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Estimation of the Relationship between Growth and Consumption Rates in Juvenile Pacific Cod (*Gadus macrocephalus*)

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Introduction

- The Gulf of Alaska Integrated Ecosystem Research Project (GOAIERP) is an ecosystem study examining physical and biological mechanisms determining survival of 5 focal juvenile groundfish in the Gulf of Alaska
- This lab study focuses on Pacific cod, an abundant and commercially important groundfish in the GOA, which are generalist upper trophic level predators
- Little information available on juvenile growth parameters
- These data are required inputs in ecosystem modelling

Fish were fin-clipped and held in temperature-controlled tanks

Objectives/Methods

- Estimate maximum consumption rates (C_{max}) of juvenile (1+) cod across temperature treatments (4°C, 8°C, 12°C) in the laboratory
- Estimate growth of cod at maximum, medium, and low rations, as well as predict optimum (C_{opt}) rations that maximize growth
- Conduct a secondary study to test predicted optimum ration-growth relationship
- Clarify energy allocation strategies in cod as a function of temperature/ration using physiological growth indices (RNA/DNA ratios and total-body lipid)
- Fish in all treatments cultured on identical diet for 30 days in 50 L tanks

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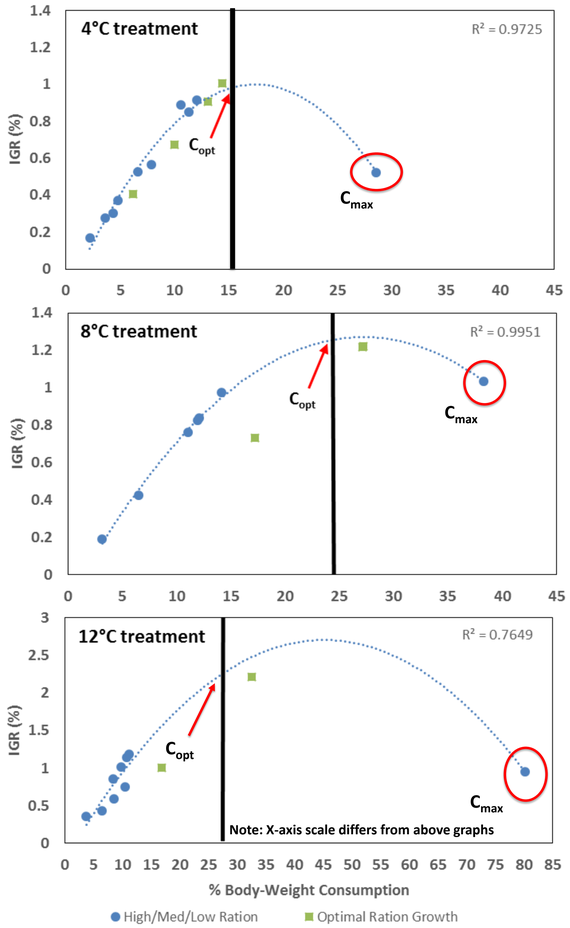
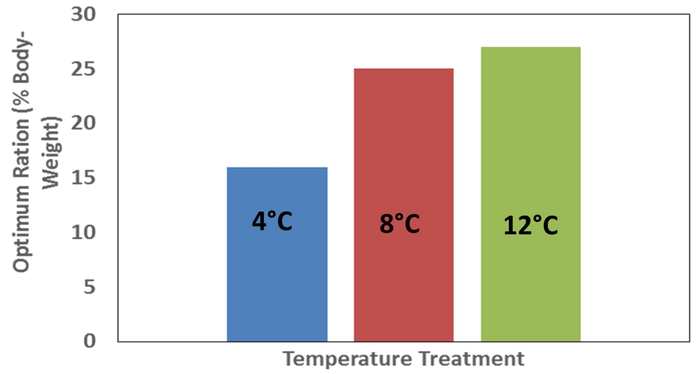
Parabolic growth curves generated using instantaneous growth rates and consumption estimates of all fish for a given treatment

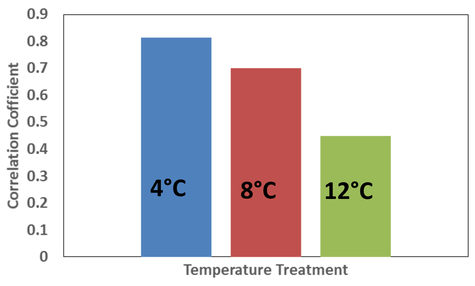


- High consumption negatively affects growth at all temperatures
- Reduced growth potentially due to digestive inefficiency and reduced assimilation efficiency (observed in Atlantic cod; Lemieux et al. 1999)
- Optimum ration (C_{opt}) that maximizes growth predicted from growth curves
- Optimum ration, while lower than high ration (C_{max}), maximized growth of fish in a secondary study
- Highest growth rates at optimum ration range from ~1% (4°C) to ~2% body-weight/day (12°C)

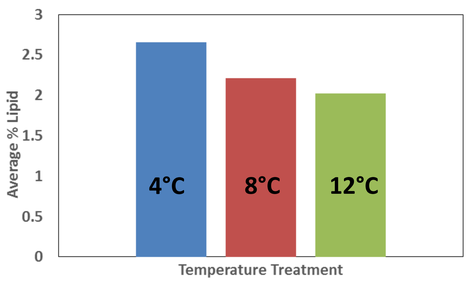


- Optimum ration (C_{opt}) that maximizes growth increases with increasing temperature
- C_{opt} ranges from 16%-27% body-weight

Gadus macrocephalus



- Decreasing correlation of RNA/DNA and growth rates with increasing temperature (4°C > 8°C > 12°C)
- Suggestive of physiological stress with exposure to higher temperature



- Average lipid content decreases with increasing temperature (4°C > 8°C > 12°C)
- Low somatic growth and higher lipid at colder temperature indicates a temperature effect on energy allocation

Conclusions

- Cod capable of high consumption, but at cost of growth
- Comparison with juv. walleye pollock under similar conditions (~12-17% bw/day) suggests cod consume greater biomass
- Optimum ration might be better indicator of highest growth rate rather than maximum ration
- RNA/DNA-growth rate relationship suggests onset of physiological stress at temperatures higher than 8°C
- Colder temperatures favor increased lipid synthesis/storage vs somatic growth (higher condition)

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