Popular science summary of the PhD thesis

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Title of the PhD thesis	Physical processes affecting stock dynamics of blue whiting in the Northeast Atlantic Ocean
PhD school/Department	DTU Aqua

Science summary

Blue whiting is a very abundant mesopelagic fish in the Northeast Atlantic and currently (2025) supports one of the world's largest pelagic fisheries. However, the number of young fish that survive to join the adult stock biomass (i.e., recruitment) changes widely from year to year, and this variability is not well explained by spawning stock biomass alone. Because of this, short-term recruitment forecasts used for management advice are still quite uncertain.

My PhD thesis shows that recruitment variability in blue whiting is closely linked to ocean-climate conditions around the main spawning grounds west of Ireland and the British Isles. I found that wind stress curl in the year before spawning is strongly related to recruitment per spawner, and adding this wind index to stock-recruitment models improves recruitment forecasts compared to the current geometric-mean approach. I also show that ignoring this climate effect can change projected spawning stock biomass and catch advice, which affects how stock risks are evaluated.

To understand the mechanisms underlying the relationship between wind stress curl and recruitment, I combined analyses of transport and temperature indices across the spawning region with an agent-based drift model for eggs and larvae. I found that recruitment tends to be higher in years with circulation patterns that both retain early life stages locally over Porcupine Bank and transport larvae northward towards nursery areas. Finally, I found that higher recruitment is often associated with cooler, more subpolar-influenced conditions during early life, likely reflecting broader changes in water masses and feeding conditions linked to the subpolar gyre.

Overall, the thesis supports a connected chain of processes in which pre-spawning winds influence circulation patterns, which shape drift and the early life environment, and ultimately affects recruitment success. This provides a step toward more climate-informed and ecosystem-based management for blue whiting.