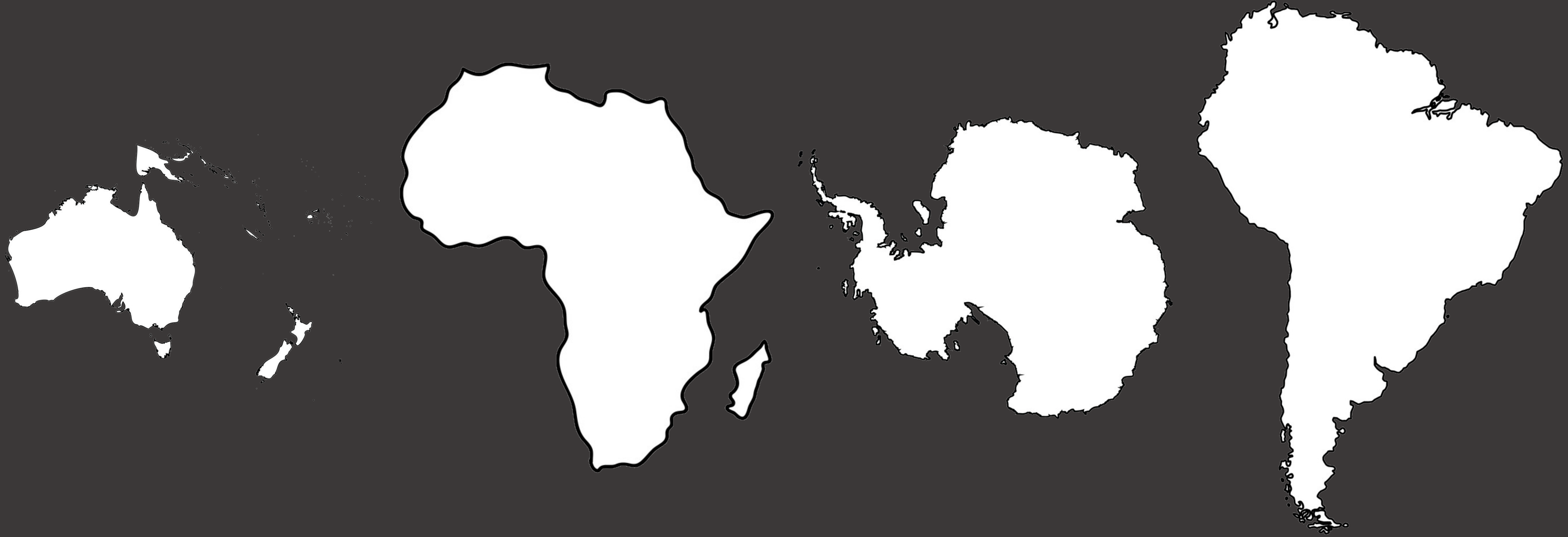


Mercury biomagnification in aquatic food webs: a meta-analysis of the Southern Hemisphere

