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Going with the flow: Employing network analysis to explore Northeast US shelf ecosystem consequences of alternative anadromous forage biomass scenarios.

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Historically, anadromous fish played larger roles in the marine ecosystem. However, loss of habitat has led to reduced potential population productivity, extirpations, and susceptibility to a suite of anthropogenic and environmental sources. The reduced productivity has had consequences, forcing bycatch caps and moratoria on harvest. Improving connectivity and accessibility to spawning habitat would increase population sizes, but would come with economic costs. To access the ecosystem and economic benefits of biomass restoration we inputted historical references of anadromous forage fish biomass in Northeast US marine system to emulate the increase of connectivity of riverine systems to ocean. We used Ecopath with Ecosim (EwE 6.0) and network analysis to identify the total flow from forage species to key predators. A variety of economically important species, as well as species of concern, were identified as being positively impacted by biomass restoration. We also observed change of keystone groups order for the different scenarios. The main difference being the replacement of coastal sharks by Odontocetes as one of the top keystone species, which indicates effects of biomass changes in the ecosystem functional structure. Analysis of flow allowed us to quantify how much energy is transferred to higher trophic levels by the increase of forage species biomass. This study highlights the overall benefits linked to increased connectivity of watersheds to ocean, suggesting that biomass restoration could play an important role in improving fisheries and ecosystem functioning.

Keywords: Anadromous fish, marine ecosystem, network analysis

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