

EGU21-327

<https://doi.org/10.5194/egusphere-egu21-327>

EGU General Assembly 2021

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Shifts in Herring and Mackerel Resources in the Northeast Atlantic under Global Warming

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Global warming is one of the most imminent challenges facing humanity in the 21st century. It will not only have a profound effect on ecosystems but also on economies around the world. The shift in habitats of economically important marine species caused by rising seawater temperatures will bring challenges to the existing fishing industry, especially small fishing businesses. This research tries to build mathematical models to find out shifts in herring and mackerel resources in the Northeast Atlantic under global warming, and offer advice on how to deal with potential development challenges.

First, several models are designed to predict the change in seawater temperature over the next 50 years. We base our prediction model on the Coupled Model Intercomparison Project Phase 6 (CMIP6) and conduct a detailed analysis of different possible levels of seawater temperature increases caused by different carbon emissions levels. Then the lifecycles and migration behavior of herring and mackerel are researched and the influence of seawater temperature increases on their ecosystems is predicted and charted. The tendency of herring and mackerel populations going further offshore and northerly is obvious.

Second, after analyzing the migration of fish populations, we research the fishing industry in the region and deem it necessary for small fishing companies to make adjustments to their fishing methods. If global warming follows the relatively moderate economic development model, which is the most likely scenario, fish populations will too far away for small fishing companies to harvest near 2091. Our suggested strategy is that fishing vessels capable of operating without land-based support should be increased so that they can operate in waters further from the coast to maintain the harvest.

Finally, the models' sensitivity is tested, and the results demonstrate the effectiveness and robustness of our modeling. This research provides insights into how small fishing companies should relocate themselves to optimize their business, in order to deal with long-term development challenges, and seize the opportunity in fishing under the effects of Global Warming.