

Intraspecific diversity in Atlantic cod (*Gadus morhua*) drives unique top-down control in coastal food web

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Abstract

Diversity in life histories within species profoundly influences biological interactions and resonates throughout food webs, yet quantifying these intricate processes is challenging. To explore the impact of intraspecific diversity on food web functioning, we applied century-long observational dataset of the fish community in the coastal Skagerrak to an allometric trophic network model. Representing fish, zooplankton, and phytoplankton taxa as 148 guilds interlinked by 2054 feeding links, we constructed the Skagerrak food web and quantified the roles of two Atlantic cod (*Gadus morhua*) ecotypes. Our results revealed a compelling dynamic: the coastal Fjord cod ecotype had a pronounced intraspecific influence on the biomass growth of the offshore North Sea cod ecotype, whereas the North Sea cod ecotype exerted stronger interspecific top-down control on other fish species. The coexistence of these ecotypes enhanced ecosystem robustness and connectivity. These findings highlight the critical importance of incorporating intraspecific diversity into sustainable fisheries management practices.

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