds positively up to an inflection point, beyond which the effect is negative), (2) whether sediment and nutrients operated as single or multiple stressors and whether they interacted, and (3) whether sediment effects were more pervasive than those of augmented nutrient concentrations. In the 21-day experiment, subsidy-stress patterns across the nutrient gradient were frequently found for algal and invertebrate taxa and communities, but consistently negative response shapes were more prevalent across the sediment gradient. Overall, nutrients and fine sediment acted predominantly as multiple stressors and sometimes in complex interactive ways. The relative strengths of sediment and nutrient effects were similar for algal response variables but sediment was the more pervasive stressor for invertebrates. These results indicate that managers should seek to control both nutrient and fine sediment inputs to streams to achieve good ecological stream condition, but measures to reduce or avoid further sedimentation are particularly likely to be effective in mitigating ecological impairment and preventing further harm.

SS4

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EVASION OF CO2 FROM STREAMS – A MAJOR COMPONENT OF THE CARBON EXPORT THROUGH THE AQUATIC CONDUIT IN A BOREAL CATCHMENT

Evasion of carbon dioxide (CO2) from streams was studied in a 67 km2 boreal catchment in northern Sweden. 13 subcatchments were sampled for dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) during a four year period (2006-2009) with a total of 104 sampling occasions. Evasion of CO2 from the stream surface was hypothesized as a major carbon component of the aquatic conduit due to the degree of CO2 supersaturation observed in a previous study. By combining concentration measurements and field determined relationships with a high resolution (5*5 m) digital elevation model (DEM) we were able to calculate the CO2 evasion from the entire stream network in detail. The evasion of CO2 from the entire catchment was 10.4 g C m-2 yr-1, which corresponded to 69 % of the entire aquatic carbon (C) flux (lateral as DIC, DOC and vertical as CO2). The spatial variability in CO2 evasion was large but the stream surface area based flux tended to increase with increasing catchment area. Despite this pattern the 1st and 2nd order streams contributed to 50 % of entire CO2 evasion from the stream network. Considering the vertical loss of CO2 from boreal stream systems gives a more complete representation of the aquatic conduit for carbon and increases the significance of aquatic C loss in landscape C budgets.

O5

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STREAM DEGRADATION AFFECTS NITROGEN CYCLING IN NUTRIENT-ENRICHED HEADWATER STREAMS

In north-eastern Austria, marshlands have been turned into the most productive arable land of the country. As a result, most headwater streams are heavily loaded with nutrients and organic matter from adjacent crop fields. Channel degradation, bank incision, and deforestation exert additional pressures on stream functioning and nutrient cycling. In the present study, we investigated the effects of channel and bank degradation on in-stream nutrient uptake, stream metabolism, and nutrient processes at the sediment-water-interface in nutrient-enriched headwater streams. For this, we compared meandering, forested reaches with channelized, reed-covered reaches of low order streams. Forested reaches were either of natural origin or resulted from restoration measures. Reach-scale NH4 uptake parameters were calculated from short term 15NH4 additions with NaCl as conservative tracer. Transient storage was calculated with the model OTIS-P on base of conductivity break-through curves from the salt injections. Metabolism rates were based on single-station diel O2 curves. Autotrophic and heterotrophic NH4 uptake, sedimentary NH4 release, and potential denitrification were studied in the lab. Both forested and reed-covered stream sections were mainly heterotrophic; however, reed sections showed a high temporal variability in gross primary production with sudden changes from heterotrophy to autotrophy during periods of enhanced light availability (e.g. during spring or after reed cutting). Forested sections revealed a significant increase in surface transient storage and a significant decrease in NH4 uptake lengths compared to reed sections. Uptake velocities did not differ significantly between sites. NH4 uptake was mainly driven by autotrophs. Reed sections showed significantly higher potential denitrification rates and a higher NH4 release from the organic-rich sediments than forested stream sections.

