NOTICE OF PUBLICATION

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Sustainable Aquaculture for a Secure Future

Title: **Overcompensation of circulating and local insulin-like growth factor-1 during catch-up growth in hybrid striped bass (*Morone chrysops*×*Morone saxatilis)* following temperature and feeding manipulations**.

Author(s): Matthew E. Picha[1], Peggy R. Biga[2], Nicholas Galt[2], Andy S. McGinty[1], Kevin Gross[3], Vickie S. Hedgpeth[4], Thomas D. Siopes[4], and Russell J. Borski[1]

[1]Department of Biological Sciences, North Carolina State University, Raleigh, NC 27695, USA
[2]Department of Biology, University of Alabama at Birmingham, Birmingham, AL 35294, USA
[3]Department of Statistics, North Carolina State University, Raleigh, NC 27695, USA
[4]Department of Poultry Science, North Carolina State University, Raleigh, NC 27695, USA

Date: **01 July 2014** Publication Number: AquaFish Research Report **14-325**

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Abstract: Teleosts and other aquatic ectotherms have the ability to withstand prolonged periods of low water temperatures (cold-acclimation) and fasting, and can often respond with phases of accelerated (compensatory) growth when favorable conditions are restored. We assessed whether complete feed restriction prior to (24 °C, days 0–23) and/or during (14 °C, days 24–114) a simulated period of cold-acclimation could elicit episodes of compensatory growth (CG) and catch-up growth upon warm-up to 24 °C and satiation feeding (days 115–148). Control hybrid striped bass (HSB: *Morone chrysops* × *Morone saxatilis*) were fed to satiation throughout the entire experiment under these temperature fluctuations. Compensatory growth and ultimately catch-up growth were achieved in groups of HSB that were deprived of feed during either the initial period at 24 °C (days 0–23), during the cold- acclimation period (14 °C, days 24–114), or during both of these periods (days 0–114). Further, it appears that HSB are better able to compensate for weight loss when skeletal length is not significantly compromised during the treatment period,which occurred in HSB feed restricted during cold-acclimation only. Themost dramatic CG responses were defined by specific growth rates (SGRs) up to 4.2 times that of controls and were accompanied by hyperphagia and improvements in temporal and overall feed conversion. Levels of plasma

AQUAFISH RESEARCH REPORTS are published as occasional papers by the Management Entity, AquaFish Innovation Lab, Oregon State University, Corvallis, Oregon 97333-3971 USA. The AquaFish Innovation Lab is supported by the US Agency for International Development under Grant No. EPP-A-00-06-00012-00. See the website at <aquafishcrsp.oregonstate.edu>.

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insulin-like growth factor (IGF)-1 and muscle IGF-1 mRNA were significantly correlated to growth rate for all groups throughout the experiment (R2= 0.40, 0.23, respectively), with an overcompensation of both observed in HSB with the most elevated SGRs during the CG response. Interestingly, opposing trends were observed between muscle mRNA expression of growth hormone receptor (GHR)-1 and -2, with fasting at 24 °C and 14 °C resulting in depressed levels of GHR-1 and elevated levels of GHR-2 relative to controls. Levels of muscle myostatin (MSTN)-1 mRNA were significantly depressed in HSB fasted at 24 °C and/or 14 °C while MSTN-2 mRNA was lower following initial feed restriction at 24 °C. Likewise, levels of unprocessed pro-MSTN (precursor) and mature MSTN protein were both depressed in fasted fish at 24 °C. This study demonstrates that a previous period of feed restriction and cold-acclimation followed by realimentation at more favorable water temperatures produces a strong CGresponse and catch-up growth in fish. These studies also suggest that an overcompensation of circulating and local IGF-1 along with changes in MSTN mRNA and protein expression may contribute to accelerated growth rates characteristic of CG. Furthermore, our studies indicate that overall feed conversion can improve by as much as 30% with CG induced through temperature and feeding manipulations with no adverse effects on growth of HSB. This raises the possibility that CG protocols can improve production efficiency of HSB and other temperate teleosts in pond or tank culture.

This abstract was excerpted from the original paper, which was published in Aquaculture (2014). 428-429:174-183.

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