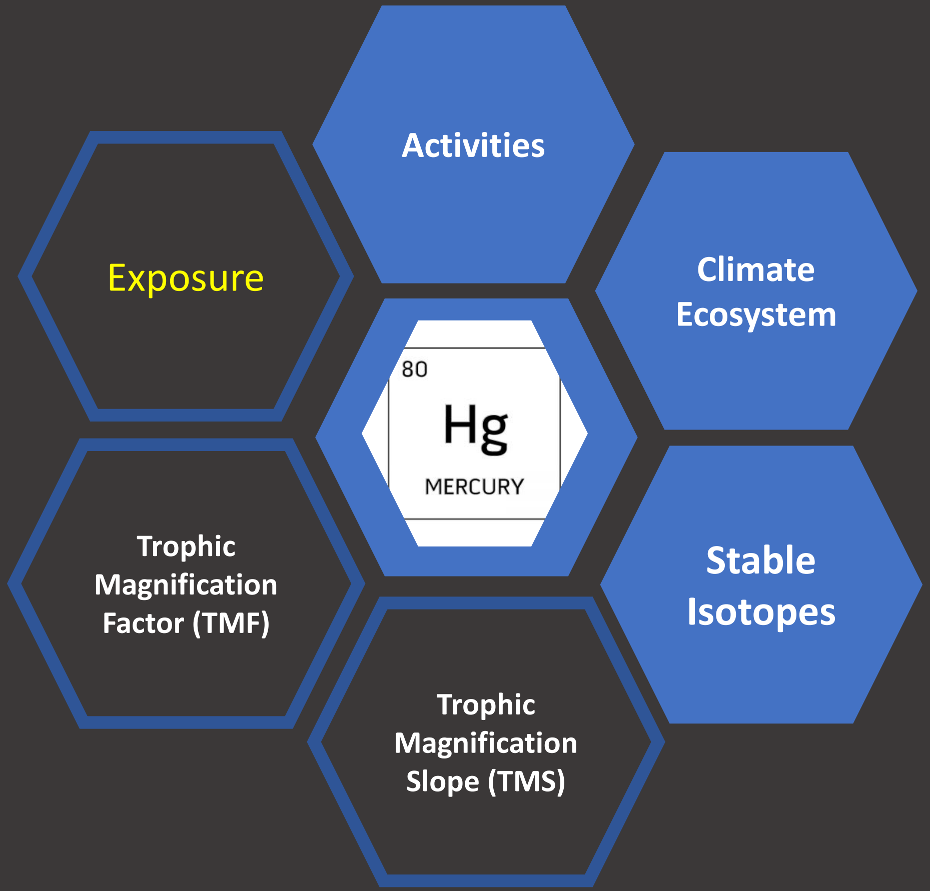
M. Sc. Francisco Quesada Alvarado

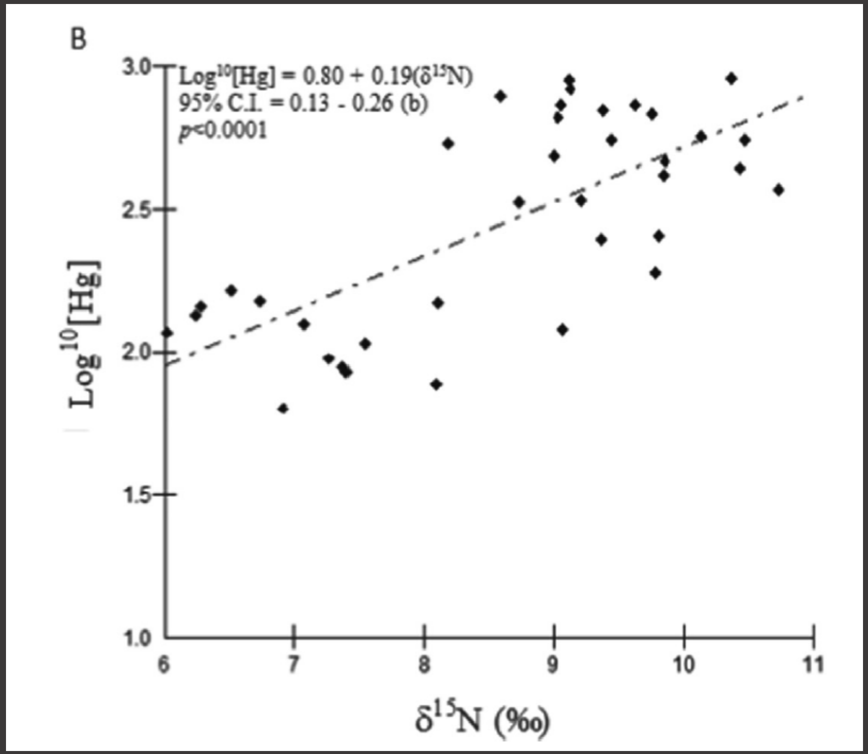
Ph. D. Gustavo Chiang

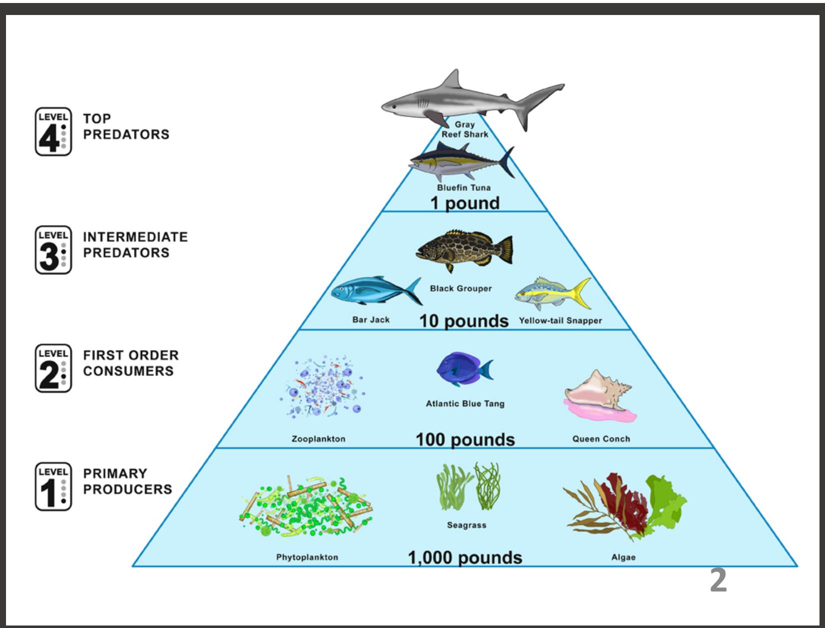
Universidad Andrés Bello

DOCTORADO EN MEDICINA DE LA CONSERVACIÓN

Biomagnification in aquatic trophics webs







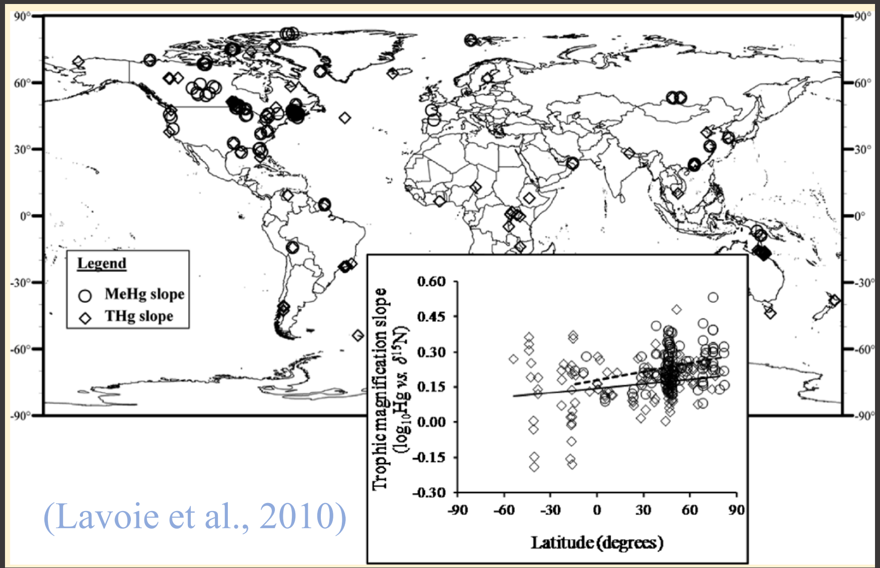
•(Lavoie et al., 2010; Azevedo et al. 2016; Viana et al. 2023)

Problem

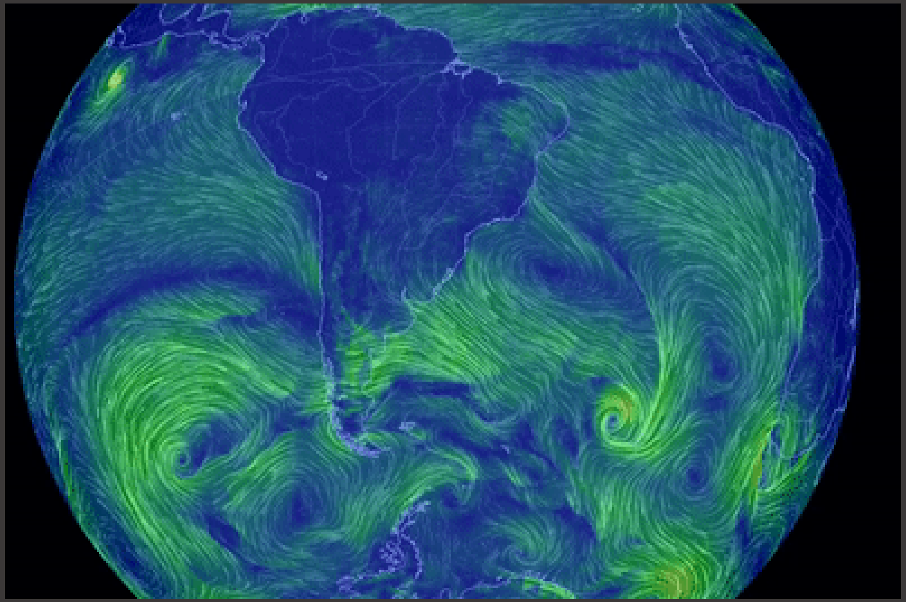
- Industrialization, deforestation, forest fires, and pollution, Gold mining.
- The last biomagnification study on global levels was 14 years ago (Lavoie et al., 2013)

- Northern Hemisphere has the highest levels of biomagnification

- The number of studies about N.H & S.H was unequal



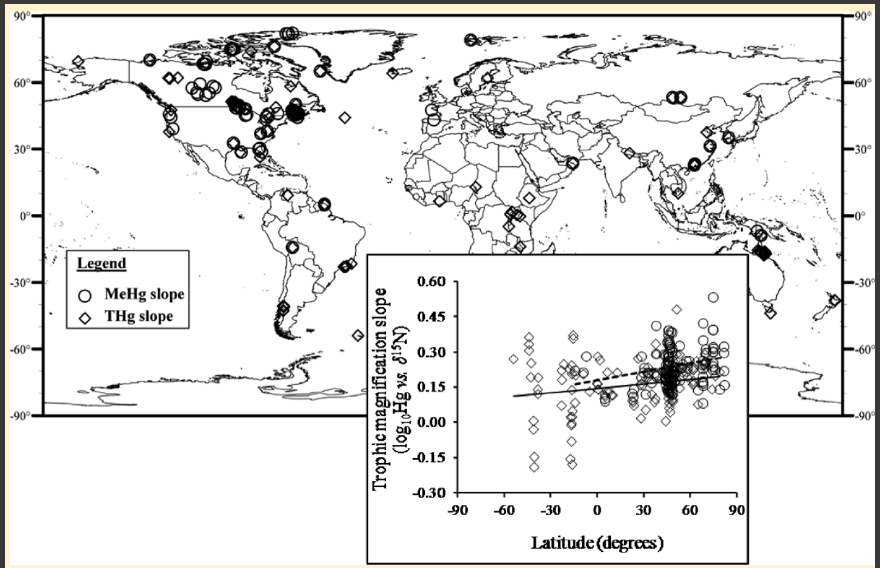
(Lavoie et al., 2010)

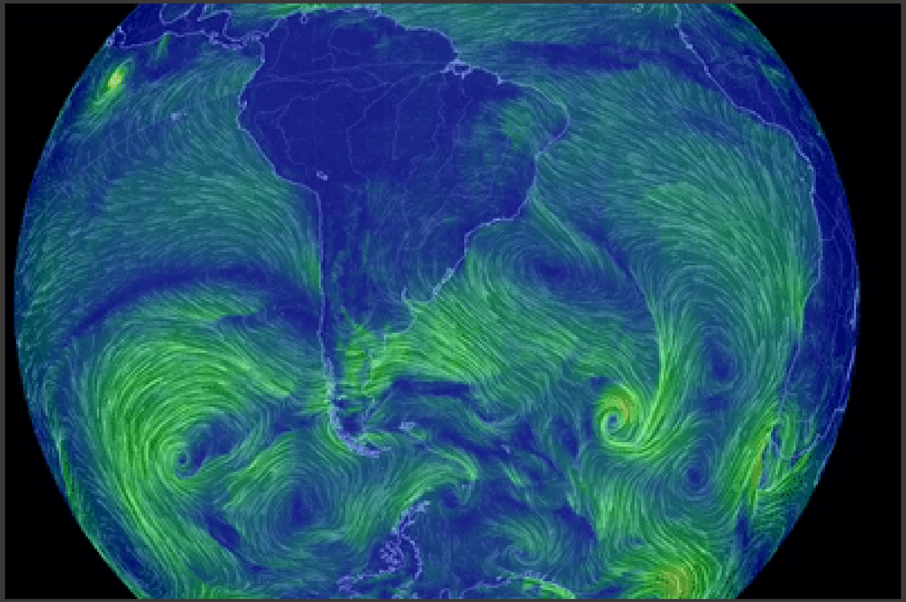


Problem

- In the last 10 years, progress has been made on biomagnification topics in the Southern Hemisphere.

- The work is carried out by countries and continents independently, ignoring the connection between the continents.





General Objective

To determine the biomagnification of mercury in aquatic ecosystems by ecoregion and continents of the Southern Hemisphere.

