

**BEHAVIORAL PERFORMANCE OF  
WILD-CAUGHT AND LABORATORY-REARED  
RED DRUM LARVAE**

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**EXTENDED ABSTRACT ONLY- DO NOT CITE**

**Introduction**

Many experiments with fish larvae are carried out in laboratory tanks or enclosures using laboratory-reared larvae. Yet, reared larvae can differ in morphology, histology, physiology and behavior from wild-caught specimens (Ferron and Leggett, 1994; Sundell et al., 1998; Boglione et al., 2001). To examine potential behavioral differences between reared and wild red drum larvae and to validate behavioral experiments that use reared red drum, we conducted behavioral experiments with lab-reared and wild-caught red drum larvae. Specifically, we asked the question: do reared red drum larvae have similar behavioral performance as wild larvae?

**Methods**

Experiments were conducted on laboratory-reared and wild-caught red drum (*Sciaenops ocellatus*) larvae representing three size classes (8-, 13-, and 27-mm TL). Lab-reared larvae were hatched and reared in conical 150-L tanks and wild-caught red drum larvae were collected from seagrass meadows in the Aransas Estuary, Texas. Three behavioral tests were performed: routine swimming, acoustic startle response, and visual startle response. Routine swimming was measured as normal swimming activity prior to eliciting startle responses. Acoustically-mediated startle responses were stimulated with a 500-

Hz tone. Visually-mediated startle responses were stimulated by a black oval (1 x 1.5 cm, long axis-vertical) on a white card (10 x 15 cm) at the end of a pendulum as it accelerated toward the larva. The oval was meant to mimic the frontal silhouette of an attacking piscine predator.

Behaviors were recorded on videotape and quantified through frame-by-frame analysis and means calculated from five replicates per larvae. Startle responses were scored as 0 (no response), 1 (response distance < one body length), or 2 (larger response). ANOVA, with size class and source of larvae (reared or wild) as main effects, was used to test for overall ontogenetic differences and differences between wild and reared larvae. Fisher's protected LSD tests were used to make separate planned comparisons between reared and wild larvae at each size. T-tests were used to make comparisons between acoustically- and visually-mediated response characteristics within each combination of size and source of larvae.

## Results

Mean routine swimming speeds of wild and reared larvae were not significantly different at 8- and 13-mm TL, but 27-mm wild larvae exhibited lower speeds than reared larvae ( $P < 0.001$ ). In acoustic response tests of all three sizes, mean response scores were higher in wild larvae than reared larvae ( $P < 0.01$ ), with response score varying among size classes in both groups ( $P < 0.001$ ; Fig. 1a). Wild larvae that were 8 mm TL had a higher mean response score in visual tests than reared larvae of similar size ( $P < 0.001$ , Fig. 1a). In contrast, 27-mm reared larvae had higher visually-mediated response scores than similarly sized wild larvae ( $P < 0.01$ ). For each size, mean time to response was significantly greater for reared larvae than wild larvae in acoustic tests ( $P < 0.01$ ; Fig. 1b).

In both acoustically- and visually-mediated startle responses of reared and wild larvae, response speeds and distances varied among sizes ( $P < 0.001$ ), while response durations remained relatively constant (Fig. 2a-c), although visually-mediated response duration was lower for the largest reared larvae than it was for smaller reared larvae ( $P < 0.001$ ). Visually-mediated response distances were of greater magnitude than acoustically-mediated responses ( $P < 0.001$ ). The greater distances were covered over longer periods so that response speeds were similar in both tests. In acoustic tests, 8-mm wild larvae had higher response speeds than reared larvae ( $P = 0.001$ ) and 27-mm reared larvae had higher response distances, durations, and speeds than wild larvae ( $P < 0.05$ , Fig. 2a-c). In visual tests, 8- and 13-mm reared larvae had significantly higher

response distances and durations than wild larvae ( $P < 0.001$ ), and 13-mm reared larvae had higher response speeds than wild larvae ( $P = 0.014$ ).

