Diet as a mechanism for seasonal and geographic differences in juvenile pollock condition

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Significance

- Nutritional stress faced by young-of-the-year pollock in the winter may have implications on mortality and recruitment.
- Certain geographic locations may provide advantages in fish growth and survival.

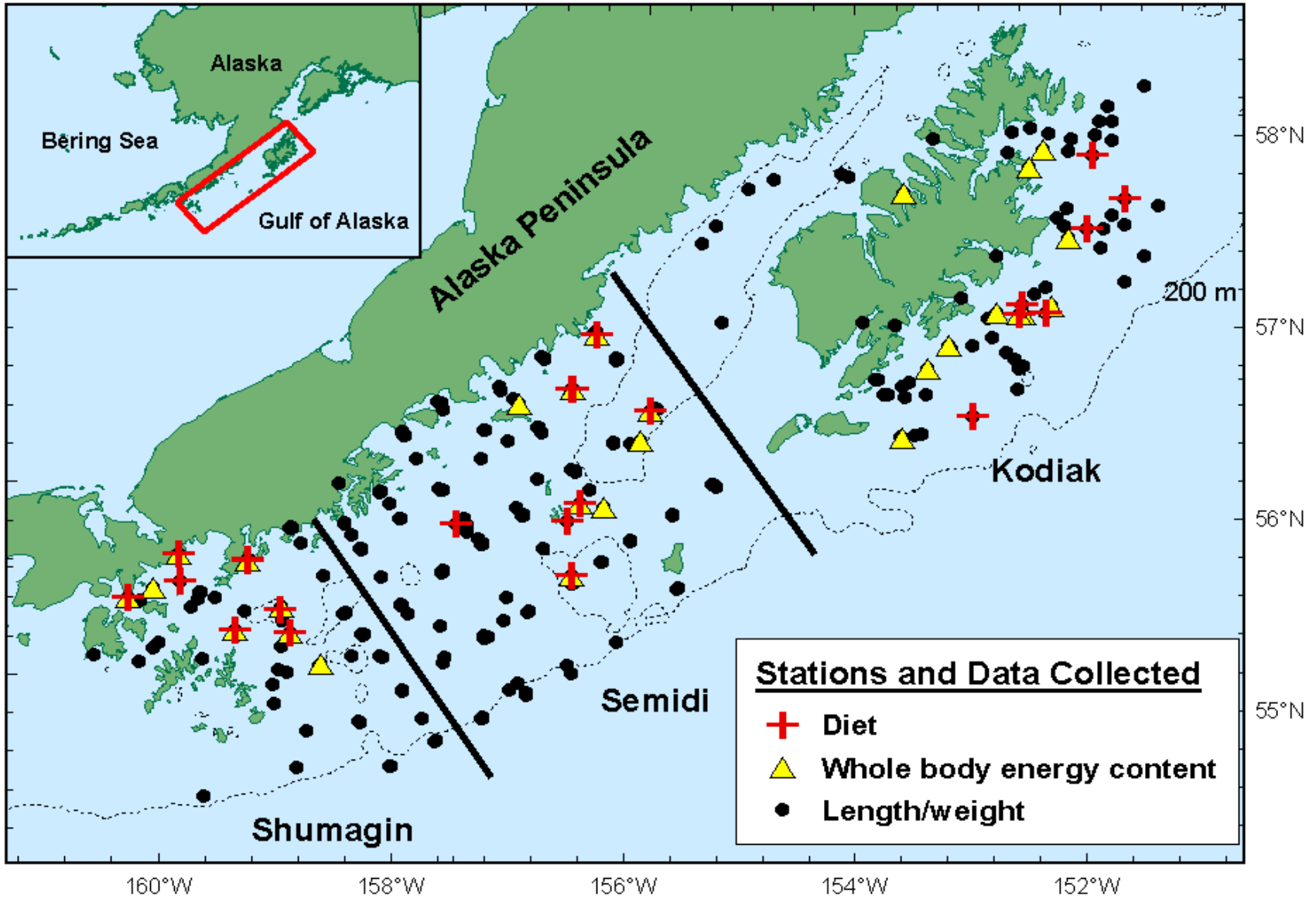
Objectives

- Examine seasonal and geographic patterns in diet.
- Relate these patterns to changes in fish condition.

