

Comparative ecology of freshwater fish communities in Vindhya-Satpura Rift valley and eastern Himalayan foothills in India

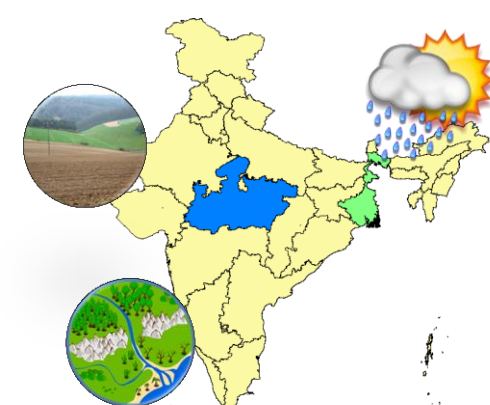
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INTRODUCTION

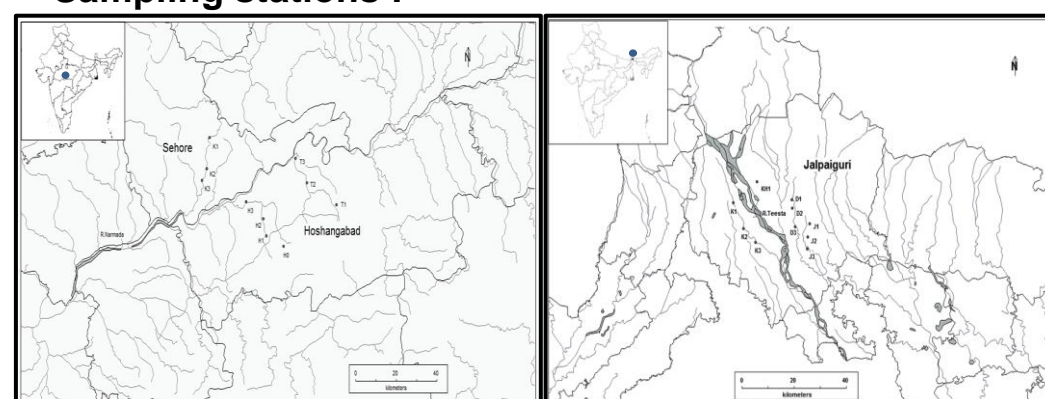
Freshwater fish communities are controlled by a host of biotic and abiotic factors. In this study the role of these factors are dissected to examine their influence on structuring these communities. Our study compares communities from two contrasting ecoregions, **Madhya Pradesh (MP)** and **West Bengal (WB)** to investigate if similar ecological factors could drive diversity and distribution patterns in these regions, despite being in different environmental conditions.



We propose to answer the following questions:

- What are the common environmental drivers which structure the fish communities in such varied conditions?
- Does season affect richness and diversity similarly in these regions?

Sampling stations :



Madhya Pradesh	West Bengal
R. Hathed, R. Kolar, R.Tawa	R. Karala, R. Khulnai, R. Dharala, R. Jarda
<ul style="list-style-type: none"> • Dry tropical deciduous forests. • The vegetation is fragmented by agricultural fields and human settlements. 	<ul style="list-style-type: none"> • Mostly tropical forests at the upper regions of the area whereas the lower regions are more used for agricultural purposes. • Almost entirely covered with alluvium, boulders and pebbles .

METHODS

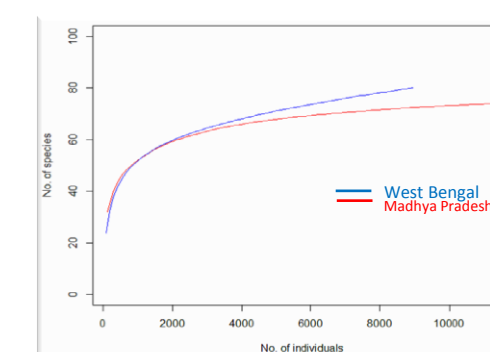
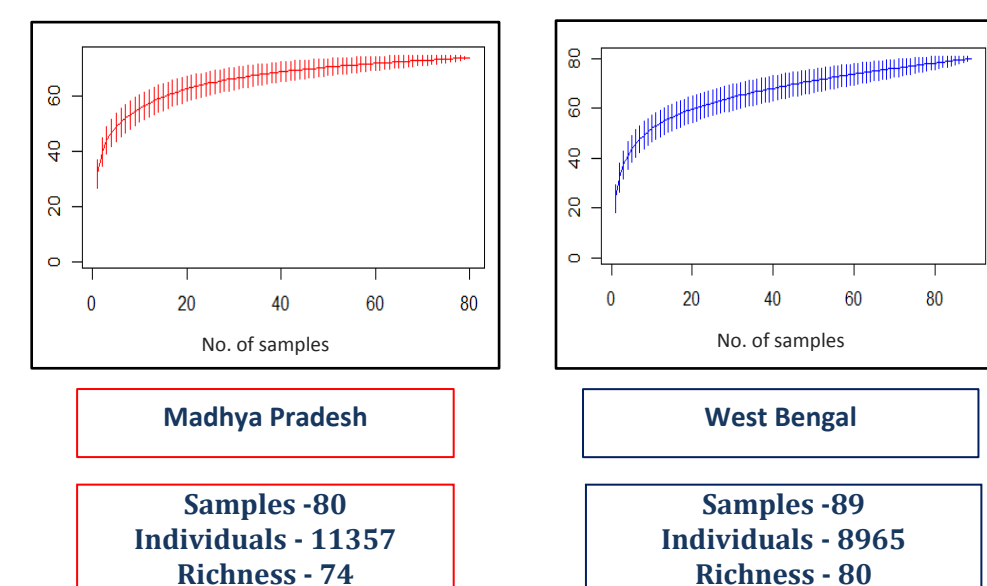
- 10 sites in MP and WB were sampled thrice a year – **Winter (WIN), Pre-monsoon (PRM) and Post monsoon (POM)** for fish abundance and environmental data.
- Sampling period – **January 2015- October 2017**
- Fish abundance data has been obtained using cast net, gill net and drag net with similar effort across all sites. Physical characteristics and physico-chemical parameters and anthropogenic

