HSWRI Aquaculture Program Research Report
**** December 2005 & January 2006 ****

Tracking Studies Shed New Light on Hard-Wired "Intelligence" in Cultured Juvenile White Seabass

We recently examined our growing database of acoustic fish "tracks" to evaluate if cultured white seabass emigrate from release embayments using tidal cues. We were pleasantly surprised to find that not only did the seabass emigrate on outgoing tides but they did so under cover of nightfall (Figure 1)! Two independent studies conducted in Mission Bay and Agua Hedionda Lagoon revealed that 48% of the seabass emigrated from the bay within a week of their release and they all left under the cover of darkness on an ebbing tide. For those that remained in the embayment, survival appeared to be low. We either recovered the tags from the sea floor or we did not hear from them again.

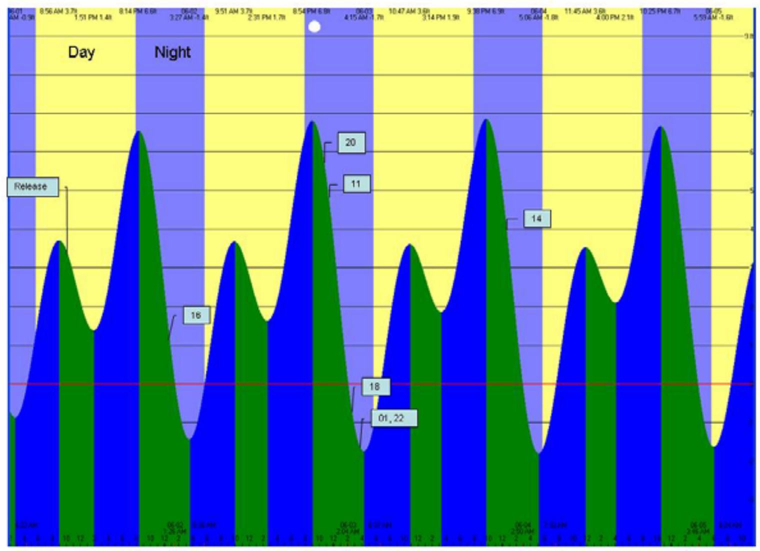


Figure 1. Tidal and lunar cycles immediately after release of white seabass into Mission Bay in San Diego. Individual identification codes are represented inside boxes with lines showing when they were detected at buoy stations outside the bay.

We are currently investigating the acoustic properties of the tags in order to determine if predators such as harbor seals can hear them. If so, this may bias the observed mortality patterns for the tagged fish and limit the usefulness of this approach as an assessment tool for our replenishment program.

Optimized First Feeding Regime for Larval White Seabass

We recently conducted an experiment to determine the best day to initiate feeding of larvae white seabass (*Atractoscion nobilis)*. We examined differences in survival, swimbladder inflation, growth and stress tolerance when *Artemia* nauplii were offered at 3, 4 and 5 days post hatch (dph).

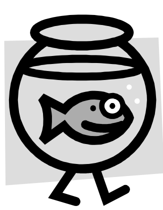
Table 1. Summary results for white seabass fed *Artemia* nauplii as a first feed on three consecutive days (CSI= cumulative stress index, with lower values being more tolerant to hyper-saline stress).

Age at First Feeding (dph)	Survival (% at 11 dph)	Inflation (% at 5 dph)	TL (mm at 9 dph)	CSI (60 ppt at 5 dph)
3	67.8	0	4.88	32.0
4	68.2	90	4.53	46.7
5	44.3	78	4.22	70.7

As shown in Table 1, no larvae inflated their swimbladders when fed at 3 dph. We also noted that the percent of larvae with inflated swimbladders in each trial did not vary between 5 and 8 dph, which suggests that the first week is critical to proper inflation. The treatment that yielded the best combined results was when larvae were first fed at 4 dph. When fed at 4 dph, the greatest number of larvae survived and inflated their swimbladders, and growth and stress tolerance were both good.

These results suggest that feeding larvae prior to swimbladder inflation inhibits inflation. Furthermore, delaying feeding may result in reduced stress tolerance and associated survival. We plan to replicate this study for white seabass and also apply it to all of the other species we are culturing as a means of optimizing larval rearing success.

Age-Specific Larval Fitness in White Seabass



As illustrated above, stress tests can be a useful tool for determining larval fitness, which in turn can be used to optimize culture protocols. In order to understand how stress tolerance changes during larval development, we used a standard salinity exposure test on white seabass larvae from hatch to 25 dph.

Our salinity stress test followed the methods of Dhert (1992). Larvae were exposed to

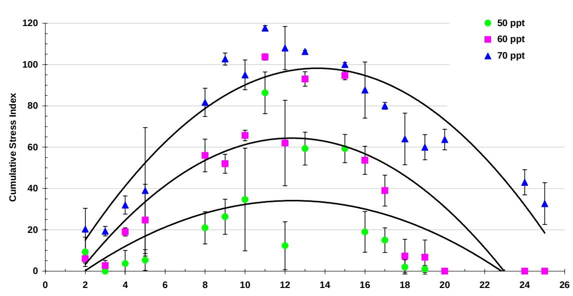


Figure 2. Relationship between larval age (dph) and cumulative stress index (CSI) at three salinities. CSI values are inversely proportional to stress tolerance.

elevated salinities (50, 60 and 70 ppt) and mortality was recorded every five minutes for one hour. A cumulative stress index (CSI) was calculated for each treatment, with lower CSIs indicative of greater stress tolerance. Our results showed that white seabass larvae are most sensitive to stress at 8-16 dph (Figure 2), which encompasses the timing of notochord flexion. Based on these results, we are re-evaluating our most recent culture protocols that had larvae being moved from hatching pools to nursery systems at 12 dph.

Figure 3. White seabass early flexion larvae at 11 dph.

Literature Cited

Dhert, P., Lavens, P., Sorgeloos, P., 1992. Stress evaluation: a tool for quality control of hatchery-produced shrimp and fish fry. Aquaculture Europe 17:6 – 10.

Acknowledgements

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The Aquaculture Research Program has been active for more than 20 years at HSWRI. The primary objective of this Program is to evaluate the feasibility of culturing marine organisms to replenish ocean resources through stocking, and to supply consumers with a direct source of high quality seafood through traditional aquatic farming. Please direct any questions to Mark Drawbridge at mdrawbr@hswri.org.

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