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Manuscript on Predictive Freshwater Biodiversity Models (M51)

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Partners:	RBINS, Royal Belgian Institute of Natural Sciences, Belgium
	BOKU, Universität für Bodenkultur Wien, Austria
	ICLARM, International Center for Living Aquatic Resources Management, Malaysia
	IRD, Institut de Recherche pour le Développement, France
	UDE, Universität Duisburg-Essen, Germany
	IUCN, International Union for Conservation of Nature, Switzerland
	UOXF.AC, Oxford University, UK
	UB, Universitat de Barcelona, Spain
	UFZ, Helmholtz Zentrum für Umweltforschung, Germany
	UCL, University College of London, UK
	UCBL, Université Claude Bernard - Lyon 1, France
	UPS, Université Paul Sabatier- Toulouse 3, France
	ECOLOGIC, Ecologic GmbH Institut für Internationale und Europäische Umweltpolitik, Germany
	EC-ERC, Commission of the European Communities - Directorate General Joint Research Centre, Italy
	UD, University of Debrecin, Hungary
	NRM, Naturhistoriska riksmuseet, Sweden
	FIN, FishBase Information and Research Group, Inc.

BIOFRESH

Biodiversity of Freshwater Ecosystems: Status, Trends, Pressures, and Conservation Priorities

Project no. 226874

Large scale collaborative project

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PP	Restricted to other programme participants (including the Commission Services)	
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CO	Confidential, only for members of the consortium (including the Commission Services)	

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In case the report consists of the delivery of materials (guidelines, manuscripts, etc)

Delivery name	Delivery file name	From Partner	To Partner
A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates	Tedesco et al. (2013)	IRD	IGB

Introduction

Aim of the Deliverable

In light of future climate change, new predictive approaches quantifying true extinction rates (i.e. number of extinctions per unit time) are now critically needed to start organizing sound, science-based conservation actions, as the potential delays between being "committed to extinction" and becoming extinct (i.e. the so called "relaxation time") constitute a window of opportunity to prevent these potential extinctions.

Summary of the manuscript*

Results of this paper focusing on freshwater fishes extinction rates in rivers strongly contrasts with previous alarming predictions of huge future extinctions due to on-going climate change. More importantly the study shows that current anthropogenic threats generate extinction rates in rivers far greater than natural and climate change expected extinction rates, highlighting the need for urgent and effective conservation measures to reduce the impacts of present-day anthropogenic drivers of riverine fish extinctions.

Current models estimating impact of global climate change induced habitat loss on biodiversity usually project high percentages of species "committed to extinction" on an uncertain timescale. Reducing this uncertainty is particularly important for conservationists as the lag time between becoming "committed to extinction" and going extinct may range from decades to many millennia and constitutes a window of opportunity to prevent these potential extinctions. The present paper shows that this limitation can be overcome by using an empirically derived “extinction-area” curve for freshwater fishes and predicts that only few (7%) river basins worldwide (over more than 90,000 rivers analysed) should suffer an increase in natural extinction rates from area loss due to climate change by 2090. Rivers projected to experience an increase in extinction rates are located in regions where semi-arid and Mediterranean climates currently occur (i.e. southwest USA, Mexico, southern America, north-east Brazil, northern and southern Africa, southern Europe, western and middle Asia, Australia). Area loss due to climate change in these drainage basins will hasten natural extinction rates by only 1.24 times (median value). Converting these rates in real numbers for a subset of 1010 river basins where species lists are known, the authors predict the extinction of 1 to 5 species by 2090 in no more than 20 rivers worldwide. Furthermore, based on well documented fish extinctions from Central and North American rivers over the last century, the authors also show that recent extinction rates are, on average, 150 times greater than natural extinction rates and 130 times greater than projected extinction rates from habitat loss due to climate change.
To conclude there still is a chance to counteract actual and future fish species loss by preferentially focusing conservation actions on the other important human-driven threats generating on-going fish extinctions in rivers such as habitat degradation and fragmentation, overexploitation, eutrophication and introduction of non-native species.

*Other papers related to the deliverable have been published by IRD and UPS within BioFresh:

Dias SM, Jézéquel C, Tedesco TA, Hugueny B, Beauchard O, Brosse S & T Oberdorff). River fragmentation by dams lead to extinction of resident and migratory fish species. (In prep.).

Lauzeral C, Leprieur F, Beauchard O, Duron Q, Oberdorff T & S Brosse (2011). Identifying climatic niche shifts using coarse-grained occurrence data: a test with non-native freshwater fish. ***Global Ecology and Biogeography*** 20, 407-414.

Pereira HM, Leadley PW, Proença V, Alkemade R, Scharlemann JPW, Frernandez-Manjarrés JF, Araujo MB, Balvanera P, Biggs R, Cheung WWL, Chini L, Cooper HD, Gilman ER, Guénette S, Hurtt GC, Huntington HP, Mace GM, Oberdorff T, Revenga C, Rodrigues P, Scholes RJ, Sumaila UR, Walpole M (2010). Scenarios for global biodiversity in the 21st century. ***Science*** 330, 1496-1501.

Tisseuil C., Vrac M., Grenouillet G., Wade A., Gevrey M., Oberdorff T., Grodwohl JB, Lek S. (2012). Strengthening the link between hydro-climatic downscaling and species distribution modelling : Climate change impact on freshwater biodiversity. ***Science of the Total Environment*** 424, 193-201.

Toussaint A., Beauchard O., Oberdorff T., Brosse S & Villéger S. Historical assemblage distinctiveness and the introduction of widespread non-native species explain worldwide change in freshwater fish taxonomic dissimilarity. ***Global Ecology and Biogeography*** (In press).

Villéger S, Blanchet S, Beauchard O, Oberdorff T & S Brosse (2011). Current and future patterns of freshwater fish homogenization over the globe. ***Proccedings of the National Academy of Sciences*** 108, 18003-18008.

Villéger S, Blanchet S, Beauchard O, Oberdorff T & S Brosse (In Revision). From current distinctiveness to future homogeneization of the world's freshwater fish faunas. ***Diversity and Distributions***.