

Effects of alternative foods on body size and survival of larval Lake Sturgeon

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Introduction

Rearing larval fish is expensive, time consuming, and labor intensive because live foods are utilized. Live foods are necessary to produce enough juveniles of sufficient size to improve recruitment and meet production goals. Several studies have been conducted to investigate the effects of alternate food types on body size and survival to identify more cost effective food types. Formulated diets have been used successfully to rear larval Sturgeons (Kappenman et al. 2011) but also unsuccessfully (Dilauro et al. 1998). Studies investigating transitions from live to alternate food types are limited. Less expensive, alternative food types providing both high survival and growth would benefit aquaculture.

- **Objective: to determine if larval Lake Sturgeon (*Acipenser fulvescens*) fed live *Artemia spp.* will transition well to dead or formulated food.**
- **Hypothesis: fish transitioned to an alternative food type will have lower survival and decreased growth as measured by TL and weight.**

Methods

- The study was conducted at the Black River Streamside Rearing Facility (BRSRF) along the Upper Black River in Cheboygan County, Michigan from June 4 to July 29, 2015.
- Eggs were collected in the upper Black River and fertilized at BRSRF.
- Larvae were reared in nine 3.0 L aquaria at a density of 20 fish per nauplii (*LA*), and frozen *Artemia* (*FA*).
- Larvae were assigned to three feeding types: Trout crumble starter diet (Bio-Oregon; TD), Live *Artemia spp.* weight (dbw) *LA*. Fish assigned to transition to TD were also fed 100% dbw TD.
 - Weeks 1 and 2: 26% dry body tank.
 - Week 3: two groups of fish transitioned from *LA* to TD or *FA* at 13% dbw while one group of fish were fed *LA*.
 - Weeks 4 and 5: 13% and 11% dbw, respectively; fish fed TD, *FA*, or *LA* only.
- Survival was monitored daily and weight per fish and TL were calculated weekly to represent growth (Figures 1-3).
- Repeated measures ANOVAs and a Tukey –Kramer multiple pairwise comparisons were performed for TL, weight per fish, and survival .

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Results

- Survival at six weeks post exogenous feeding (PEF) varied by food type group ($F_{2, 2} = 42.14$, $P = 0.0232$; Figure 4).
- Fish fed LA ($T_2 = 6.98$, $P = 0.0199$) as well as FA ($T_2 = 6.98$, $P = 0.0199$) had significantly higher survival than fish fed TD. Survival between fish fed LA and FA were equivalent ($T_2 = 0$, $P = 1.0000$; Figure 4).
- Significant differences in mean weight per fish were documented across food types and weeks ($F_{2, 6} = 03.13$, $P < 0.0001$; Figures 5 and 6).
- Significant differences were documented in mean TL of fish in all food types across weeks ($F_{2, 6} = 55.71$, $P = 0.0001$; Figures 7 and 8).
- Tukey –Kramer post-hoc analysis revealed significant differences among fish fed the different food types which is denoted by different letters (A, B, or C) in Figures 4-8.

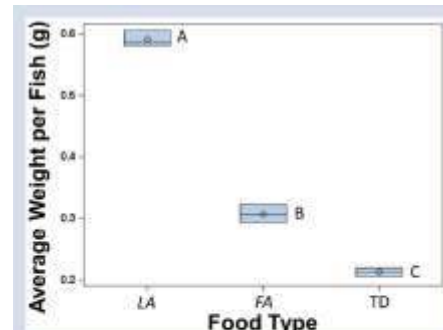


Figure 4: Mean weight per fish among the fish fed the three food types at six weeks PEF. All weights were significantly different from each other ($P < 0.0001$).

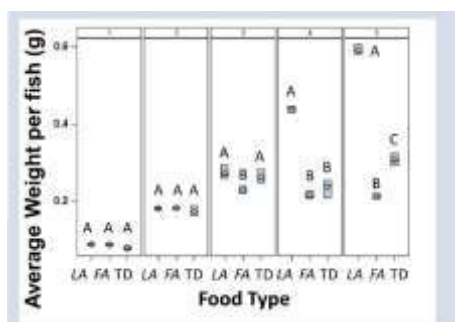


Figure 5: Mean weight per fish among the fish fed the three food types across the five week study. Points with different letters within the same week are significantly different from each other ($P < 0.0001$).

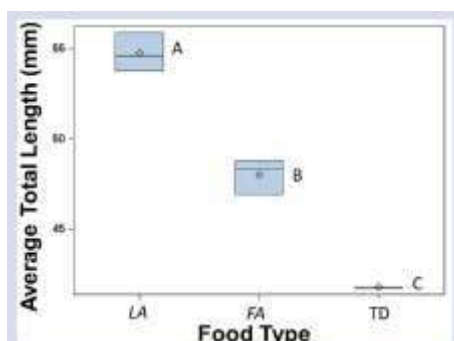


Figure 6: Mean TL among fish feeding on the three food types at six weeks PEF. All TLs were significantly different from each other ($P < 0.0001$).

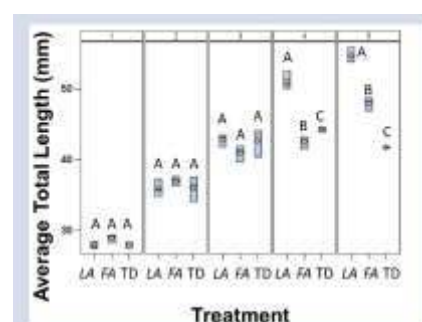


Figure 7: Mean TL among the fish fed the three food types across the five week study. Points with different letters within the same week are significantly different from each other ($P < 0.0001$).

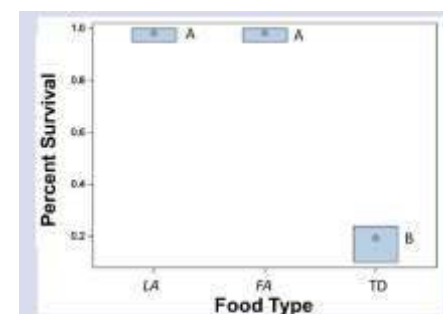


Figure 8 : Mean percent survival among the fish fed the three food types at six weeks PEF. Fish fed TD survived significantly less than fish fed LA or FA ($P = 0.0232$).

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Discussion

- Fish fed an alternative food type did not transition successfully as represented by mortality and comparatively low growth.
- Fish fed TD experienced low survival, but surviving fish increased weight and length.
- Fish fed FA did not gain weight but increased in length while experiencing high survival.
- Several experiments have shown success in food transitioning.
 - Bardi et al. (1998) transitioned Gulf of Mexico Sturgeon larvae in one week.
 - Agh et al. (2013) found live food fed Persian Sturgeon had high survival, but cofed Sturgeons had high growth rates.
- Future studies should focus on alternative food types transitions at different life stages, regimes, or cofeeding strategies to increase larval rearing efficiency.
- Alternative dead or formulated food types would decrease the cost of rearing larval Sturgeon and other fishes.



Figure 1: Larvae fed TD at week 6.



Figure 2: Larvae fed LA at week 6.

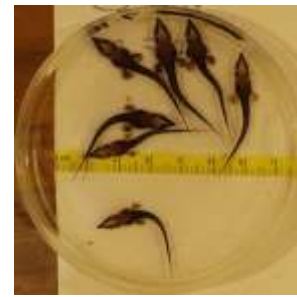


Figure 3: Larvae fed FA at week 6.

References

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Acknowledgements

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