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Assessing regional patterns of juvenile salmon growth in the Salish Sea

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Assessing patterns of early marine growth in juvenile salmon in the Salish Sea and surrounding waters

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Fisheries and Oceans Canada

Outline

Introduction

1. Importance of early marine growth
2. What is Insulin-like Growth Factor-1 (IGF-1)?
3. Use of IGF-1 as index of ocean growth
4. Areas of interest and sampling

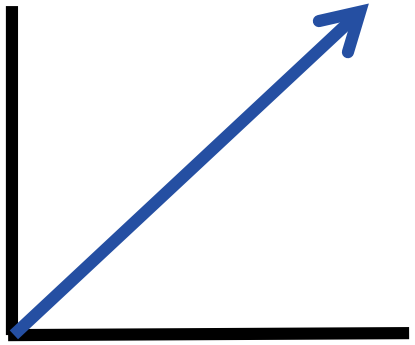
Analysis and Results

1. Large scale regions
2. Small scale sub-regions
3. Inter-annual

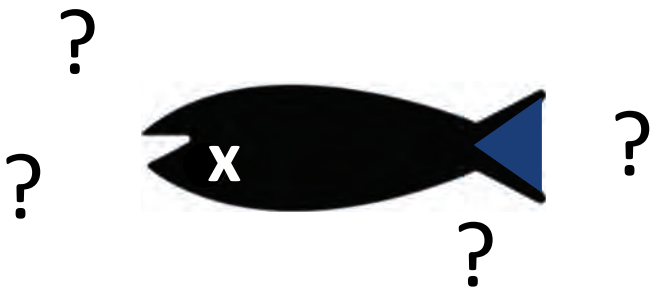
What's next?

Early marine growth is positively correlated to adult survival

- Positive correlation between early marine growth and survival to reproductive age

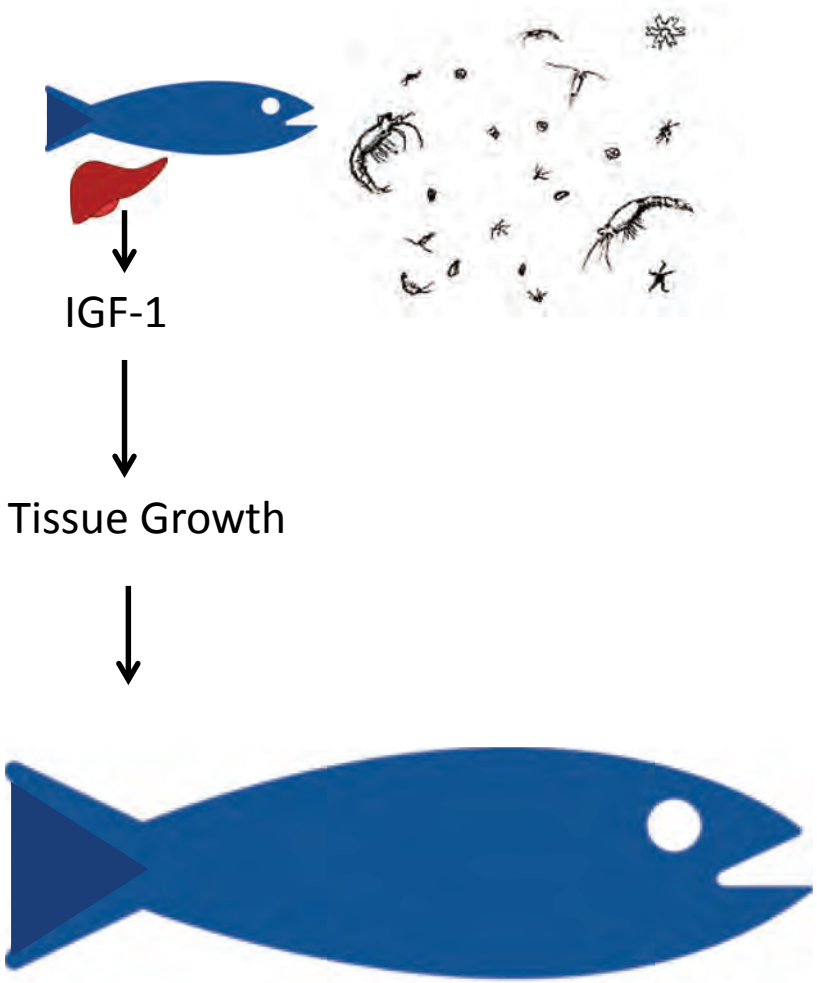


- Understanding growth patterns at sea introduces means to understand mortality at sea



Growth → Marine Survival → Adult Return

Increases in IGF-1 are indicative of growth

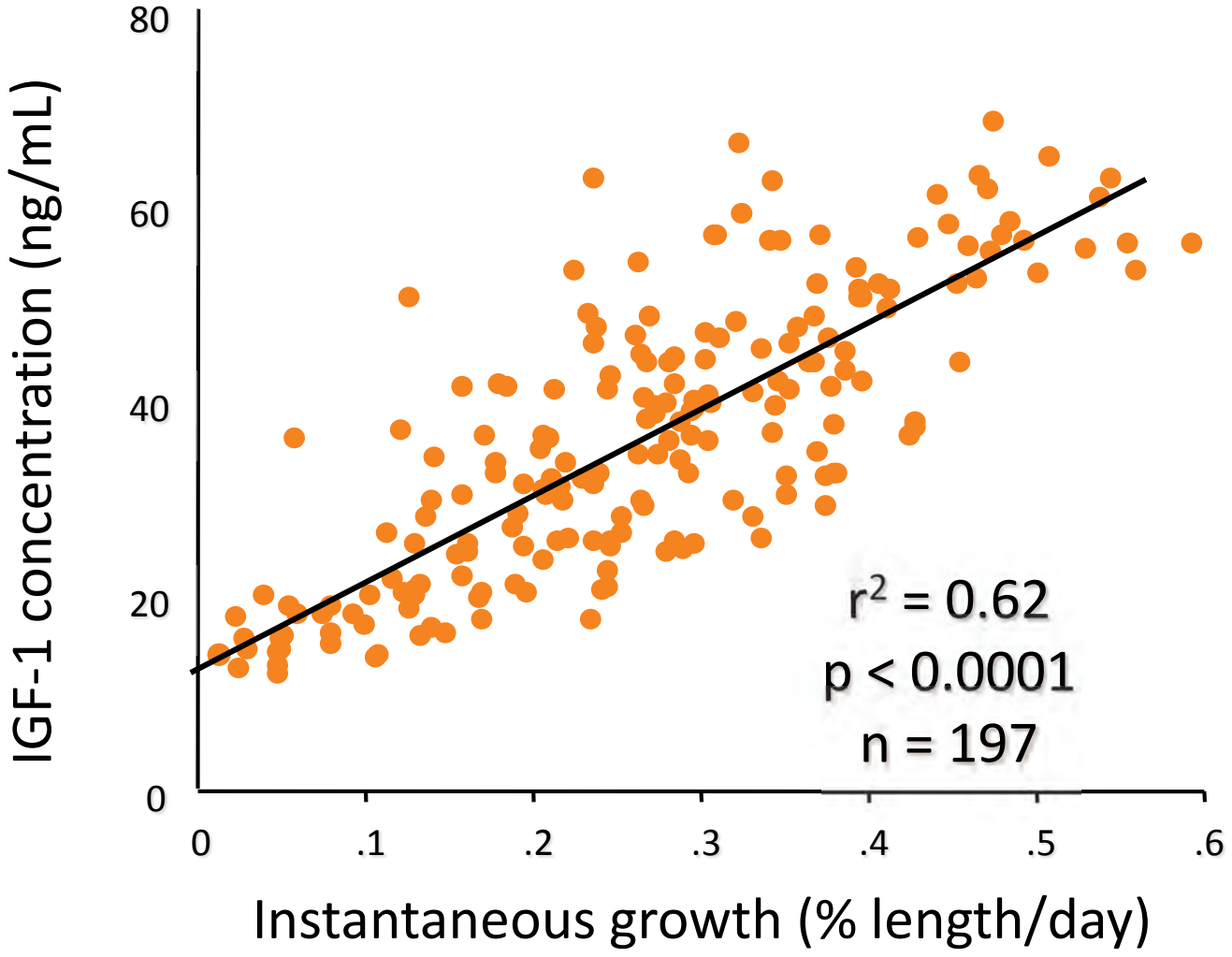


What is IGF-1?

