Food Energy Value of Chinook Salmon as Prey of Northern and Southern Resident Killer Whales

Killer Whale/ Salmon Fishery Interactions
September 2011 Workshop

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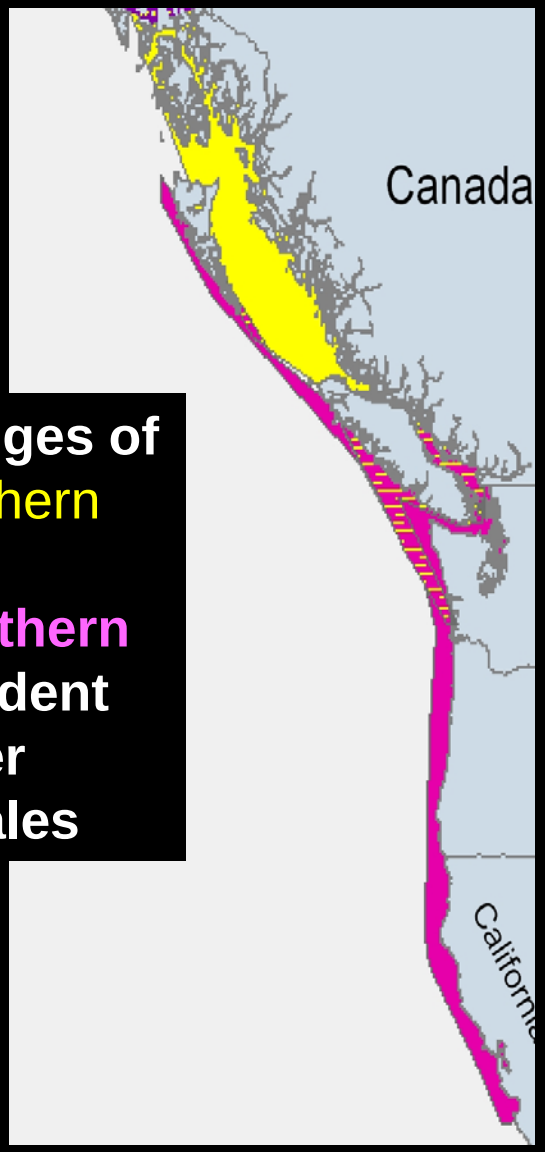
Potential factors contributing to the population decline of resident killer whales

- **Exposure to toxic contaminants**
- **Reduction in prey quantity or quality**
- **Noise & disturbances from vessel traffic**



Ranges of northern and southern resident killer whales

Study Objectives

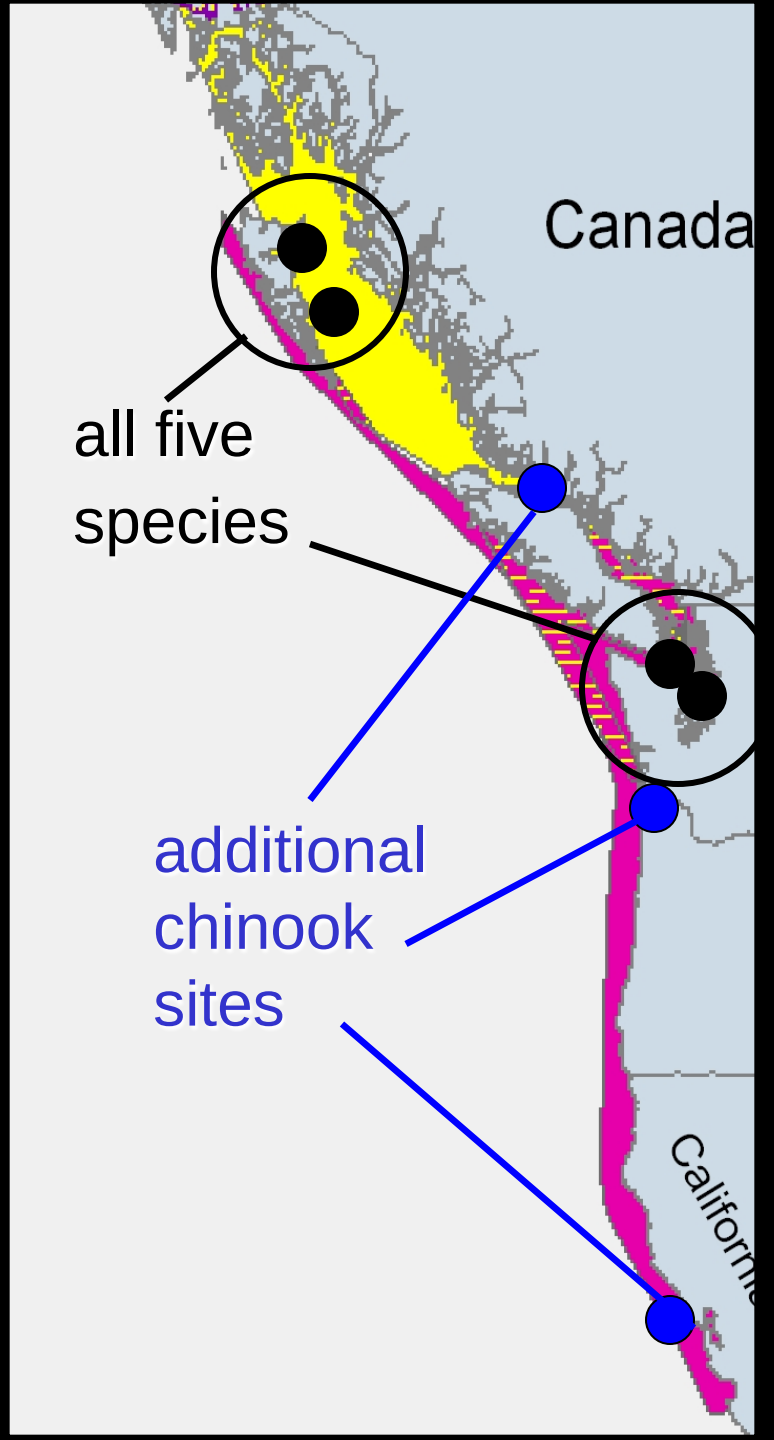
Assess whether prey quality, as determined by lipid content, fish size and caloric content, varies regionally among salmon species and populations

Figure from "2004 Status Review of Southern Resident Killer Whales (*Orcinus orca*) under the Endangered Species Act"

Sampling Design

- Compare prey quality in 5 Pacific salmon species from (north/ central British Columbia) with (Puget Sound/ Strait of Juan de Fuca).

- Compare prey quality in Chinook salmon populations from northern British Columbia to California.