Methods

- Sampling
  - Four different time periods, tracking the 2000 year-class
    - **Aut00** - August, September 2000 (37-109 mm)
    - **Win01** - February, March 2001 (73-158 mm)
    - **Sum01** - June, July 2001 (90-190 mm)
    - **Aut01** - September 2001 (125-259 mm)
  - Mid-water and bottom trawls
  - Day and night sampling
  - All fish were frozen

Study Area


Alaska
Bering Sea
Gulf of Alaska
Alaska Peninsula
200 m
Kodiak
Semidi
Shumagin
Stations and Data Collected
Diet
Whole body energy content
Length/weight
58°N
57°N
56°N
55°N
160°W
158°W
156°W
154°W
152°W

Methods

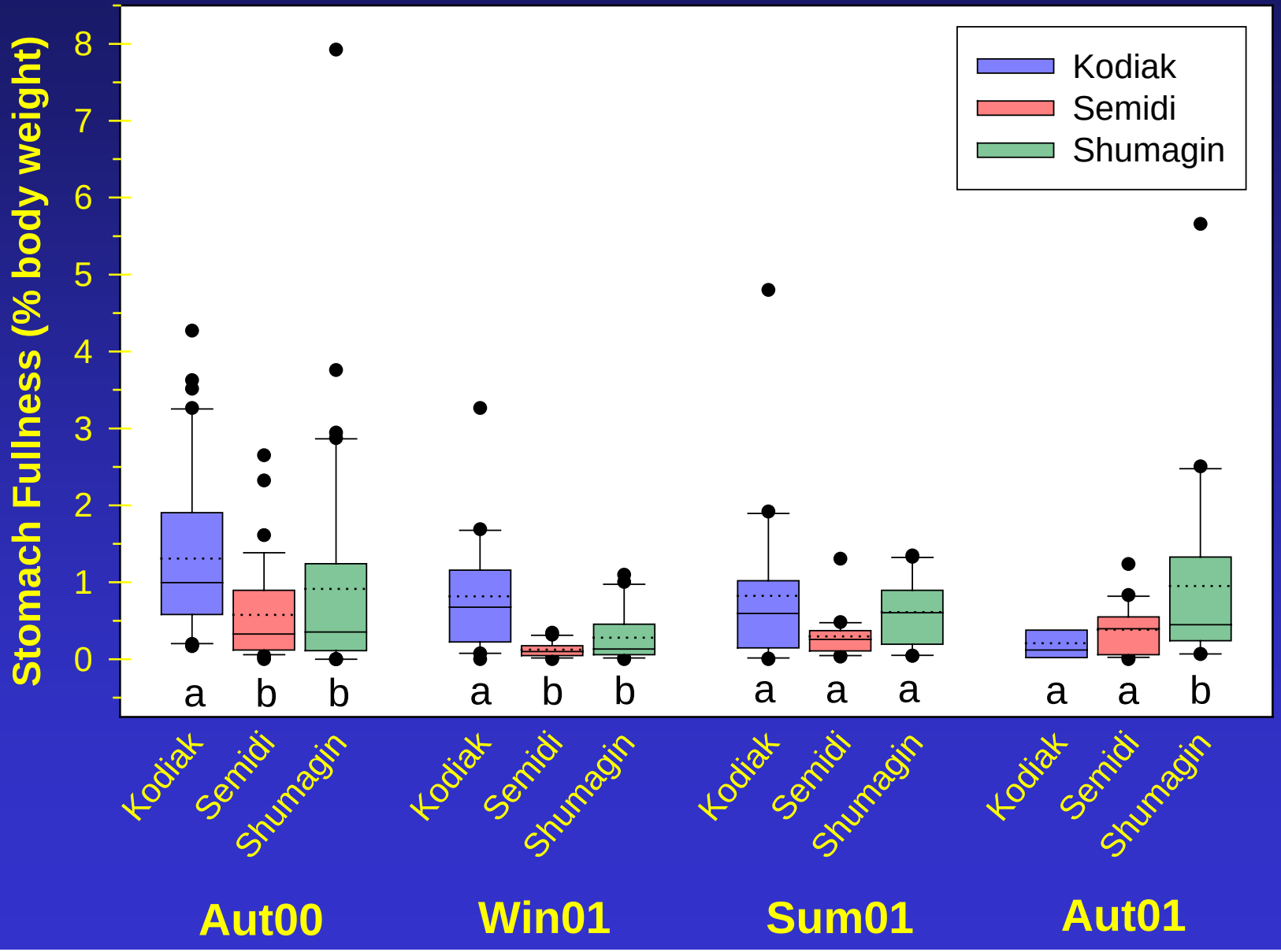
- Diet Analysis
  - Stomachs excised from thawed fish (n=284)
  - Contents sorted to lowest possible taxa
  - Prey items enumerated and weighed