- Insulin-like Growth Factor-1
- Hormone released from the liver
- IGF-1 travels to the tissue and stimulates body growth

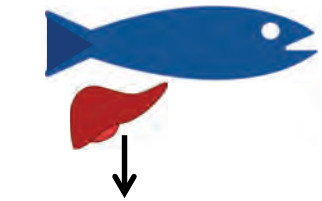
Can IGF-1 be used as an ecological tool?

IGF-1 is positively correlated with instantaneous growth in juvenile salmon



Beckman et al. 2004 TAFS

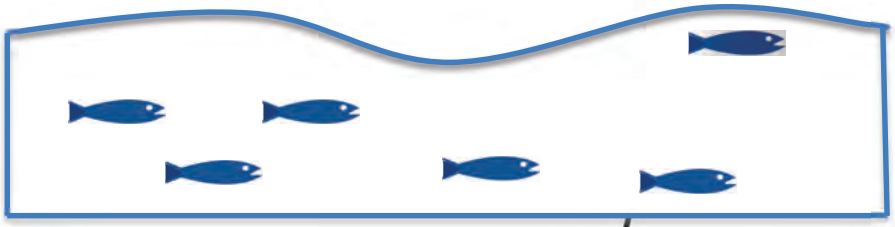
IGF– 1 can be used as an index of ocean growth in juvenile salmon

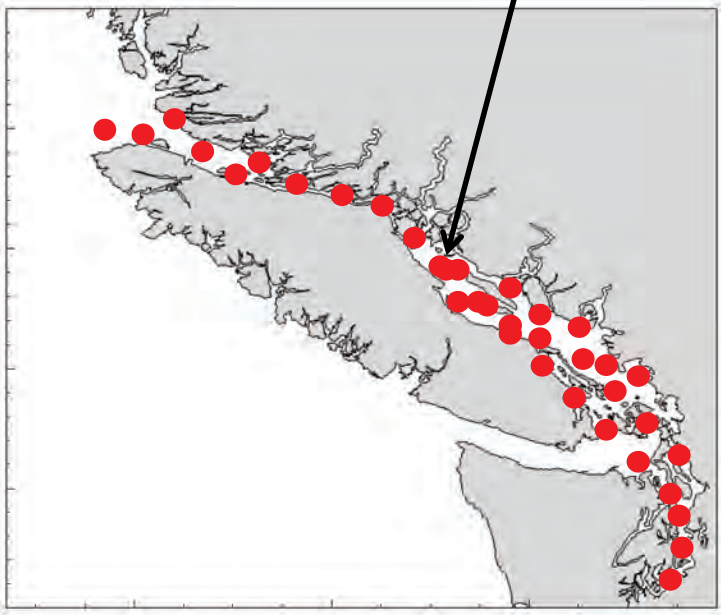


IGF-1

Measure blood plasma IGF-1

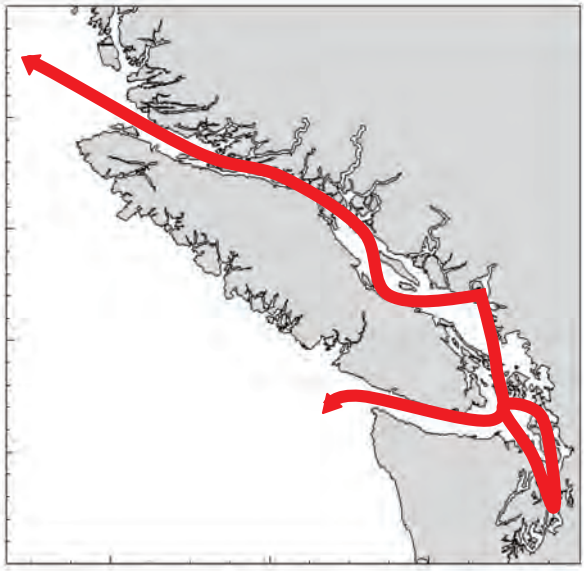
Tissue Growth





Juvenile salmon sampling occurs along marine migration routes

Juvenile salmon sampling in 2012 and 2013



2012: Juvenile Chinook, coho, chum, sockeye, and pink

2013: Juvenile Chinook, coho, and chum

1. Large scale region analysis: Coho and chum
2. Small scale sub-region analysis: Coho and chum
3. Inter-annual analysis: Chinook, coho, and chum

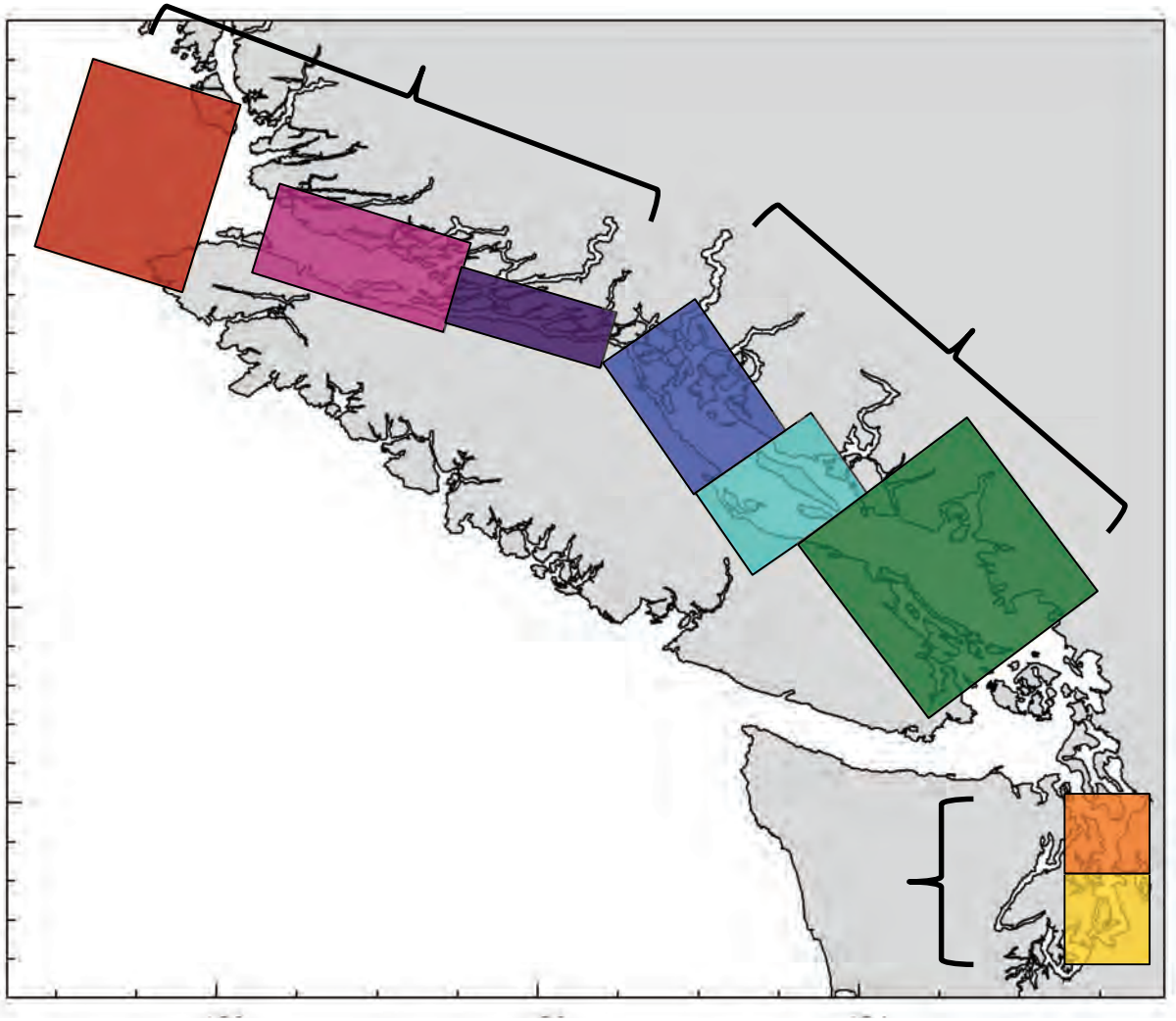
From north to south; large scale regions of interest