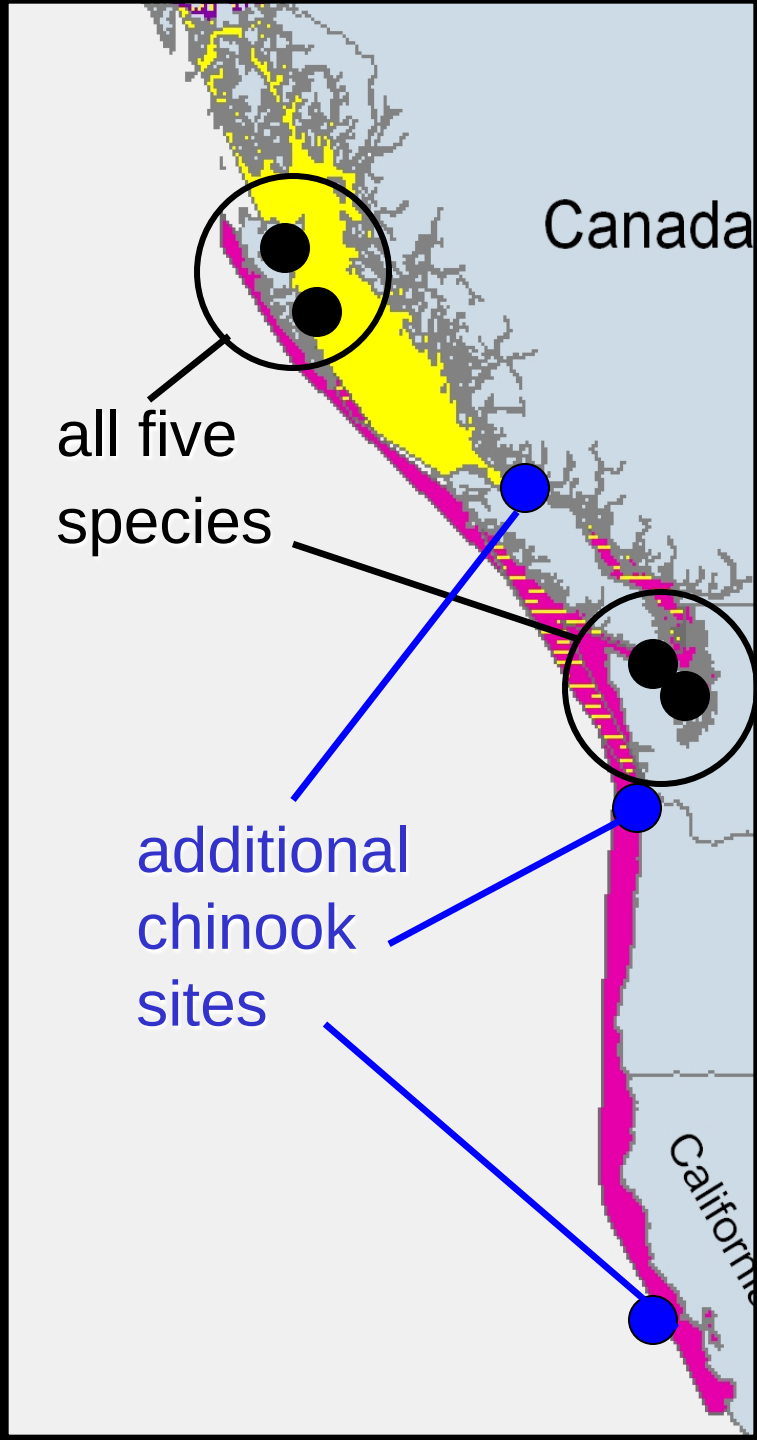


Methods

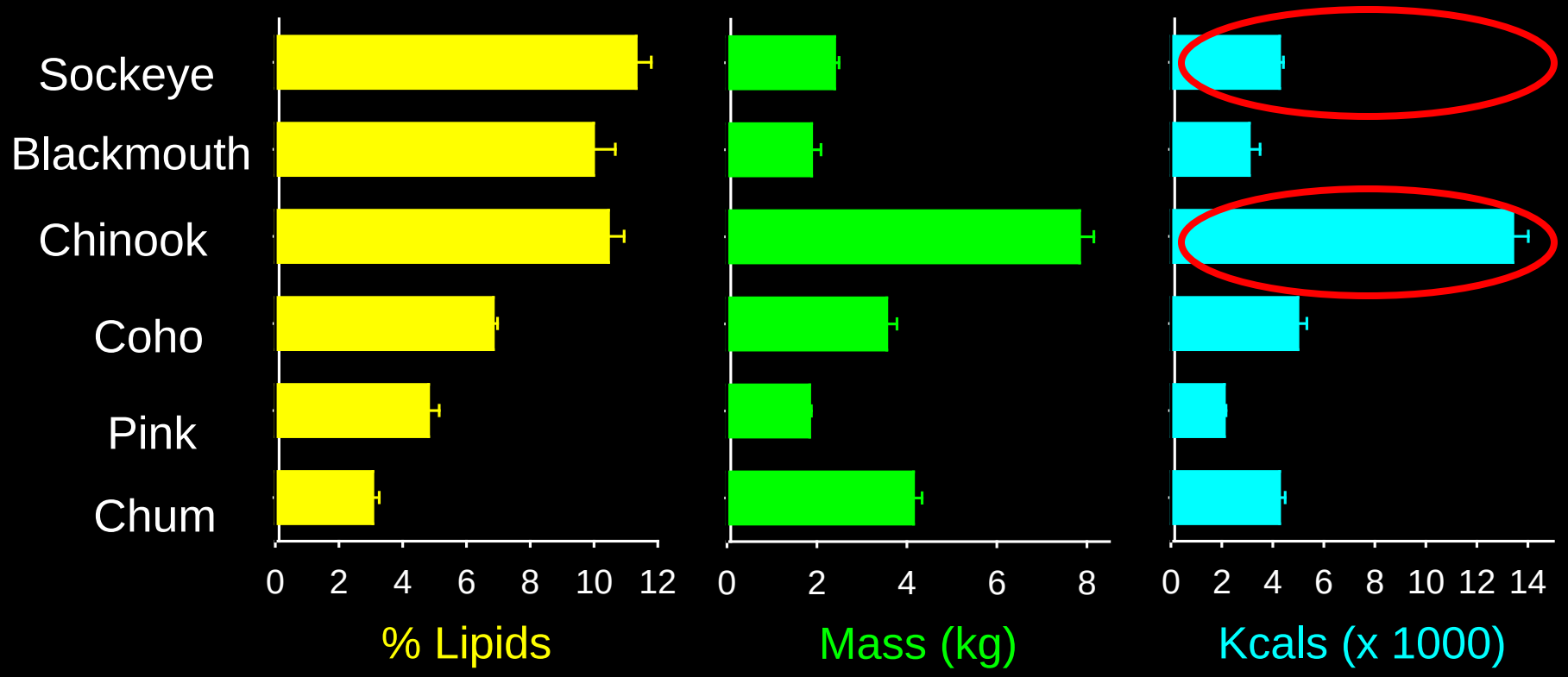
- whole body samples ground and dried
- created composite samples of 2 – 3 fish of same sex
- measured % moisture, %lipids, % protein,
- calculated Kcals