Methodology

- **Biomagnification+Hg+ Continent**
- **Biomagnification+Hg+TMS/TMF**
- **Biomagnification+Hg+country**

- Regression: TMS vs Latitude (Continent, Climate, Ecosystem)
  TMF vs Latitude (Continent, Climate, Ecosystem)

- Differences: TMS X Continent, Climate, Ecosystem and Trophic Web
  TMF X Continent, Climate, Ecosystem and Trophic Web

- GLM: TMS + Ocean Physicochemical Variables
  TMF + Ocean Physicochemical Variables

Results & Discussion

Africa: 24

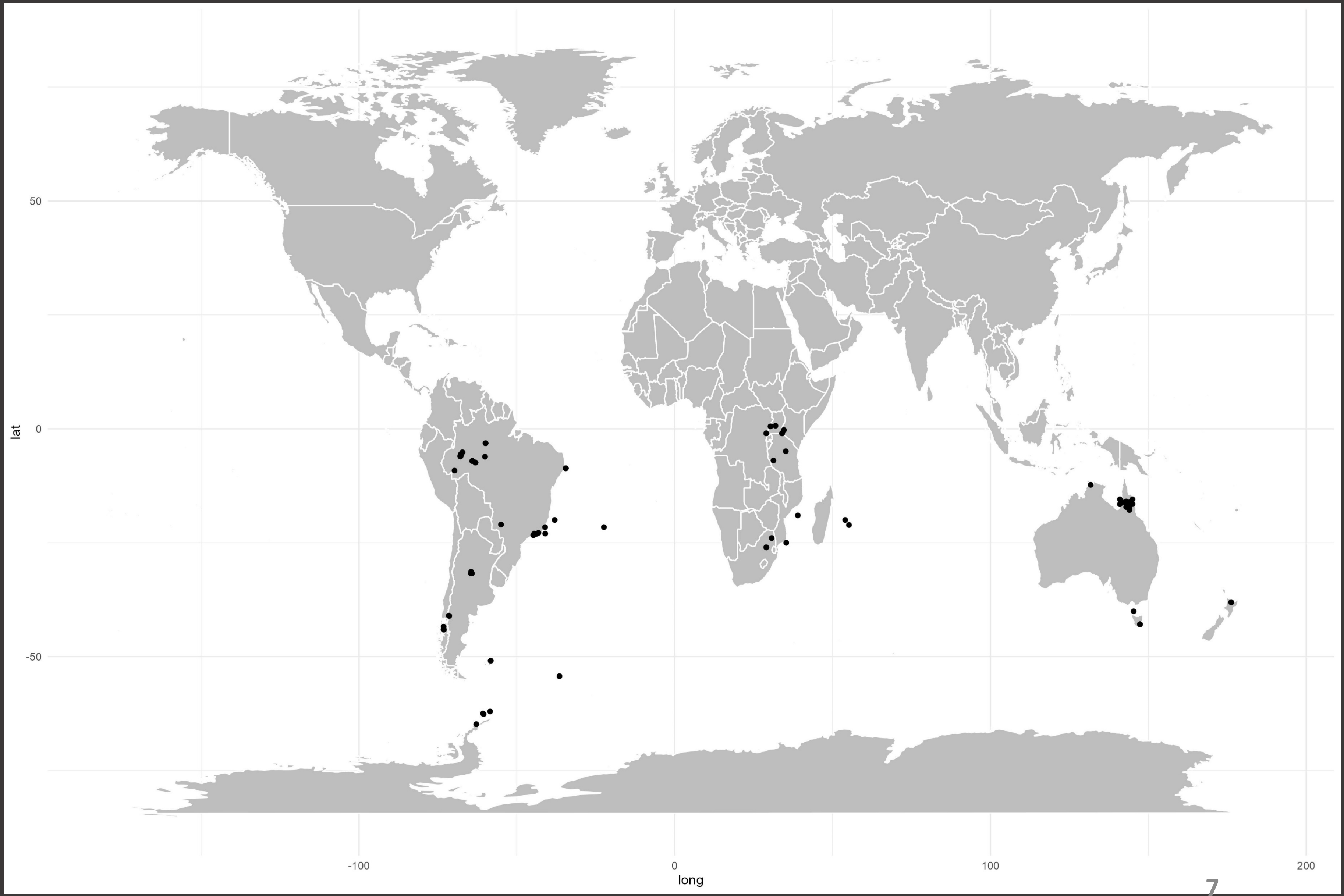