From north to south:

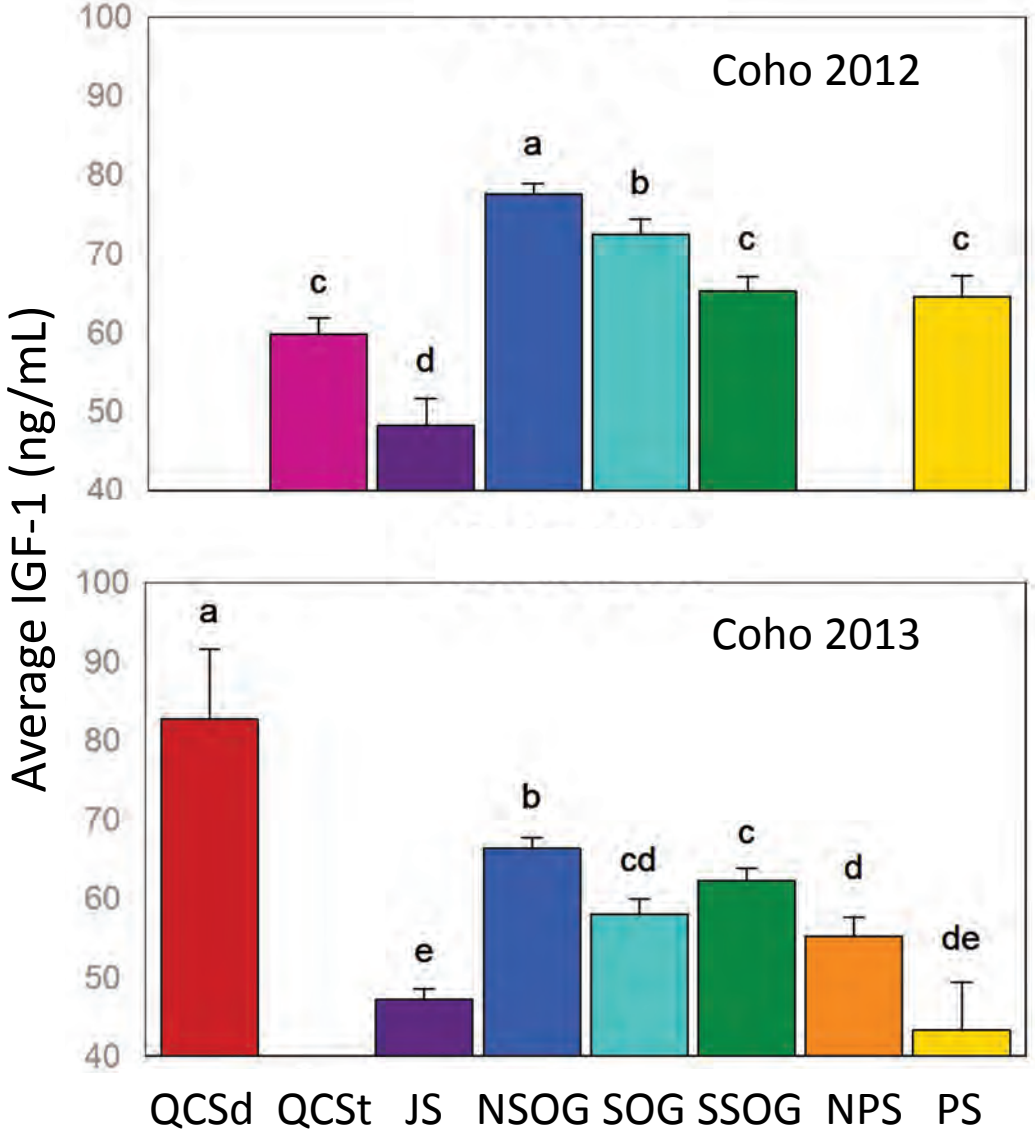
Queen Charlotte Sound
Queen Charlotte Strait
Johnstone Strait

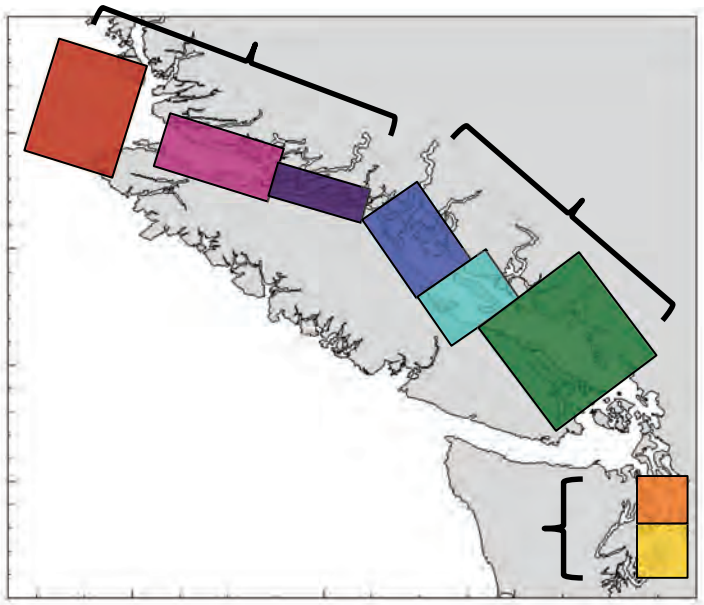
North Strait of Georgia
Mid Strait of Georgia
South Strait of Georgia

North Puget Sound
Puget Sound



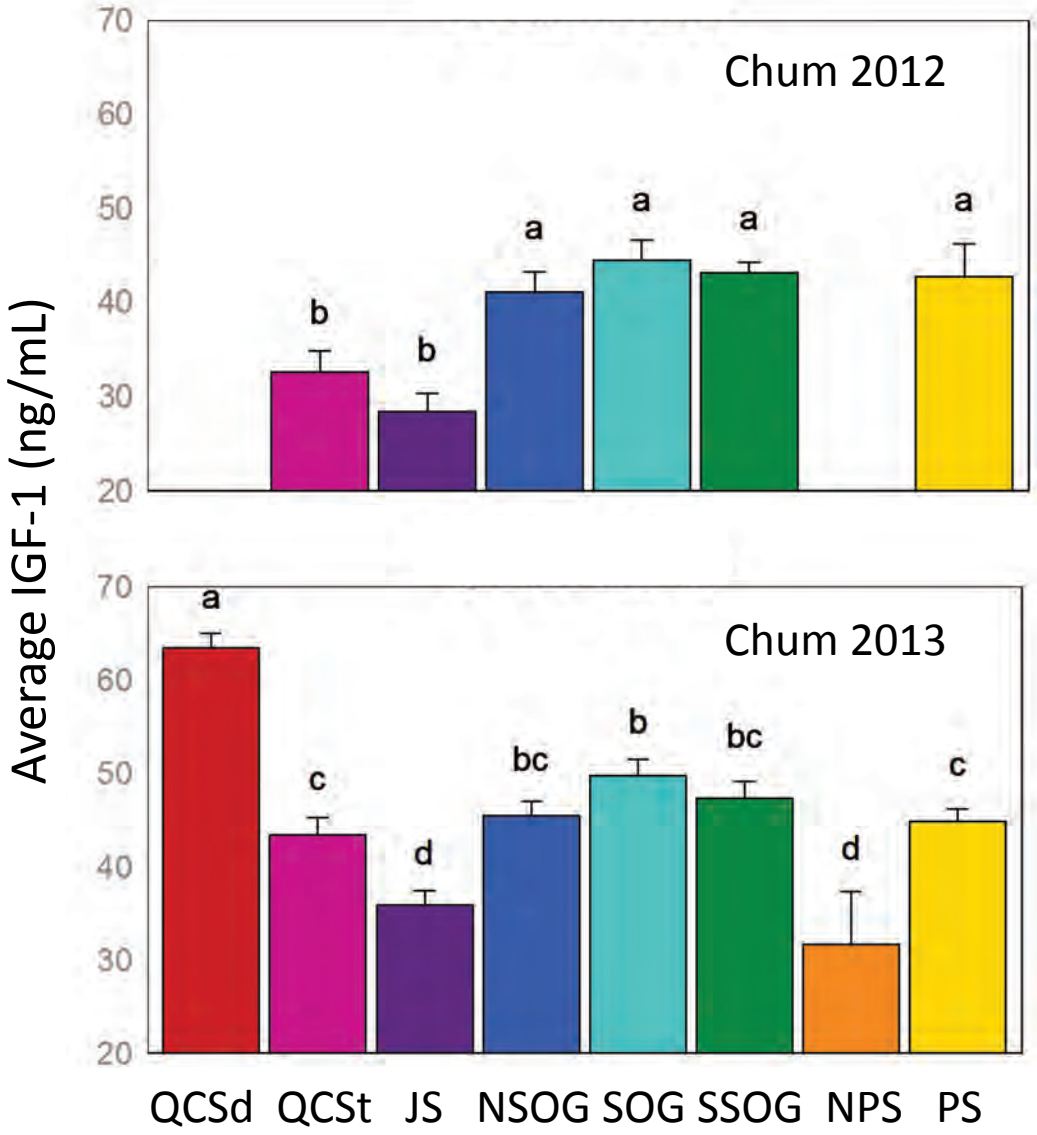
Coho salmon IGF-1 differs significantly across large scale regions