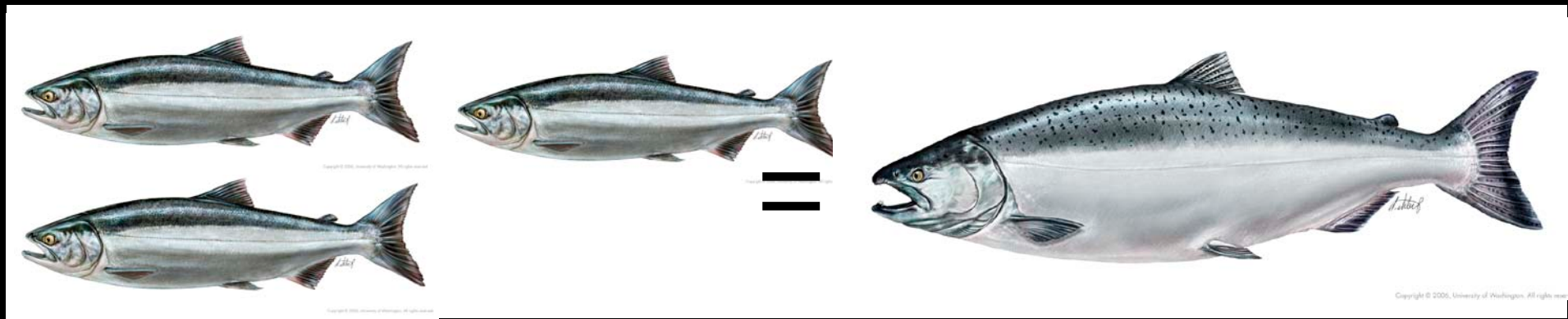
Results

How do Pacific salmon species differ in quality?



