

**TABLE S8** | Results from MRM based on LMs for both Rabosky (genetic + polytomies) and Cassemiro *et al.* (2023) (genetic) phylogenies.

Variables	PBsimRabosky	pvalue_PBsimRabosky	PBsimCasse	pvalue_PBsimCasse
Int	0.24	0,00	0.21	0,00
D_energ_s	<b>-0.04</b>	<b>0.08</b>	-0.04	0.12
D_water_s	0,00	0.91	0.01	0.71
D_temp_s	0.03	0.14	-0.01	0.52
D_Habitat_size_s	0.01	0.39	0.01	0.18
D_Habitat_Div_s	0.02	0.04	0.01	0.27
D_Habitat_harsh_s	<b>0.05</b>	<b>0,00</b>	<b>0.04</b>	<b>0,00</b>
D_Habitat_position_s	0.01	0.45	-0.01	0.37
D_Habitat_fragm_s	0,00	0.76	-0.01	0.51
D_Habitat_water_s	<b>-0.02</b>	<b>0,00</b>	<b>-0.03</b>	<b>0,00</b>
D_Habitat_SampEff_s	<b>-0.04</b>	<b>0,00</b>	<b>-0.05</b>	<b>0,00</b>
D_Marine_Incurs_s	-0.02	0.1	-0.02	0.19
D_CurrentLGM_s	<b>0.02</b>	<b>0.09</b>	<b>0.02</b>	<b>0.08</b>
D_Pebas23mya_s	<b>-0.02</b>	<b>0.05</b>	<b>-0.03</b>	<b>0.03</b>
D_hydro_s	0.01	0.38	0,00	0.55
D_spat_s	<b>0.07</b>	<b>0,00</b>	<b>0.08</b>	<b>0,00</b>
r.squared	0.36	0,00	0.24	0,00
F.test	174.88	0,00	97.89	0,00

## REFERENCE

- Cassemiro FAS, Albert JS, Antonelli A, Menegotto A, Wüest RO, Cerezer F *et al.* Landscape dynamics and diversification of the megadiverse South American freshwater fish fauna. *PNAS*. 2023; 120(2):e2211974120. <https://doi.org/10.1073/pnas.2211974120>

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