SS12

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BEYOND BIVALVES: THE POTENTIAL ROLE OF BENTHIC MICRO-CONSUMERS IN THE PELAGIC-BENTHIC COUPLING IN RIVERS

Benthic filter feeders can play an important role in controlling riverine plankton and in importing planktonic production into benthic food webs. This function has largely been attributed to filter-feeding bivalves with emphasis on invasive species. However, several other benthic consumers on plankton exist, even though quantitative studies on their role are rare. In the present study we address the role of benthic micro-consumers (biofim-dwelling protozoans and small metazoans) in controlling plankton in rivers. During a 16-month study, we showed that natural biofilm communities from a large river are dominated by suspension feeding groups. Quantitative measurements showed high community clearance rates on both picoplankton (bacteria) and nanoplankton (algae and protozoans). These data suggest that biofilm-dwelling micro-consumers can play an important role as benthic grazers on potamoplankton besides bivalves. However, the community clearance behaviour of the micro-consumers differed considerably from that of bivalves, e.g. with respect to temperature response and food size preference. The different consumer groups and their specific feeding patterns need to be considered when estimating the total effect of benthic consumers on plankton.

O3

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HABITAT STRUCTURE AND FOOD QUALITY AS DRIVERS OF AQUATIC BENTHIC INVERTEBRATE DIVERSITY IN DEGRADED PEATLANDS

Peatlands in the province of Noord-Holland, the Netherlands, appear as pastures of ancient peat intersected by shallow ditches. For decades these systems have been exposed to intensifying farming practices and increased nutrient inputs. These and related anthropogenic activities promote peat degradation, causing the accumulation of fine degraded peat particles. Fine particle accumulation dramatically alters the habitat by smothering surfaces producing habitat homogeneity, and increasing turbidity, causing dramatic declines in submerged vegetation. Simultaneous to these developments, 28 years of monitoring data indicates declining diversity in benthic invertebrate communities. To elucidate the possible link between particle accumulation and the observed decline in biodiversity, this study investigated a)the role of habitat structure, and b)the role of food quality in driving the decline in benthic invertebrate diversity. To this purpose, a field experiment was performed and feeding experiments were run in the laboratory. Field samples were collected from three different ditch habitats: 1)bank-side vegetation 2)benthic sediments, and 3)submerged artificial vegetation (galvanized steel cages housing plastic plants). The feeding tests were run with different species of invertebrate detritivore. The influence of particles on food uptake was determined by invertebrate lipid analysis. Our results show significant differences in species diversity between the three habitats with bank-side vegetation having the highest diversity and benthic sediments the lowest, while invertebrate lipids responded positively to the concentration of particles to which animals were exposed. We conclude that peat degradation and the resulting prominence of organic particles in the ditches primarily interferes with the availability of substrate for invertebrate settlement, and that the food quality of the excess particles is high and could potentially support a substantial invertebrate fauna. These observations underpin measures to remove fine sediments to improve the ecological status of the test area via reduction of the excessive accumulation of peat particles.

SS15

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THE USE AND STANDARDISATION OF HYDROACOUSTICS FOR THE ASSESSMENT OF FISH POPULATIONS IN LAKES AND RESERVOIRS

The use of transmitted underwater sound to survey fish populations (known effectively interchangeably as hydroacoustics, echo sounding or sonar) has a long and extensive record of successful application, particularly in the marine environment where most of its major developments have historically taken place. In recent decades, technological developments, including the miniaturisation of electronic components and rapidly increasing computing power, have facilitated the production of hydroacoustic systems which can be readily deployed from small vessels on fresh waters. This presentation gives an introduction to this still developing field, with appropriate examples of its application, and provides a set of guidelines specifically for the application of hydroacoustics to the investigation of fish populations in European standing freshwater bodies. As such it will help to produce hydroacoustic surveys which are compatible with current best practice, well reported and will facilitate the future valid comparison of hydroacoustic datasets for lakes and reservoirs from across Europe. In addition to explaining the basic principles of hydroacoustics and reviewing appropriate hardware and software currently available, guidance is also given on pre-survey planning, survey and data acquisition, post-survey data analysis, and finally reporting and data archiving.

