

Warming alters reproductive investment in Northeast Atlantic sole populations: small fish thrive, large fish compromise

Bui Tuan Anh¹, De Troch Marleen², Poos Jan Jaap³, Bekaert Karen⁴, Sys Klaas⁴, Lemey Laura⁴ and Depestele Jochen⁴

¹ Department of Biology, Marine Biology, Ghent University

E-mail: tuananh.bui@ugent.be

² Ghent University, Krijgslaan 281/S8, Ghent, Belgium

³ Wageningen University and Research, Wageningen, The Netherlands

⁴ Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Oostende, Belgium

Reproductive investment is a major life-history trait affecting individual fitness. Understanding reproductive investment is important to assess population dynamics under current and future environmental changes. In this study, we investigated how fish's reproductive investment scales with body size and how temperature affects fish's reproductive investment. To this end, we applied a mixed-effects modelling framework to a large dataset of gonad weight collected from 2004 to 2022 from four populations of common sole (*Solea solea*) in the North Sea, Irish Sea, Bristol Channel and Celtic Sea North, and Eastern English Channel. The results showed that sole exhibit hyper-allometrically scaling of reproductive investment with body size, implying that larger individuals have higher relative reproductive investment than smaller individuals. Increasing temperatures led to contrasting responses of reproductive investment across body sizes, i.e. increasing in small fish while decreasing in large fish. This may suggest a lower optimal reproduction temperature at a larger body size in sole. This study provides additional evidence for hyper-allometric reproductive scaling in fish and sheds light on how temperature impacts reproductive investment, with implications for population dynamics.

Keywords

Reproductive Investment; Hyper-allometric Scaling; Temperature; Gonad; Solea Solea