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Eastern Scotian Shelf and Barents Sea intercomparison: climate fluctuations, human impact, and system resilience

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Climate variation and overfishing of top predators have caused a restructuring of several formerly cod-dominated North Atlantic shelf ecosystems. The Barents Sea, currently holding the world's largest cod stock and having undergone significant demersal fish biomass fluctuations, has not experienced major ecosystem restructuring. In contrast, the collapse of eastern Scotian Shelf demersal fish stocks in the early 1990s led to a trophic cascade with a dramatic increase in forage fish and alternating responses at lower trophic levels. In the early 1990s, the Barents Sea had the lowest 5-year cod fishing mortality ($F = 0.45$) since the 1950s; whereas cod fishing mortality ($F = 0.96$) on the eastern Scotian Shelf was the highest on record. At the same time, a deepening of the Icelandic low-pressure system led to increased inflow of warm-water masses to the Barents Sea and colder water temperatures on the eastern Scotian Shelf. These interacting forces of ocean climate and fishing mortality led to diametrical responses: a rapid increase in Barents Sea cod biomass during the mid-1990s and a collapse of the eastern Scotian Shelf stocks. Evidence indicates that a predator-prey role reversal is an important factor in the lack of recovery of the eastern Scotian Shelf demersal stocks despite a nearly 20-year fishing moratorium. In the Barents Sea, a limited overlap between the distribution of forage fish and demersal fish larvae, and a directed forage fish fishery limits the potential for predator–prey role reversal.

Keywords: climate variation, ecosystem effects of fishing, spatial overlap, trophic regulation.

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