Does barotrauma reduce the efficacy of stocking deepwater fishes?

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ABSTRACT:

Over 40 million hatchery-reared fish are stocked annually in the Laurentian Great Lakes for native species restoration and to support recreational and commercial fisheries. Previous research has shown that hatchery-reared bloater (*Coregonus hoyi*), a deepwater coregonine, descend rapidly at rates up to 20 m/min upon release from the surface to the lake bottom at stocking sites upwards of 100 m depth. For hatchery-reared fish who have not experienced changes in water pressure prior to release into the wild, rapid compression could cause stress and physical trauma (barotrauma) or death. To investigate the impact of compression barotrauma, experiments were conducted at the Jordan River National Fish Hatchery (Elmira, MI, USA), where fingerling and adult bloater, fingerling cisco (C. artedi), and yearling lake trout (*Salvelinus namaycush*) were placed in the USGS Hyperbaric Apparatus for Fish (HAfF) to simulate descent to target depths. Treatments encompassed three compression rates (rapid = 1.5 atm/min, slow = 1.5 atm/hr, very slow = 0.5 atm/hr) across three depths (5, 20, 50 m) resulting in nine different treatments and three controls (2, 4, 8 hr). Cisco and bloater showed similar responses to increased pressure regardless of compression rate: sustained erratic swimming, high ventilation rate, and eventual loss of equilibrium and death at the highest pressure. At depths beyond 10m (i.e. 1 additional atm), buoyancy and equilibrium loss progressively increased and fish did not recover without a reduction in pressure. Compared to these two coregonine species, lake trout response to compression was to reduce activity and rest on the bottom ("parr stance") with infrequent bursts of erratic swimming; they also regained equilibrium more quickly after decompression. No deaths were recorded for fingerling bloater, cisco, or lake trout, but 0% (5m), 17.8% (20m) and 36.7% (50m) of adult bloater died during the trials. These results suggest that compression barotrauma can cause stress, disequilibrium, and potentially death in hatchery-reared deep-water fishes. Further studies are needed to guide management agencies in developing rearing and stocking practices that minimize the effects of compression barotrauma.