- Condition Analysis
  - Individual lengths and weights measured (n=2199)
  - Whole body energy content determined using bomb calorimetry or proximate analysis (n=168)

Results

- Diet
  - Stomach Fullness
  - Major Prey
  - Diet Composition
  - Frequency of Occurrence
- Condition
  - Length-Weight Regressions
  - Whole Body Energy Content

Diet: Stomach Fullness



Diet: Major Prey

Euphausiids

Thysanoessa spp.

T. inermis & *T. spinifera*

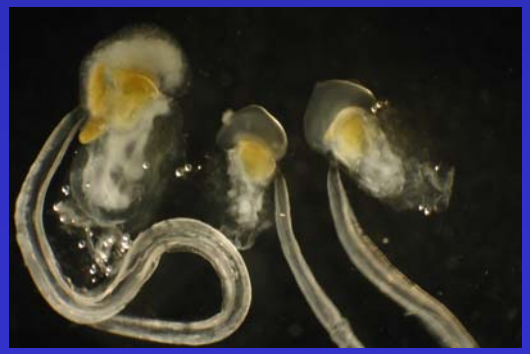
Calanoid Copepods

Large (≥2 mm)

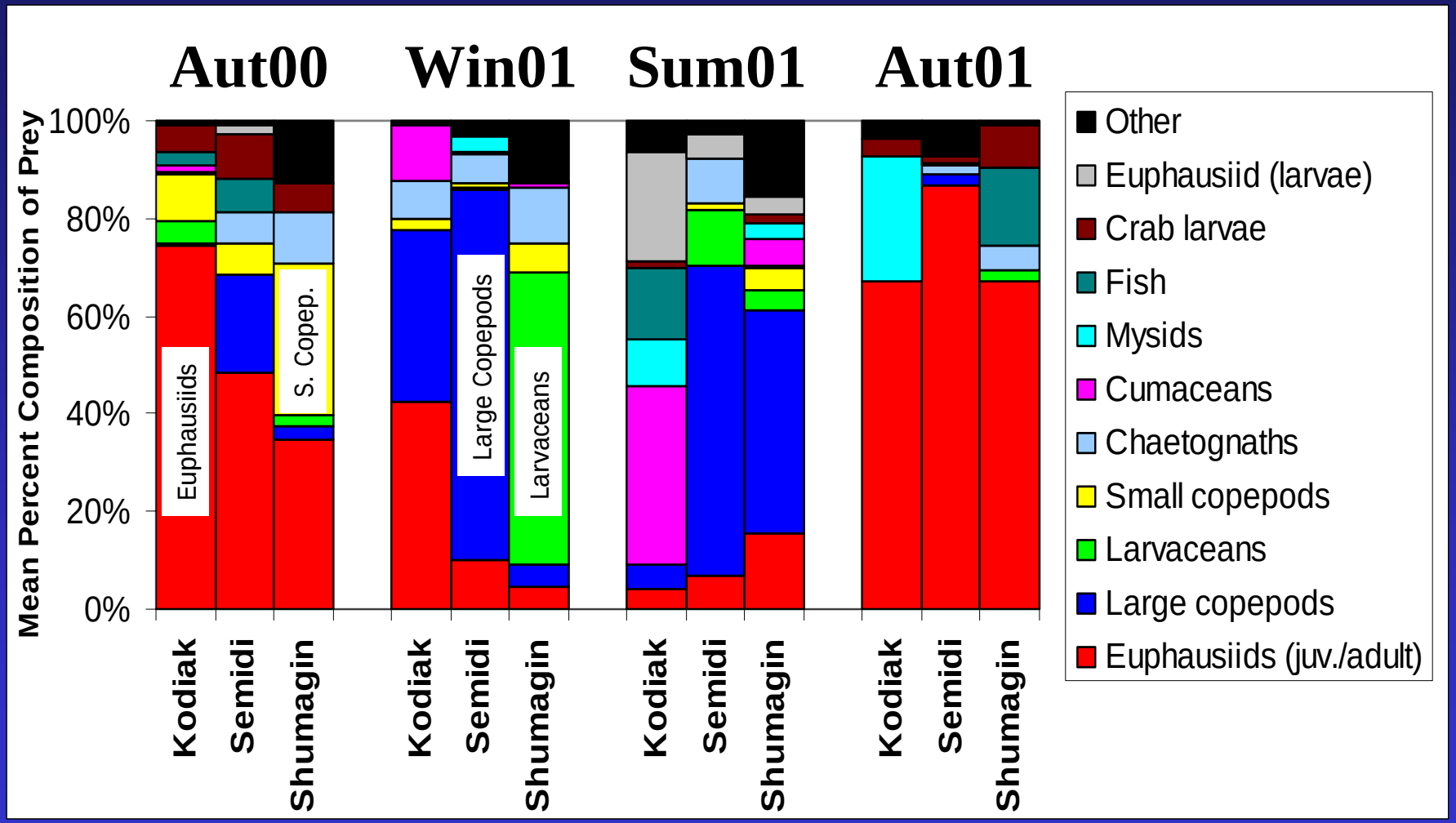
Small (<2 mm)

Larvaceans

Oikopleura spp.



Diet: Composition of Prey Items (by weight)



Diet: Frequency of Occurrence (%) of Prey

Prey Taxa	Aut00			Win01			Sum01			Aut01		
	Kod	Sem	Shum	Kod	Sem	Shum	Kod	Sem	Shum	Kod	Sem	Shum
Euphausiids (juv./adult)	**92.5**	67.6	32.5	**80.0**	15.0	5.0	10.0	10.0	20.0	85.7	85.0	80.0