SS1

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HYDROGEOLOGICAL CONTROLS ON INVERTEBRATE COMMUNITIES IN TEMPORARY STREAMS

Temporary (ephemeral) headwater streams represent a significant proportion of the total stream drainage network but are poorly studied in comparison to permanent (perennial) and larger streams. It is increasingly recognised that these systems provide a diverse range of habitats and support significant aquatic, semi-aquatic and terrestrial faunal biodiversity. However, the true richness associated with these systems remains poorly quantified, particularly in temperate environments, which are typically characterised by an absence of environmental extremes. In this paper, we compare the temporary stream invertebrate communities associated with two karstic geologies (Carboniferous limestone and chalk) in the UK. We consider the ways in which hydrogeology influences the degree of flow permanence (hydroperiodicity) and how the community at individual sites may be controlled by its position within the stream network in relation to perennial water bodies and the presence of refugia. We argue that temporary stream communities represent model systems for the examination of impacts associated with climate variability and anthropogenic water resource development. However, their potential to serve as sentinel systems may only be realised if we can adequately characterise the contemporary communities and their dynamics.

SS10

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SUSPENSION FEEDERS AND FPS – 30 YEARS OF COLLABORATING WITH BJÖRN

In 1975 the RheoGroup from the University of Lund, of which Björn was a member, worked together on a project on lake outlets in Swedish Lapland. I was invited to join them and the experience was very influential on my subsequent research. Björn and I kept in contact after this initial collaboration and he joined me to investigate spiralling of organic matter in lake outlets in southern England. We continued to collaborate, but now at an outlet in northern Sweden. This was when FPs (faecal pellets) became part of our scientific conversation. The Golf Stream project showed that FPs from dense aggregations of suspension feeders had a large effect on organic matter transport in the stream. It was then Björn's idea to increase the scale and look at the transport of blackfly larval FPs in large, unregulated rivers and their tributaries. Many millions of FPs were in transport in these systems and Björn published the results in an important paper in Oikos. The project was driven by his scientific insights, enthusiasm and hard work. Typically, Björn wanted to put the findings into a wider context and he then organised a meeting to discuss the influence of blackflies in both aquatic and terrestrial habitats. After wonderful hospitality provided by Björn and Anita at their home, the international group then met for two days at a field station outside Umeå. A wide-ranging paper in Ecoscience resulted. Many of us owe Björn Malmqvist a great deal and it is a pleasure to be able to record my thanks to him at this Symposium.

O5

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RELATING BACTERIAL DIVERSITY AND EXTRACELLULAR ENZYMATIC FUNCTIONING: DIFFERENCES BETWEEN STREAM AND LAKE COMMUNITIES

Species richness has been generally linked to ecosystem functioning. While this relationship has been mainly investigated in larger organisms, the role that microbial diversity plays in controlling ecosystem functioning remains largely overlooked. In this study we examined the effects of loss in bacterial species richness on the enzyme capabilities to decompose differential organic matter sources. Stream and lake samples were analysed to determine the potential differences in the species richness- enzymatic functioning relationship in the two aquatic ecosystems. A dilution series of bacterial inocula collected from natural communities of Fibyån stream and lake Eklon (both in Sweden) was prepared by serial transfer of the inoculum into sterilized river water (1:10). This procedure was designed to create a gradient of bacterial richness in the two systems. Bacterial cultures were kept at 20°C in the dark, during 1 week, and bacterial abundance was monitored daily by flow cytometry. On days 5 and 7 five extracellular enzyme activities (cellobiohydrolase, β-glucosidase, β-xylosidase, leucine-aminopeptidase and phenoloxidase) were measured. Batch cultures were also sampled for molecular fingerprinting by Terminal Restriction Fragment Length Polymorphism (TRFLP) at the end of the experiment. The much higher values of the cellobiohydrolase: phenoloxidase and β-xylosidase: β-glucosidase relationships in river communities indicated that different organic matter sources were used by rivers and lake communities. This might indicate a use of allochthonous material in the river (cellulose and hemicellulose from plant material) while lignin might be more available in lakes where the longer residence time permits the organic matter to age. The intentional decrease in bacterial diversity was linked to a decrease in the bacterial functioning (enzymes activities) in the two systems, but it was more pronounced in river communities. The results stress the implications of bacterial biodiversity in freshwater systems (lakes and streams) in the maintenance of ecosystem functioning.