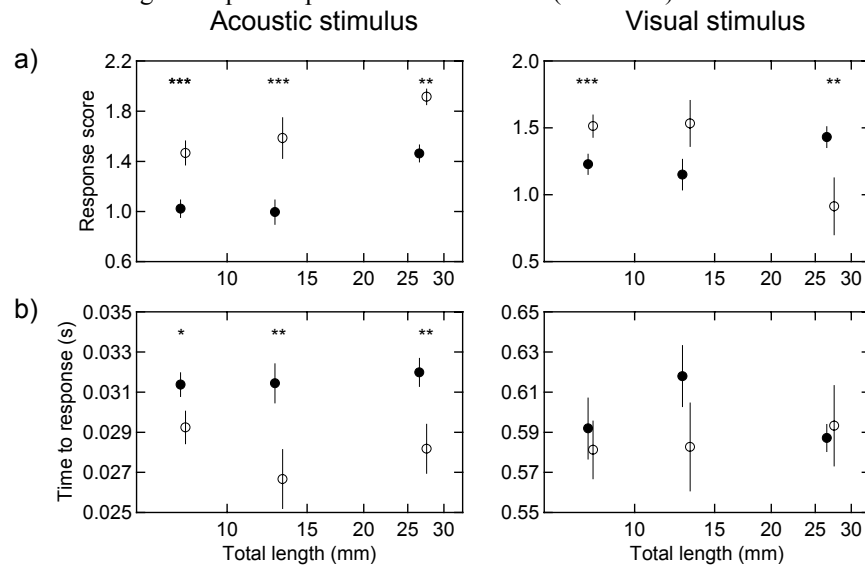


Figure 1. Relationships between mean ( $\pm$  S.E.) startle response (a) score and (b) time to response and larva total length in wild-caught ( $\circ$ ) and hatchery-reared ( $\bullet$ ) red drum larvae when larvae were exposed to an acoustic (left side) or visual (right side) stimulus. Asterisks represent significant differences between wild and reared larvae at a particular size (\*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ ). Data points for wild and reared larvae are slightly offset laterally for clarity.

## Conclusions

Our results suggest that some measures of behavioral performance in reared fish may accurately reflect capabilities of wild red drum (in particular, routine swimming speed of 8- and 13-mm larvae, time to response for a visual stimulus, and perhaps acoustically- and visually-mediated startle response speed). Values for other variables, including, acoustically- or visually-mediated responsiveness, time to response for acoustic stimuli, and acoustically- or visually-mediated response distance and duration, obtained from reared fish, overestimate or underestimate the performance of wild larvae. Differences in responsiveness to

threatening stimuli suggest that reared larvae may be more susceptible to predation than wild larvae. Observations of responses during actual predator

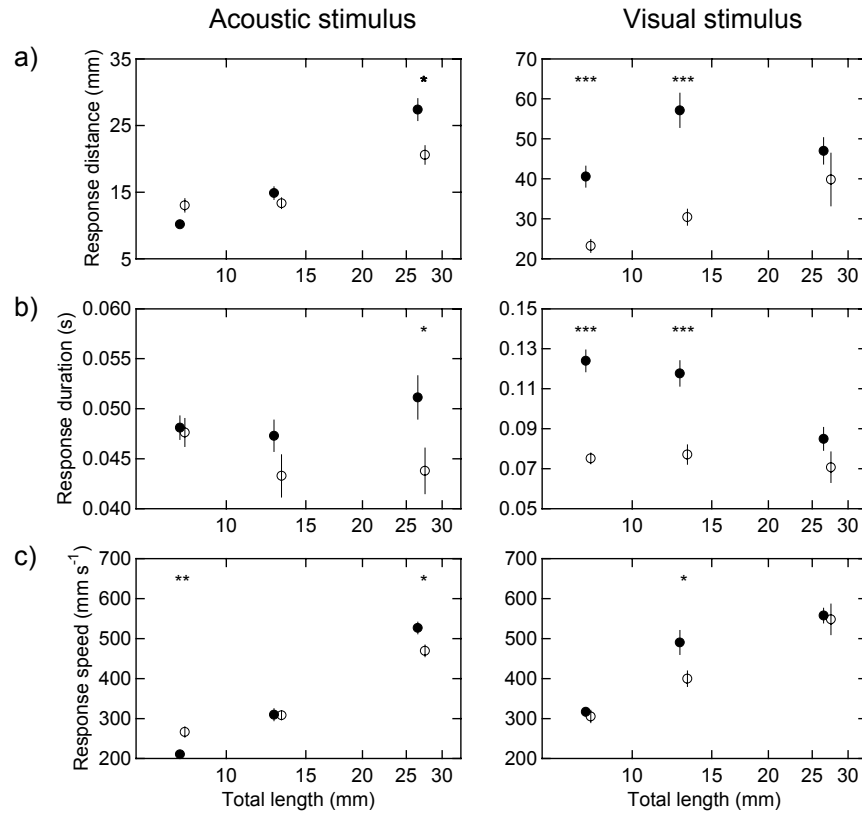


Figure 2. Relationships between mean ( $\pm$  S.E.) startle response (a) distance, (b) duration, and (c) speed and larva total length in wild-caught (○) and hatchery-reared (●) red drum larvae when larvae were exposed to an acoustic (left side) or visual (right side) stimulus. Asterisks represent significant differences between wild and reared larvae at a particular size class (\* P < 0.05, \*\* P < 0.01, \*\*\* P <

0.001). Data points for wild and reared larvae are slightly offset laterally for clarity.

attacks on red drum larvae are needed to determine which aspects of startle response behavior are most important in predator evasion, as has been done for Atlantic herring (Fuiman, 1993). Predator avoidance behavior in fishes is probably developed during early life experiences and hatchery rearing may inhibit its full development. This becomes a concern when reared fish are used to artificially enhance natural stocks, as is done with red drum (McEachron et al., 1998).

### **Literature citations**

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