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**Title:** Endocrine Biomarkers of Growth and Applications to Aquaculture: A Minireview of Growth Hormone, Insulin-Like Growth Factor (IGF)-I, and IGF-Binding Proteins as Potential Growth Indicators in Fish

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**Abstract:** Growth in fish and other vertebrates is under endocrine control, particularly through the growth hormone (GH)-insulin-like growth factor (IGF) axis. For this reason, it has been of interest to aquaculture researchers and the industry to establish endocrine biomarkers that can both reflect and predict growth rates in fish subject to various biotic and abiotic manipulations. Ultimately, by understanding the hormones that control growth and utilizing them as biomarkers, we hope to achieve optimal growth conditions in the aquaculture environment with less need for lengthy and costly grow-out trials. While the most appropriate endocrine biomarkers for growth can be both species and situation specific, IGF-I may be the most promising candidate for measuring instantaneous growth in fish. This is based on the direct contributions of IGF-I in regulating cell proliferation and ultimately somatic growth, along with its previously established correlations with the specific growth rate in fish under various conditions that alter growth. However, other endocrine indices, such as GH and IGF-binding proteins (IGFBPs), are also important contributors and may in some instances prove a strong

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corollary to growth rate. This review discusses the potential utility of GH, IGF-I, and IGF-BPs as growth biomarkers for those manipulations most relevant to the aquaculture industry, namely, feeding regimen, diet composition, temperature, photoperiod, and stress.

This abstract is excerpted from the original paper, which was published in *North American Journal of Aquaculture* 70:196-211.

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