O3

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LESSONS FROM 10 YEARS OF INTEGRATED CATCHMENT MANAGEMENT RESEARCH

Over the last 10 years a dedicated group of scientists, resource managers and members of the community have engaged in a research programme using an integrated catchment management (ICM) approach. This work has been focused on the Motueka Catchment near Nelson, New Zealand. The research has had a broad focus from the mountain tops to the sea and included work on water allocation, water quality, freshwater fisheries management, effects of river plumes on coastal resources, and approaches to building human capital and facilitating community action. The resource management issues facing the Motueka Catchment are similar to those challenging many other catchments around the world, but it is still reasonably healthy. Therefore, our research has focused on understanding physical/social catchment connections and maintaining and improving catchment health, rather than trying to rehabilitate a 'broken' system. We have learnt many lessons over the last 10 years including 1) ICM is about people, people, people, 2) Catchments extend off the coast, 3) Everything is connected, 4) Look at different scales - zoom in, zoom out, 5) Relationships take time, 6) Collaboration beats confrontation, 7) Manage expectations, 8) Critical events have long lasting consequences, 9) Communities should design their future, not wait for it to happen, and 10) Longterm datasets are critical for understanding changes in the environment. The ICM research programme is currently winding up, but the ICM philosophy will continue to offer some solutions to the serious resource management issues that are faced in New Zealand and elsewhere.

O7

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DESTRUCTION OF TROPICAL PEATSWAMPS IN THE INDO-MALAYSIAN REGION – REGIONAL AND GLOBAL IMPACTS ON CARBON CYCLING

The tropical peatswamps of Indo-Malaysia are unique ecosystems characterized by waterlogged peat substrate, low pH (typically 2.9-4.5), low nutrients, and slow litter decomposition. They are the most carbon-rich freshwater ecosystems in the world, storing carbon in peatlayers (up to 25 m deep) and vegetation (trees to 70m tall). Ongoing destruction of these swamps by logging, drainage and fire – mostly for conversion to oil palm – results in CO2 release >10% of world fossil fuel emissions. We are studying ecosystem functioning of pristine and disturbed peatswamps. Our methods include comparative field studies (studying litter degradation, peat cores, plants, invertebrates, fish), laboratory experiments (e.g. pot trials), colorimetry assays (phytochemistry), and molecular and enzymatic techniques (microbes). Contrary to previous assumptions, microbes are diverse, abundant and active, but litter decomposition is inhibited because leaves of peatswamp flora are highly sclerophyllous and toxic (adaptations to deter herbivory in the low nutrient habitat), hence leading to peat accretion. Results of stable isotope studies suggest that rather than decomposing litter, bacteria mostly respire carbon leached from leaves and wood and bacteria are the base of the aquatic foodwebs. Acidity and waterlogging in pristine swamps enable pioneer plants to increase their phenolic content because they absorb low molecular phenolic acids leached from litter. We hypothesise they use these for physical (structural) and chemical defences (herbivory and UVB). Conversely, disturbed peatswamps have lower phenolic levels, and there is lower uptake by plants – hence potentially less availability for defence. Drainage creates aerobic conditions which greatly accelerates microbial decomposition while logging eliminates leaf litter input – thus both result in shrinking layers of peat. Increasing disturbance progressively enhances microbial activity and peat oxidation leading to escalating CO2 release until the peat is entirely gone. Emissions reach maximum levels during dry season burning resulting in globally detectable rises in atmospheric CO2.

