biology and life sciences forum

MDPI

Abstract

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

Christos Gkenas [1,*,‡], Joana Martelo [1,2], Julien Cucherousset [3], Filipe Ribeiro [1], João Gago [1,4], Maria Judite Alves [2,5], Diogo Ribeiro [1,4], Gisela Cheoo [6] and Maria Filomena Magalhães [2]

1 Centro de Ciências do Mar e do Ambiente (MARE), Faculdade de Ciências, Campo Grande, Universidade de Lisboa, 1749-016 Lisboa, Portugal; jmmartelo@fc.ul.pt (J.M.); fmvribeiro@gmail.com (F.R.); joao.gago@esa.ipsantarem.pt (J.G.); diogorrribeiro@hotmail.com (D.R.)
2 Centro de Ecologia, Alterações Ambientais e Evolução (cE3c), Faculdade de Ciências, Campo Grande, Universidade de Lisboa, 1749-016 Lisboa, Portugal; mjalves@museus.ulisboa.pt (M.J.A.); mfmagalhaes@fc.ul.pt (M.F.M.)
3 UMR5174 Laboratoire Évolution & Diversité Biologique (EDB), Centre National de la Recherche Scientifique (CNRS), Université Paul Sabatier, ENFA, 118 Route de Narbonne, 31062 Toulouse, France; julien.cucherousset@univ-tlse3.fr
4 Escola Superior Agrária, Instituto Politécnico de Santarém, 2001-904 Santarém, Portugal
5 Museu Nacional de História Natural e da Ciência, Universidade de Lisboa, 1250-102 Lisboa, Portugal
6 Faculdade de Ciências, Campo Grande, Universidade de Lisboa, 1749-016 Lisboa, Portugal; giselacheoo@gmail.com
* Correspondence: chrisgenas@gmail.com
† Presented at the IX Iberian Congress of Ichthyology, Porto, Portugal, 20–23 June 2022.
‡ Presenting author (Oral presentation).

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

check for updates

Citation: Gkenas, C.; Martelo, J.; Cucherousset, J.; Ribeiro, F.; Gago, J.; Alves, M.J.; Ribeiro, D.; Cheoo, G.; Magalhães, M.F. Historical Food-Web Changes in Invaded Fish Communities in the Lower Guadiana Basin. *Biol. Life Sci. Forum* **2022**, *13*, 2. https://doi.org/10.3390/blsf2022013002

Academic Editor: Alberto Teodorico Correia

Published: 1 June 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

Author Contributions: Conceptualization, C.G., J.C. and M.F.M.; methodology, C.G., J.C. and M.F.M.; investigation, C.G., J.M., J.C., F.R., J.G., M.J.A., D.R., G.C. and M.F.M.; writing—original draft

preparation, C.G.; writing—review and editing, C.G. and M.F.M.; visualization, C.G.; project administration, C.G.; funding acquisition, C.G. All authors have read and agreed to the published version of the manuscript.

Funding: This study was conducted in the frame of the project ISO-INVA co-funded by international funds through Lisboa 2020—Programa Operacional Regional de Lisboa, in its FEDER component (Project ref. LISBOA- 01-0145-FEDER-029105) and national funds through FCT—Fundação para a Ciência e a Tecnologia, I.P (Project ref. PTDC/CTA-AMB/29105/2017).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions.

Conflicts of Interest: The authors declare no conflict of interest.