Title
Overwinter survival of juvenile Lake Herring in relation to body size, physiological condition, energy stores, and food ration

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Journal
Transactions of the American Fisheries Society

Abstract.
Populations of lake herring Coregonus artedi in Lake Superior have exhibited high recruitment variability over the past three decades. To improve our understanding of the mechanisms which influence year-class strength, we conducted a 225-d laboratory experiment to evaluate the effects of body size, physiological condition, energy stores, and food ration on the winter survival of age-0 lake herring. Small (total length [TL] range 5 60–85 mm) and large (TL range 5 86–110 mm) fish were maintained under thermal and photoperiod regimes that mimicked those in Lake Superior from October through May. Fish in each size-class were maintained at two feeding treatments: brine shrimp Artemia spp. ad libitum and no food. The mortality of large lake herring (fed, 3.8%; starved, 20.1%) was significantly less than that of small fish (fed, 11.7%; starved, 32.0%). Body condition and crude lipid content declined for all fish over the experiment; however, these variables were significantly greater for large fed (0.68% and 9.8%) and small fed (0.65% and 7.3%) fish than large starved (0.49% and 5.7%) and small starved (0.45% and 4.8%) individuals. Final crude protein and gross energy contents were also significantly greater in large fed lake herring (17.6% and 1,966 cal/g), followed by small fed (17.1% and 1,497 cal/g), large starved (15.4% and 1,125 cal/g), and small starved (13.2% and 799 cal/g) fish. Lake herring that died during the experiment had significantly lower body condition and energy stores relative to those of the surviving fish. These results suggest that the depletion of energy stores contributes to greater winter mortality of small lake herring with limited energy uptake and may partially explain the variability in recruitment observed in Lake Superior.

MICHU
MICHU-05-300

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