

**DIFFERENTIAL RESPONSE TO STRESS IN A POPULATION OF
STRIPED BASS**

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Introduction

Stress is unavoidable in the aquaculture environment. Repeated or prolonged exposure of fish to common hatchery stressors such as handling and net confinement activates the hypothalamic-pituitary-interrenal axis leading to increased plasma cortisol, decreased growth rates and an increased incidence of disease (Pankhurst and Van Der Kraak, 1997). Because of the adverse effects of stress on performance, fish displaying a lower level of responsiveness to stress may perform better in a culture environment than those individuals that display a high level of responsiveness. Striped bass are an important component of the US aquaculture industry; however, the limited availability of wild broodstock and inconsistent reproduction in captivity hamper rapid expansion of the industry. If individuals with high and low responsiveness to stress could be identified, then a domestication program could be developed to select for lines of striped bass which are divergent for stress responsiveness. This would permit the evaluation to be made of which trait is advantageous in a culture environment. With this goal in mind, we investigated the physiological response to stress in a

population of male striped bass maintained at the University of Maryland's Crane Aquaculture Facility.

Methods

In separate experiments, we evaluated the response to: 1) repetitive semen collection (RP) during an 8-week spawning season and 2) a 1-minute net confinement provided monthly (MC) over a 6 month period to fish from 3 families (MD, MD36 and NC) of striped bass using plasma levels of cortisol as an index of the stress response. For the semen collection experiment, 16 male striped bass were removed from a 7 m diameter holding tank and placed into a 3.5 m diameter tank for easier access. The fish were handled once per week during an 8-week spawning season. Each week they were netted, anesthetized in MS-222, their abdomen was squeezed to express between 4 - 6 ml of milt, and 1.5 ml of blood was drawn from the caudal vessels. For the net confinement experiment, 36 male striped bass were maintained in a 3.5 m diameter-holding tank. At monthly intervals for 6 consecutive months, the fish were removed from their holding tank, held in a net out of water for 1 minute and then placed into a 2 m tank for easier access. After 1 hour, a time previously determined to be the peak for plasma cortisol levels in this population, groups of fish (n=6) were rapidly removed from the tank anesthetized and bled before being placed back into their permanent holding tank.

Results and Discussion

Circulating levels of cortisol in the RP population increased significantly ($p < 0.05$) during the 8-week spawning season. Mean cortisol values determined for individuals during the same period ranged from 35-226 ng/ml indicating that males in this population are highly variable in their response to these stressors. Mean plasma cortisol in striped bass males exposed to the monthly net confinement were significantly lower ($p < 0.01$) in NC family fish when compared to levels for MD or MD36 fish (see figure).

The cortisol response to the net challenge decreased significantly each month for fish sampled in July, August and September ($p < 0.05$), leveled off in October and then decreased for the remainder of the study suggesting that the fish were adapting to the stressor. Within the MC group, there were fish that consistently demonstrated a high response and those that consistently demonstrated a low response to the net stressor. The differences in plasma cortisol levels between individuals and between the striped bass families compared in this study suggest

a heritable component to the response. Identifying individuals with a lower response to stress could enable the production a stress-tolerant domestic broodstock with the ability to thrive in the artificial aquaculture environment.

Literature Cited

Pankhurst, N. M. and G. Van Der Kraak. 1997. Effects of stress on reproduction and growth of fish. In: Iwama, A.D., Pickering, A.D., Sumpter, J.P. and Schreck, C. B. (eds.). *Fish Stress and Health in Aquaculture*. Cambridge University Press, Cambridge, U.K., pp. 73-93 (Society for Experimental Biology Seminar Series vol. 62).