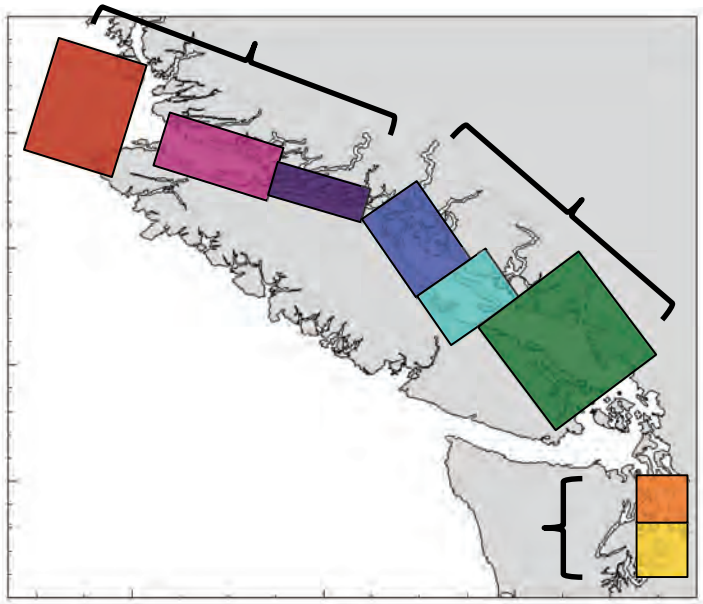




- 2012: **Low** in JS
  High in NSOG and SOG
- 2013: **Low** in JS and Puget
  High in QC Sound and NSOG

Chum salmon IGF-1 differs significantly across large scale regions





- 2012: **Low** in QCSt and JS
- 2013: **Low** in JS and N. Puget
  High in QC Sound

IGF-1 levels differ from north to south when compared to the Strait of Georgia

N

S

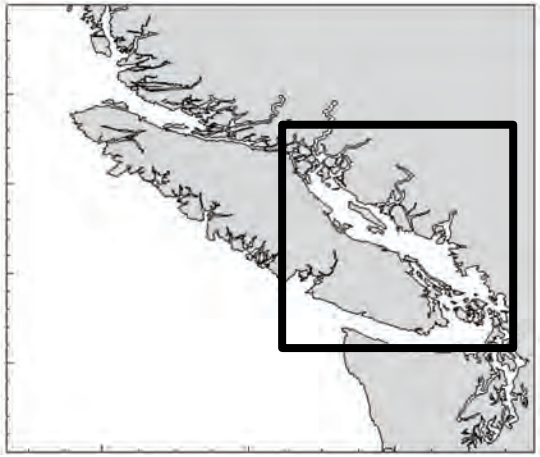
	Coho 2012	Coho 2013	Chum 2012	Chum 2013
Queen Charlotte Sound	X	HIGH	X	HIGH
Queen Charlotte Strait	LOW	X	LOW	AVERAGE
Johnstone Strait	LOW	LOW	LOW	LOW
Puget Sound	LOW	LOW	HIGH	AVERAGE

IGF-1 levels also vary from north to south within the Strait of Georgia

- Species specific variation exists between north, mid, and south Strait of Georgia:
  - Coho 2012 and 2013 show **significant regional variation** in IGF-1 from north to south
  - Chum 2012 and 2013 show **no significant variation** in IGF-1 from north to south

- What are possible explanations for these species specific patterns?

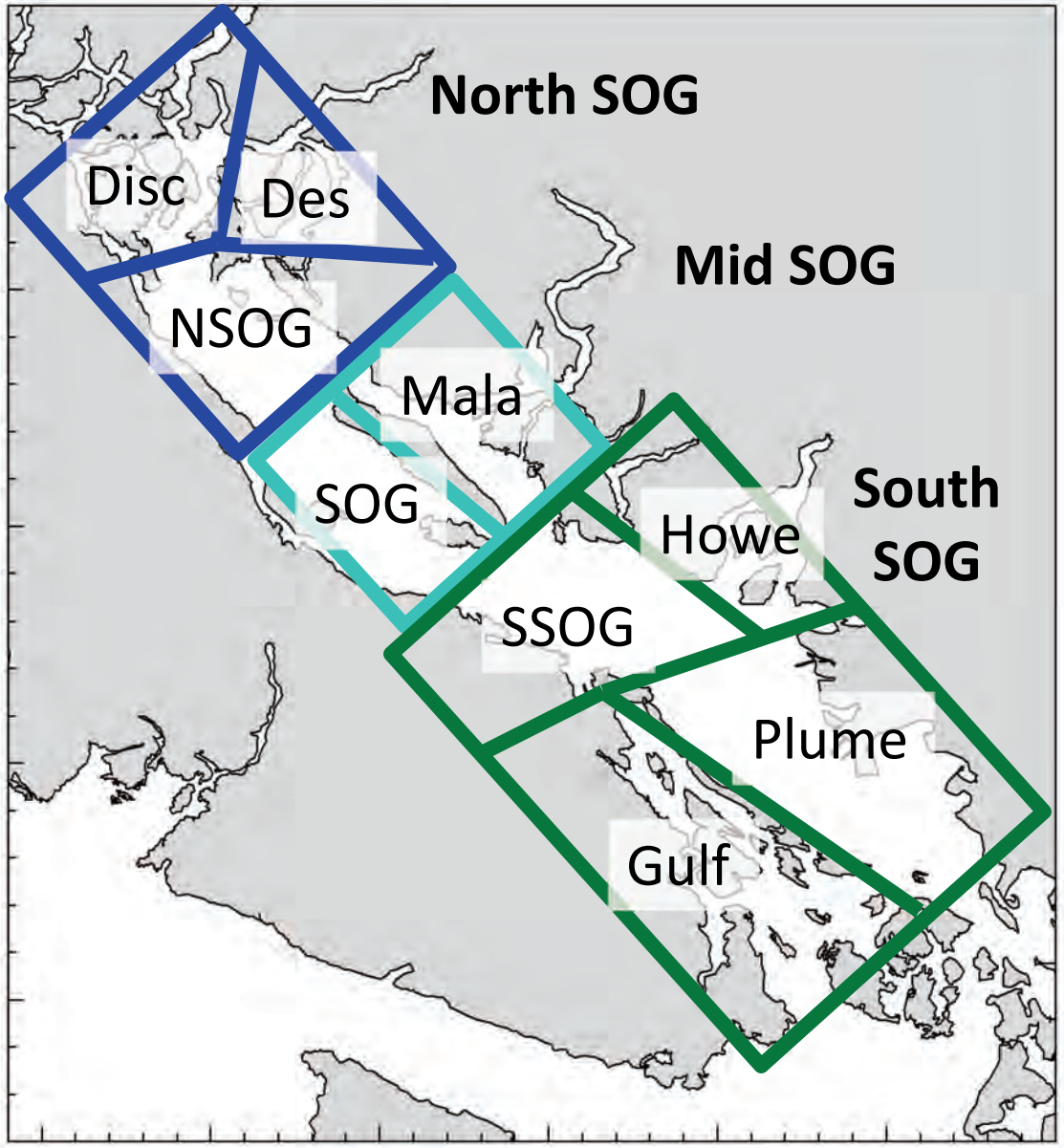
Strait of Georgia: sub-regions of interest



