Testing assumptions required to estimate lake-wide parasitic sea lamprey abundance

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ABSTRACT:

Invasive sea lamprey populations in the North American Laurentian Great Lakes are the target of the worlds' longest running vertebrate invasive species control program. However, metapopulation dynamics comprising survival during the lake-resident life stage and within-lake and among-lake connectivity in the sea lampreys' invaded range are poorly understood. We deployed acoustic telemetry methods and continuous-time multistate capture-recapture modeling to learn about sea lamprey metapopulation dynamics in Lake Erie. Over a three-year study period, we acoustic-tagged sea lamprey (n = 619) and deployed acoustic receivers into all known connected waterways containing larval sea lamprey rearing habitat (n = 23), including the Detroit River (connecting Lake Erie to Lake Huron) and distributaries to Lake Ontario. Distribution of tagged sea lamprey to putative spawning waterways was shaped by both varying levels of stream attractiveness and distance-limited processes. Our research revealed that distance-limited dispersal processes could lead to within-lake stock structure for sea lamprey and that contemporary emigration out of Lake Erie occurs (both towards Lake Huron and, to a lesser extent, Lake Ontario). Estimated pre-spawn mortality during the monitored duration of the lake-resident life stage (from January until the end of the spawning season) was 0.28. Based on our novel case study application of applying continuous-time multistate capture-recapture, our methodology may be widely useful for making inferences about metapopulation dynamics of fishes from acoustic telemetry data that rigorously account of observation processes.