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Species Vulnerability and Ecosystem Fragility: A Dual Perspective in Food Webs

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Ecosystems face intensifying threats from climate change, overexploitation, and other human pressures, emphasizing the urgent need to identify keystone species and vulnerable ones. While established network-based measures often rely on a single metric to quantify a species' relevance, they overlook how organisms can be both carbon providers and consumers, thus playing a dual role in food webs. Here, we introduce a novel approach that assigns each species two complementary scores—an importance index quantifying their centrality as carbon source and a predatory index capturing their vulnerability. We show that species with high importance index are more likely to trigger co-extinctions upon removal, while high-predatory index species typically endure until later stages of collapse, in line with their broader prey ranges. On the other hand, low predatory index species are the most vulnerable and susceptible to extinctions. Tested on multiple food webs, our method outperforms traditional degree-based analyses and competes effectively with eigenvector-based approaches, while also providing additional insights.

Presenter: CALÒ, E.**Session Classification:** Session 8