

Environmental changes and the condition of Downs herring in Belgian marine waters: New insights based on historical data

Everaert Gert, Lescauwaet Ann-Katrien, Hooyberg Alexander and Vandegheuchte Michiel

Flanders Marine Institute (VLIZ), Wandelaarkaai 7, 8400 Oostende, Belgium
E-mail: gert.everaert@vliz.be

Atlantic herring (*Clupea harengus*) are found in the northern part of the Atlantic Ocean and have been one of the most important fish species on European markets since the middle ages. Based on the location of their spawning grounds different spatial components were identified in the North Sea herring population. In this research, we focused on the Downs herring that migrate to the area of the Flemish Banks in the Southern Bight of the North Sea for spawning in the beginning of November. After spawning, these herring stay a few months in Belgian waters before heading back to the foraging grounds in central parts of the North Sea (Lescauwaet et al. 2013). Gustave Gilson and Charles Gilis collected data about individual fish characteristics (length, weight, vertebrae number, age...) of a subset of the landings in Belgium from 1942 until 1950. This unique set of data, containing information of more than 6000 individual herring, was digitized by VLIZ (Lescauwaet et al. 2018). The aim of this study was to infer trends of individual fish characteristics between 1942 and 1950 and to assess whether these trends could be related to environmental drivers such as long-term climatic oscillations and temperature anomalies. To do so, we made use of regression-based techniques as described in Zuur et al. (2009). These models were assessed based on their model fit and residual diagnostics. We found that long-term climatic oscillations such as the Atlantic Multidecadal Oscillation ($p < 0.001$) and monthly temperature anomalies ($p < 0.001$) explained patterns in the condition of the herring. We found that herring caught between 1945 and 1948 were in better condition ($p < 0.001$) than in other years, but did not differ in the amount of vertebrae. Our results add new knowledge about the variability in the Downs herring as well as the environmental drivers influencing this variability in the Southern Bight of the North Sea. This is of vital importance in the context of sustainable fisheries management.

References

- Zuur, A.F., Ieno, E.N., Walker, N.J., Saveliev, A.A., Smith, G.M., 2009. Mixed Effects Models and Extensions in Ecology with R. Public health. vol. 36 Springer, New York.
- Lescauwaet, A.-K.; De Raedemaeker, F.; Vincx, M.; Mees, J. (2013). Flooded by herring: Downs herring fisheries in the southern North Sea during World War II, *in*: Lescauwaet, A.-K. *Belgian fisheries: ten decades, seven seas, forty species: Historical time-series to reconstruct landings, catches, fleet and fishing areas from 1900*. pp. 164-181
- Lescauwaet, A.K., (2018) (<http://www.vliz.be/imis?module=dataset&dasid=5919>)

Keywords: data science; fish characteristics; environment