BioFresh Newsletter

ISSUE No. 4

In this Issue

BioFresh enters 2012!

Welcome to the first BioFresh Newsletter of 2012! In this issue, we will have a short insight into the most recent BioFresh scientific papers that have been published in several acknowledged journals. UPS and IRD adressed the scientific question if the introduction of non-native species affects biodiversity patterns. The results were published in the acclaimed PNAS journal. Also, IRD led a global scale paper on global origins and distribution of freshwater endemic fishes, which was published in Global Ecology and Biogeography.

IUCN published two papers: the first one in Conservation Letters on how bias in conversation research for freshwater species has implications on the investment of conservation and environmental decision planning. The second paper refers to one of the important tasks led by IUCN in the BioFresh project, which is the identification of Key Biodiversity Areas (KBA) for freshwater species. The first results have been published in Biological Conservation.

BioFresh partners have also been active in its policy and communication activities. In the summer of 2011, an online survey was carried out about stakeholders´ perception of the freshwater biodiversity profile in policy-making. The results are now available.

IUCN together with the DG Environment published the Red Lists of two European freshwater taxa groups. The result is alarming: freshwater mollusks and fish are the most threatened taxanomic groups at European level.

Our annual meeting will be held from 27th to 30th of this month at the historic Merton College in Oxford. BioFresh partners will have the opportunity to discuss the progress and future of the project. In addition, we will discuss how to communicate BioFresh´s scientific results to the public.

This leads me to our last point: we would like to draw your attention to the latest BioFresh cutting edge animation "Water lives...", produced in cooperation with several BioFresh partners. This initiative marks the collaboration between artists, scientists and policy makers in an effort to engage the public with science and environmental policies. This animation communicates beautifully and artistically the largely unknown or hidden life of freshwater biodiversity which sustains our planet.

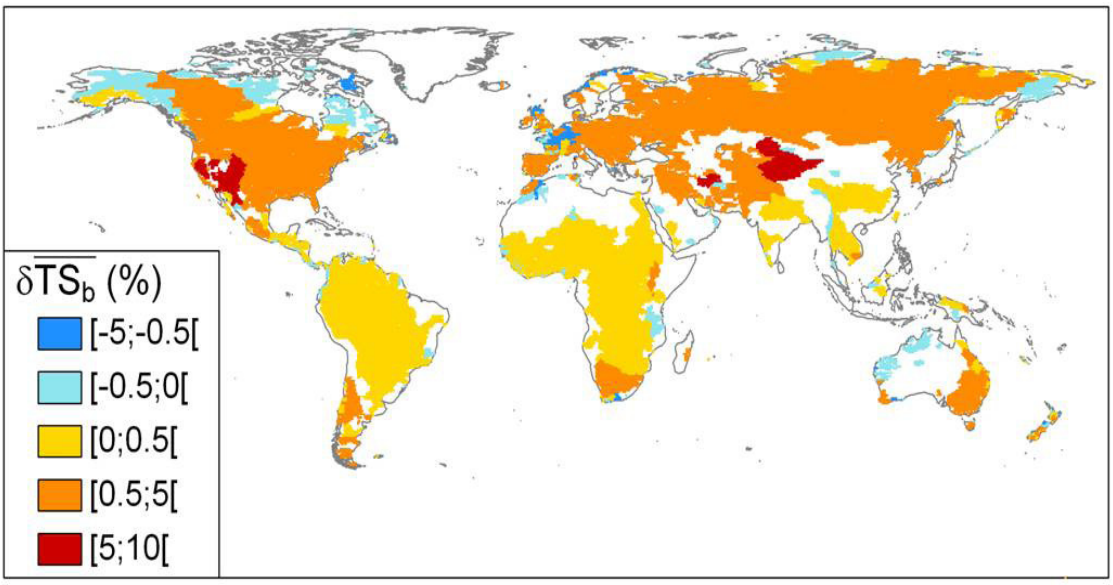
It is a creative start into spring 2012!