South America: 76

Oceania: 25

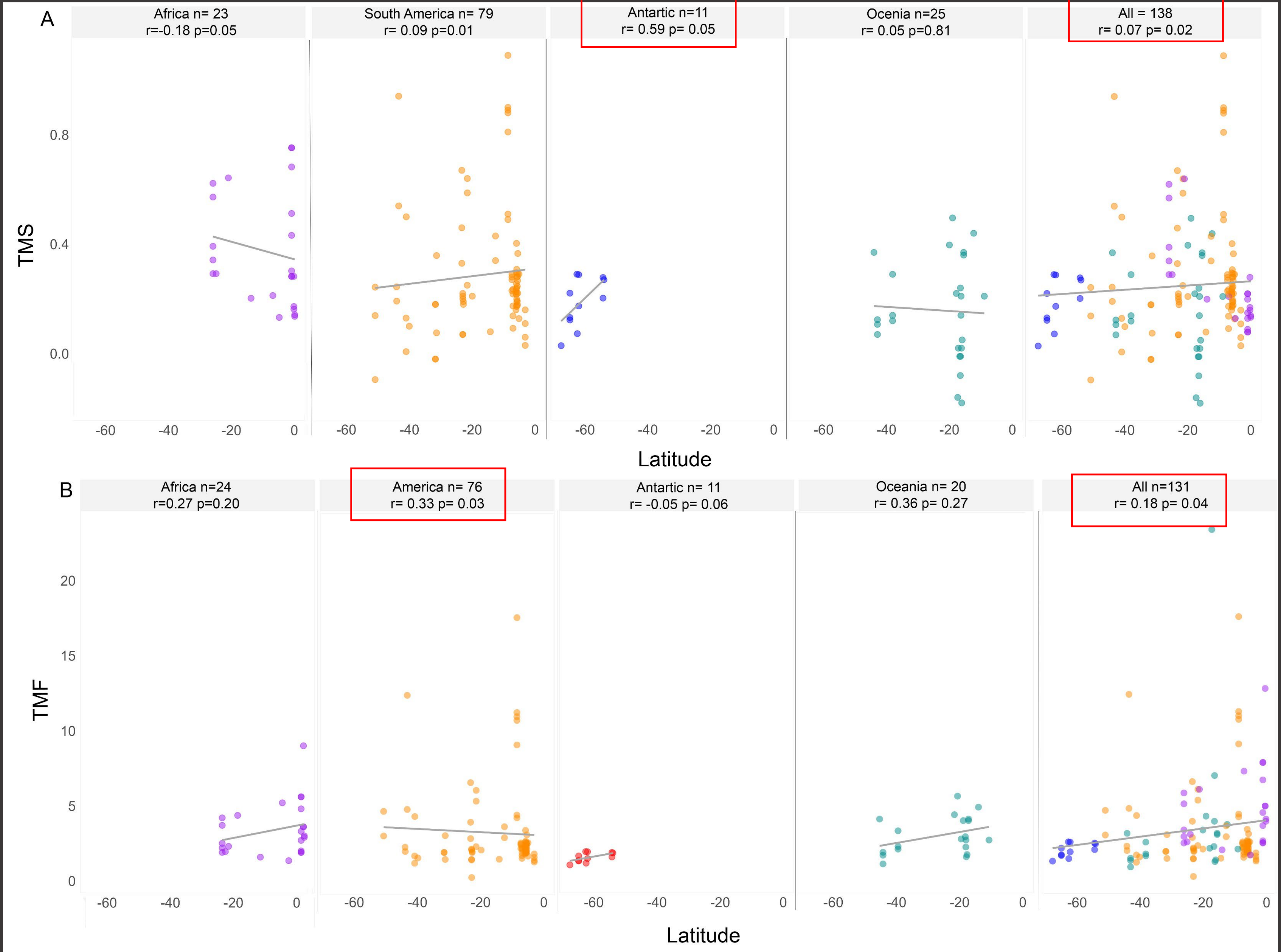
Antarctic: 12

Total: 138

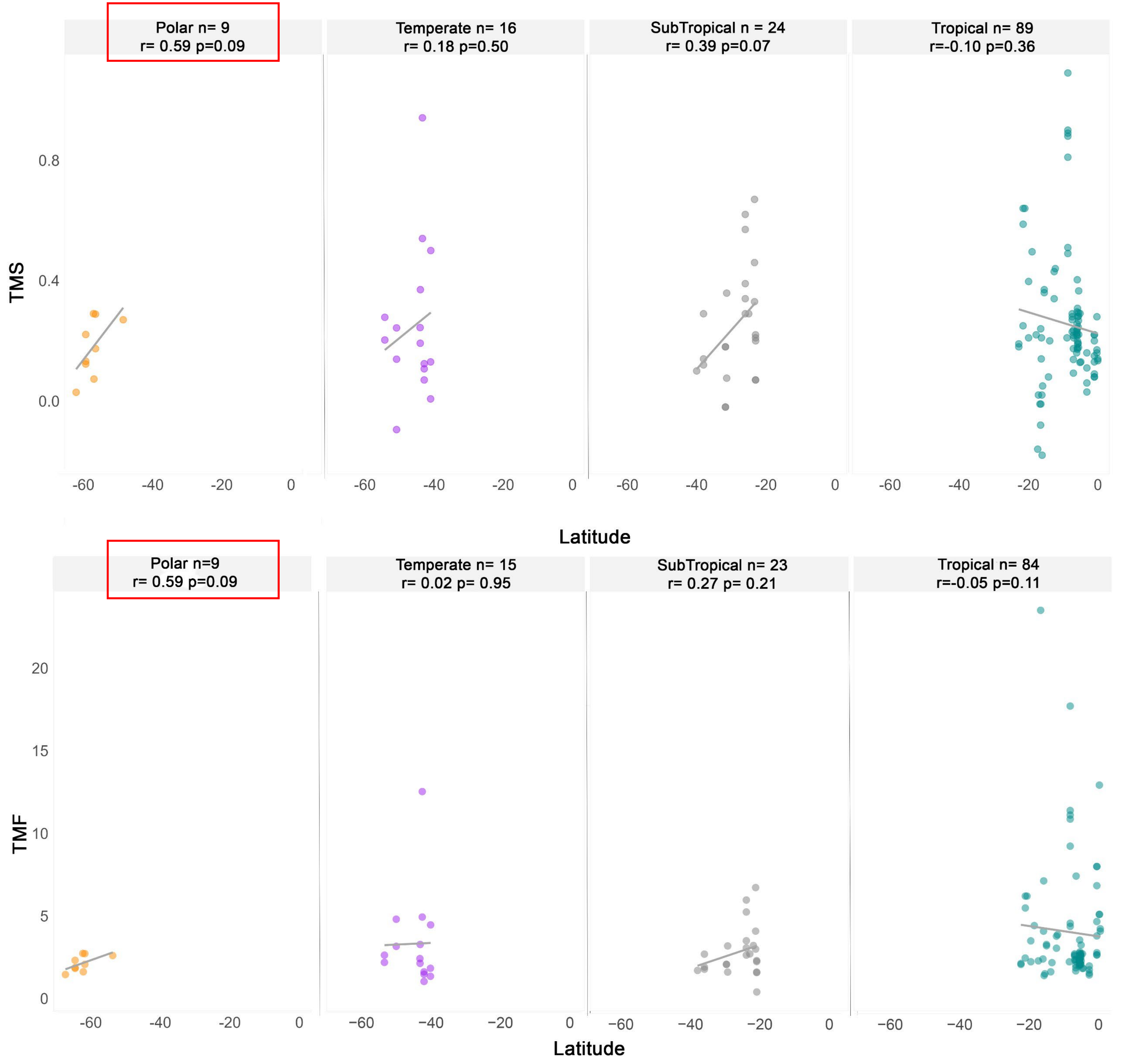
1999 - 2023



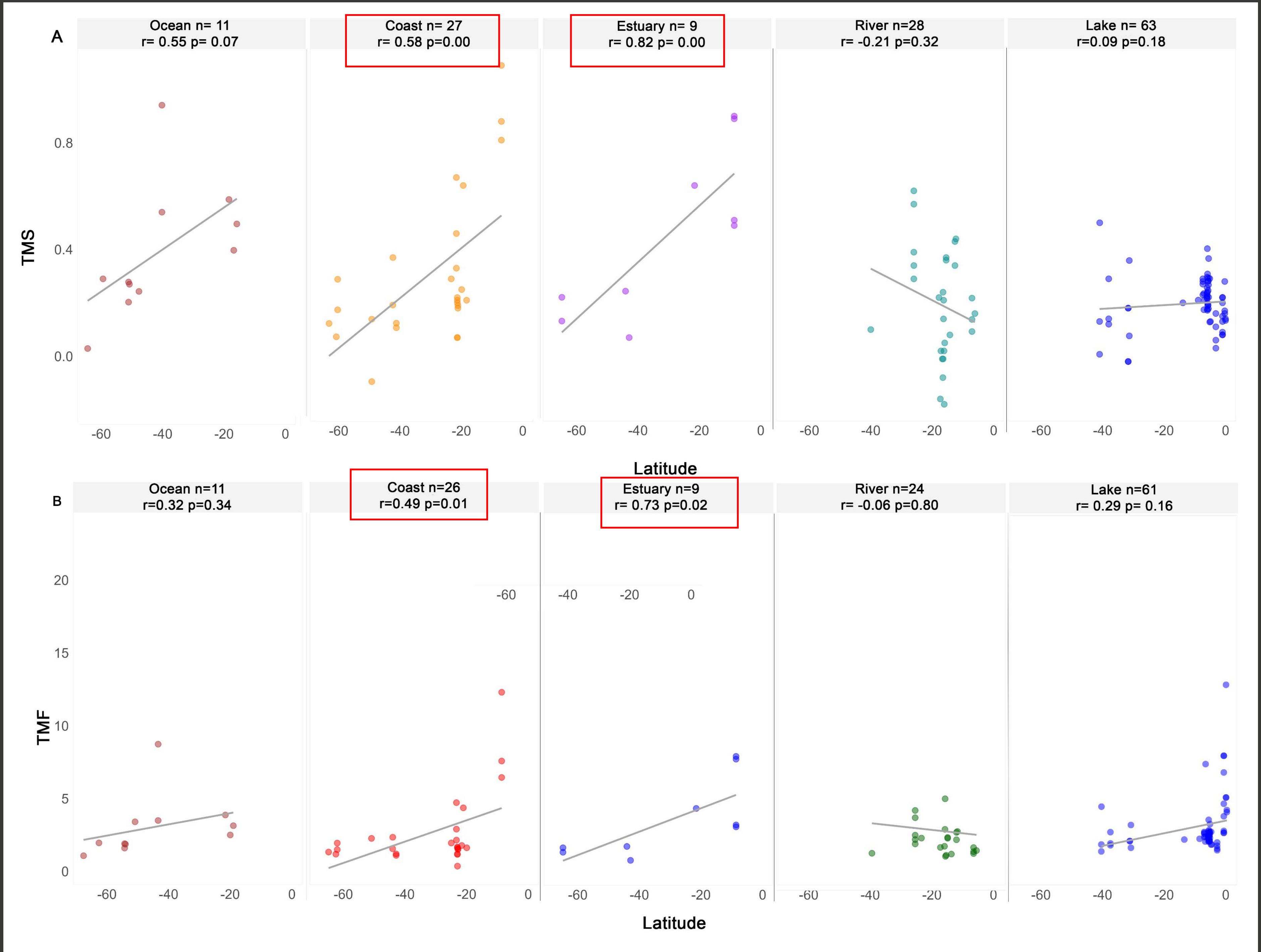
Continent Biomagnification

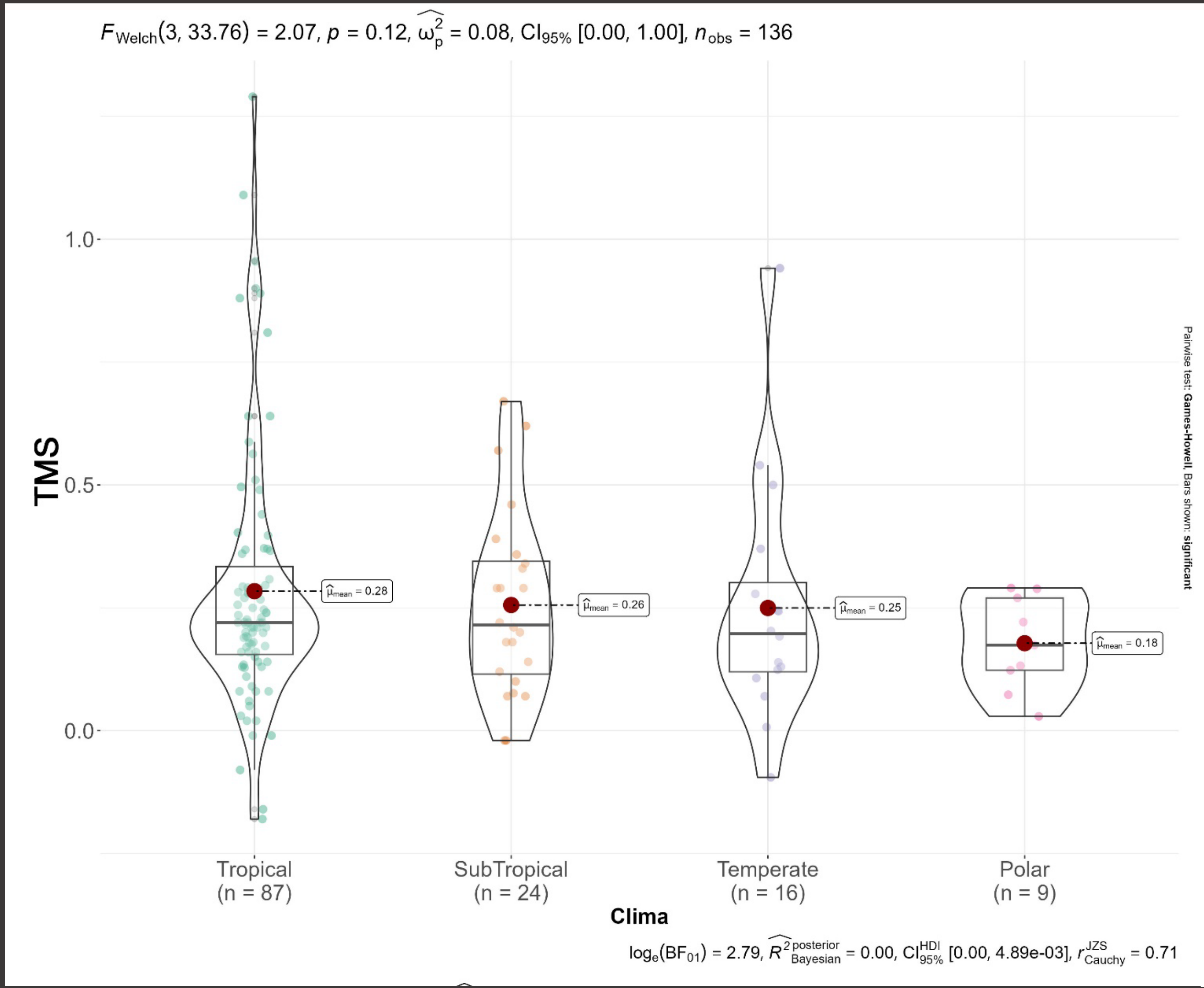


