Geomorphological habitat type drives variation in temporal species turnover but not temporal nestedness in Amazonian fish assemblages

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Abstract

Explaining the mechanisms underlying spatial and temporal variation in community composition is a major challenge. Nevertheless, the processes controlling temporal variation at a site (i.e., temporal β-diversity, including its turnover and nestedness components) are less understood than those affecting variation among sites (i.e., spatial β-diversity). Short-term temporal turnover (e.g., throughout an annual cycle) is expected to correlate positively with seasonal environmental variability and landscape connectivity, but also species pool size (γ-diversity). We use the megadiverse Amazonian freshwater ichthyofauna as a model to ask whether seasonality and landscape connectivity drive variation in temporal species turnover among geomorphological habitat types, while taking into account between-habitat variation in γ-diversity. 11,397 fish representing 260 species were collected during a year-long sampling program in an area containing the lowland Amazon's four major geomorphological habitat types: rivers, floodplains, terra firme streams, and shield streams. River-floodplain systems exhibit strong but predictable seasonality (via a high-amplitude annual flood pulse), high connectivity, and high species richness with many rare species. Terra firme and shield streams exhibit low seasonality, low connectivity, and low species richness with proportionally fewer rare species. Based on these parameters we predicted that river-floodplain systems should have higher temporal turnover than stream systems. Using a null model approach combined with β-deviation calculations, we confirmed that rivers and floodplains do exhibit higher turnover (but not nestedness) than terra firme and shield streams, even when controlling for the potentially confounding effect of higher species richness in river-floodplain systems. All habitats exhibit low temporal nestedness, indicating that short-term changes in community composition result primarily from temporal species turnover. Our results provide a timely reminder that efforts to conserve the Amazon's threatened aquatic biodiversity should account for the distinct temporal dynamics of habitat types and variation in hydrological seasonality.

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Figure 1

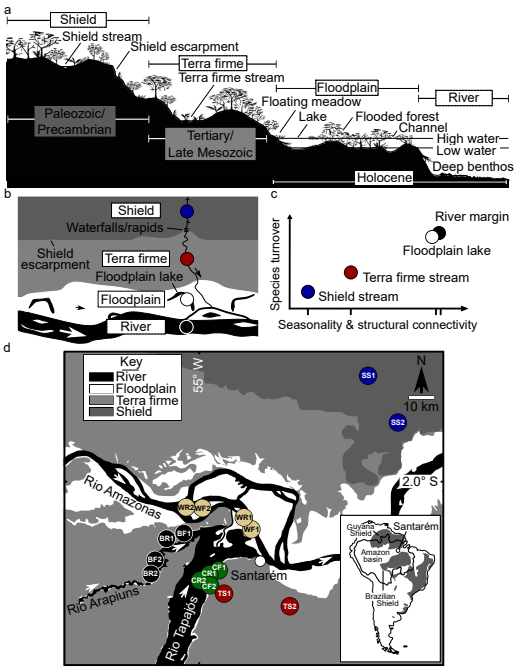

Figure 2

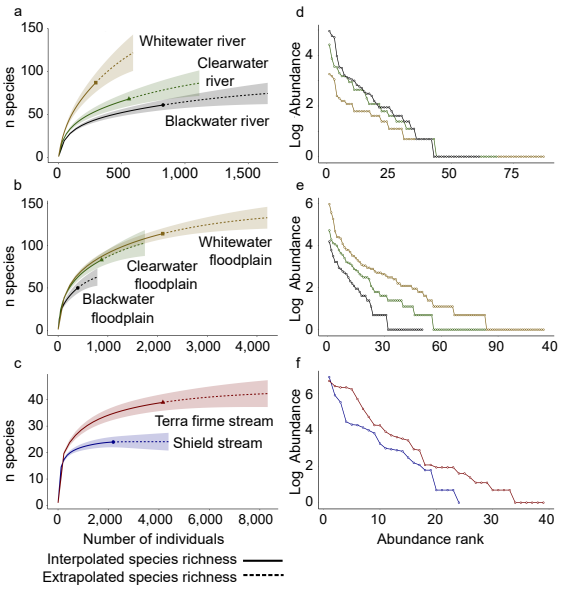

Figure 3

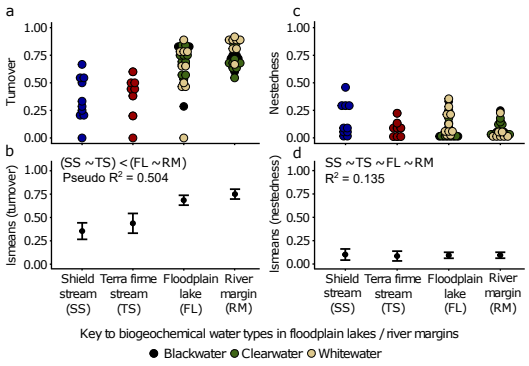

Figure 4