Advancing Great Lakes Empirical Food Web Modeling

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ABSTRACT:

Linear inverse modeling (LIM) was applied to updated observational data from an earlier Ecopath model of Lake Ontario. Mass balanced food webs for 1987-1991 and 2001-2005 were compared to evaluate hypotheses related to adaptability of alewife (Alosa psuedoharengus) in response to primary production declines and species invasions. The LIM mass balance solutions better fit the observational data. Aggregate trophic level (TL) transfer efficiencies (TTE) generally declined after establishment of invasive dreissenid mussels (Dreissena spp.), but not uniformly. TTE from TL I-II from a median of 30% to 26% ($p = 0.12$), from TL II-III declined from a median of 15% to 11% ($p < 0.1$) while TTE from TL III-IV were similar ($p=0.32$). The efficiency of alewife production relative to primary and zooplankton production declined by approximately 50 % ($p < 0.1$). Adaptive response by alewife, attributed to habitat and diet shifts, were evident in the unchanged magnitude of primary production and detrial flows to alewife. Species-group consumptive flows to alewife increased for Mysis (Mysis relicta), invasive predatory cladocerans, calanoids, cyclopoids and small cladoerans but declined for benthos and large cladocerans. Invasive predatory cladocerans increased their consumption of small zooplankton groups, However, alewife maintained their dominance and proportional consumption of these groups. The probability distribution of alewife prey size shifted larger, but there was no indication of improved growth conversion efficiency. The probability distribution of ecotrophic efficiency of alewife shifted higher, indicating an increased risk of predator over-consumption. This study demonstrates that LIM analysis can build on Ecopath structures already developed and improve investigate power and flexibility.