Prey Quality by Species

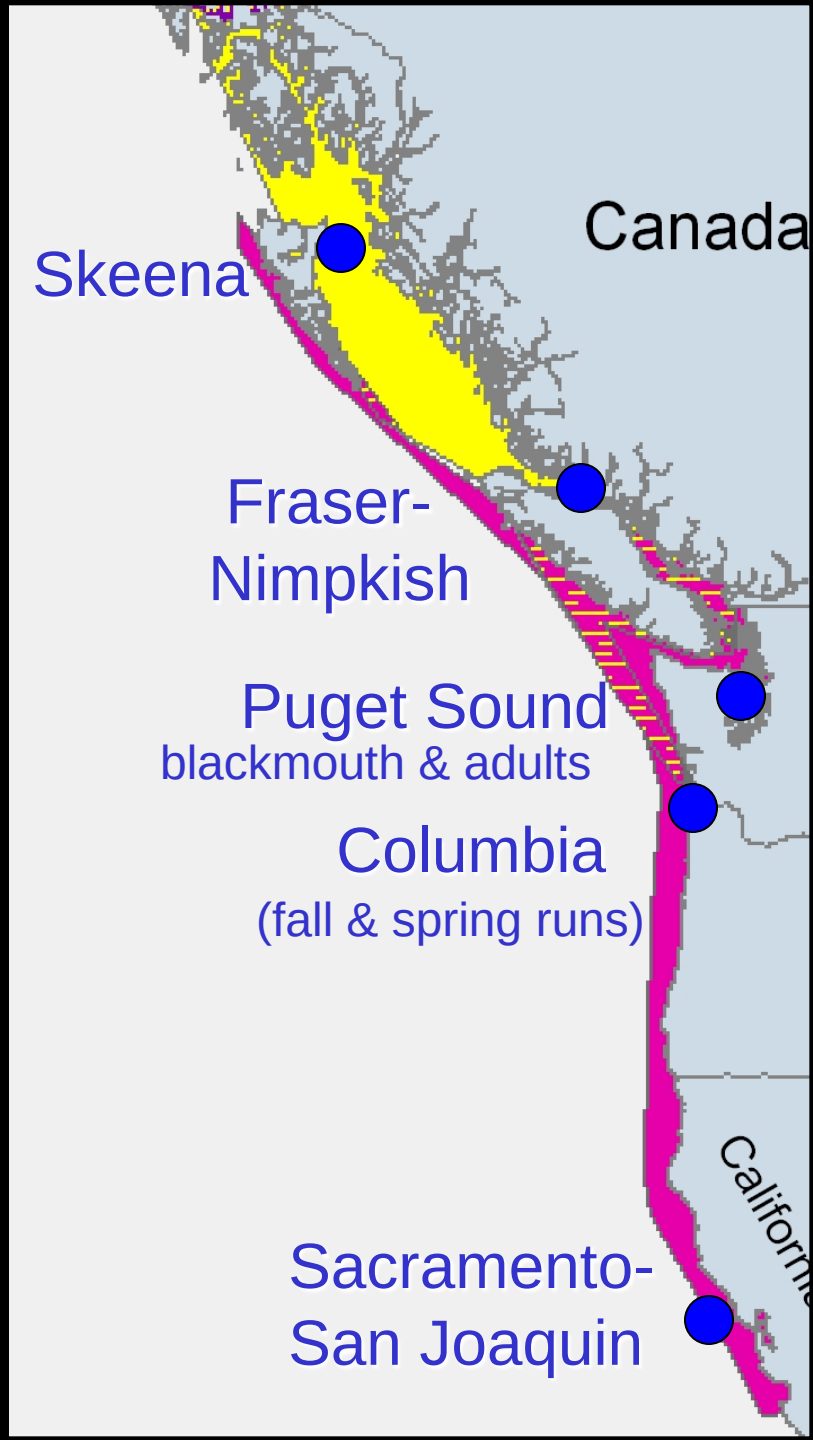




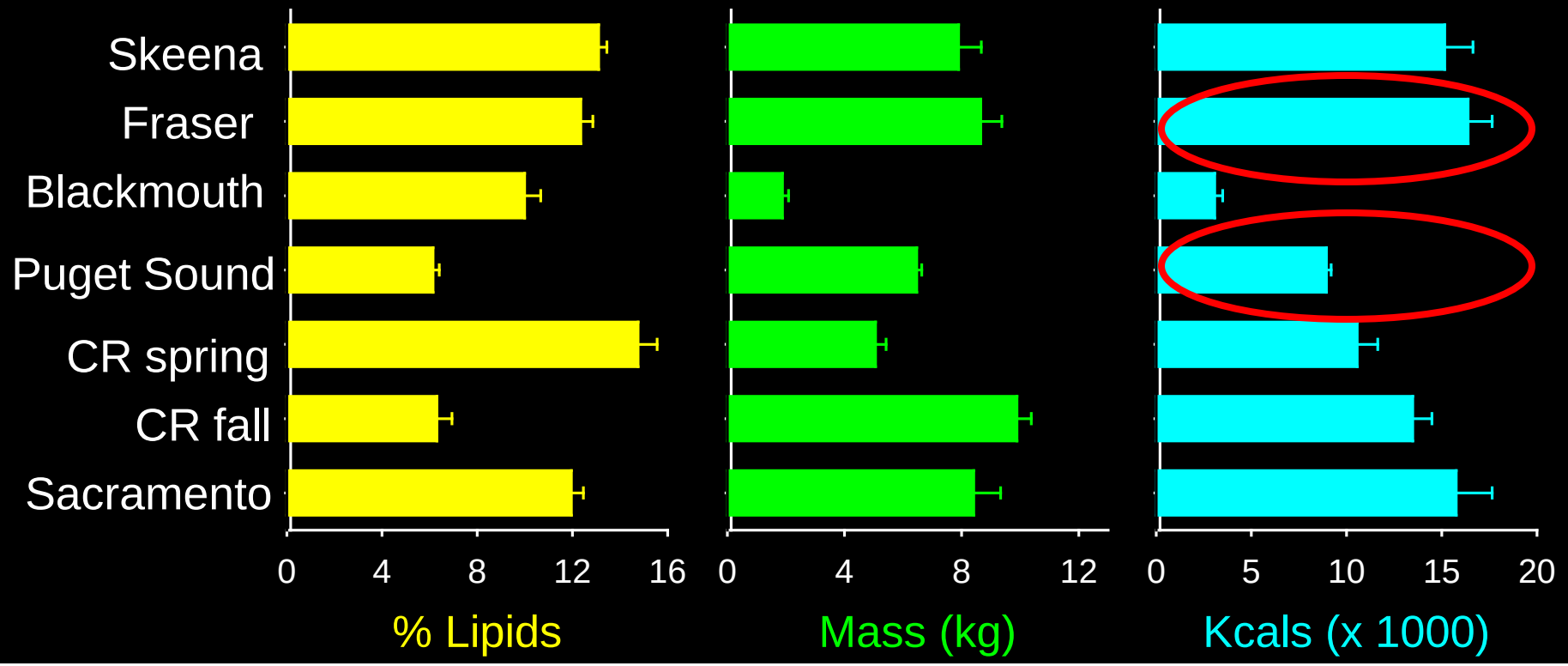
Results

How do Chinook salmon populations vary in quality?

