



Abstract

Living on the Edge: Management and Conservation of Atlantic Salmon at the Southern Limit of the Species Distribution [†]

Carlos M. Alexandre ^{1,*}, Sara Silva ¹, Catarina S. Mateus ¹, Maria J. Lança ², Bernardo R. Quintella ^{3,4}, Ana F. Belo ¹, Andreia Domingues ¹, Ana S. Rato ¹, Roberto Oliveira ¹, André Moreira ¹, Joana Pereira ¹, Inês Raposo ¹, Pedro Sousa ¹, Yorgos Stratoudakis ⁵, Pablo Caballero ⁶ and Pedro R. Almeida ^{1,7}

¹ MARE-Centro de Ciências do Mar e do Ambiente/ARNET-Rede de Investigação Aquática, Universidade de Évora, 7004-516 Evora, Portugal; ssrs@uevora.pt (S.S.); cspm@uevora.pt (C.S.M.); affadb@uevora.pt (A.F.B.); afdomingues@uevora.pt (A.D.); assrato@uevora.pt (A.S.R.); rlpo@uevora.pt (R.O.); andre.moreira@uevora.pt (A.M.); joana_gomespereira@hotmail.com (J.P.); senifox@gmail.com (I.R.); fc50839@alunos.fc.ul.pt (P.S.); pmra@uevora.pt (P.R.A.)

² MED-Instituto Mediterrânico para a Agricultura, Ambiente e Desenvolvimento & Departamento de Zootecnia, Escola de Ciências e Tecnologia, Universidade de Évora, 7004-516 Evora, Portugal; mjlanca@uevora.pt

³ MARE-Centro de Ciências do Mar e do Ambiente, Faculdade de Ciências, Universidade de Lisboa, 1600-548 Lisboa, Portugal; bsquintella@fc.ul.pt

⁴ Departamento de Biologia Animal, Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisboa, Portugal

⁵ Departamento do Mar, IPMA-Instituto Português do Mar e da Atmosfera, 1749-077 Lisboa, Portugal; yorgos@ipma.pt

⁶ Dirección Xeral de Patrimonio Natural, Consellería de Medio Ambiente, Xunta de Galicia, 15781 Santiago de Compostela, Spain; pblo.cbllero.javierre@xunta.gal

⁷ Departamento de Biologia, Escola de Ciências e Tecnologias, Universidade de Évora, 7004-516 Evora, Portugal
* Correspondence: cmea@uevora.pt; Tel.: +351-962858816

[†] Presented at the IX Iberian Congress of Ichthyology, Porto, Portugal, 20–23 June 2022.

[‡] Presenting author (Oral communication).



Citation: Alexandre, C.M.; Silva, S.; Mateus, C.S.; Lança, M.J.; Quintella, B.R.; Belo, A.F.; Domingues, A.; Rato, A.S.; Oliveira, R.; Moreira, A.; et al. Living on the Edge: Management and Conservation of Atlantic Salmon at the Southern Limit of the Species Distribution. *Biol. Life Sci. Forum* **2022**, *13*, 107. <https://doi.org/10.3390/blsf2022013107>

Academic Editor: Alberto Teodorico Correia

Published: 16 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/>).

Abstract: Atlantic salmon (*Salmo salar* L.) are an emblematic anadromous fish species that inhabit marine and freshwater ecosystems in the Northern Hemisphere. In Portugal, the southern limit of its global distribution range, the species is classified as *Critically Endangered* (CR), and occurs only in the Minho and Lima rivers, which hold the most abundant populations, with occasional confirmed occurrences in the Cávado and Douro rivers. In this region, the species faces several highly detrimental threats (e.g., dams and other obstacles, unsuitable fishing legislation, and climate change), but some knowledge gaps about the biology, ecology, and structure of these southern populations often impair any attempt to define and implement effective management and conservation programs. We present the objectives, actions, and preliminary results of a set of projects and partnerships, recently implemented in Portugal, focused on increasing knowledge about local salmon populations to contribute to the development of suitable management guidelines for the target species. Within the project “SALMONLINK—Contribution of scientists and fishermen to the conservation and participatory management of Atlantic salmon populations in Portugal”, several actions have been implemented for the past three years to improve knowledge about this species, including the assessment of salmon distribution and abundance, adult and juvenile migration patterns, and population structure. In complement to these measures, we are also implementing (in Portugal) the international projects “SMOLTrack III & IV—Quantifying smolt survival from source to sea: informing management strategies to optimize returns”, which are specifically focused on smolt seaward migration and aim to obtain more information on this particularly vulnerable life-stage. Combined with a strong link with the local commercial and recreational fishing communities, who are providing data on salmon catches and contributing to an overview of the socioeconomic value of salmon in Portugal, these projects will contribute to increasing the knowledge of these populations, and at the same time, within the context of the constant transfer of knowledge between all the involved parties, advise the adaptation of the current fishing legislation to the conservation and management requirements of this highly endangered species.

Keywords: Atlantic salmon; fisheries management; sustainability; population ecology and structure

Author Contributions: Conceptualization, C.M.A. and P.R.A.; methodology, C.M.A., P.R.A., C.S.M., B.R.Q., Y.S., P.C.; formal analysis, C.M.A., S.S., C.S.M., I.R.; investigation, C.M.A., C.S.M., S.S., A.S.R., J.P., R.O., A.M., A.F.B., A.D., P.S.; resources, C.M.A. and P.R.A.; data curation, S.S., C.M.A., J.P., C.S.M.; writing—original draft preparation, C.M.A.; writing—review and editing, S.S., C.S.M., B.R.Q., M.J.L., Y.S., P.C., P.R.A.; supervision, C.M.A., C.S.M., P.R.A.; project administration, C.M.A. and P.R.A.; funding acquisition, C.M.A., M.J.L., P.R.A. All authors have read and agreed to the published version of the manuscript.

Funding: The present study was supported by European Funds (EMFF - European Maritime and Fisheries Fund), through the project SMOLTRACK (S12.817653) and, more specifically, by the Operational Program MAR2020 (project SALMONLINK: MAR-01.03.02-FEAMP-0048). Funding was also provided by the Portuguese Science Foundation through the strategy plan for MARE (Marine and Environmental Sciences Centre), via project UIDB/04292/2020, and under the project LA/P/0069/2020 granted to the Associate Laboratory ARNET. FCT also supported this study through the individual contracts attributed to Carlos M. Alexandre (CEECIND/02265/2018) and to Bernardo R. Quintella (2020.02413.CEECIND), and the PhD scholarships attributed to Sara Silva (2021.05558.BD), Ana S. Rato (2021.05339.BD) and Andreia Domingues (2021.05644.BD).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data is available from correspondence author, upon reasonable request.

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