SS5

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RENCONCILING DIFFERENCES IN THE TEMPERATURE-DEPENDENCE OF ECOSYSTEM RESPIRATION ACROSS TIME SCALES AND ECOSYSTEM TYPES

The temperature-dependence of ecosystem respiration varies temporally with the scale of analysis and spatially within and among ecosystem types, but the underlying mechanisms are poorly understood. Elucidating these mechanisms is key to assessing to what extent temperature-induced increases in ecosystem respiration may exacerbate global warming by increasing net carbon efflux from the biosphere to the atmosphere. Here we demonstrate that the short-term temperature dependence of ecosystem respiration converges on a common activation energy identical to that of the respiratory complex (~0.65 eV) for diverse terrestrial and aquatic ecosystems (lakes, rivers, soils, forests, estuaries, oceans), as predicted by the Metabolic Theory of Ecology (MTE). By contrast, long-term, annual flux exhibits a substantially greater temperature-dependence in aquatic (~0.65 eV) relative to terrestrial ecosystems (~0.32 eV). These disparate temperature dependencies are predicted by MTE under the assumption that heterotroph abundance and respiration are constrained by autochthonous primary production in terrestrial ecosystems, but to a lesser extent in most aquatic ecosystems owing to the influence of allochthonous carbon. More generally, these findings highlight similarities in the kinetics of respiration for diverse biota at the biochemical level, as well as pronounced differences in the structure of terrestrial and aquatic communities. As a consequence of these differences, our model and data suggest that the effects of warming on the carbon cycle may be more pronounced in aquatic than in terrestrial ecosystems.

O3

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THE EFFECT OF HYDROPEAKING ON BENTHIC MACROINVERTEBRATES.

More than 95% of electricity is produced at hydro-electric power stations in Norway. Since demand for electricity is increasing, hydropower will remain a major issue also in the future. Although this source of electricity is sustainable, it also strongly impacts the environment. The aim of the present project is to assess the effects of rapid flow fluctuations on riverine ecosystems to help develop production regimes that allow for the maintenance of structural and functional integrity of these ecosystems. We specifically focus on benthic macroinvertebrate communities. We have studied two components of the downstream reaches, the ramping zone that becomes dewatered at low flow and the permanently wetted section. In addition, we considered equivalent components upstream from the power plants and also in control rivers. We collected quantitative benthic samples in each of the sections. Hydropeaking strongly influences macrozoobenthos communities by reducing biomass and biodiversity, but also by modifying the physiological and ecological characteristics of the community through effects on biological (species) traits. Daily flow variation requires particular adaptations of macroinvertebrates: The proportion of short life cycles and small-sized macroinvertebrates increases. Because of the large range of hydraulic conditions covered by reaches subject to hydropeaking, taxa with narrow niche breath for these conditions are discriminated compared to generalists. Furthermore, exogenous individuals (mainly cladocera and copepods), probably released from the reservoirs, constitute a large proportion of the community, especially in the ramping zone. These exogens from reservoirs are likely to strongly influence trophic relations that are already perturbed through the loss of biodiversity (i.e. loss of trophic links). In future studies we will develop a habitat model and relate biological characteristics (species traits) of the community to the flow regime and ecological functioning.