Photo by Andrew Henry



Regional Variation in Chinook Quality



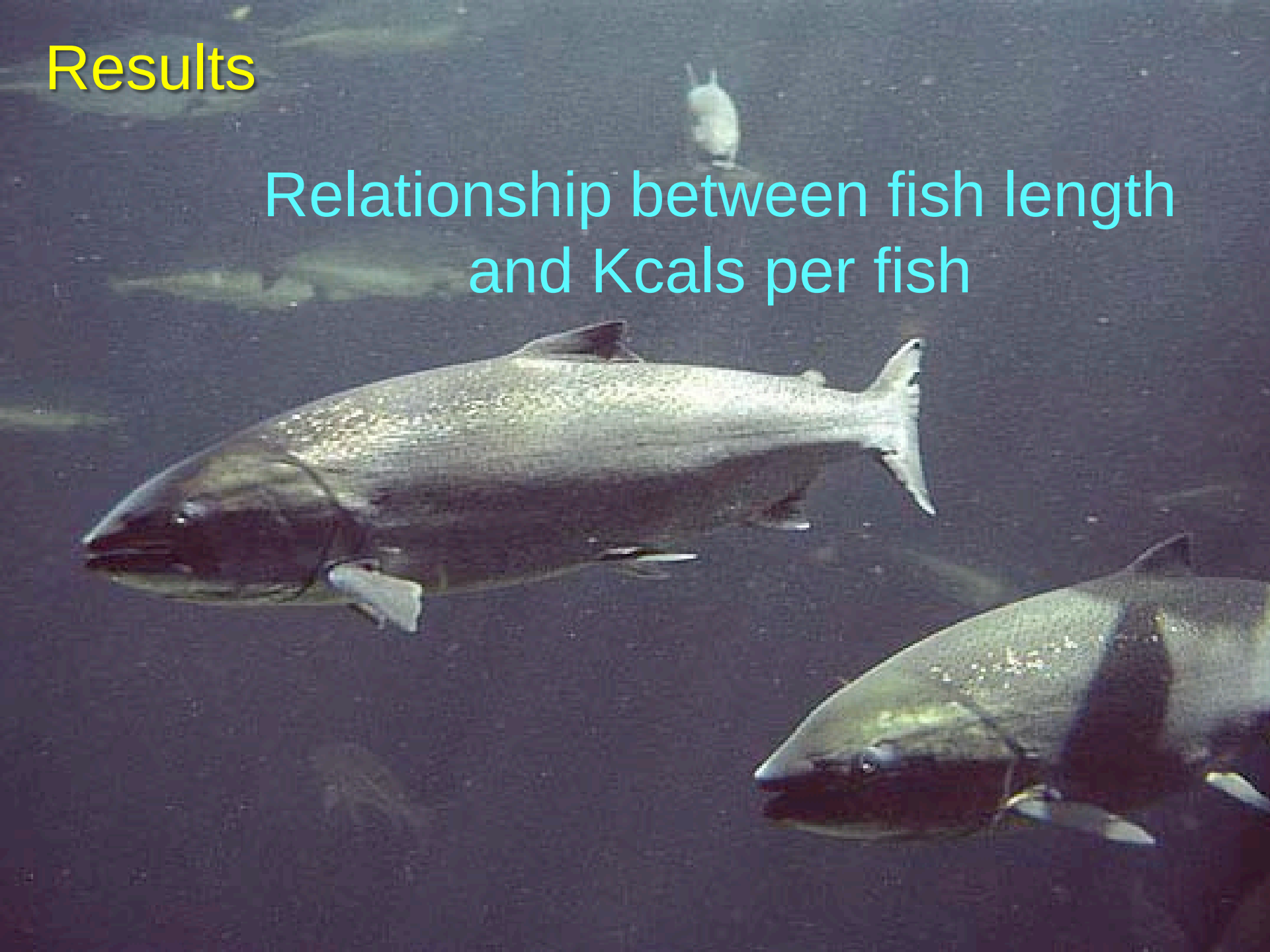
2 Puget Sound

=

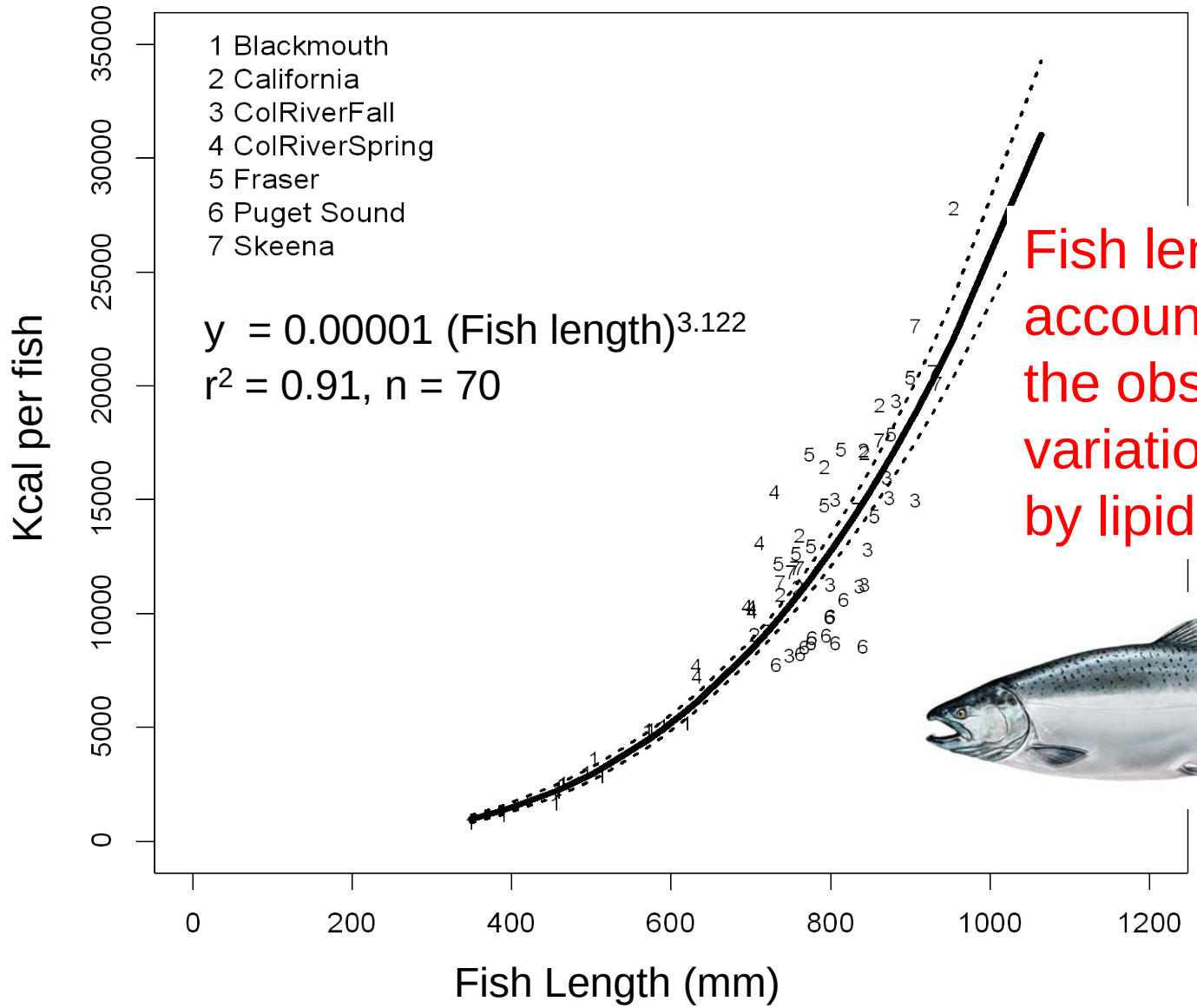
1 Fraser River

Results

Relationship between fish length and Kcals per fish

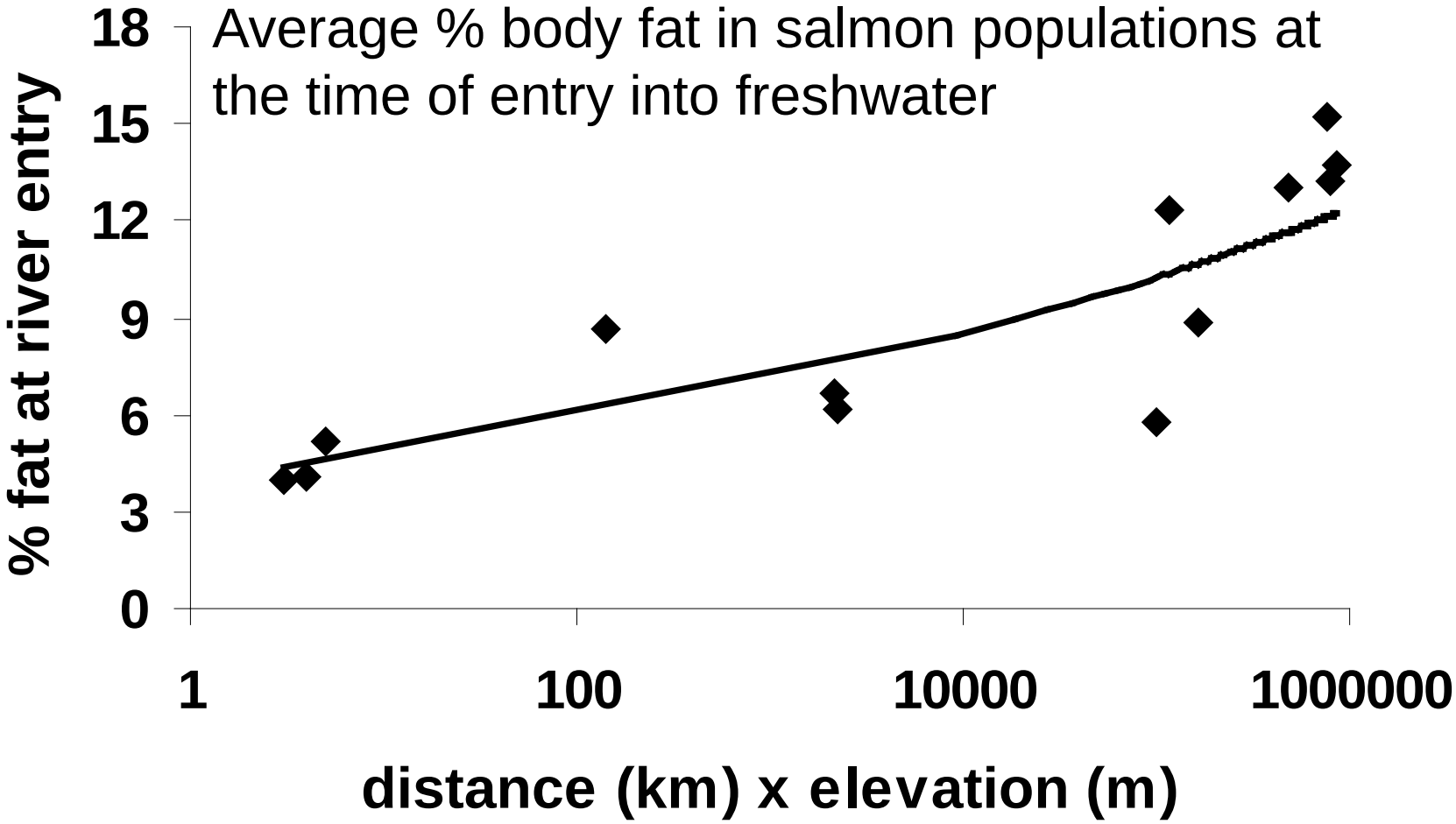