Large copepods (>2mm)	22.5	**56.8**	20.0	65.0	**95.0**	25.0	35.0	**95.0**	85.0	14.3	**60.0**	0.0
Larvaceans	47.5	8.1	27.5	15.0	25.0	**95.0**	0.0	50.0	**85.0**	0.0	45.0	20.0
Small copepods (<2mm)	60.0	51.4	62.5	30.0	35.0	50.0	30.0	20.0	75.0	14.3	5.0	15.0
Chaetognaths	2.5	16.2	15.0	35.0	25.0	20.0	0.0	15.0	15.0	0.0	10.0	10.0
Cumaceans	10.0	0.0	0.0	50.0	5.0	10.0	45.0	0.0	20.0	0.0	0.0	0.0
Mysids	0.0	0.0	0.0	0.0	5.0	5.0	15.0	0.0	10.0	28.6	10.0	0.0
Fish	7.5	13.5	0.0	0.0	0.0	0.0	15.0	0.0	0.0	0.0	10.0	15.0
Crab larvae	25.0	18.9	12.5	5.0	0.0	0.0	45.0	0.0	45.0	14.3	30.0	45.0
Euphausiids (larvae)	10.0	24.3	0.0	0.0	0.0	0.0	40.0	5.0	30.0	0.0	0.0	0.0
Other	50.0	18.9	27.5	35.0	25.0	60.0	85.0	25.0	65.0	42.9	75.0	65.0
Unidentifiable	22.5	27.0	20.0	10.0	0.0	0.0	30.0	20.0	50.0	0.0	10.0	20.0
Empty	0.0	2.7	10.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0	5.0	0.0
n	40	37	40	20	20	20	20	20	20	7	20	20