Climate
Biomagnification

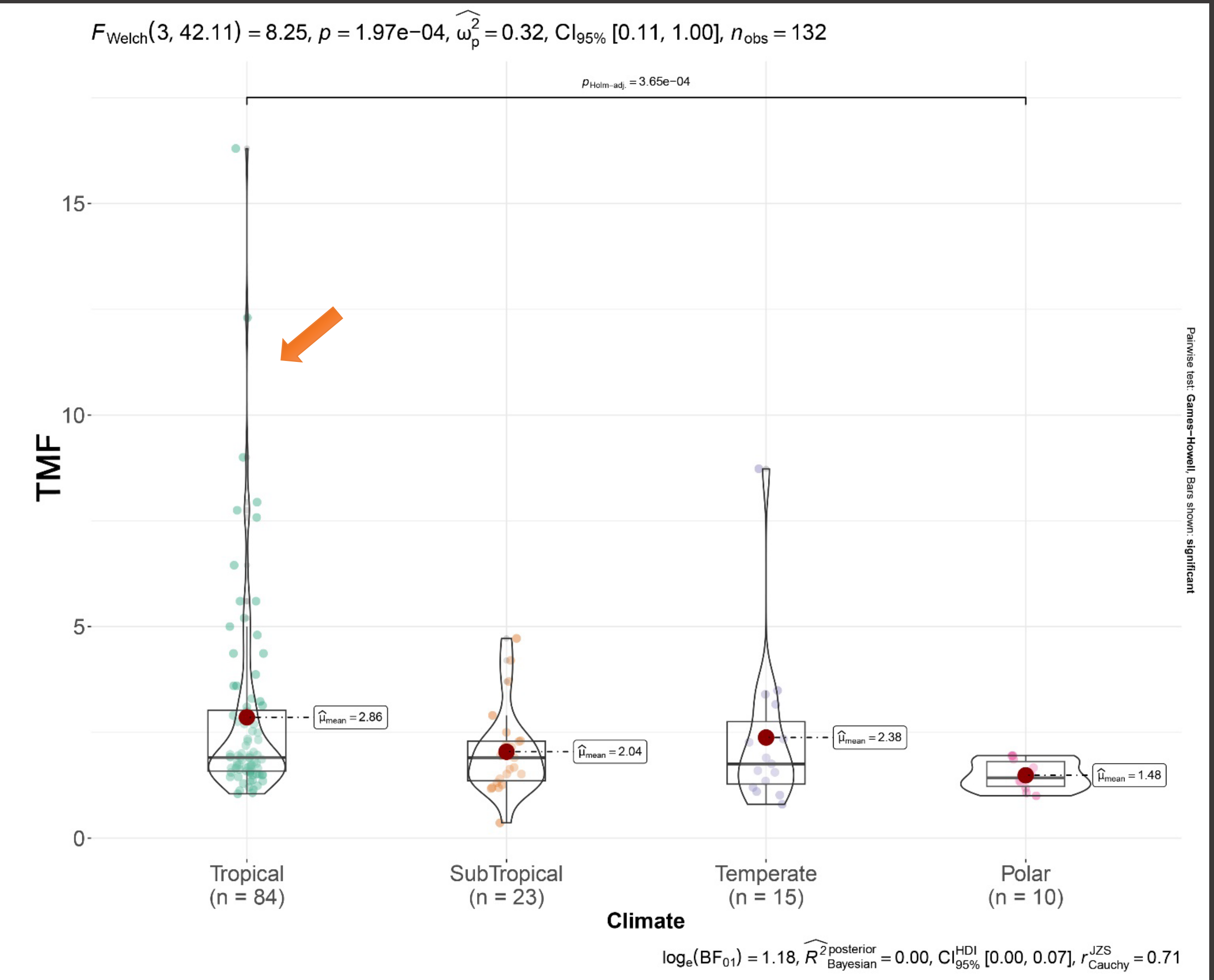


Ecosystem Biomagnification



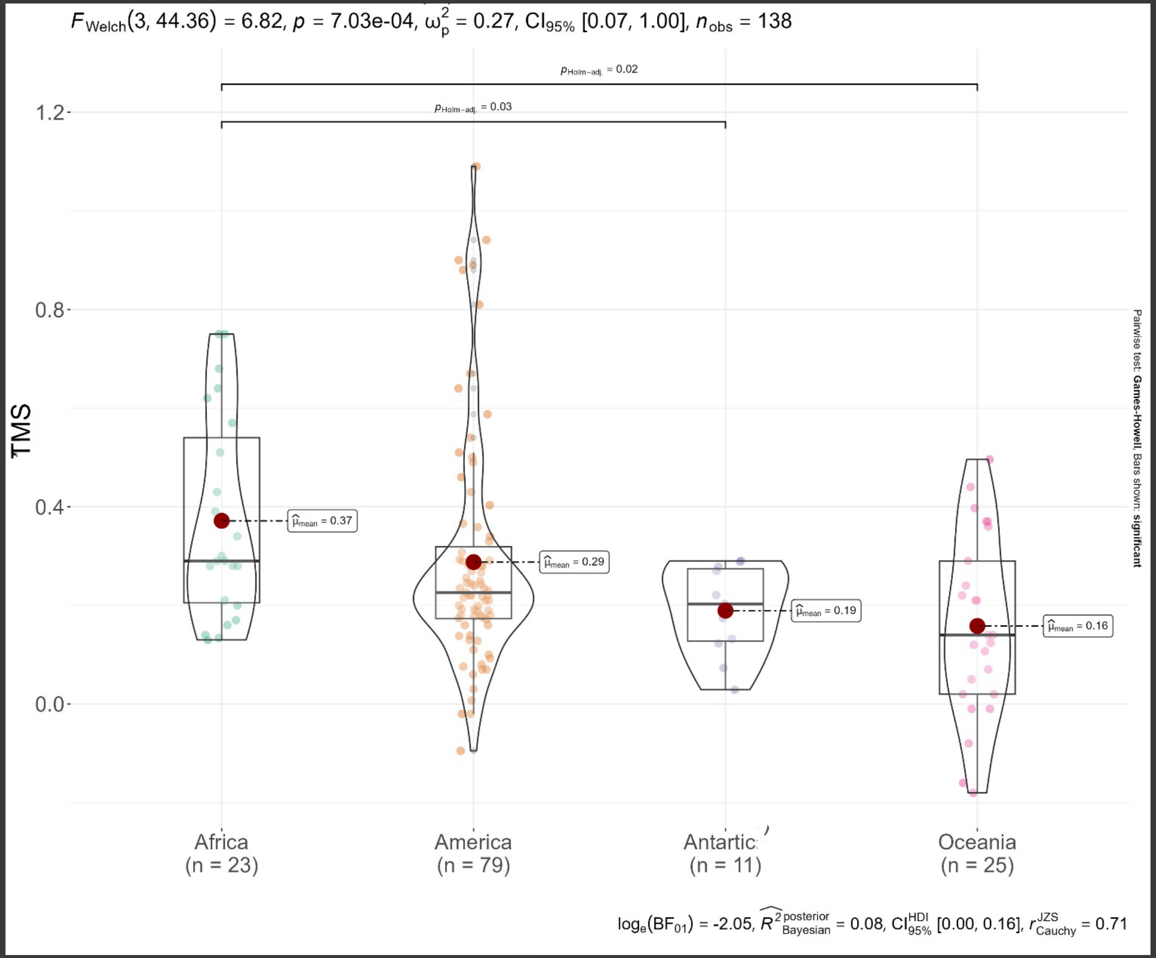


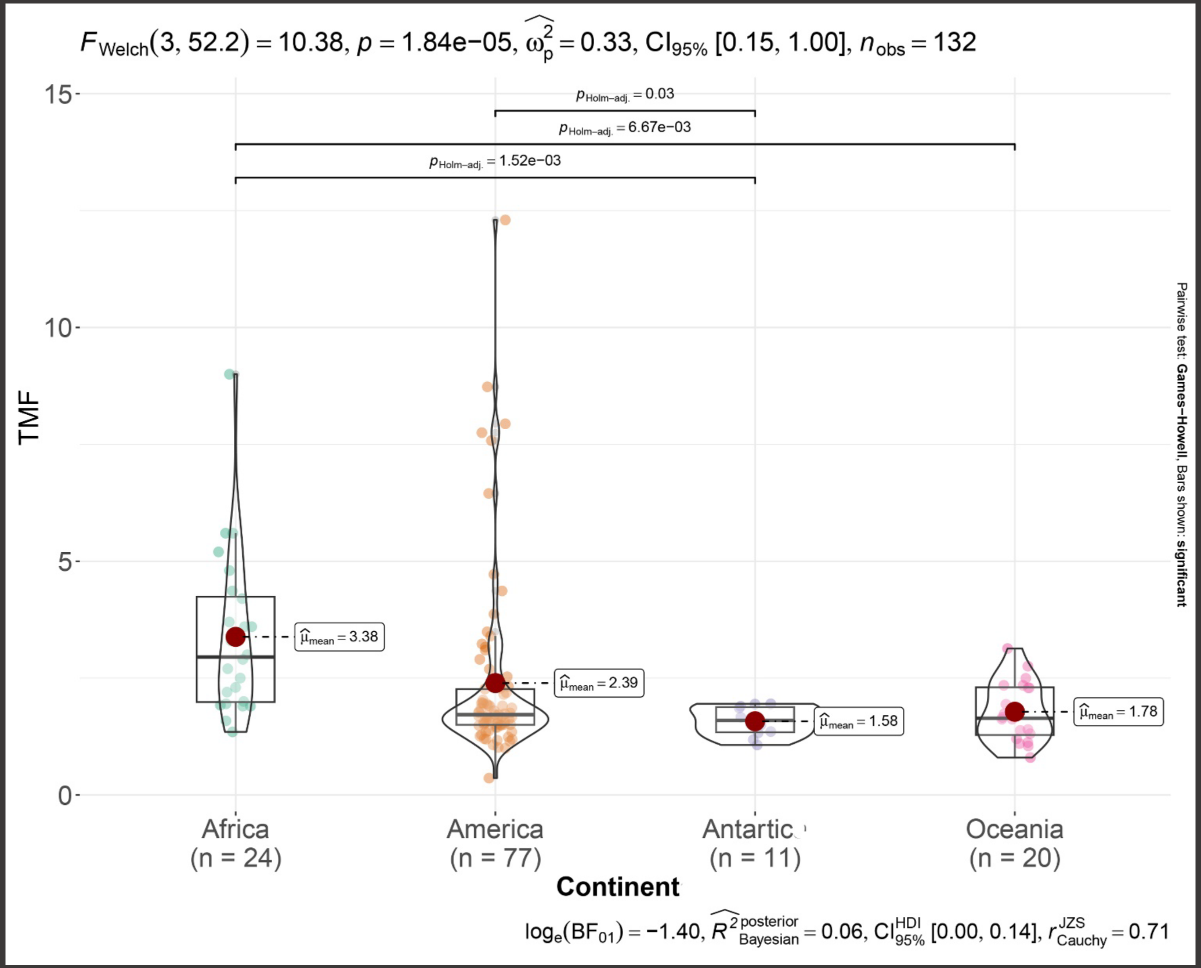
TMS



TMF

Climate

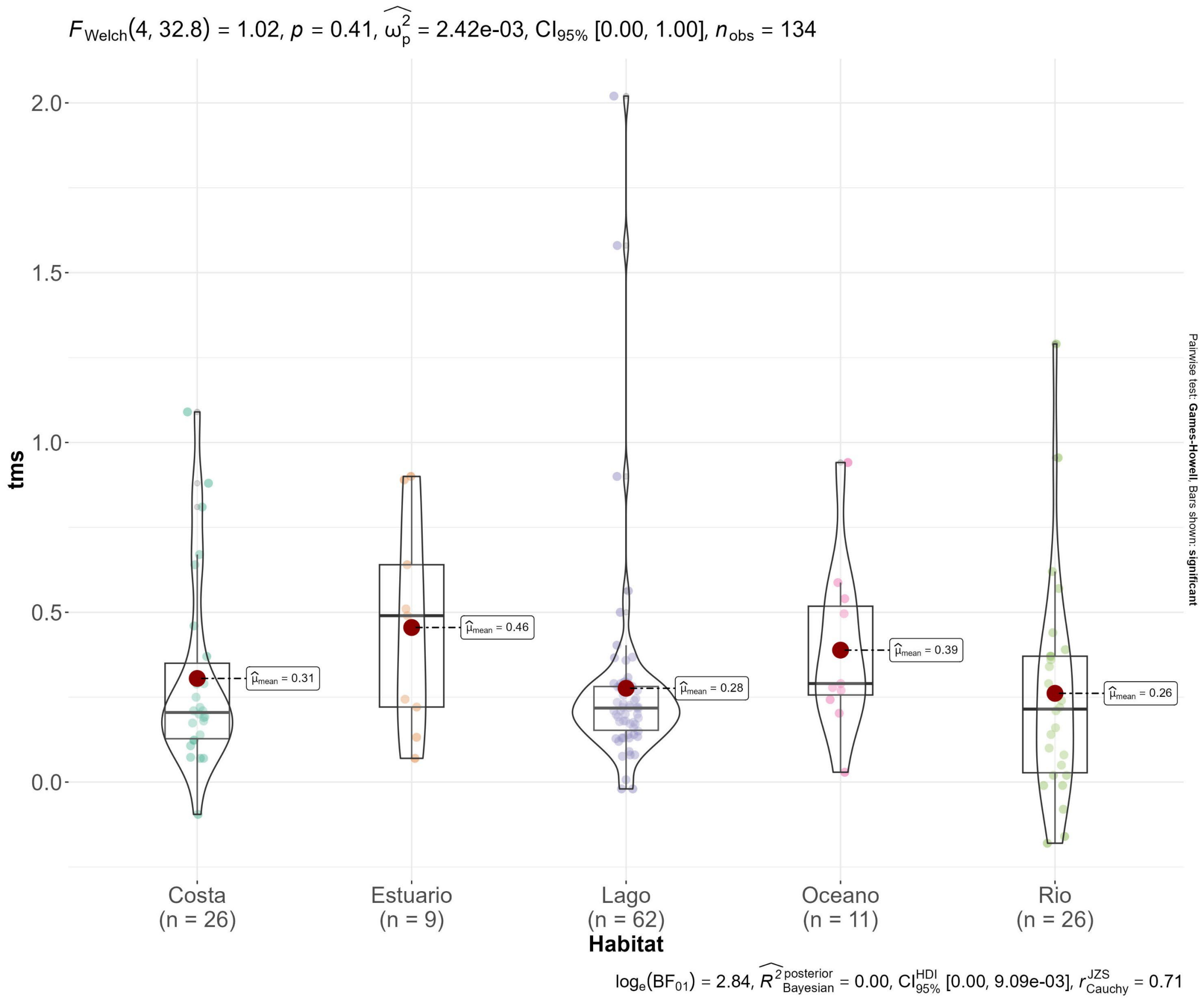


