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Zakariya Ghalmane, Pascal Poncelet, Roberto Interdonado, Dino Ienco, Pierluigi Carbonara, Angelo Cau, Antonio Esteban, **Maria Teresa Farriols**, Maria Cristina Follesa, Cristina Garcia-Ruiz, Germana Garofalo, Gioacchino Bono, Taha Imzilen, Igor Isajlović, Stefanos Kavadas, Irida Maina, Porzia Maiorano, Chiara Manfredi, Jurgen Mifsud, Panagiota Peristeraki, Mario Sbrana, Maria Teresa Spedicato, Ioannis Thasitis, Nedo Vrgoc, Bastien Mériot, 2026.

[A new framework for measuring community diversity in temporal ecological networks](#)

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Abstract: Assessing changes in community diversity is a central issue with regard to many fundamental and applied aspects in ecology, biogeography and conservation. However, some important features for the assessment of community by diversity measures still need to be considered to quantify spatio-temporal variation, notably their explicit variation through time while integrating network structure and species differences. Here we introduce a new framework based on complex network analysis and on an extension of Hill numbers. It encompasses three main aspects: i) the differences/distances between species (e.g., co-occurrence, function, phylogeny, taxonomy), ii) the topological properties of the network, and iii) the variability along the time dimension by introducing three measures quantifying the overall temporal dynamics of the network. To illustrate how the new framework reveals complementary patterns beyond those identified by traditional approaches in previous studies, we analyze two data sets that vary in both their temporal extent and the types of communities they represent: (i) Mediterranean exploited fish communities sampled during 25 years, (ii) Amazonian bat communities surveyed during 4 years. Our results showed that the fish communities could be classified into five different clusters according to their spatio-temporal behaviors, as well as environmental and fishing forcings. Bat community diversity has higher values in larger forest fragment areas, while habitats with small areas exhibit very high changes through time mainly due to species turnover. By simultaneously incorporating essential features of communities, the new framework enhances identification of their spatio-temporal trends, and helps to identify priority zones of interest for management and conservation.

Keywords: Diversity, Function, Phylogeny, Taxonomy, Complex networks, Centrality measure.