Results

- Diet
  - Stomach Fullness
  - Major Prey
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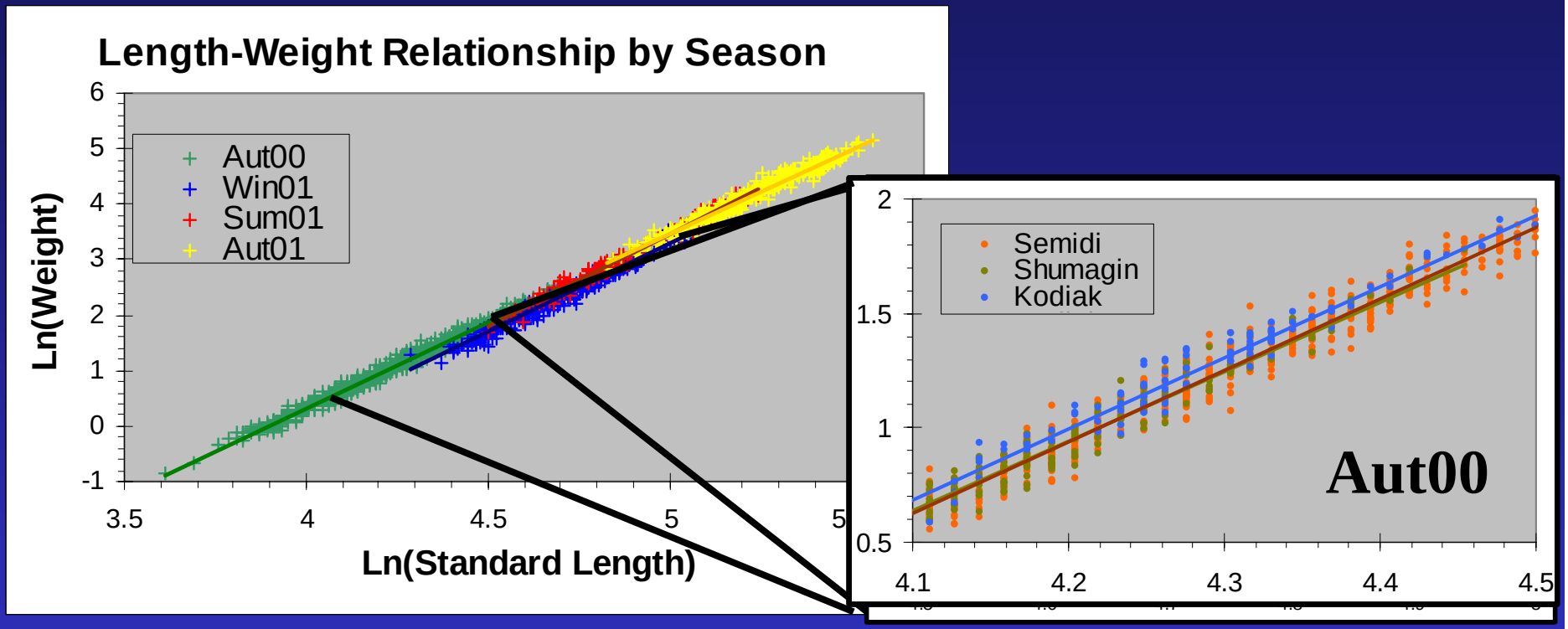
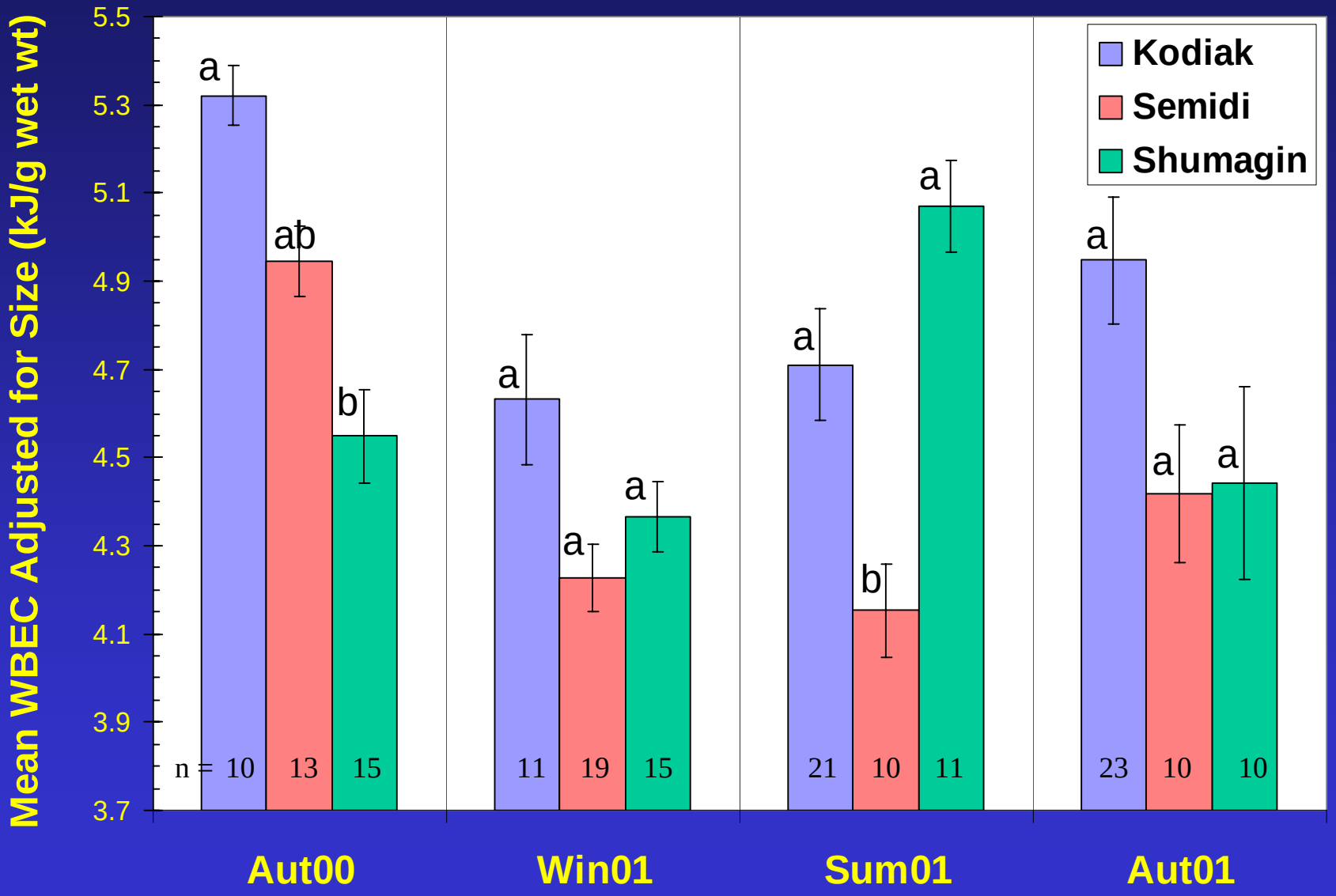
- Condition
  - Length-Weight Regressions
  - Whole Body Energy Content

Condition: Length-Weight Relationship



- Pollock body condition was low during winter in each region (ANCOVA; $P<0.001$).
- Fish from the Kodiak region were more robust than other regions in Autumn (2000) and Winter (2001) (ANCOVA; $P<0.05$).

Condition: Whole Body Energy Content



Conclusions

- Nutritional “stress” in wintertime
  - Stomach fullness decreases.
  - Pollock diets shift away from euphausiids.
  - Diet may be contributing to low fish condition in winter.
- Geographic variation in nutritional stress
  - Kodiak fish benefit from higher stomach fullness and more energy-rich prey.
  - Better diet near Kodiak may be driving higher fish condition.

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