Factors affecting somatic growth in juvenile Pacific halibut

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PURPOSE

To provide the RAB with a description of the studies conducted by IPHC Secretariat on factors affecting somatic growth in juvenile Pacific halibut.

BACKGROUND

The recent decrease in size-at-age (SAA) of Pacific halibut since the 1990s, combined with low recruitment of cohorts spawned at the time of the initial decrease in SAA in the 1990s, have contributed to a decrease in exploitable Pacific halibut biomass. Despite the importance of this decrease in exploitable biomass for fisheries management, our understanding of the potential causes for the historical change in SAA is still rather scarce. Changes in SAA in Pacific halibut have been hypothesized as being attributable to a variety of causes, including a fisheries-dependent effect through size-selective harvest, changes in population dynamics of the Pacific halibut stock due to a density effect, or changes in somatic growth as a result of environmental and ecological influences. Of the different possible environmental influences, temperature is believed to play a predominant role in influencing somatic growth in the Pacific halibut. Therefore, research activities at the IPHC in this area are devoted to further understanding the potential effects of environmental conditions on somatic growth by evaluating the effects of temperature, among others, on spatial, temporal, and age-specific growth patterns in the Pacific halibut.

DISCUSSION

In order to provide information on the effects of factors that may influence growth in the Pacific halibut, the IPHC is engaged in research activities designed to develop and validate physiological tools for measuring and monitoring growth patterns (Appendix I).

The strategy that was chosen initially involved the identification of potential molecular markers for growth studies by identifying genes expressed in growth-relevant tissues such as white and red skeletal muscle and liver.

The second strategy involved the manipulation of growth rates in juvenile Pacific halibut by temperature manipulation. Through acclimation at a low temperature (2 C), growth was suppressed, whereas through temperature-induced growth compensation, growth was stimulated, resulting in two opposite growth patterns (growth suppression/slow growth versus growth induction/fast growth; Figure 1) that could be compared in order to identify those genes that respond to temperature and that, therefore, could be considered acceptable growth markers.

This strategy has resulted in the identification of a large set of potential growth markers that could be useful for the detection of different growth patterns in the wild. Current efforts are devoted to the validation of the identified potential growth markers for their use in monitoring the growth pattern of Pacific halibut in a spatial and temporal manner. A specific deliverable of these studies is the development of sensitive assays for measuring the expression levels of growth markers that can be used on skeletal muscle samples from captured Pacific halibut in order to

derive direct information on growth patterns and potential. Initially, selected growth markers will be tested using skeletal muscle samples from age-matched Pacific halibut caught in the NMFS trawl survey corresponding to three different size categories (< 40 cm; 40 – 60 cm and > 60 cm) (Figure 2). These studies will inform whether the size differences among fish of the same age (e.g., 3-yr olds) are due to growth differences. These studies are being conducted in part with funding from the North Pacific Research Board (Grant Number 1704).

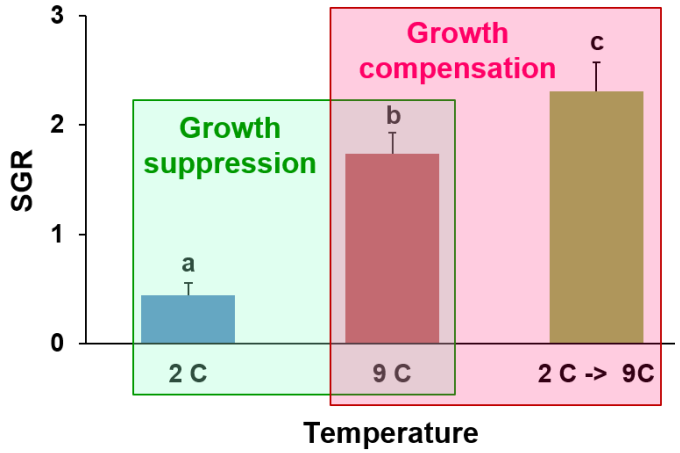

Figure 1. Effects of temperature manipulation on standard growth rate (SGR) in juvenile Pacific halibut. Growth suppression was achieved by acclimating fish at a low temperature (2 C) and growth stimulation was achieved by reacclimating at 9 C fish that were previously acclimated at 2 C as a result of growth compensation.

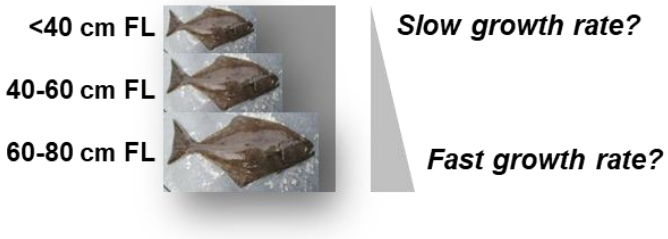

Figure 2. Proposed first application of selected growth markers to determine if size differences among Pacific halibut of the same age (age-matched) can be attributed to growth differences.

RECOMMENDATION

That the RAB:

1) **NOTE** paper IPHC-2020-RAB021-09, which outlined the studies on growth in juvenile Pacific halibut by the IPHC Secretariat.

APPENDICES

Appendix I: Graphical summary of research activities related to the identification of physiological markers for growth monitoring of the Pacific halibut population.

APPENDIX I

Graphical summary of research activities related to the identification of physiological markers for growth monitoring of the Pacific halibut population