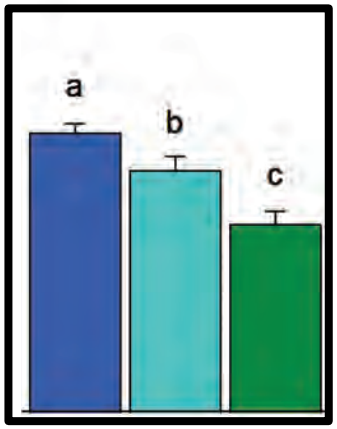
NSOG: Discovery Islands
Desolation Sound
North SOG

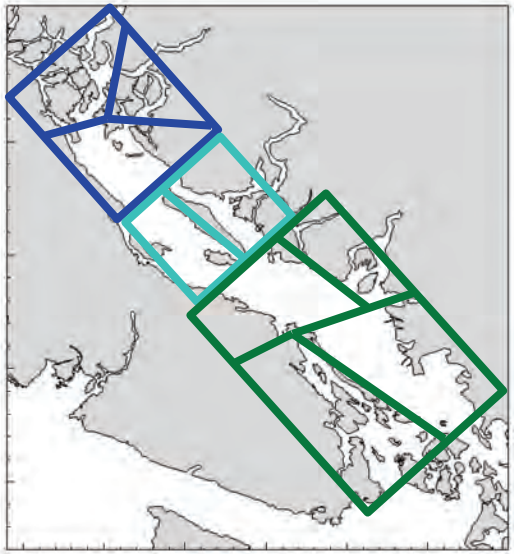
SOG: SOG
Malaspina

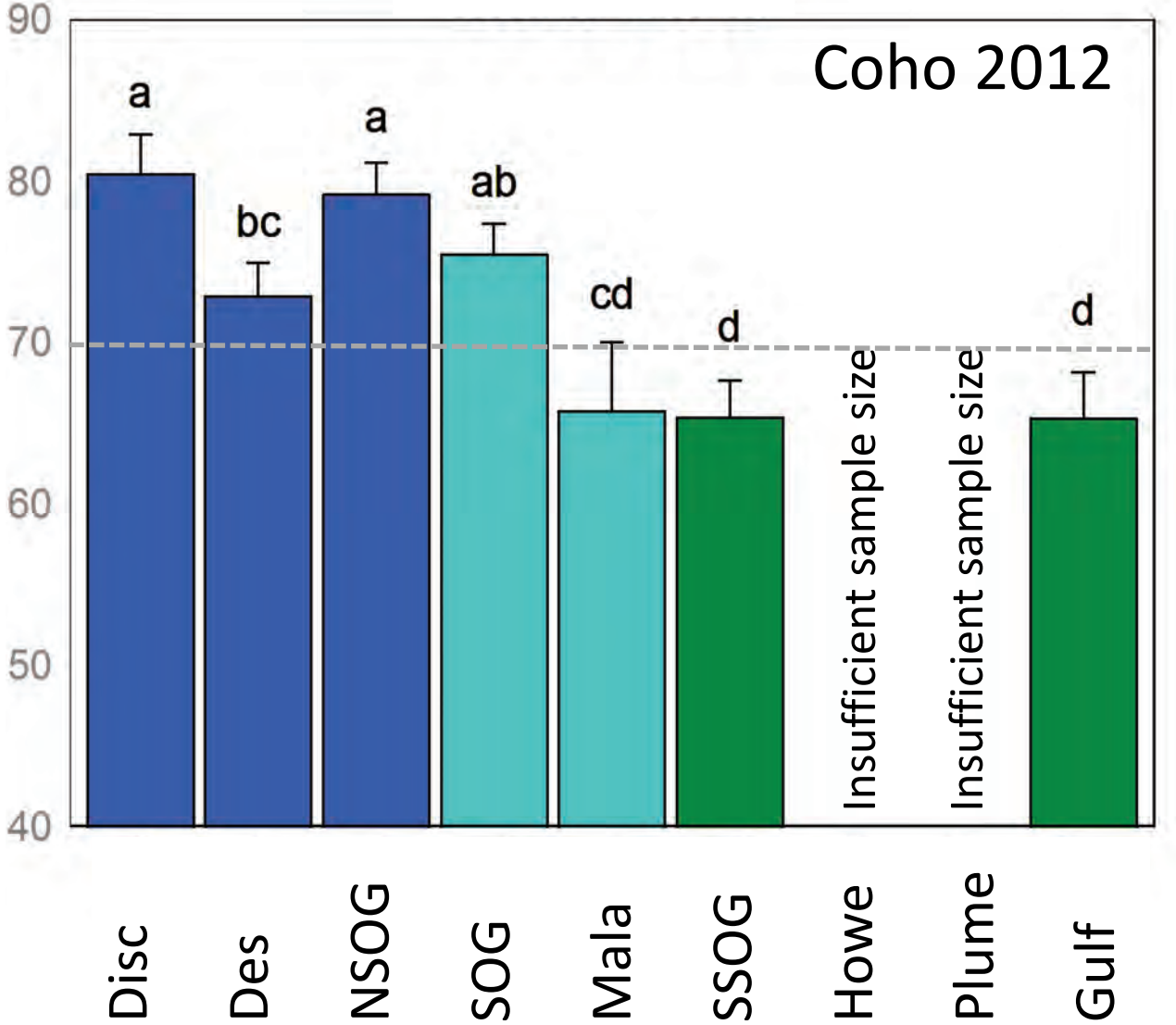
SSOG: South SOG
Howe Sound
Gulf Islands
Plume



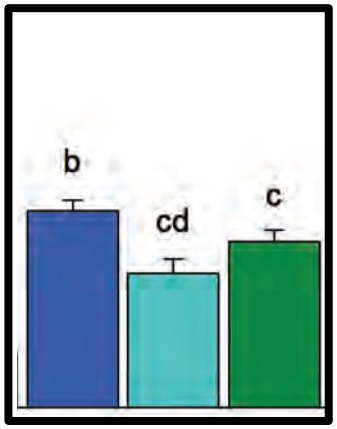
Coho IGF-1 variability increases with sub-regional analysis