Best regards,

Carla Pinho
BioFresh Coordination Team

BioFresh in PNAS

Are non-native species responsible for a global homogenization of the freshwater fish fauna?



Current homogenization levels of the world fish fauna. Positive values indicate a homogenization and negative values a differentiation. Map: Sebastien Brosse

A recent BioFresh paper from UPS (Toulouse) and IRD (Paris) measured how non-native species introduction, combined with the extirpation of native species, affects biodiversity patterns, notably by increasing the similarity among species assemblages. This biodiversity change, called taxonomic homogenization, has been assessed for freshwater fishes, at global and regional (i.e. biogeographic realm) scales using a data matrix describing fish assemblages in more than 1000 river basins dispersed throughout the world.

This paper shows that the current homogenization of the freshwater fish faunas is still low at the world scale (0.5%) but reaches substantial levels (up to 10%) in some highly invaded river basins from the Nearctic and Palearctic realms. In these realms experiencing high changes, non-native species introductions are the main driver of taxonomic homogenization. Species extirpations, on the contrary, hardly affected taxonomic homogenization patterns, mainly because species extirpations are still rare at the basin scale.

These results suggest that the so called "Homogocene era", characterized by a planet where all, previously independent regions lose their taxonomic distinctiveness and share a common and uniform pool of species, is not yet the case for freshwater fish fauna at the worldwide scale. However, the apparent congruence between strong homogenization areas, and known biodiversity and invasion hotspots underlines the need for further understanding of the ecological consequences of homogenization processes.

Reference: *Villeger S., Blanchet S., Beauchard O., Oberdorff T. & Brosse S. 2011. Homogenization patterns of the world's freshwater fish faunas. Proceedings of the National Academy of Sciences of the United States of America. 108: 18003-18008.*

➲ brosse@univ-tlse3.fr

➲ villeger@univ-tlse3.fr

Sebastien Brosse, UPS

BioFresh Paper in Global Ecology and Biogeography

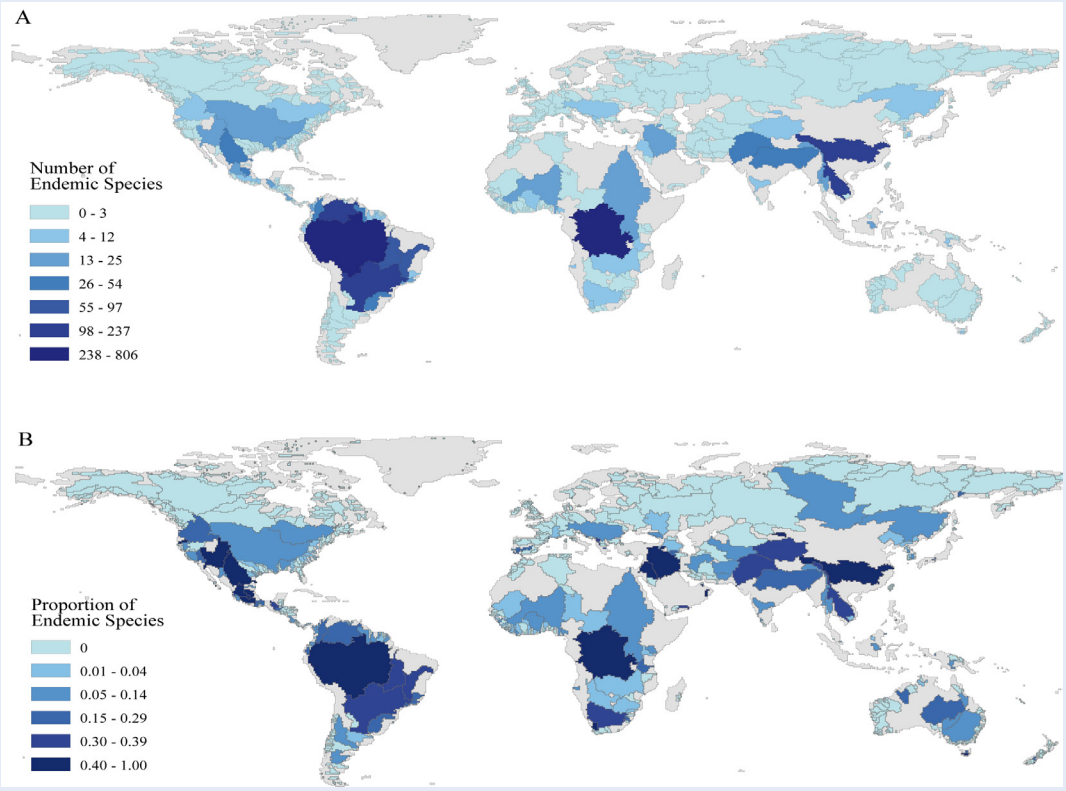
Planning for change: the origin, distribution and conservation of endemic fish species

