

## ***Interactive comment on “Illustrating a new approach to estimating potential reduction in fish species richness due to flow alteration on a global scale” by S. Yoshikawa et al.***

### **Anonymous Referee #3**

Received and published: 24 September 2013

The paper addresses the important issue of freshwater ecosystem decline at global scale by using two statistical models (one linear using mean river discharge and one non-linear using different flow components and geographic parameters). This paper highlights the fact that a simple linear relationship between fish species richness (FSR) and mean river flow is not sufficient to identify the decline in FSR caused by climate change. Indeed the second model captured more locations and the magnitude of FSR decline was higher such as in the north of Eurasia. However, the use of only 26 river basin mainly located in the north hemisphere might not be sufficient to be aggregated to global scale. Until now, relating ecological parameters from freshwater ecosystems

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to river discharge parameters has been poorly explored at the exception of Xenopoulos et al (2006) and few studies looked at environmental flow globally. However this paper did not seem to intend to improve actual global environmental flow models so I am not sure if environmental flow models should be described at all. This study aimed at finding which flow parameters other than mean discharge will be affecting FSR due to climate change. The paper uses two statistical model to relate FSR with river flow components. It uses one RCP scenario to study the impact of climate change and uses 11 AOGCMs as input in the hydrological CaMa-Flood model which was calibrated with 26 GRDC river discharge. The second statistical model captured higher rates of FSR reduction in more scattered places than the first statistical model. The results clearly show that reduction in FSR can go up to 50% reduction and more specifically due to higher winter flows, earlier spring flows and lower summer low flows in snowy regions. However, the level of uncertainty is high in terms of forcing data and physical model processes. The uncertainty due to climate variability and river discharge were considered by using only 15 years but maybe 30 years would be more appropriate to capture variability. The uncertainty caused by climate models (due to climate change) was covered by looking at the range of 11 AOGCMs. Finally, the uncertainty due to changes in forcing data was not considered as only one RCP scenario was used. The paper refers to biodiversity loss but maybe some more recent and specific literature exist. The possible positive impact of climate change on FSR might not be excluded as well. It was not clear what kind of GRDC data were used in term of level of flow alteration of rivers. Was the dataset based on pre-dam data (“natural” river flow). This paper does not consider anthropogenic flow alteration due to irrigation, dam and reservoirs and this might be an important parameter to consider before analysing climate change impact. Also, future changes in land use settings might be important to be included. In the discussion, other issues such as physical and chemical mechanisms are considered to be important for survival of freshwater ecosystems and river water temperature might be prevalent. It would be interesting to know how a “more careful selection of flow metrics” could be carried out. It is also important to consider that an increase in FSR can be cor-

related with increases in invasive exotic species and might not be a positive thing. The advantage of the hydrological CaMA-Flood model is that it runs on a daily basis and seem to simulate well river discharge. However, the use of this model at global scale might be too ambitious since land use and dam and reservoir module are not included. Finally, the figures A1 to A4 are not clear and their aggregation to continent level might be lead to misinterpreted outcome. The paper used a balanced writing between the different parts. The abstract is clear and the text is concise. The authors addressed important issues and brought innovation by relating FSR with other flow components spatially. The manuscript should include the previous minor comments for an improved version.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 7837, 2013.

## HESSD

10, C5143–C5145, 2013

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