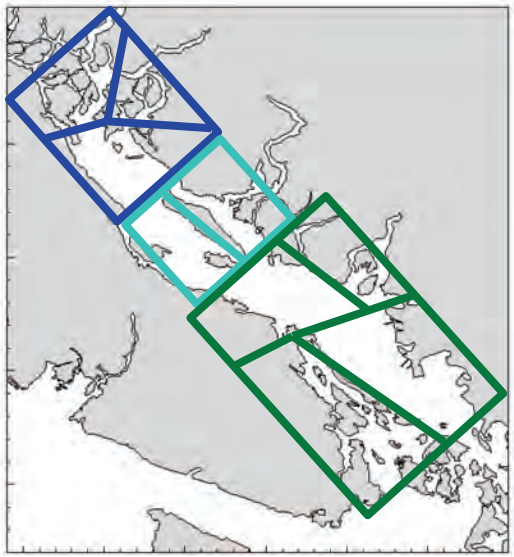


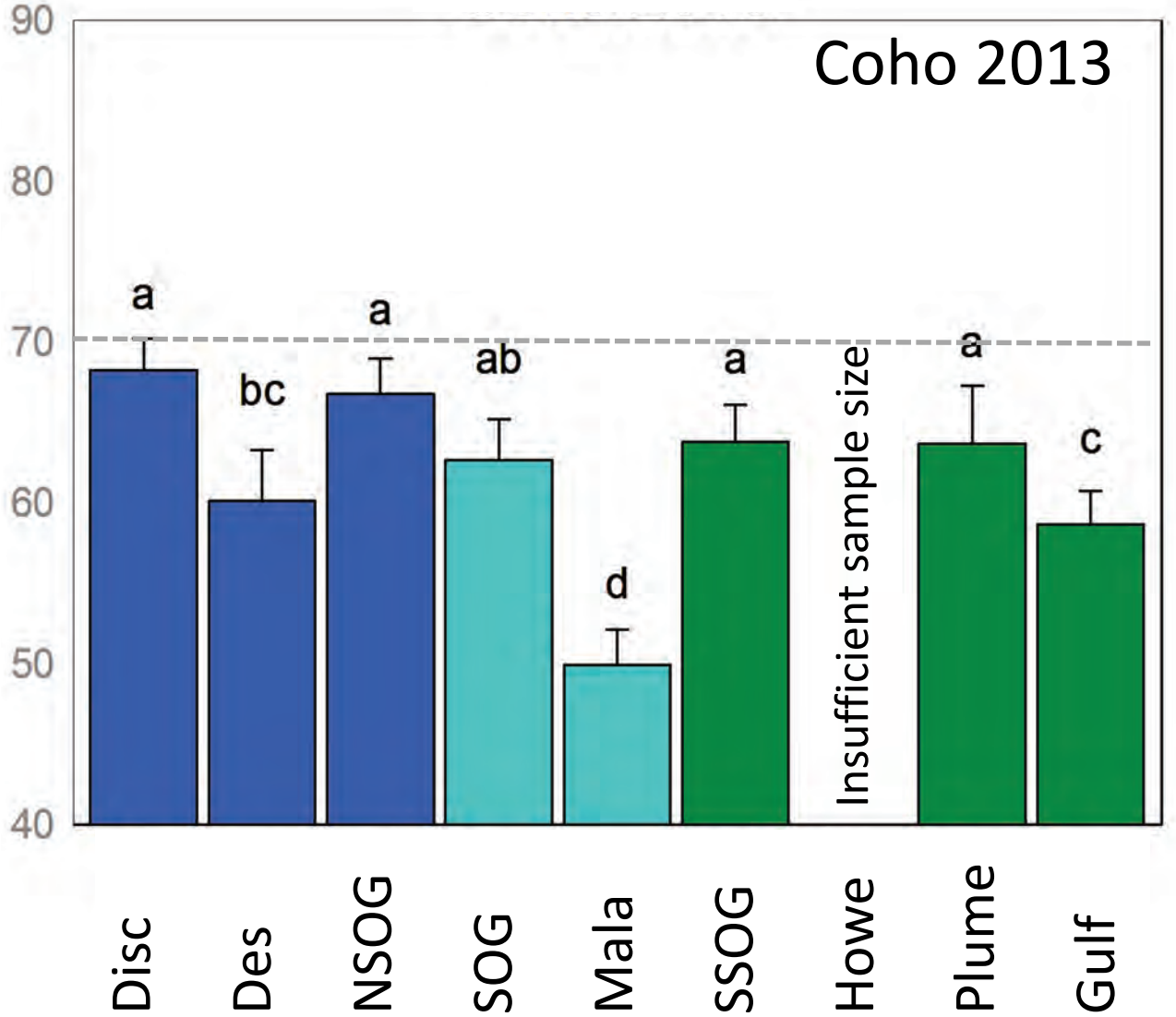




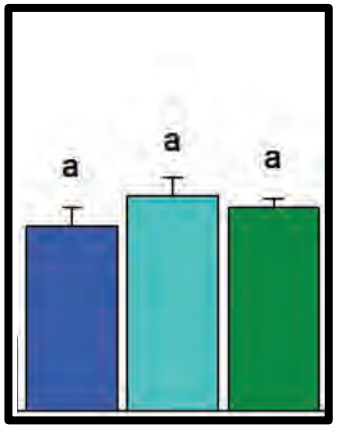
Coho IGF-1 variability increases with sub-regional analysis