A newly published paper from BioFresh partners led by IRD in the journal *Global Ecology and Biogeography* explores the global origins and distribution of freshwater fish endemism using a global database of species occurrence on drainage basins, combined with environmental, historical and biological data. The study applies an island biogeography framework to river drainage basins and highlight evolutionary mechanisms producing two kinds of endemism: neo-endemism, arising from within-drainage cladogenetic speciation and paleo-endemism, arising from species range contraction or anagenetic speciation. The study shows that these two types of endemism are distributed differently across space and taxonomic lineages. As a result of radiative speciation, the first endemism category (neo-endemism) contributes to overall species richness of drainage basins and is occurring mostly in large drainage basins that have experienced a stable climatic history, and belongs to taxonomic families having poor dispersal abilities. The second category (paleo-endemism), not directly contributing to drainage basin richness, occurs in highly isolated places (like islands or peninsulas) and mostly belongs to families that originated in the sea. The non-random spatial and taxonomic distribution of neo-endemism and paleo-endemism sharply reflects the role of evolutionary processes and provides a way to identify areas of high conservation interest based on their high present and future diversification potential. These findings add to the growing discussion on how evolutionary processes can be incorporated into conservation planning and suggest that disentangling paleo-endemic from neo-endemic species when mapping biodiversity hotspots may be an interesting prospect for future conservation practices.

Reference: *Tedesco, P. A., Leprieur, F., Hugueny, B., Brosse, S., Dürr, H. H., Beauchard, O., Busson, F. and Oberdorff, T. (2012), Patterns and processes of global riverine fish endemism. Global Ecology and Biogeography. doi: 10.1111/j.1466-8238.2011.00749.x*

➲ pablo.tedesco@mnhn.fr

Pablo Tedesco, IRD



Global freshwater fish endemism by river drainage basin. Map: Pablo Tedesco

BioFresh in a special issue of Hydrobiologia

Vulnerability of biota in mediterranean streams to climate change

A paper from the UB BioFresh partner and the University of California is under review in a special issue of *Hydrobiologia* on mediterranean climate streams. It focuses on the likely responses of freshwater biota to expected climate changes in mediterranean climate streams, and the conservation and management challenges we face ahead.

Rivers and streams of mediterranean climate regions worldwide host many unique species and are under a great deal of stress from the high level of human development. It is expected that the effects of climate change will be particularly severe in these regions. Some changes have already been observed, and include increased annual average air temperatures, decreased annual average precipitation, hydrologic alterations, and increased frequency, intensity and duration of extreme events, such as floods, droughts, and fires.

Mediterranean biota will likely be displaced towards higher elevations and the poles, while communities will be further homogenized and undergo high extinction rates. Other anthropogenic disturbances can exacerbate impacts of climate change, such as the increase of agricultural or industrial practices or human population. The resilience and resistance of mediterranean biota confers natural mechanisms to cope with harsh environmental changes, but they might not be enough for such a vulnerable and unique biota facing somehow unpredictable and intense changes. This work is an important achievement for BioFresh aims, as it evidences mediterranean climate streams need particular attention regarding future environmental changes, particularly from scientists, policy makers and water managers. In addition, by being involved in the special issue of Hydrobiologia the UB team was able to exchange contact and knowledge from other researchers focused on mediterranean freshwaters, which will be fruitful for gathering datasets for freshwater biota of such biodiversity hotspots.

