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Long-term effects of EPA and DHA enriched diets on digestive enzyme activity, aerobic scope, growth and survival in age-0 Lake Sturgeon (*Acipenser fulvescens*)

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Highlights

- High DHA diet significantly altered the fatty acid composition of whole body.
- High DHA diet significantly increased growth when temperature was declining.
- High DHA diet significantly reduced mortality by 44% after the first diet transition.

Abstract

Nutritional condition during early life could have long lasting effects on metabolism, growth trajectory and ultimately ecological fitness. We examined effects of *Artemia* nauplii enriched with eicosapentaenoic acid (EPA; C20:5n3) and docosahexaenoic acid (DHA; C22:6n3) on fatty acid profile, digestive enzyme activity, energy density, aerobic scope, growth and survival in age-0 Lake Sturgeon (*Acipenser fulvescens*). Four diets were used in the study: 1) control (absence of EPA and DHA): freshly hatched *Artemia* nauplii, 2) low DHA: *Artemia* enriched with *Chlorella vulgaris*, 3) high DHA: *Artemia* enriched with Red AlgaMac and 4) time-control: *Artemia* left for the time to match growth that would occur during the enrichment. At 20 days post hatch (dph), fish were fed one of four diets three times a day ad libitum for 29 days after which all fish were fed the same diet of bloodworm twice a day ad libitum until the end of the experiment, which included a simulated overwintering event for 45 days at 3 °C. Fish were sampled after 24 days of feeding the aforementioned diets, as well as before and after the

simulated overwintering event at 145 and 190 dph, respectively. Fish fed the high DHA diet did not change the measured parameters compared to fish fed the control diet after 24 days of feeding; however, before overwintering fish fed high DHA showed higher lipase activity ($p = 0.01$) compared to the control group and significantly increased body mass when temperature decreased ($p < 0.05$). Further, fish fed the high DHA diet showed a substantially lower mortality than fish fed the control diet following the diet transition from *Artemia* to bloodworm (44%; $p < 0.05$). Our results suggest the importance of EPA and DHA during early life on growth and survival, which could be used to improve post-release survival rates in conservation aquaculture of Lake Sturgeon, a species at risk or endangered across its natural range.