Biogeosciences
Discussions

Open Access

BGD

Interactive comment

Interactive comment on "Minimum temperature and precipitation determine fish richness pattern in China's nature reserves" *by* Wende Chen et al.

Anonymous Referee #2

Received and published: 6 April 2018

General Comments

The authors collate fish diversity data in an attempt to test an array of competing hypothesis to explain geographical richness patterns. Models of fish richness patterns are constructed to test 1) the energy hypothesis, 2) the physiological tolerance hypothesis, 3) the climatic seasonality hypothesis, 4) and the habitat heterogeneity hypothesis. The authors approach suffers from several weaknesses, which I will attempt to identify and describe to help the authors as they improve their manuscript.

Each individual model is apparently designed to represent competing hypotheses and is fed with variety of environmental variables. However, the selection criteria and reasoning behind the array of variables used to represent and test among the different hypotheses is rather unclear. Several environmental variables used in models to rep-

resent different hypotheses are likely to be correlated. For example, mean annual temperature was one of several included in a model testing the energy hypothesis and minimum temperature included in a model testing the physiological tolerance hypothesis. Thus, relationship of the models constructed to the hypotheses being tested is unclear. Any unique expectations predicted by competing hypothesis are not articulated, thus, its hard to see how the authors can rigorously test several competing models to explain fish diversity patterns.

Furthermore, competing models were compared using r squared. However, higher r squared can be achieved in models by simply including more explanatory variables. Constructed models that test each hypothesis included differing numbers of variables, sometimes including additional quadratic terms, with seemingly little justified basis for doing so. R squared may not be an appropriate measure to choose among competing hypothesis. In sum, the authors statistical design does not seem capable of testing among the various hypotheses proposed to control fish richness patterns. In that sense, the presentation of this manuscript as a legitimate test of competing hypotheses to explain richness patterns might be reconsidered.

The methodological design also suffers from an apparent inability to account for the effect of sampling effort on species richness. It is well known that species richness increases with sampling effort. The authors claim that including area of reserve size as a co-variable can successfully account for potential sampling biases. The claim, however, is inadequate, as large reserves can be poorly sampled, and small reserves can be well-sampled. No mention or data on sampling effort are made obviously available in the main text. Again, the authors might reconsider their presentation of the data. Rather than a rigorous test of competing richness hypotheses, a more descriptive approach might be more appropriate.

In terms of style, often weak paragraph structure detracts from the authors' argumentation, or makes it unclear. Individual sentences within paragraphs tend to jump from one idea to another, often with apparently little relation. This makes is difficult for readers

to follow the argumentation and hides logical gaps in reasoning. Imprecise language also adds to overall confusion and leads to seemingly contradicting statements.

Judged on the statistical approach, a lack of rigorous control for sampling effort on richness, and unclear argumentation, this reader did not find the conclusions to be strong or convincing.

I hope the following specific comments can help the authors as they redraft their manuscript.

Specific Comments

Line 42 – 67 – The greater fraction of the introduction reads like a general overview of species diversity hypotheses. However, none of these are explicitly linked to the organisms and habitat being investigated, fish in wetlands. For example, in describing the energy availability (line 47) hypothesis author's mention kinetic and potential energy. Why? How does this relate to fish? If this is indeed important, its needs explanation. If not, it is distracting. In describing the physiological tolerance hypothesis (line 49-52) authors describe species tolerance to drought. It's not clear what this means, since fish live in water, they do not experience drought. If the authors wish to test among competing hypotheses, some unique predictions for each should hypothesis be articulated, and these should be explicitly linked to their study group, not described in general terms. Line 68-75 – What is the message of this paragraph? Each sentence introduces a completely new idea, none of which are adequately explored. . ..The separate ideas include: 1) Aquatic habitats are undersampled. 2) Aquatic habitats are disproportionately diverse. 3) Aquatic habitats are threatened. 4) Aquatic biodiversity is related to fishery productivity. 5) Understanding environmental determinants of aquatic biodiversity is important. The concluding statement (#4) that investigating environmental determinants of fish diversity is a worthwhile task, does not follow logically from the preceding sentences, which either describe generalisms about fish diversity, habitat disturbance or their relation to fisheries. Climate is not mentioned. Line 76 –

