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Historical Food-Web Changes in Invaded Fish Communities in the Lower Guadiana Basin †

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Abstract: Freshwater ecosystems are increasingly being reshaped by biological invasions, leading to biotic homogenization and biodiversity loss. However, the extent to which novel species may drive changes in food-web structure over time remains poorly understood. Clarifying changes in historical ecological processes is critical to inform conservation and restoration efforts in recipient ecosystems. Here, we address food-web changes associated with fish invasions in the Lower Guadiana Basin (LGB) over the past 40 years, by contrasting feeding relationships between museum-archived and contemporary specimens, using stable carbon (δ13C) and nitrogen (δ15N) ratios. Specifically, trophic niches of museum-archived fishes sampled throughout 1978–1987 and 1999–2004 corresponding to the initial establishment and spread of non-native fishes, respectively, were compared with those of fishes sampled in 2019, characterizing the integration of non-native species in the recipient ecosystem. We focused on five native species (*Anaecypris hispanica*, *Cobitis paludica*, *Iberochondrostoma lemmingii*, *Squalius pyrenaicus* and *Squalius alburnoides*) and four non-native species (*Lepomis gibbosus*, *Australoheros facetus*, *Micropterus salmoides* and *Gambusia holbrooki*) with potential to cover multiple trophic positions in the food-webs. We approached historical baseline resources using prey items in gut contents of the museum-archived fishes and characterized primary producers and macroinvertebrates in 2019. Prior to analysis, samples were normalized for high lipid content and corrected for preservation. We found considerable asymmetries in niche partitioning among species as invasion progressed. Over time, native species tended to be displaced to lower trophic levels, while non-native species showed significantly higher trophic niches, driven mainly by increases in trophic (δ15N) range. Our study highlights that stable isotopes may provide important insights on historical food-web structure and particularly on processes underpinning ecological changes associated with anthropogenetic pressures on freshwater ecosystems.

Keywords: food-webs; stable isotopes; museum specimens; trophic niche; non-native species

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