O1

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USE OF SIZE DIVERSITY OF MEDITERRANEN BARBEL (BARBUS MERIDIONALIS) AS AN INDICATOR OF ENVIRONMENTAL PERTURBATION IN MEDITERRANEAN RIVERS

Effective indicators are needed to measure the health of rivers. These comprehensive, sensitive and quantitative tools must be able to detect changes at the catchment scale as well as at the reach and smaller spatial scales. Fish can be used as biotic indicators and Indices of biotic integrity (IBIs) are commonly used for assessing the ecological health of entire fish assemblages. Nevertheless, they are slightly sensitive in very low-diversity fish communities, such as we found in Mediterranean rivers. In this case, population parameters can be useful. Size structure analysis is one of the most commonly used because it reflects the interaction of the dynamic rates of recruitment, growth and mortality. We present a new proposal to resume length-frequency distributions based on the calculation of size-diversity in order to compare size structure among samples. We test differences in size-diversity, catch per unit effort (CPUE) and body condition between several populations of Mediterranean barbel and to examine possible correlations between fish population parameters and ecological factors. We analyzed 14 stretches with different ecological conditions. Statistical analysis (ANCOVA) showed that there were only significant differences ($P<0.05$) in size diversity which could imply differences in habitat characteristics condition between populations. Flow regime, pollution and riparian cover seem to be the main ecological factors affecting the size structure of this species in the area studied. Therefore, the size diversity of the Mediterranean barbel may be a good indicator of environmental perturbation in Mediterranean stream ecosystems.

O2

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ASSESSMENT OF ALTERNATIVES FOR CONTROLLING CYANOBACTERIAL BLOOMS IN A TROPICAL URBAN WETLAND

Aquatic systems in the Northern Andes have shown in recent years deterioration associated with the increase of human settlements and an important number of wetlands have ended immersed within cities. Such systems have been documented as eutrophic, with algal blooms, accelerated growth of macrophytes, and silted. A program aimed to the restoration of the urban wetlands of Bogotá (Colombia) began the restoration of the Juan Amarillo wetland –located at 2,600 m in altitude– with the reconstruction of a 22-ha lake. The system built is shallow, with a high nutrient concentration, reduced physiognomic complexity and low littoral-plant cover. A permanent Chlorophyceae and Cyanophyceae bloom occurred few months after the reconstruction of the lake in 2002. In 2006-2007, we carried out an experimental research to study some strategies for controlling algal blooms in the wetland. Our research comprised: 1. Measuring the growth rate of floating and emergent macrophytes. 2. Lymnological monitoring. 3. Assessing the effect of low-level polluting substances on algal blooms. 4. Assessing the effect of the floating macrophyte cover on algal blooms. 5. Building a dynamics model for phosphorous and nitrogen, and 6. Preparing a proposal to increase the surface area covered by macrophytes. Our results show that the phytoplankton community has reached a degree of maturity and the lake conditions enable the permanent bloom of cyanobacteria. Macrophytes used were not effective for controlling algal blooms due to the permanent nutrient release from sediments and the algae adaptation to poor solar radiation. We include a discussion with the most relevant conclusions drawn from our experiments, the current problem of the wetland, and the need to consider a new design of the ecosystem due to its impossibility of achieving its self-regulation in the present scenario.

SS14

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PARASITES AND PATHOGENS CAN MODIFY THERMAL PREFERENCES OF FRESHWATER SNAILS

Parasites are underestimated biotic factors in ecological research. Huge interest of parasitologists and immunologists did not find favor in the eyes of researchers involved in ecological studies. Freshwater ecosystems are rich in host-parasite associations. A very interesting group of organisms living in association with freshwater animals are trematodes. Out of more than 20,000 species almost 70% use freshwater snails as first intermediate hosts. Digenetic larvae can lead to alterations in the age structure of population of host snails by castration of adult animals, and mortality increase or acceleration of maturation of juvenile ones. Infected hosts can differ from non-infected ones in a behavior and also in a susceptibility to environmental conditions. These changes may alter the size or density of the snail-host population. Research on natural infection of Lymnaea stagnalis and Planorbarius corneus by trematode larvae was conducted. The snails were used also for thermal experiments. The main aim of this study was to investigate changes in natural infestation of snails, and to find the correlation between the invasion of pathogens and thermal preferences of infected hosts. We examined nearly 12,000 individuals. The changes of parasites’ prevalence in snails’ populations depended on season. Studies on thermal behavior of snails establish that both: parasite species and parasite stage affect the thermal preferences of hosts. The behavioral fever of individuals exposed to bacterial or fungal pyrogens were also observed. The results can lead to the assumption that the temperature is an important factor in seasonal changes of parasites’ prevalence in populations of studied snail species. The decrease in number of infected snails occurring in the shore-zone of lakes has been associated both - with increased snail mortality, and with a change in the thermal preferences of hosts.