Physio-chemical parameters	Physical parameters
<ul style="list-style-type: none"> • Water Temperature • pH • Total Dissolved Solids (TDS) • Conductivity • Dissolved Oxygen 	<ul style="list-style-type: none"> • Stream Width and depth • Water velocity • %of pool, run and riffles • Substrate components (1.Abiotic-boulders, rocks,clay,silt,sand. 2.Biotic- woody debris, leaf litter)
Anthropogenic Disturbances	
<ul style="list-style-type: none"> • Water surface- oily, organic debris, clear • Presence / Absence of dams • Riparian vegetation-trees / shrubs / grasses / herbaceous • Predominant surrounding land use-forest / pasture / agricultural / residential 	

- Identification and abundance of each fish species counted from pool, run, riffle.
- **Species abundance curves** were plotted.
- GLMMs were used to test role of environmental factors on species richness (SR) and diversity (H) with season as random factor. **Likelihood ratio tests (LRT)** was used to check the importance of random effect in the models. Variable selection was performed using **stepwise regression based on AIC values and biological reasoning.**
- **Conservation status** was assessed for the species found.

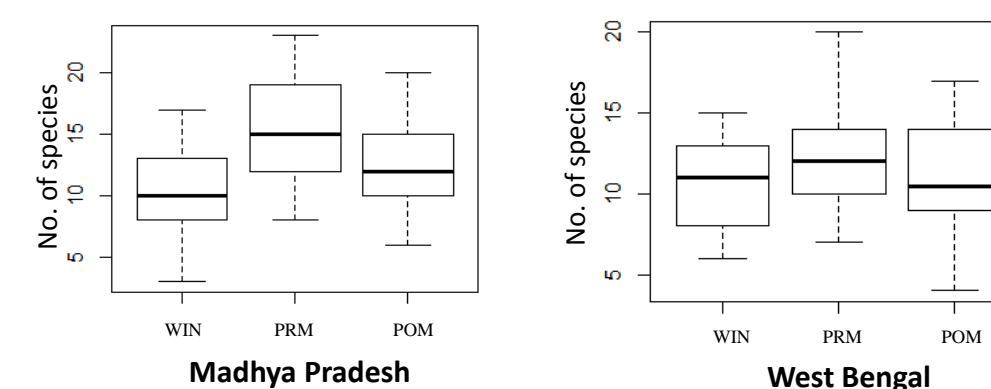
RESULTS

Species Accumulation Curves (Rarefaction)