➲ afflipe@ub.edu

Ana Filipa Filipe & Núria Bonada, UB

Mediterranean stream near Granada.

Photo: Núria Bonada

BioFresh in Conservation Letters

Implications of bias in conservation research and investment for freshwater species.

This paper, recently published in *Conservation Letters* (with assistance from the BioFresh project), demonstrates the urgent need to increase our knowledge of freshwater biodiversity in response to the ever increasing pressures on freshwater ecosystems. Without such knowledge freshwater ecosystems and their associated species will continue to be largely neglected in conservation planning and environmental development decisions.

Our knowledge of freshwater biodiversity is fragmented due to bias in conservation research toward primarily terrestrial or charismatic taxonomic groups. In this paper we utilise the most comprehensive assessment of freshwater biodiversity for an entire continent (Africa) to examine the implications of this shortfall. We analysed the range maps of 4,203 freshwater species (fishes, molluscs, dragonflies and damselflies, and crabs) and 3,521 bird, mammal, and amphibian species. Results indicate that groups that have been the focus of most conservation research (birds, mammals and amphibians) are poor surrogates for patterns of both richness and threat for many freshwater groups, and that the existing protected area network underrepresents freshwater species. Areas of highest species richness and threat are congruent with areas where reliance on ecosystem services by humans and pressures placed on freshwater ecosystems are high.

These results have implications for targets to reduce biodiversity loss and safeguard associated ecosystem services on which millions of people depend globally.

The paper is published as: *William R. T. Darwall, Robert A. Holland, Kevin G. Smith, David Allen, Emma G. E. Brooks, Vineet Katarya, Caroline M. Pollock, Yichuan Shi, Viola Clausnitzer, Neil Cumberlidge, Annabelle Cuttelod, Klaas-Douwe B. Dijkstra, Mame D. Diop, Nieves García, Mary B. Seddon, Paul H. Skelton, Jos Snoeks, Denis Tweddle, Jean-Christophe Vié (2011). Implications of bias in conservation research and investment for freshwater species. Conservation Letters. 4(6): 474-482.*

➲ William.DARWALL@iucn.org

William Darwall, IUCN

Afrithelphusa monodosa

Photo: Piotr Naskrecki

BioFresh in Biological Conservation

Freshwater Key Biodiversity Areas and conservation in Africa

In the same year that Darwin published "On the Origin of Species", the explorer Livingston first encountered Lake Nyasa/Malawi in Eastern Africa. These two seemingly unrelated events would become inextricably linked as over the coming years scientists began to realise the rich evolutionary cauldron that waters of the African Great Lakes represent. Today the fish of the region continue to inspire researchers from around the world, and are one of the key examples of how Darwin's theories can lead to an explosion of species. However, the story of the discovery of this rich biological heritage goes hand in hand with its exploitation, and today the region supports over 200 million people who rely on freshwater animals and plants for food and livelihoods. Faced with the increasing pressures that such a population brings the biodiversity of the region is threatened as never before.

The collision of the human and natural worlds that we see in the Great Lakes region raises a number of questions about how we can manage areas for competing interests and, given the limited funding available for conservation, how best to prioritise conservation action between areas. Over the last 12 months, as part of the BioFresh project, the IUCN Freshwater Biodiversity Unit has been developing a method to identify Key Biodiversity Areas (KBAs) for freshwater species. The final method has now been published in the Journal of Biological Conservation. KBAs are areas considered to be the most important sites globally for species conservation based on criteria relating to the risk that species will be lost in future (Vulnerability) and the spatial options for saving the species in other parts of the world if a particular site is lost (Irreplaceability).