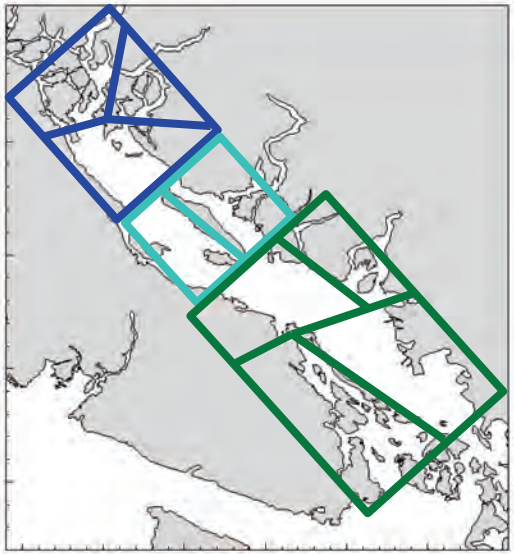


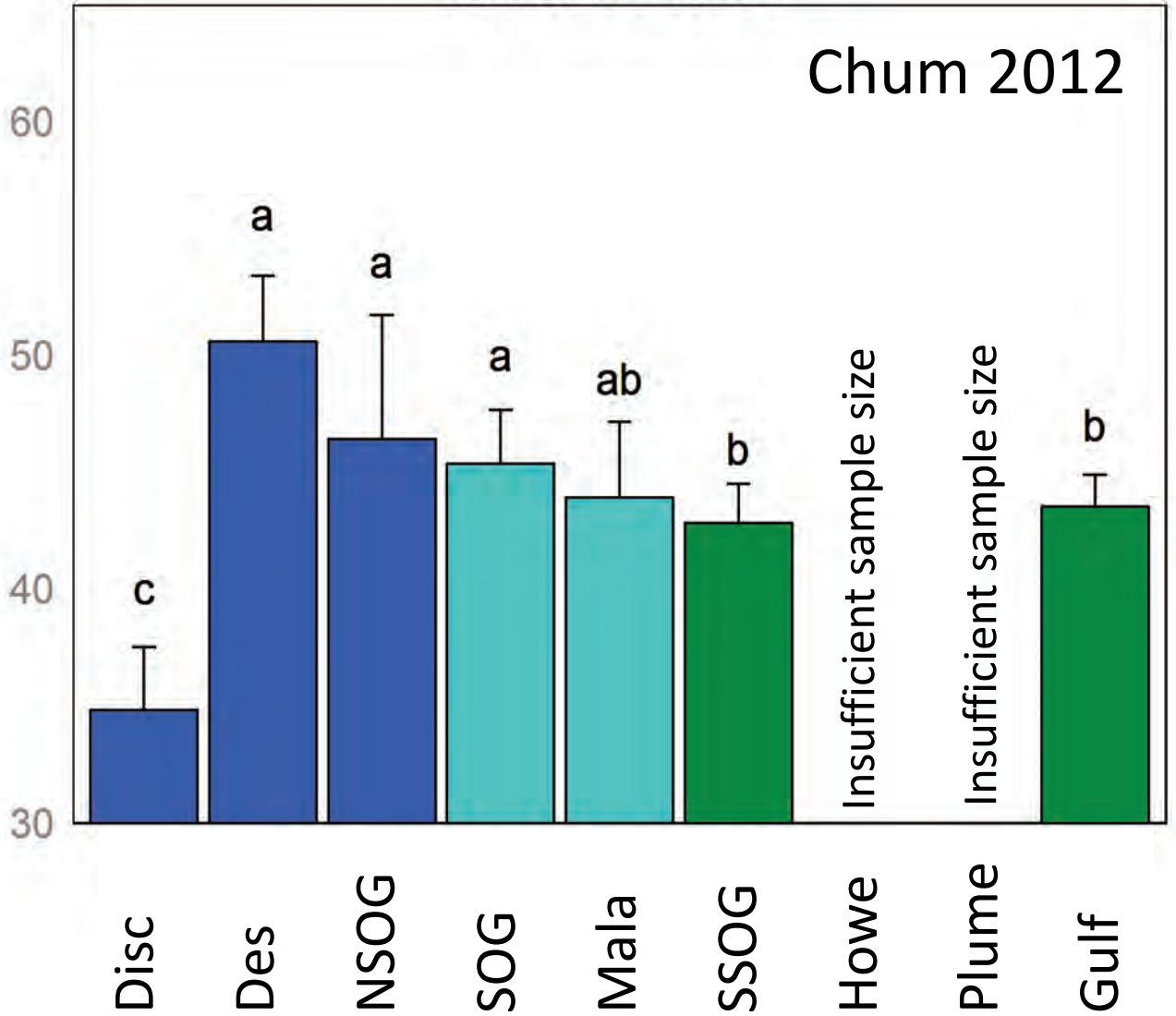




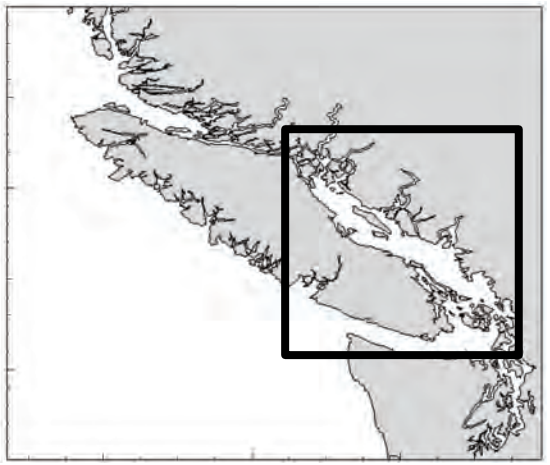
Chum IGF-1 variability increases with sub-regional analysis

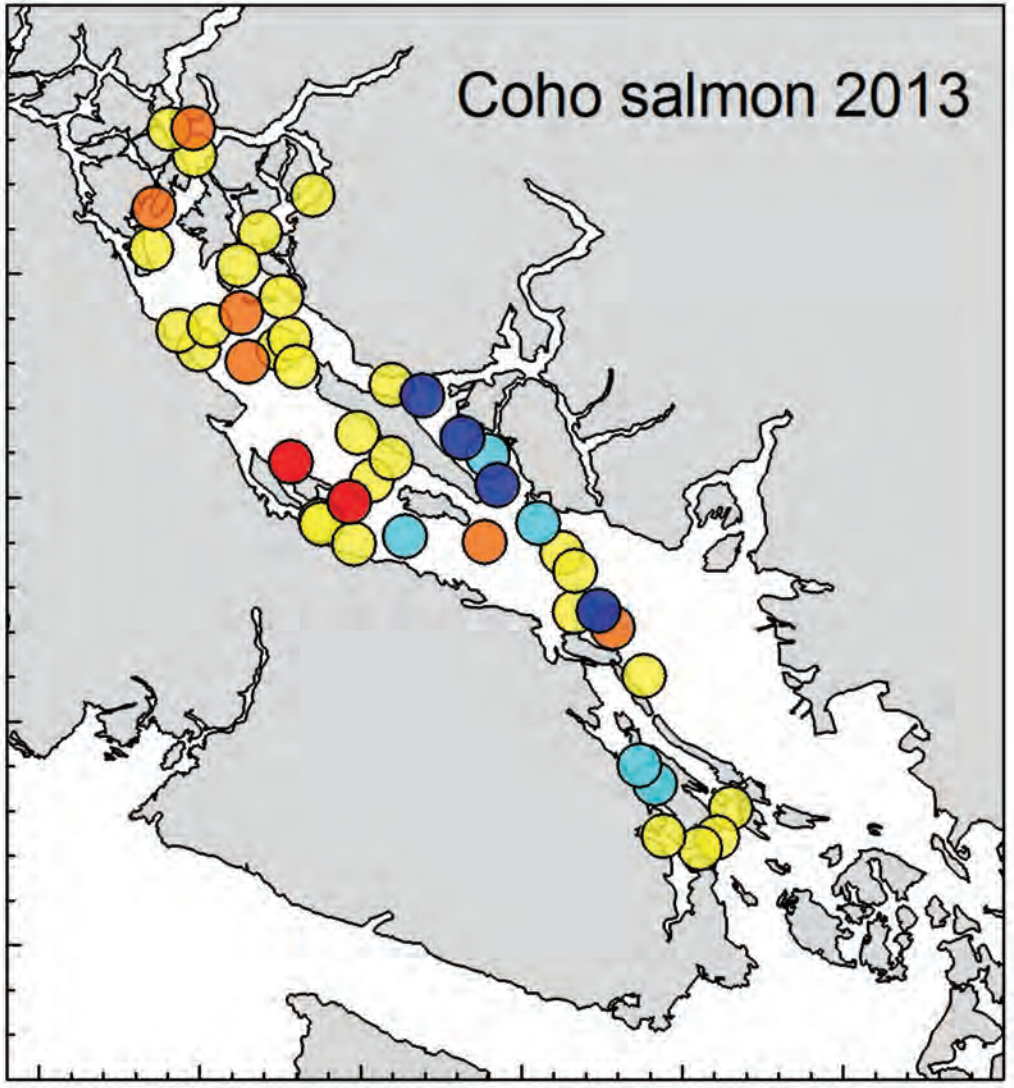






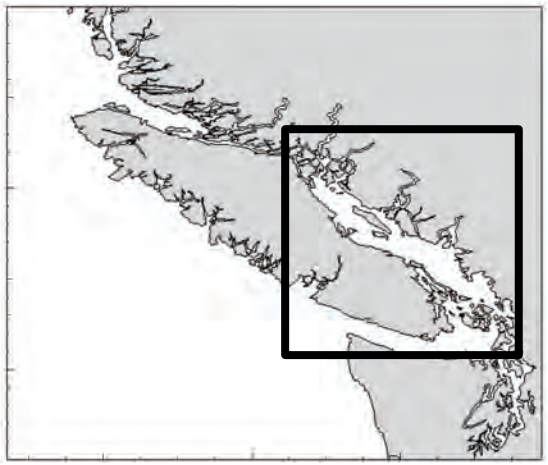
Do geographic sub-region differences in IGF-1 depict tow-by-tow relationships?