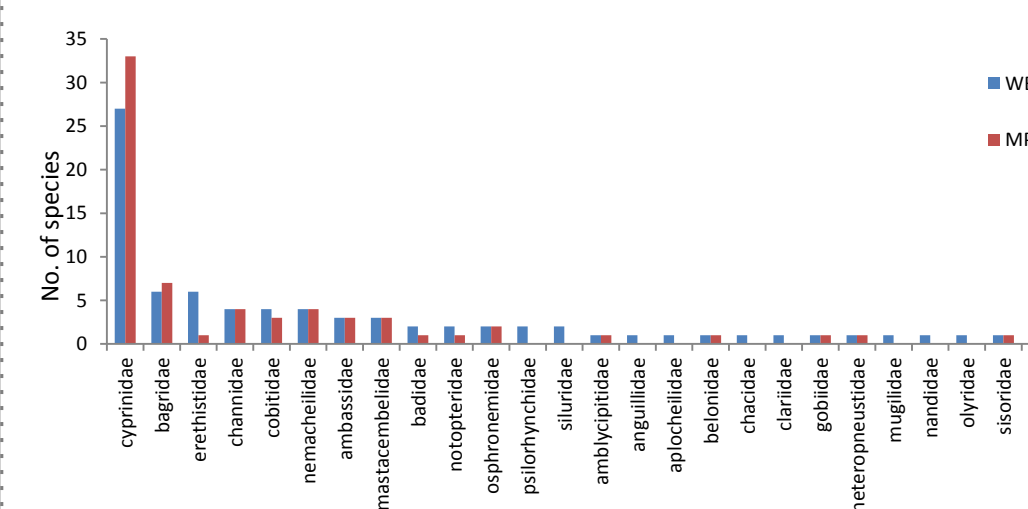


For ~9000 individuals randomly sampled, WB has a higher diversity with 80 species compared to MP which has 72 species.

Species Richness over seasons



Family-wise comparative distribution



GLMM to test for seasonal and spatial factors:

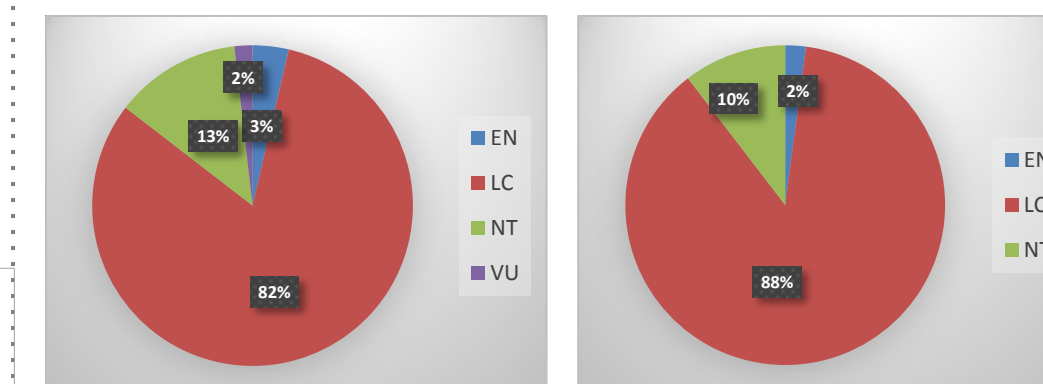
- Season doesn't seem to play significant role in explaining variation in SR or H (LRT, p-value >>>0.05)

Madhya Pradesh			
Variable	Estimate	Std. Error	Pr(> t)
SR			
pH	8.75	2.76	0.0035
H			
Total Dissolved Solutes.CV	0.012	0.005	0.024
Dissolved Oxygen	-0.057	0.022	0.013

West Bengal			
Variable	Estimate	Std. Error	Pr(> t)
SR			
Conductivity.CV	0.32	0.11	0.007
Stream Depth	-4.23	1.56	0.012
Water Velocity	-1.48	0.36	0.0003
Altitude.CV	-0.24	0.104	0.031
H			
pH	0.62	0.29	0.04
Dissolved Oxygen	-0.37	0.11	0.003
Dissolved Oxygen .CV	-0.03	0.011	0.024
Stream Depth	0.79	0.28	0.009
Stream Depth.CV	-0.014	0.005	0.013
Water Velocity.CV	-0.005	0.002	0.024

CV= Coefficient of Variation

Conservation Status



Distribution of fish in various IUCN categories in a) Madhya Pradesh and b) West Bengal. EN- Endangered; LC- Least Concern; NT- Near Threatened; VU- Vulnerable.

	Madhya Pradesh	West Bengal
Endangered (EN)	Hypselobarbus mussullah, Tor khudree	Gonoproktopterus spp.
Near Threatened (NT)	Glossogobius giuris, Mastacembelus pancalus, Notopterus notopterus, Ompak bimaculatus, Parambassis lala, Tor tor, Wallago attu	Anguilla bengalensis, Glossogobius giuris, Notopterus notopterus, Parambassis lala, Glyptothorax telchitta
Vulnerable (Vu)	Salmostoma horai	

CONCLUSION

This ongoing study throws light on the structure of fish communities of WB and MP. Long term studies would help in realizing the complete fish diversity in these regions. Our results reveal that similar environmental factors determine fish diversity (such as dissolved oxygen) in these two regions, despite their geographical contrasts. Spatial factors seem to have more influence than season in both areas. Also, presence of similar dominant families and identical most-speciose season indicates towards likely occurrence of common mechanisms that drive fish community structure across diverse eco-regions. Knowledge about the existing diversity and functional traits need to be collected before these streams are altered by human use. Lack of knowledge among local people about the issues regarding rivers and sustenance of fish communities may be a significant obstacle in conserving and maintaining the present populations from further deterioration.

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