O7

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MACROZOOBENTHOS OF TEMPERATE SHALLOW LAKES AGAINST A BACKGROUND OF SELECTED ABIOTIC PARAMETERS OF WATER AND BOTTOM SEDIMENTS

Shallow lakes differ in many respects from deep ones, mainly as a consequence of light reaching the bottom and the lack of constant water column stratification in the former group, resulting in a higher influence of the processes occurring at a sediment-water interface upon lake functioning. Therefore bottom fauna is an essential part of shallow lake ecosystems. The aim of the present research was to characterize macrozoobenthos structure as well as some abiotic parameters of water (transparency, light attenuation, temperature, conductivity, pH, oxygen concentration) and bottom sediments (water and organic mater content, sediment oxygen demand, particle-size composition) in Central European, low-land, shallow, eutrophic lakes. Thirteen lakes were chosen for the study, including five macrophyte-dominated and eight phytoplankton-dominated ones. The latter group was further divided into shallower (four lakes, 0.9-1.3 m deep) and deeper (four lakes, 2.2-3.8 m) lakes. The lakes were sampled monthly for three years. The total number of macrozoobenthic taxa was the highest in the macrophyte-dominated lakes, lower in the shallower phytoplankton-dominated lakes, and clearly the lowest in the deeper phytoplankton-dominated lakes. The density and biomass of macrozoobenthos in the macrophyte-dominated lakes were higher than in those dominated by phytoplankton. In the latter, the abundance of bottom fauna was surprisingly low and did not differ between the shallower and deeper lakes. The amount of light reaching the lake bottom had the strongest impact upon the structure of bottom fauna. The results suggest that in shallow lakes with phytoplankton domination even small differences in depth (ca.1-2 m) can cause some pronounced changes in their abiotic environment and macrozoobenthos structure. This new finding may be of a high practical value, as it can explain different results of restoration measures taken in seemingly similar lakes.

SS10

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IMPACT OF LAND-USE DISTURBANCES ON STREAM BIODIVERSITY ACROSS GEOGRAPHIC LANDSCAPES

One major question for land-use disturbance impact on biodiversity is how big an effect size there is from each type of disturbances across geographic regions. Documenting biodiversity loss, diagnosing causes, and finding solutions are a challenge. Few studies have compared the response of bioindicators to different types of land-use disturbances across geographic landscapes. We investigated the relationships of land-use, stream conditions, and benthic diversity across three geographic regions: the Chilliwack River (BC, Canada), the East River (south China), and the Colorado River (Texas, USA). We analyzed and determined the impacts of different land-use disturbances (forest harvesting, farmland change, and urbanization) on benthic biodiversity. We used total impervious area (TIA, % of total urban/rural areas within a catchment) or forest harvesting history to measure land-use disturbances. Using partial least squares projection to latent structures (PLS) modeling, we assessed relationships between multiple environmental variables and benthic communities. PLS models indicated that in the Chilliwack River observed benthic diversity and community biomass at previously logged sites were significantly lower than predicted. A measurable legacy of forest harvesting impacts on invertebrate diversity was detected up to 40 years after logging at a catchment-scale. In the East River, TIA was negatively related to The East River water quality index (ERWQI). Benthic taxon richness and relative abundance were influenced negatively by TIA and positively by ERWQI. Land-use disturbances severely degraded ecosystem integrity, and reduced aquatic biodiversity in the East River. Results of the Colorado River tributary sites revealed negative relationships between TIA and bioindicators (macroinvertebrate and diatom indices). Environmental indicators (water quality, sediment quality, and physical integrity) indicated a strong impact of land-use disturbance through urbanization on stream ecosystems. Our studies across geographic regions revealed that landscape indicators incorporating historical land-use offer promise for assessing and predicting biodiversity status in riverine landscapes.

