ICES CM 2016/D:236

Changing trophic structure and energy dynamics in the Northwest Atlantic influences Atlantic salmon abundance.

Timothy F. Sheehan[1], Mark D. Renkawitz[1], Katherine E. Mills[2], Heather J. Dixon[3], Rasmus Nygaard[4]

[1]National Marine Fisheries Service, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, Massachusetts 02543 USA
[2] Gulf of Maine Research Institute, 350 Commercial Street, Portland, ME 04101, USA
[3]University of Waterloo, 200 University Avenue West, Waterloo, Ontario, N2L 3G1, Canada
[4]Greenland Institute of Natural Resources, Kivioq 2, P.O. Box 570, 3900 Nuuk, Greenland

In the Northwest Atlantic, changes in large-scale climate conditions resulted in a phase shift in productivity associated with North American salmon population declines. The nature and timing of these downturns were closely aligned with similar changes in European salmon populations. The coherence of these wide-spread declines suggests that conditions experienced in common marine areas were causative. The productivity shifts were associated with changes in ecosystem conditions and trophic structure that influence the growth, survival, and abundance of many species. To understand the link between trophic mechanisms and Atlantic salmon population declines in the Northwest Atlantic, contemporary (2006-2011) and historic (1965-1970) stomach content data were compared from Atlantic salmon caught at the West Greenland feeding grounds. Atlantic salmon consumed a variety of prey taxa; primarily capelin and Themisto sp.. Diets were similar between contemporary and historic samples, although lower-quality boreoatlantic armhook squid, nearly absent from historic data, was of moderate importance in contemporary samples, while higher-quality capelin decreased in importance. Congruent with the regional phase shift in productivity, mean energy density estimates of capelin decreased by approximately 33.7%, resulting in lower estimates of total energy consumed by Atlantic salmon over time. Similar energy dynamics have also been identified for important Northeast Atlantic salmon forage species. Collectively, these results indicate that altered trophic mechanisms, caused by changing ocean conditions, negatively influenced Atlantic salmon across its range and have likely had a similar impact on many other commercially, culturally, and ecologically important species.

Keywords: Northwest Atlantic, Greenland, Atlantic salmon, capelin, diet, food quality, energy density

Contact author: Timothy F. Sheehan, NOAA Fisheries Service, Tim.Sheehan@noaa.gov, +001 508 495 2215