Kcal- fish length relationship for all populations



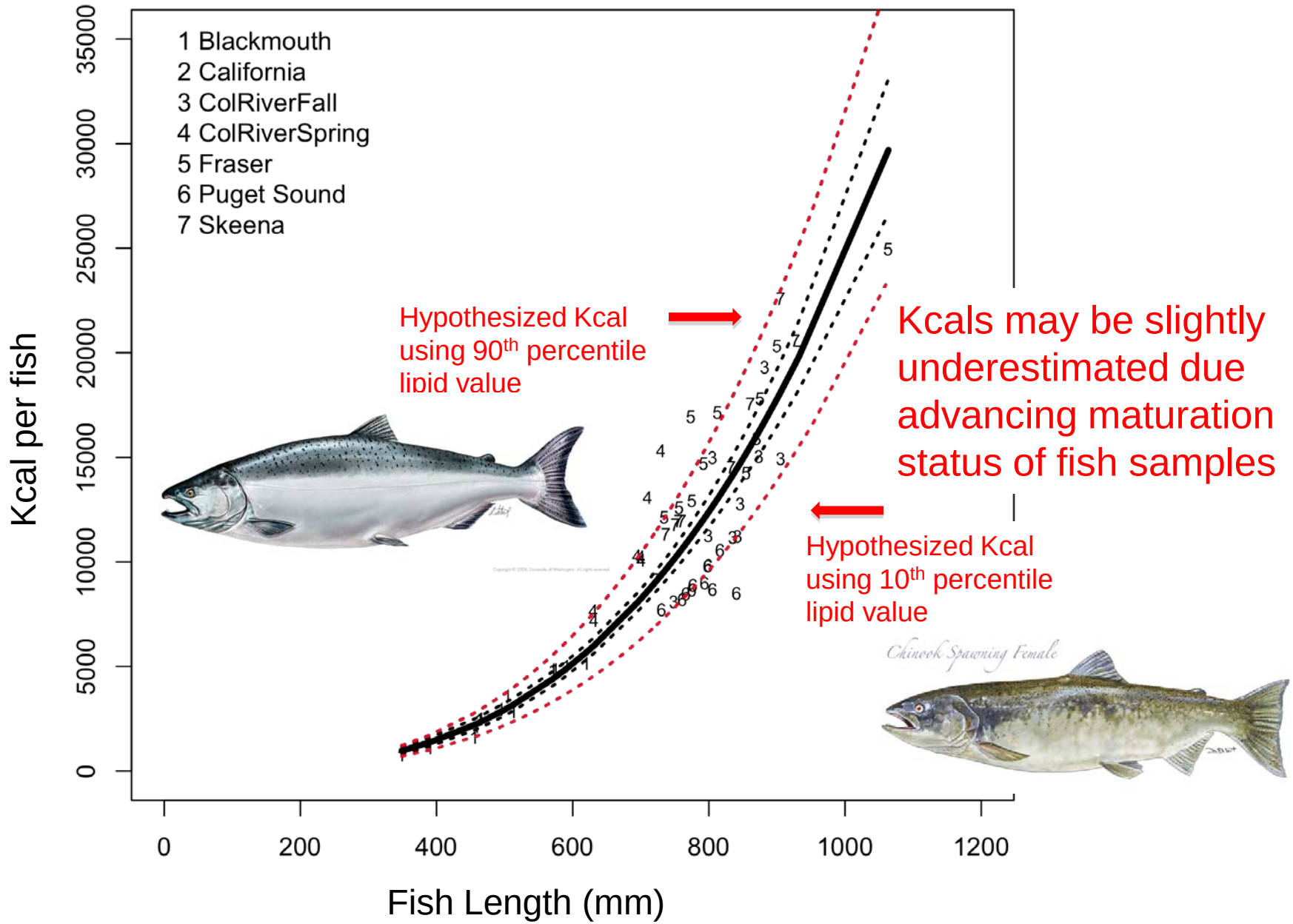
Fish length accounts for 91% of the observed variation, followed by lipid content (6%)

Lipid content for specific salmon populations could be estimated.