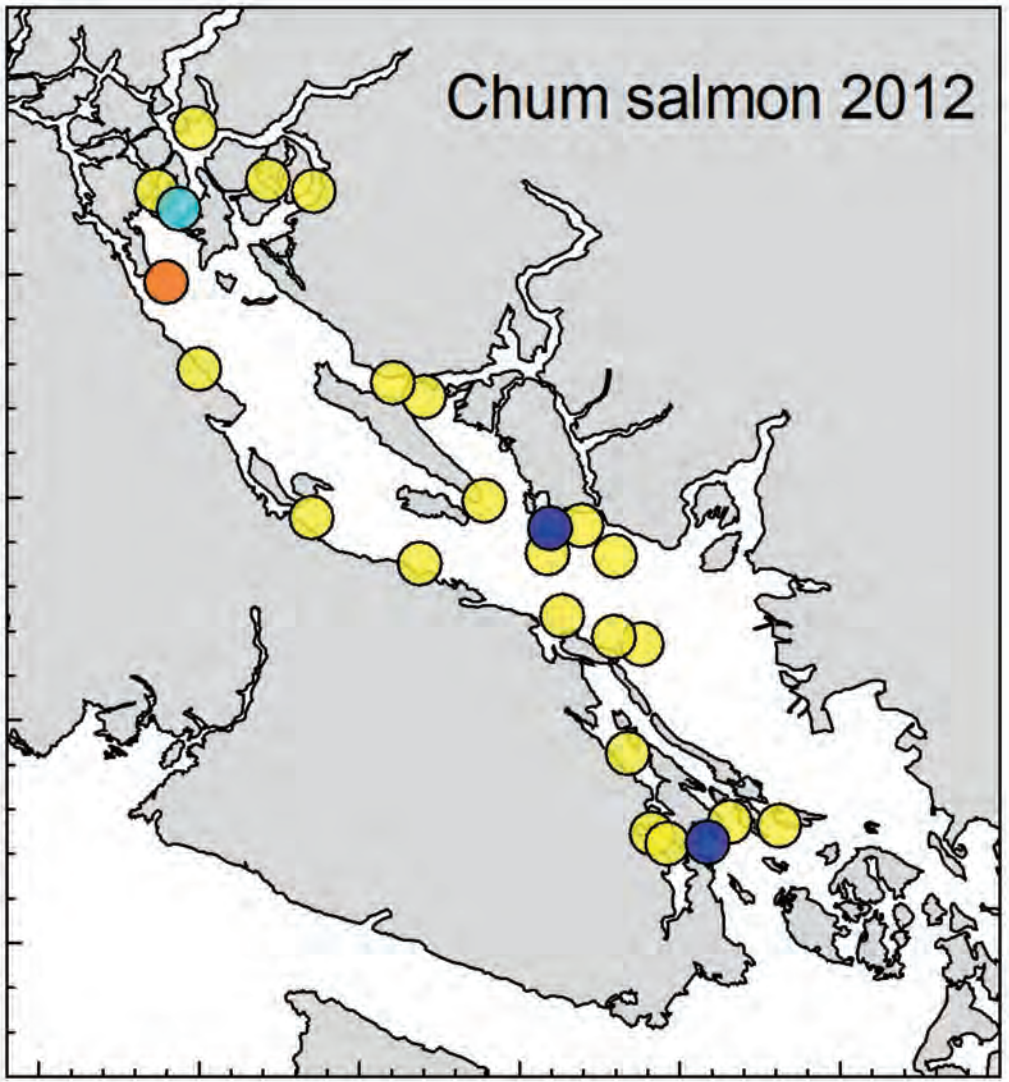




- >1 StDev
- >0.5 StDev
- Average
- <0.5 StDev
- <1 StDev

Are these tow-by-tow relationships species specific?

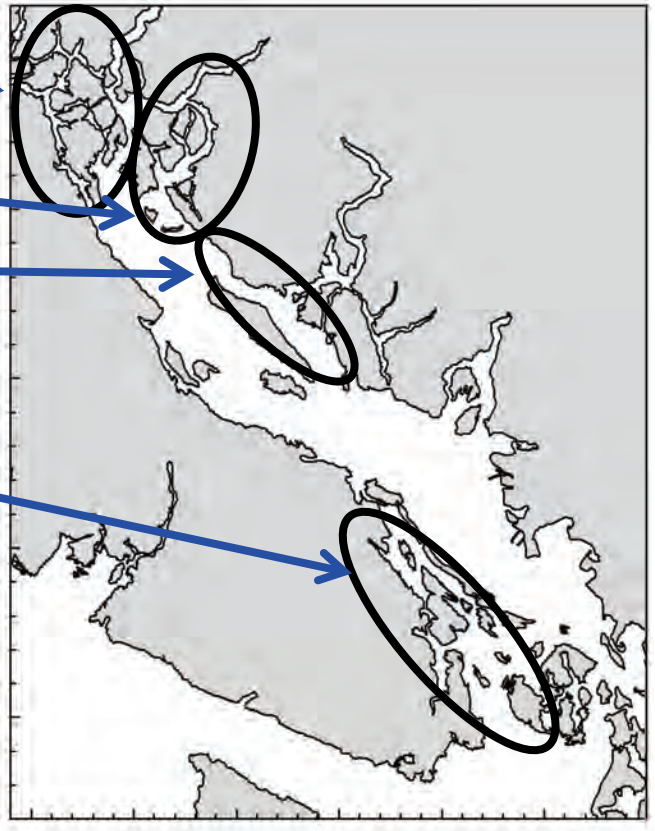




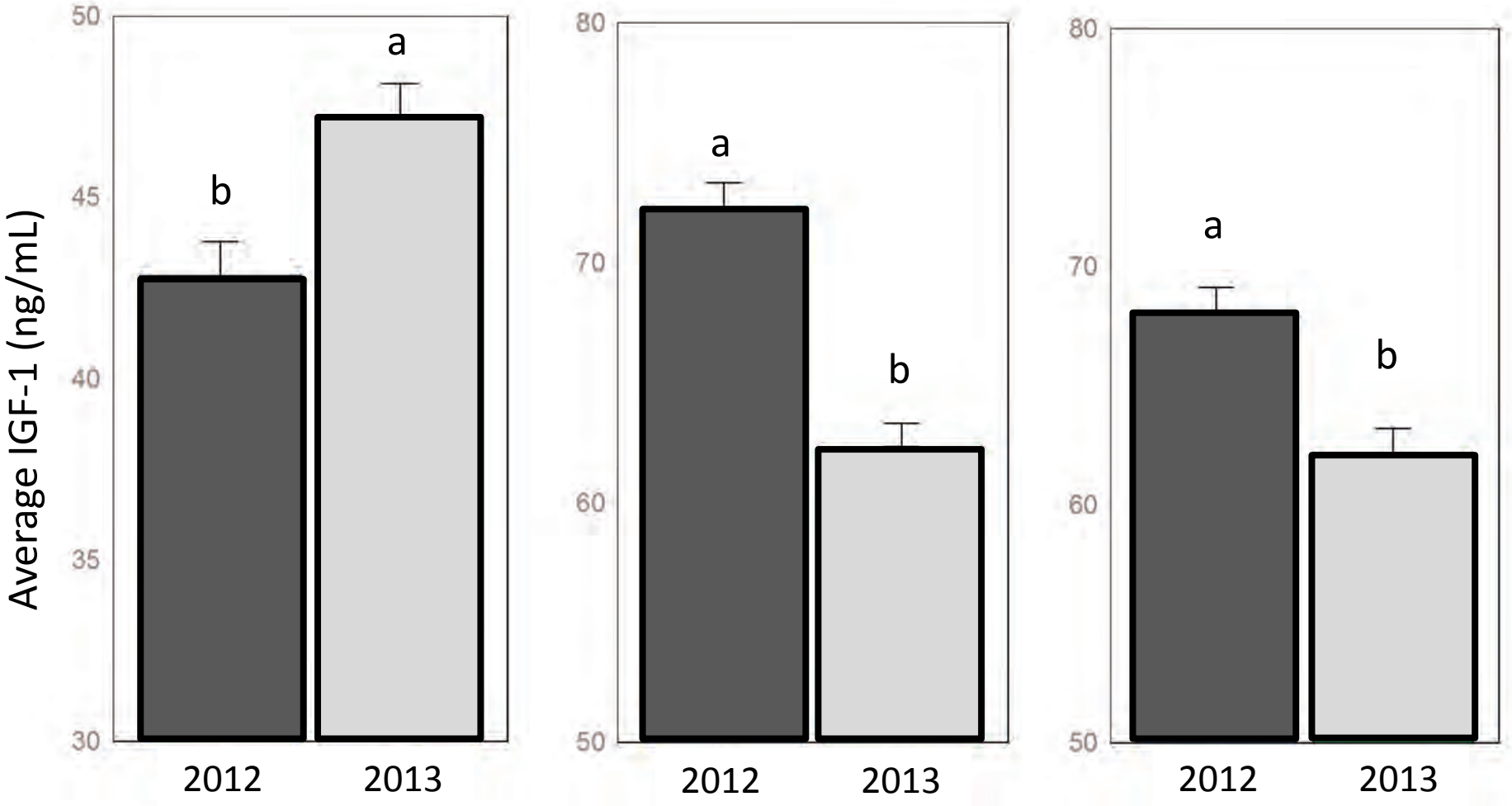
>1 StDev
>0.5 StDev
Average
<0.5 StDev
<1 StDev

IGF-1 levels vary from north to south within the Strait of Georgia

- Some regions within SOG appear to have more extreme IGF-1 deviations
  - Discovery Islands
  - Desolation Sound
  - Malaspina
  - Gulf Islands
- Variation from north to south exists, but why?
  - Geographic or biotic divisions?
  - Species specific?



The implications of these patterns will become more apparent when adult return data are available.



IGF-1 offers a unique way to spatially and temporally assess growth

- The geographic scale used to asses growth is important
  - Large scale regions
  - Small scale sub-regions
  - Tow-by-tow
- Are there ecological processes at play within the Salish Sea driving these variations in growth?
  - Yes, but how do we identify these relationships?

Future sampling and analysis plans

- Sampling in 2014
  - Inter-annual comparisons over 3 years
  - Additional regional and sub-regional analysis

- Discriminate species specific patterns
  - Are regions consistent across a three year period?
  - Is there overlap between species?
  - Geographic delineations?
  - Biotic delineations?

Acknowledgements

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Pacific Salmon Commission