SS1

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RECOVERY OF BACTERIA FROM DRY RIVER SEDIMENTS AFTER A PERIOD OF SIMULATED AND NATURAL DROUGHT

Sediment bacteria are very dynamic in the mineralization of organic matter and significantly contribute to C flux. Water scarcity represents a limiting factor for the microbial communities associated to temporary river sediments. Bacterial activity decreases, nearly ceasing, when sediments get dry, although prokaryotes are able to survive for long period of drought by adopting specific strategies. However, the capacity of bacterial communities to recover their functional properties after rewetting has been scarcely investigated. Recently two European Projects (TempQsim - FP5 and MIRAGE - FP7), have been devoted to the study of intermittent rivers. In this frame we investigated the capacity of sediment bacteria to recover their activities after periods of drought and the effects on species composition. To achieve this goal we utilised laboratory experiments where natural sediments were incubated under controlled conditions. The first microcosm experiment was run utilising artificially dried sediments collected in four temporary rivers located in the Mediterranean area (Italy, Greek, Portugal). Successively we had the opportunity to test the recovery of the microbial community in dry sediment from a temporary river in southern Italy after it remained emerged for several weeks under summer conditions. We observed a prompt recovery of the microbial community metabolic properties (bacterial C production, respiration, extracellular enzymatic activities) and changes in the community composition (FISH). These results are a further confirmation of the capacity of prokaryotic organisms to survive in adverse conditions and to promptly reactivate their functions with several ecological implications.

P00

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THE INFLUENCE OF SOME ENVIRONMENTAL VARIABLES ON THE EPHEMEROPTERA, PLECOPTERA AND TRICHOPTERA ASSEMBLAGES STRUCTURE AND DIVERSITY – A ROMANIAN CARPATHIANS BASIN CASE STUDY

The study presents the description of the structure and diversity analysis of Plecoptera, Ephemeroptera and Trichoptera larvae communities of the Vișeu Basin (1606 km2) in correlation with biotope characteristics. The results are based on quantitative benthic macroinvertebrates and EPT qualitative samples of 29 stations of the reference zone. The EPT community's diversity is expressed through Menhinik and Simpson indexes. The assessed biotope variables were: altitude, slope, riverbed width, depth, substratum, pools diversity, riffles, runs and bends, bank vegetation, channel modification, riverine land use. 24 mayfly, 21 stonefly and 30 caddisfly species were identified. The mayfly and stonefly communities present the highest diversity in Ruscova River, lower Vaser River and upper Vișeu River. The caddisfly communities present high diversity in Frumușeaua Basin, upper Vișeu River and Ruscova Basin. The Kruskal Wallis ANOVA non-parametric test and correspondence analysis (CA) reveal that mayflies and stoneflies high diversity is conditioned by the lithologic substrate dominance, ligneous riverine vegetation presence and banks natural dynamic. The low mayflies, stonefies and caddisflies diversity is associated with embanked without vegetation banks and coarse sand dominant substrate sectors. Pearson correlation reveal that the EPT diversity not correlate significantly with river bed depth and width. Mathematical models were developed to forecast the EPT communities dynamic (as river ecological status indicator) in the conditions of the biotope variables changing induced by human activities, and to be useful for watershed management. The study highlight that the EPT community's structure and diversity are conditioned by the riparian vegetation type, bank line dynamics, type of substratum, conditions affected by water works.

Author Index

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Y

Z