Having developed the criteria we were given an excellent opportunity to translate our research into practical action when we were invited by the Critical Ecosystem Partnership Fund (CEPF) and the MacArthur Foundation to identify priority areas for guiding significant conservation investment of funds in the African Great Lakes region. Using the freshwater KBA criteria developed through BioFresh we identified priority catchments and examined coverage of freshwater species within the existing protected area network. Using the criteria of Vulnerability and Irreplaceability all the major lakes in the region, together with many of the adjoining catchments, were identified as priorities for investment. In many cases sites qualified under both the Vulnerability and Irreplaceability criteria emphasising the high risk of extinction to the species present, and reflecting the uniqueness of a set of species found nowhere else on earth. Freshwater species now feature as explicit targets for conservation investment in schemes run by these funding initiatives, and as Darwin's work continues to inspire scientists let us hope that some of the best examples of the beauty that evolution can bring into the world will continue to survive, support the livelihoods of millions of people, and inspire future generations.

This methodology will be applied through workpackage 7 of BioFresh to: i) identify important sites for focus on conservation of freshwater biodiversity in Europe and on the wider global scale (where data permit), and; ii) evaluate the degree of effective protection provided to these sites in Europe (in particular by the Natura 2000 network).

The paper is published as: *Holland, R.A., Darwall, W.R.T., and Smith, K.G. Conservation priorities for freshwater biodiversity: The Key Biodiversity Area approach refined and tested for continental Africa. Biol. Conserv. (2012), doi:10.1016/j.biocon.2012.01.016*

Nothobranchius furzeri
Photo: Roger Bills

➲ William.DARWALL@iucn.org

William Darwall, IUCN

BioFresh work progress

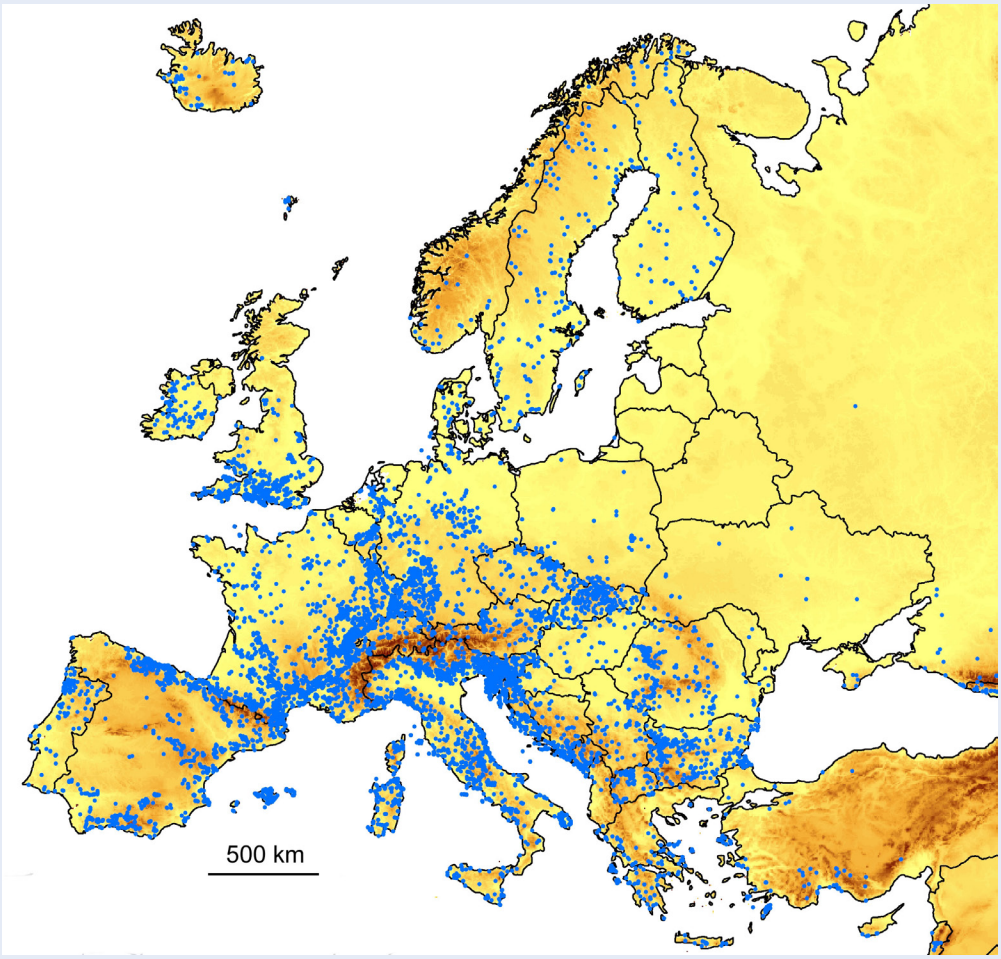
Filling the gap: distribution database of European groundwater crustaceans