80 – Again, there seems to be little paragraph structure here. Each statement introduces a new topic 1) Sampling biases in fish studies. 2) Endemism in China's fish diversity. 3) Good "reliability" of fish sampling. 4) Methodological approach and questions. Furthermore, the first and third lines of this paragraph contradict each other. How can sampling in China be both biased towards lakes and rivers, and still "ample" and "reliable"? Please clarify. Line 76 – 77 – The link between sampling biases of fish richness studies towards lakes/rivers and application of results to fine-scale conservation management is unclear. What were the results of previous studies, and how were they applied to conservation-management issues? Line 92- 93 – If the authors exclude samples from wetlands and lakes, what is left to sample? This is highly confusing. Furthermore, its not clear how this contributes to maintaining consistency in habitat type. Line 93- 94 – The author's checked sampling protocols for fish. . .but after they check it what did they do with that information. What criteria were used to exclude or include? Line 96 – 97 – Fish richness is a function of sampling effort. Its not clear how this was corrected for. Line 101 – It's not clear how these environmental variables can distinguish between the various hypotheses. For example, mean annual temperature (used to test the energy availability hypotheses) is probably correlated with mean temperature of the coldest month (used to test the physiological tolerance hypothesis). Furthermore, the more variables included for testing each hypothesis, the larger the explained variance will be. Energy availability model includes 6 variables, physiological tolerance model includes 3 variables, and so on. Comparing the r squared values as a test of each hypothesis is unwise. Line 108 – Why is river density a good measure of habitat heterogeneity? This is not clear. Line 118 – If variables are obtained from original publications, these publications need to be cited. Line 122 – Confusingly written Line 128 – "some" environmental predictors? Please be more specific. Line 129 – AREA of the reserve will not make richness data among study sites comparable. A large reserve can be poorly sampled, and a small reserve can be well sampled. Rather, the authors need to also take into account the sampling intensity. Line 129 – "fixed" variables? Are the authors using mixed models? Line 132 – I don't understand

this. Line 133 – what distances? Line 141 – why were these latitudinal bands chosen? Line 148 – Why was precipitation squared also included? Adding precipitation squared has no logical basis that has been explained. Again, comparison of r squared values as a test of the various hypotheses is inadequate. The more variables one adds, the more variance explained. Line 152 – What is this "environmental model"? Line 172 – "Nature reserves with similar area"? Was this a selection criterion? Line 172 – 174 - It is stated that similar areas of the reserves "may diminish the sampling effect". This statement seems a bit disingenuous. It is unlikely that the area of the reserve can say something about the sampling intensity at which fish were sampled. A huge reserve can be poorly sampled, and a small reserve can be well sampled. Line 197 – 198 – For other faunas water plays a weak role? It would be good to see some citations backing this claim. Line 198 - 200 – The fact that water availability is vital for fish is a rather obvious statement. What exactly are the authors proposing here? Line 201- 202 – this selection criteria was not made clear in the methods. Line 203 – 204 – What is run-off volume? Why does small run-off volume lead to lower oxygen content? What has smaller run-off? Smaller than what? What's the comparison? Line 205 – 209 – Its not clear why the authors included a quadratic relationship between richness and precipitation. The interpretation of geographical richness patterns through turbidity in mountainous regions is also not convincing. Line 218 – The authors are introducing yet another hypothesis to explain their results? "Tropical niche conservatism". Line 219 – 222 – Increased niche specialization in tropical regions is not equivalent to the tropical niche conservatism.

Technical Comments

Line 41 – "those related"

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2017-389, 2018.