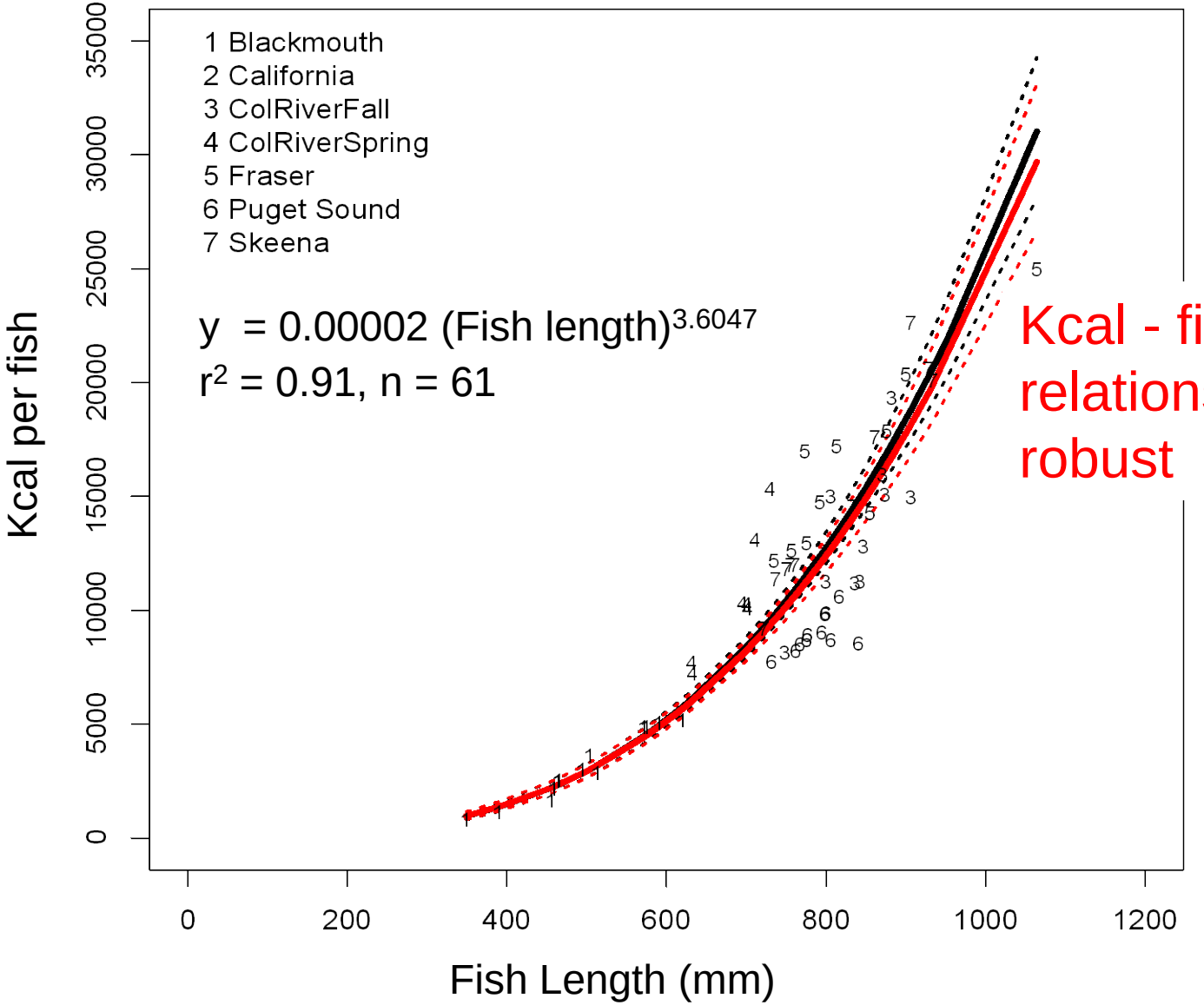


from Quinn 2005

Kcal- fish length relationship for all populations

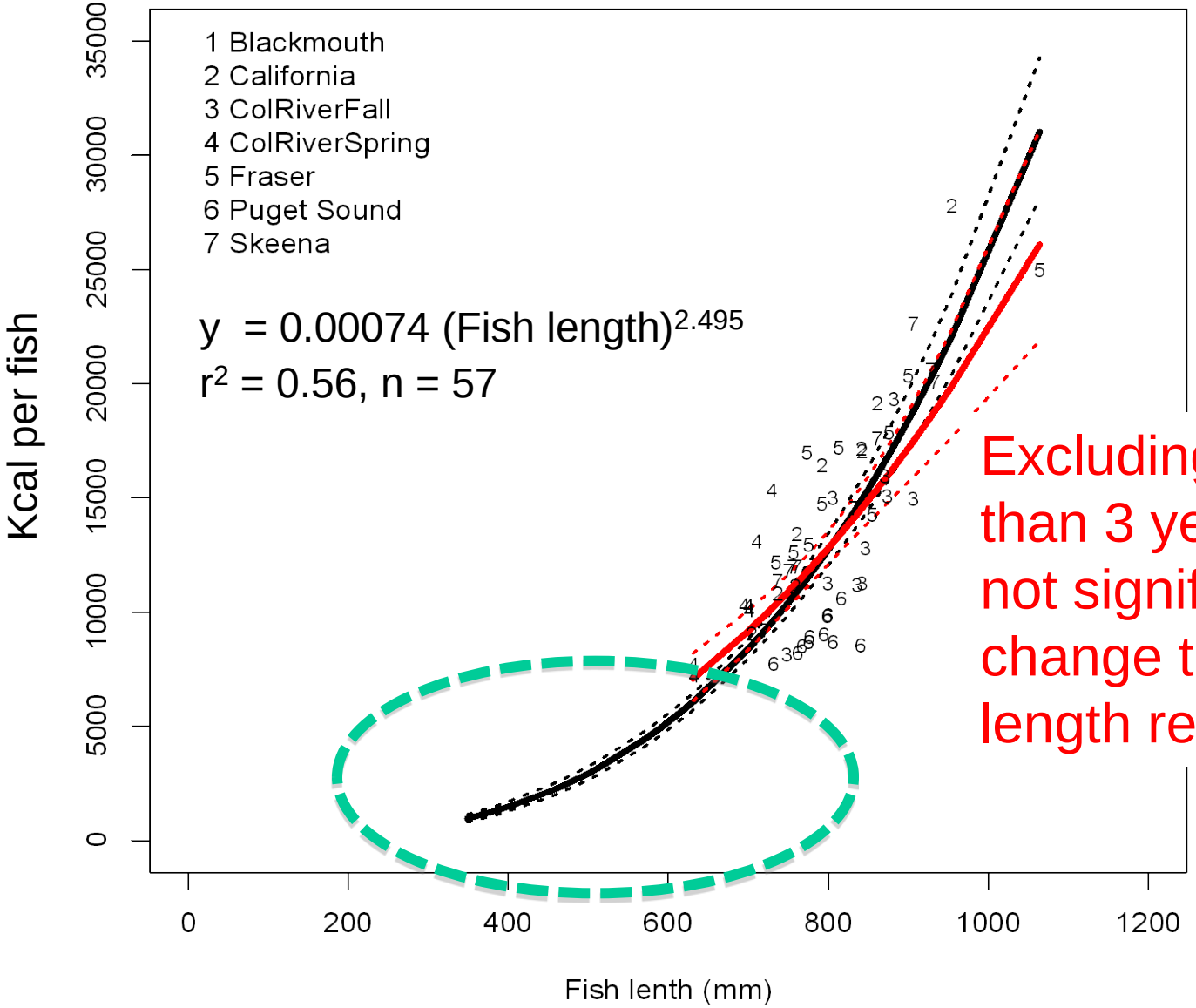


Kcal- fish length relationship - less California



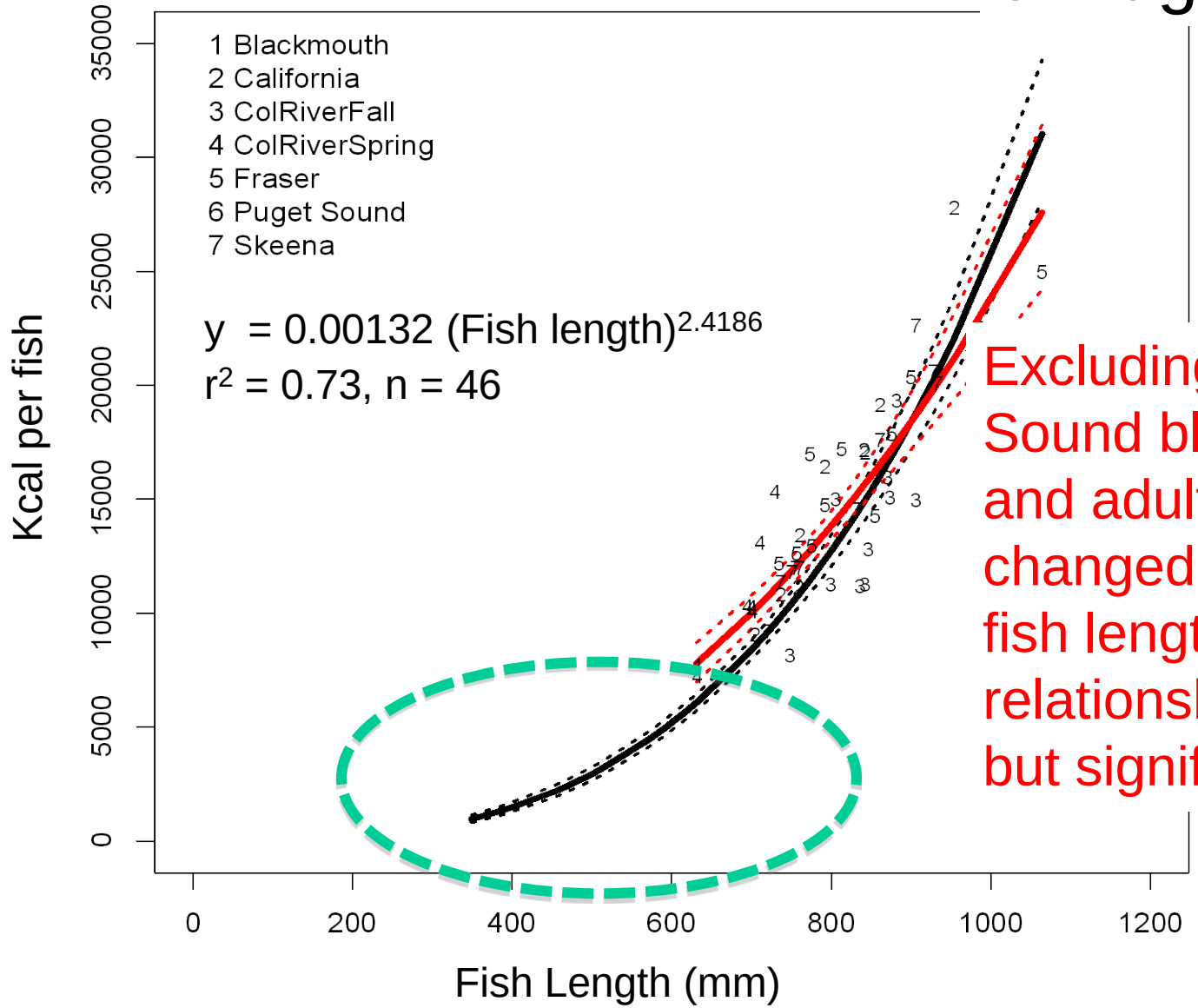
Kcal - fish length relationship is robust

Kcal- fish length relationship- less blackmouth

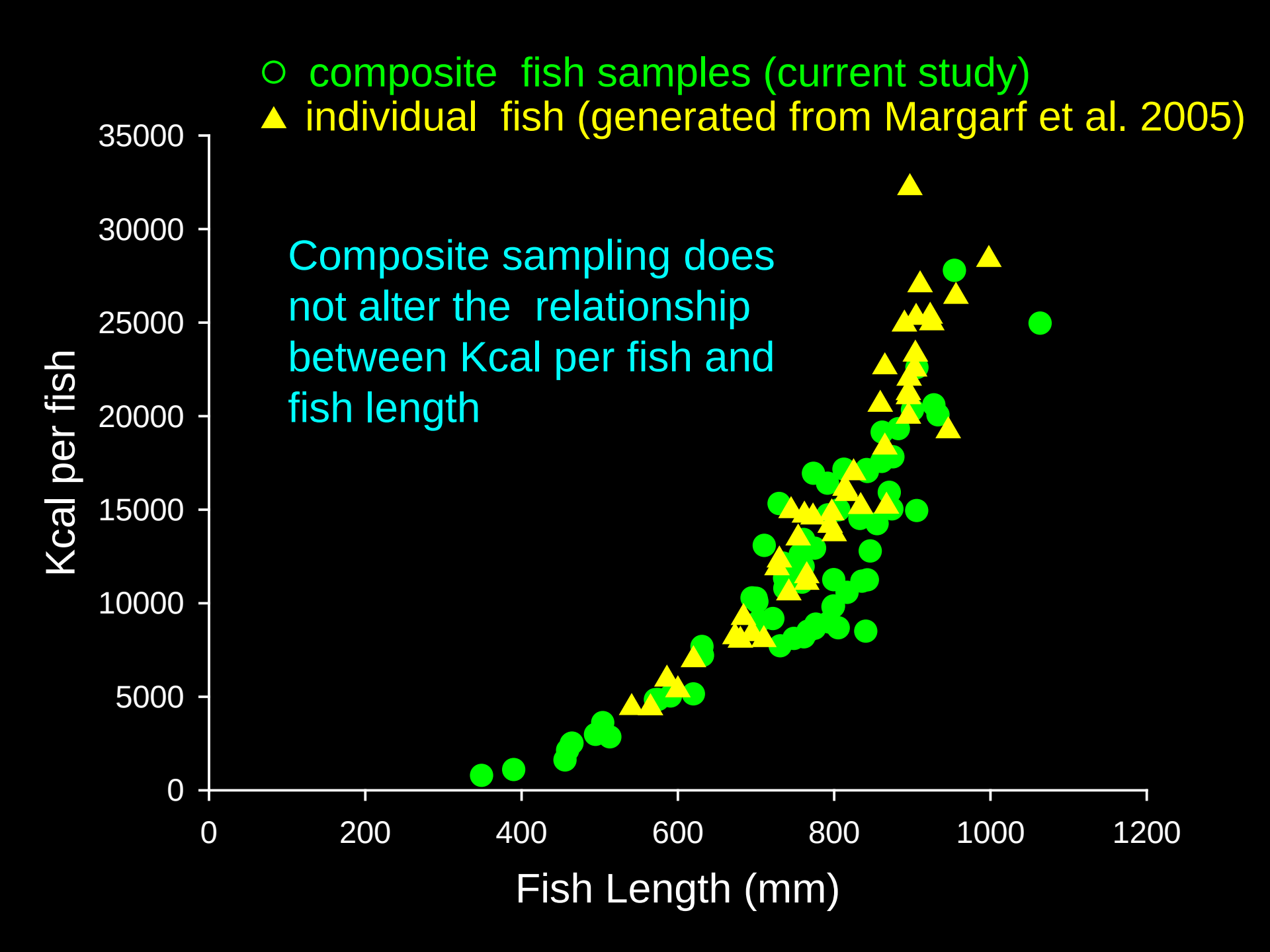


Excluding fish less than 3 years old did not significantly change the Kcal- fish length relationship

Kcal- fish length relationship - less blackmouth & Puget Sound



Excluding Puget Sound blackmouth and adult fish changed the Kcal-fish length relationship slightly but significantly


composite fish samples (current study)
individual fish (generated from Margarf et al. 2005)
Composite sampling does not alter the relationship between Kcal per fish and fish length
Kcal per fish
35000
30000
25000
20000
15000
10000
5000
0
0
200
400
600
800
1000
1200
Fish Length (mm)

Summary: Prey Quantity and Quality

- Nutritional value of a salmon (kcal per fish) is determined primarily by its size, then lipid content.
- Chinook salmon are larger than other salmon species and have a relatively high fat content so offer more energy per fish as prey to resident killer whales.
- Chinook salmon populations differ in their size and fat content , but generally their energy content is correlated with their size.
- Puget Sound Chinook salmon tend to be smaller and less fatty than other Chinook populations.