Atlantic Origin of Decadal Predictability in Barents Sea Cod Stock

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The implication of high multi-year predictability of the physical environment in the North Atlantic Subpolar Gyre
(SPG) on the marine biology has remained unexplored. Here, by analyzing decadal hindcasts from a 16-member
state-of-the-art prediction system, we reveal predictability of the marine environment in the Barents Sea. We show
that high multi-year prediction skill of the SPG hydrography can be translated to the Barents Sea Cod Stock (BSC),
and extended to lead year-11. Such an extended predictability is achieved through a dynamical-statistical predic-
tion system, wherein dynamically predicted explanatory variables are fed into a regression model. The dynamical
prediction system performs better than persistence in simulating the evolution of temperature and salinity anoma-
lies along the Atlantic pathway, and the regression model exploits high correlation (lag-7) between water mass
anomalies in the SPG and the BSC. While this reveals a strong bottom up control on BSC, we also show that top
down control on BSC in the form of fishing pressure has led to substantial deviations in the evolution of BSC
which can not be explained solely by changes in environmental conditions. Our results have implications for long
term predictability of other marine ecosystems in the eastern North Atlantic and Nordic Seas which show a strong
bottom up control.