Groundwater species distribution has been increasingly documented over the last 20 years. However, a crucial effort is still needed for filling the gap in knowledge between subsurface and surface freshwater biodiversity. Indeed, several invertebrate groups, especially within the crustaceans, attain their highest richness in groundwater. In Europe, groundwater obligate species of crustaceans represent more than 50 % of the total number of crustacean species known from freshwater in this continent. Within the framework of BioFresh, a group of researchers (1) is assembling one of the largest collections of occurrences of obligate groundwater crustaceans. Up to now, this database stores approximately 20,000 georeferenced occurrences for 1,500 species and the work is still in progress. Taxonomic groups include macro-crustaceans belonging to the Amphipoda and Isopoda as well as micro-crustaceans such as the Harpacticoida, Cyclopoida and Ostracoda. Past (i.e. referred to as the last glacial maximum) and present-day environmental data are concomitantly being extracted from multiple sources to determine the relative influence of recent history, energy and spatial heterogeneity on the distribution patterns of groundwater biodiversity in Europe. Species distribution patterns will also be used to suggest relevant conservation strategies. Information about the European groundwater crustacean database including spatial coverage and taxonomic extent will be released into the BioFresh metadatabase this summer.

(1) J.-F. Cornu, D. Eme, C. Fišer, D. Galassi, F. Malard, P. Marmonier, F. Stoch, M. Zagmajster.

➲ florian.malard@univ-lyon1.fr

Florian Malard, UCBL



Current state of the European groundwater crustacean database (January, 2012). Blue dots indicate species occurrences.

Map: Florian Malard

BioFresh & Red List

European Red List puts freshwater species into spotlight

No other ecological group of species is as threatened as freshwater taxa. The European Commission (DG Environment) and IUCN have produced Red Lists of several major European taxa groups and expectedly, two freshwater goups are the most threatened. At the European scale, Cuttelod et al., (2011) consider at least 44% of the freshwater mollusc species (373 species) as threatened, with at least 12.8% of them being critically endangered, 10.5% endangered and 20.4% vulnerable. In addition, 23 of the 109 critically endangered species are considered possibly extinct and five species are listed as already extinct. Freyhof & Brooks (2011) consider at least 37% of Europe's freshwater fishes as threatened at a European scale, and 39% are threatened at the EU27 level. At the EU27 level, 12.6% of the freshwater fishes are critically endangered, 11.3% endangered and 15.5% vulnerable. 13 species are listed as already extinct. These are the highest threat levels of any major taxonomic group assessed to date for Europe. This assessment clearly highlights the insufficient conservation of freshwater biodiversity in Europe.

The Red List is available online.