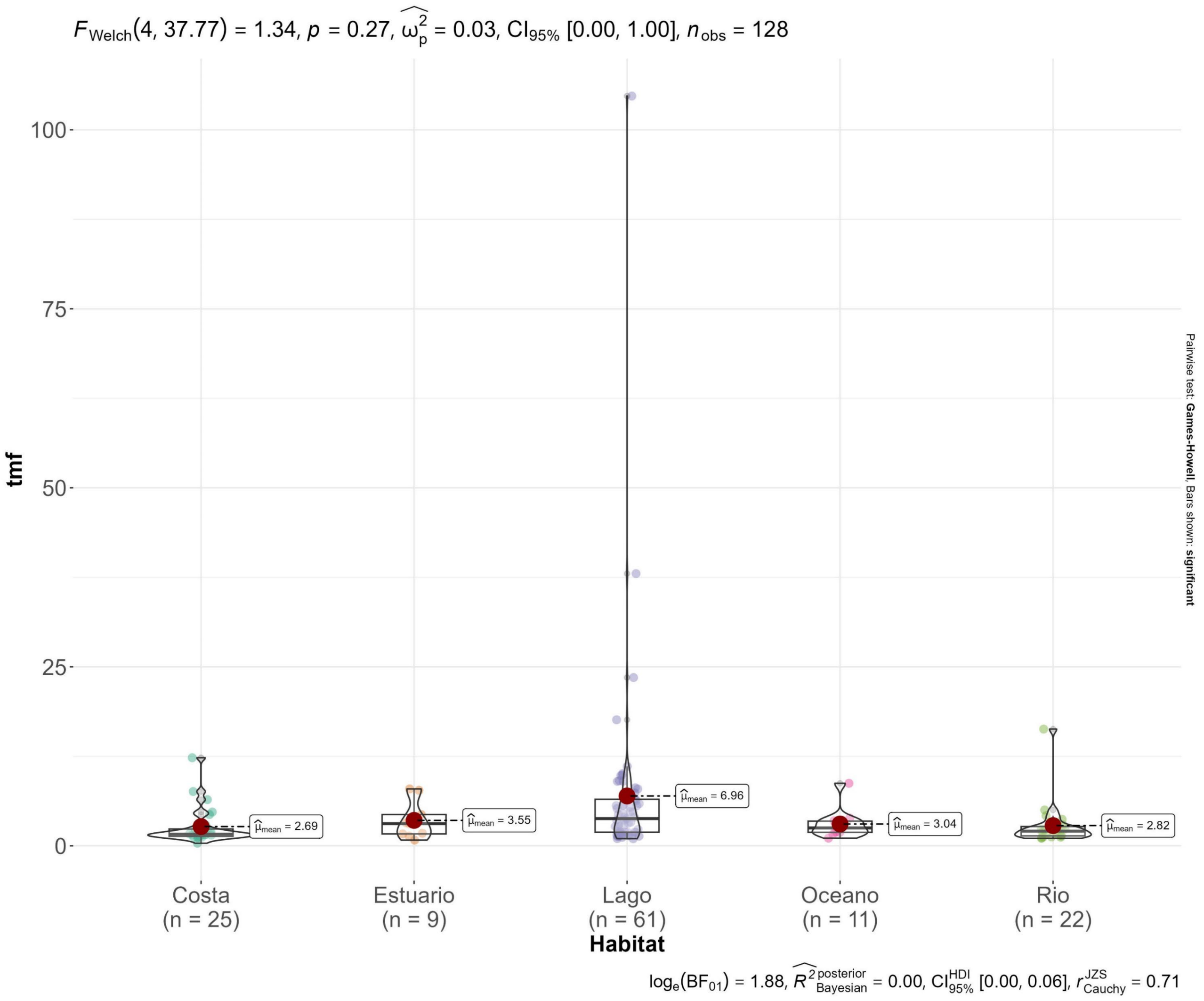


TMS

TMF

Continent

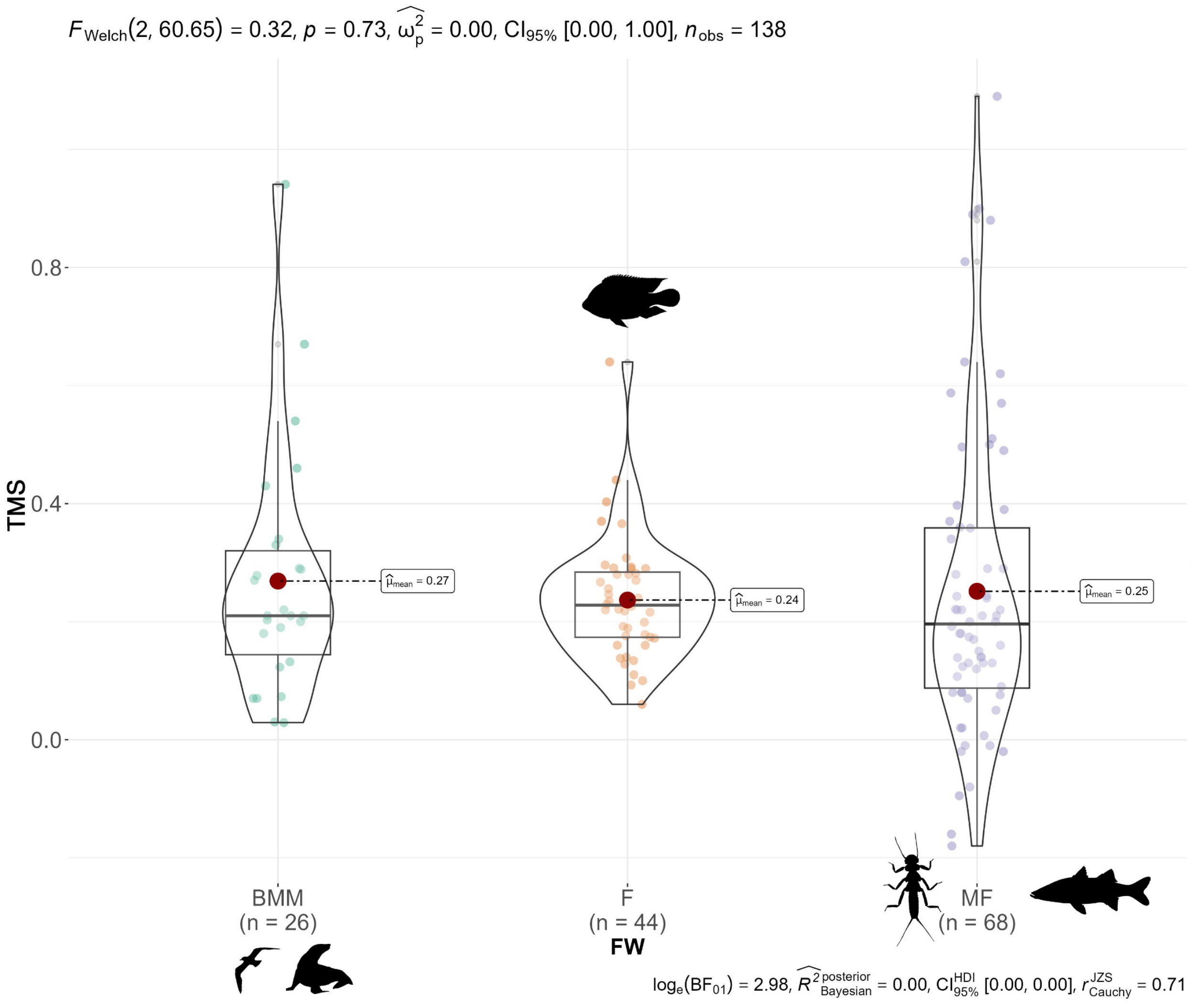




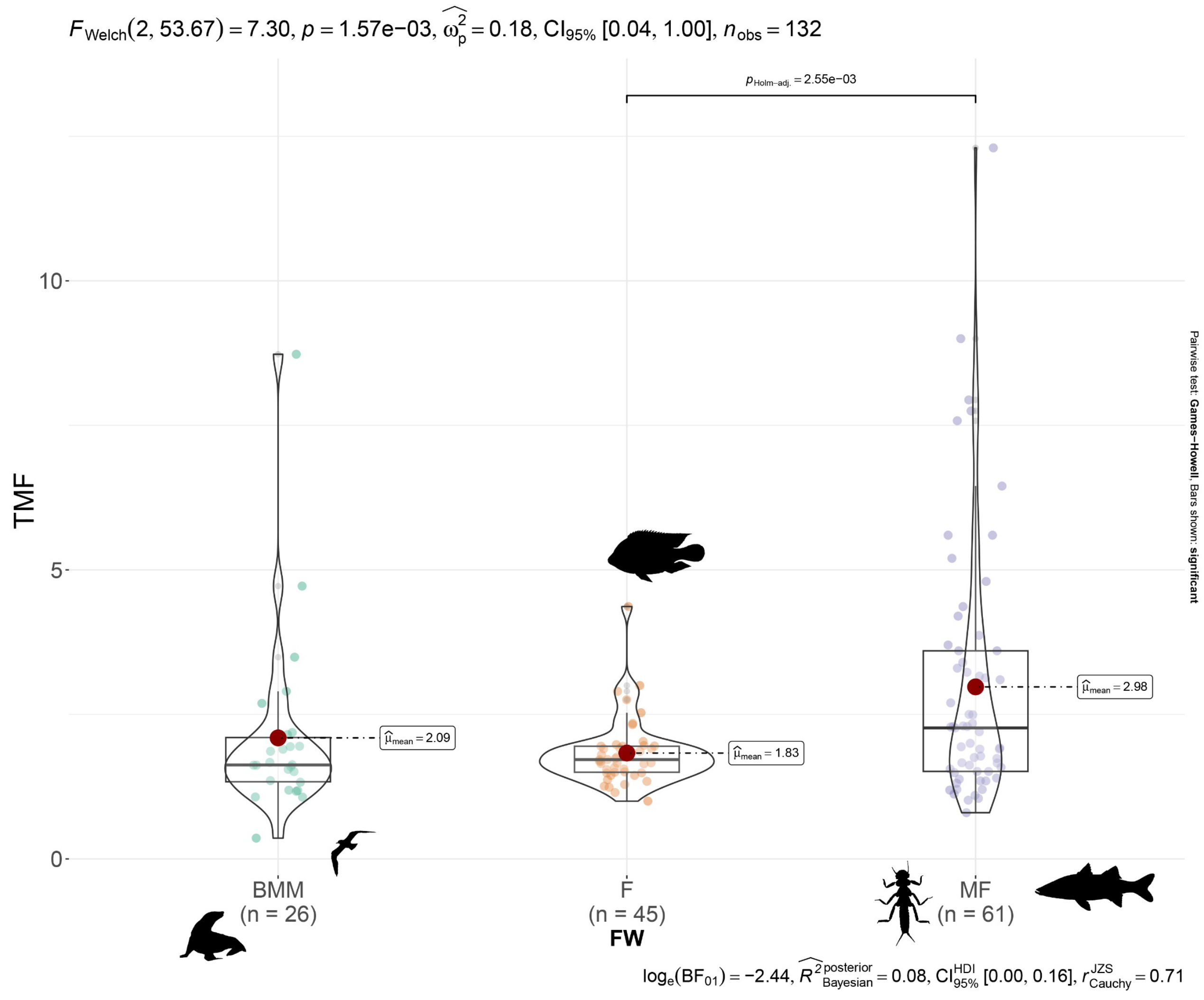
TMS

TMF

Ecosystem



TMS



TMF

Trophic Web

Da Silva et al (2005); Butler et al (2022)