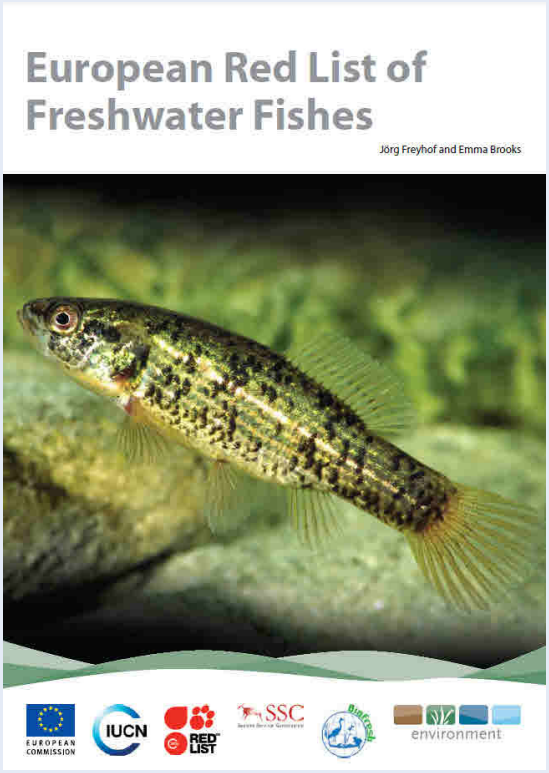
➲ freyhof@igb-berlin.de

➲ http://ec.europa.eu/environment/nature/conservation/species/redlist/downloads/European_freshwater_fishes.pdf

Jörg Freyhof, IGB

Most threatened animals in Europe are freshwater snails.

Photo: Jörg Freyhof



European Red List of Freshwater Fishes.

BioFresh & communication

BioFresh survey on freshwater biodiversity in policy-making

Between June and August 2011, BioFresh team members from the Ecologic Institute and Oxford University School of Geography and the Environment undertook an online survey of stakeholders' opinion of the status and policy profile of freshwater biodiversity in policy-making and of various communication channels that link science and policy. Fifty-two stakeholders from different sectors/policy areas who have been active primarily on water and biodiversity issues in the past years participated in the survey. A significant proportion of respondents belonged to national government agencies (29%), international NGOs (15%) and universities/research institutes (13%). Some of the main insights gathered were:

Perceptions of policy relevance of freshwater biodiversity

48% of respondents view freshwater biodiversity as a recognised policy issue but given little attention, suggesting that freshwater biodiversity is not yet a well established policy issue. The most promising ways to raise the policy profile of freshwater biodiversity are suggested to be: the provision of evidence on the value of freshwater biodiversity (especially by recognition and demonstration of ecosystem services), perception-based work targeting the policy communities and the general public as well as better integration of freshwater biodiversity in the implementation of other policies (esp. Water Framework Directive, agri-environmental policies and biodiversity (conservation) policies).

Relevance of policy-orientated science questions generated by BioFresh project

Certain policy-orientated science questions generated by the BioFresh consortium were highlighted by survey respondents as highly policy-relevant. These questions encompassed the linking of ecosystem function and ecosystem services, multi-scale conservation planning and freshwater biodiversity and ecosystem response to climate change. Conversely, questions regarding the formation and consequences of novel freshwater ecosystems, the value of eco-informatics and the framing and perception of freshwater biodiversity were rated as of limited/less policy-relevance. It could be argued that these important topics within the scientific community are relatively new concepts for the policy communities. Awareness-raising efforts on these topics remain important because of their potential value to policy decisions.

Channels of communication between science and policy

Efforts to disseminate scientific information to policy-relevant communities should concentrate on communication channels which are considered as most effective. These are, according to respondents' ratings, face-to-face briefings, policy briefs, and conferences/workshops, and to a lesser extent newspapers/magazine articles. Further work on the value of new media, especially blog posts and YouTube style videos, is also recommended.

➲ eleftheria.kampa@ecologic.eu

➲ http://www.freshwaterbiodiversity.eu/index.php/results.html

Eleftheria Kampa &
Gerardo Anzaldua,
Ecologic Institute

BioFresh - annual meeting in Oxford

The annual BioFresh project meeting will take place from 27 to 30th March 2012 at Merton College, Oxford. Set amongst cobbled back-streets, Merton is amongst the oldest Oxford colleges, founded in 1264. BioFresh partners will participate in plenary discussions and presentations about the progress and future of BioFresh and hold workpackage and cross-cutting theme meetings.
The functionality of the portal and its linkages to the scientific and dissemination workpackges will be key issues of the meeting. Delegates will stay within historic college buildings, eat meals in the great hall and have the opportunity to explore Oxford on guided tours.