Biomagnification in oceans

TMS

Model	aic	weights
tms ~ 1 + pH + NO3 + Temp + chl + OD	-10,07906131	0,191126614
tms ~ 1 + pH + Temp + chl + OD	-9,801370674	0,166349466
tms ~ 1 + pH + Temp + chl	-9,286936961	0,128621494
tms ~ 1 + pH + NO3 + chl	-9,097316554	0,116987107
tms ~ 1 + pH + NO3 + chl + OD	-8,506168216	0,0870506

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)    
(Intercept)   0.49829    0.10657   4.676 4.78e-05 ***
NO3          -0.02239    0.01590  -1.409   0.1683    
scale(chl)   -0.12004    0.04887  -2.457   0.0195 *  
scale(Temp)   0.31383    0.17637   1.779   0.0844 .  
scale(OD)     0.41970    0.20466   2.051   0.0483 *  
scale(pH)    -0.09625    0.03596  -2.677   0.0115 *  
```

R2 Ajustado = 0,536
P value= 0,000

TMF

model	aic	weights
tmf ~ 1 + pH + Temp + chl	166,8812978	0,123210915
tmf ~ 1 + pH + NO3 + chl	167,2068915	0,104700171
tmf ~ 1 + pH + chl + OD	167,3943365	0,095333212
tmf ~ 1 + pH + Temp	167,9445618	0,072404296
tmf ~ 1 + pH + chl	168,1954023	0,06386972

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)  
(Intercept) 184.0694    83.6989   2.199   0.0348 *
pH          -22.5008    10.3968  -2.164   0.0376 *
scale(Temp)   0.6429     0.3652   1.760   0.0874 .
scale(chl)   -0.6042     0.3576  -1.689   0.1003  
---
```

R2 Ajustado = 0,34
P value= 0,000

Discussion

The gold mining industry in Brazil: A historical overview

Marco Aurélio da Costa [a], Francisco Javier Rios [b,*]

LETTER

Accelerated losses of protected forests from gold mining in the Peruvian Amazon

OPEN ACCESS

Article

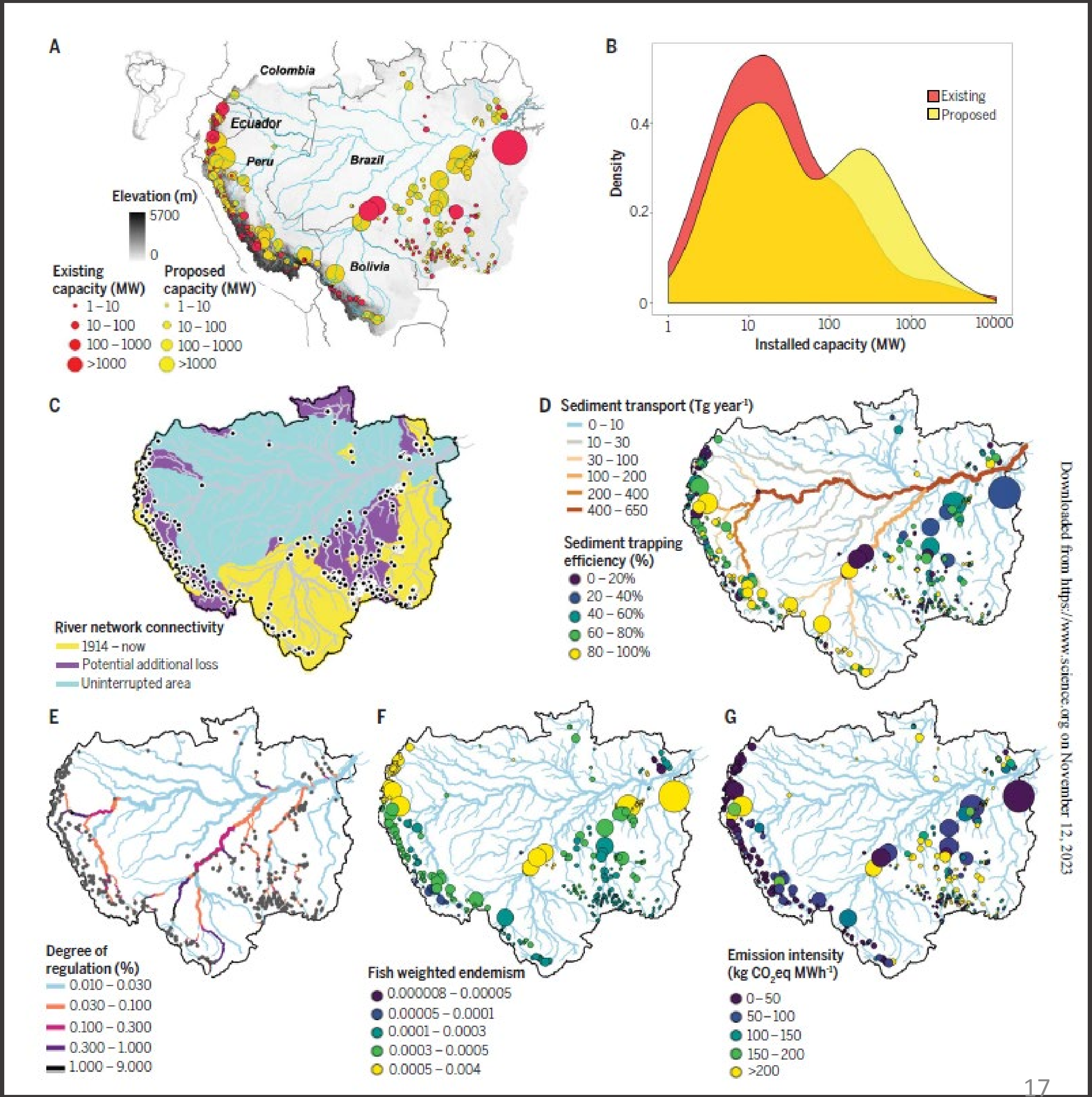
Gold Mining in the Amazon Region of Ecuador: History and a Review of Its Socio-Environmental Impacts

Carlos Mestanza-Ramón [1,2,*], Jefferson Cuenca-Cumbicus [3], Giovanni D'Orio [4], Jeniffer Flores-Toala [5], Susana Segovia-Cáceres [6], Amanda Bonilla-Bonilla [5] and Salvatore Straface [1]

Mining and human capital accumulation: Evidence from the Colombian gold rush☆

Leonardo Bonilla Mejía

Banco de la República, Colombia



•Alexander S. Flecker *et al.* Reducing adverse impacts of Amazon hydropower expansion.*Science* **375**,753-760(2022).DOI:10.1126/science.abj4017

Biomagnification

- Its depends on the amount of Hg available, not by trophic webs




Discussion

- Continents with resources exploitation highest
- Land use change-> MeHg-DOM

- Theory: low productivity, acid pH, cold temperature + TMS

(Ruiz-Vásquez et al., 2020) (Ajanaku & Collins, 2021) (Abdulrasheed Zakari et al., 2022) (Guilherme et al., 2022) (Seleen et al. 2023)

Gracias

Thank you

FranQAL@gmail.com

Agencia Nacional de Investigación y Desarrollo
Ministerio de Ciencia, Tecnología, Conocimiento e Innovación
Gobierno de Chile

Universidad Andrés Bello

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16° ICMGP Cape Town 2024

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- Guilherme, Gabriel de Oliveira, Silva, C., Stark, S. C., Carvalho, N. S., Anderson, L. O., Gatti, L. V., & Luiz. (2022). Record-breaking fires in the Brazilian Amazon associated with uncontrolled deforestation. *Nature Ecology and Evolution*, *6*(12), 1792–1793. https://doi.org/10.1038/s41559-022-01945-2