➲ http://www.merton.ox.ac.uk/

➲ http://www.dailyinfo.co.uk/guide/oxintro.html

The Planet under Pressure meeting and the BioFresh "speak for the sturgeon" installation

3D Sturgen project for the "Planet Under Pressure" Conference.
Graphic: Quadraflex

The Planet under Pressure conference will take place in London from 26 to 29th March 2012. The conference seeks to bring together stakeholders from environmental science, policy and a wider society to form innovative new partnerships and solutions for global sustainability. A number of BioFresh partners will take part in the conference, including Klement Tockner who will participate in a session entitled "Managing river corridors under the prospects of climate change: a challenge considering conflicting ecosystem services" on Tuesday 27th.

A collaborative project between partners at IGB and Oxford University will install an exciting new art-science installation at the conference: a life-size 3D projection of a sturgeon. Conference participants will be invited to "speak for the sturgeon", giving it a "voice" via a touch pad or twitter. Submitted words and phrases will swirl around the animated fish, creating a cloud of information. The installation reflects the emerging role of creative collaborations between arts and sciences in developing innovative solutions and novel partnerships for the future.

In the context of global conferences such as Rio +20 asking individuals to imagine a sustainable "future we want", the installation is designed to prompt the question: "do we dream of a world where fantastic life forms continue to provide inspiration, awe and wonder, and where engagements with nature can continue to enrich lives and culture?" On another level it will challenge policy makers to reflect on the principle of "stakeholder participation" in their policy formulation. The importance of this principle in giving voice to marginalised groups is now firmly established in international policy but could this principle extend to non-human life forms such as the sturgeon? Is Planet Earth theirs as well as ours?

➲ paul.jepson@ouce.ox.ac.uk

➲ http://www.planetunderpressure2012.net/

Paul Jepson, UOXF.AC

New BioFresh animation

BioFresh animation "Water Lives..."

The second BioFresh animation "Water Lives…" given a public release on 19th March and will be shown at the Oxford meeting. "Water Lives…" communicates the idea that freshwater is more than an inert resource, instead a living, dynamic system inhabited by beautiful, curious organisms largely unseen by the naked eye. It highlights the need to rethink our human-centric approach to water governance and appreciate the value of freshwater biodiversity if we are to assure we keep within the system boundaries of our planet. The curious and otherworldly physical form of many freshwater organisms provides abundant artistic inspiration for incorporating into an animation. Produced by Rob St. John and Paul Jepson at the Oxford University School for Geography and the Environment, the animation is conceptual and cutting edge, emphasising the unusual forms of freshwater organisms in a 6 minute piece animated by Scottish artist **Adam Proctor.** It is sound-tracked by a specially composed piece of music by Tommy Perman from Scottish, BAFTA award winning arts collective **FOUND** which samples a series of haiku about freshwater ecosystems written by acclaimed environmental poet **John Barlow**. The content of both the animation and haiku was influenced by close consultation with BioFresh freshwater scientists from University College London (Rick Batarbee) and the University of Barcelona (Ana Filipa Filipe) to define the key aspects of the scientific messages to be communicated.

➲ paul.jepson@ouce.ox.ac.uk

➲ http://biofreshblog.com/2012/03/19/water-lives-new-biofresh-animation/

Paul Jepson, UOXF.AC

Impressum

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➲ www.freshwaterbiodiversity.eu

➲ responsible for the content:
Leibniz-Institute of Freshwater Ecology and Inland Fisheries
Prof. Dr. Klement Tockner
tockner@igb-berlin.de
Dr. Jörg Freyhof
freyhof@igb-berlin.de

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