

MESOOZOOPLANKTON ARE NOT HERBIVORES:

THE IMPORTANCE OF MICROZOOPLANKTON IN MESOOZOOPLANKTON DIETS AND IN ARCTIC AND SUB-ARCTIC TROPHIC LINKAGES

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The Problem

- Despite studies demonstrating that many mesozooplankton are omnivorous, the perception that they are herbivorous persists in the literature
- Here we present results from multiple studies focusing on the importance of microzooplankton to mesozooplankton ecology
- We show also that the relative importance of microzooplankton in the diet varies between species and seasons.
- The data shown today have largely been published in Campbell et al. 2009 and 2016 with additional information in Sherr et al 2009 and 2013.

Grazing experiments were conducted on 8 cruises spanning three seasons

Dates	Season	Seas	Chlorophyll Grazing Measurements	Microzooplankton Predation Measurements
			N	N
5 May - 15 June 2002	Spring	Chukchi-Beaufort Seas	111	26
15 July - 26 August 2002	Summer	Chukchi-Beaufort Seas	161	72
15 May - 23 June 2004	Spring	Chukchi-Beaufort Seas	72	33
18 July - 26 August 2004	Summer	Chukchi-Beaufort Seas	108	39
2 April - 1 May 2008	Spring	Bering Sea	157*	114
6 April - 8 May 2009	Spring	Bering Sea	201*	69
12 May - 11 June 2010	Late Spring	Bering Sea	239*	104
7 November - 17 December 2011	Early Winter	Chukchi-Beaufort and Bering Seas	100*	41

* Size fractionated chlorophyll

Paired Micro- and Meso- Zooplankton Grazing Experiments



Microzooplankton Dilution Experiments

- 5-point (2002, 2004) or 2-point (2008-2010) dilutions
- 0.2 μm filtered SW dilution

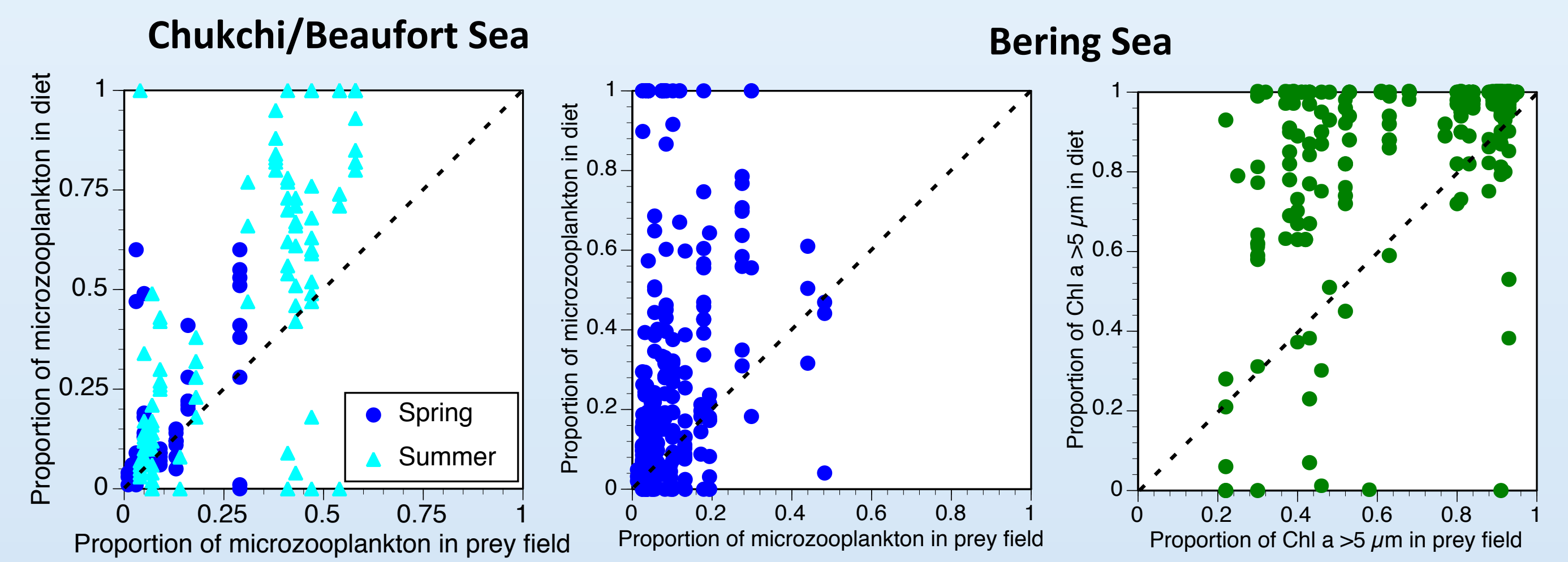
Mesozooplankton Grazing Experiments

- Animals from upper 100 m. Dominant species and life stages sorted and introduced into experimental bottles at ambient temperature in a cold room

Both

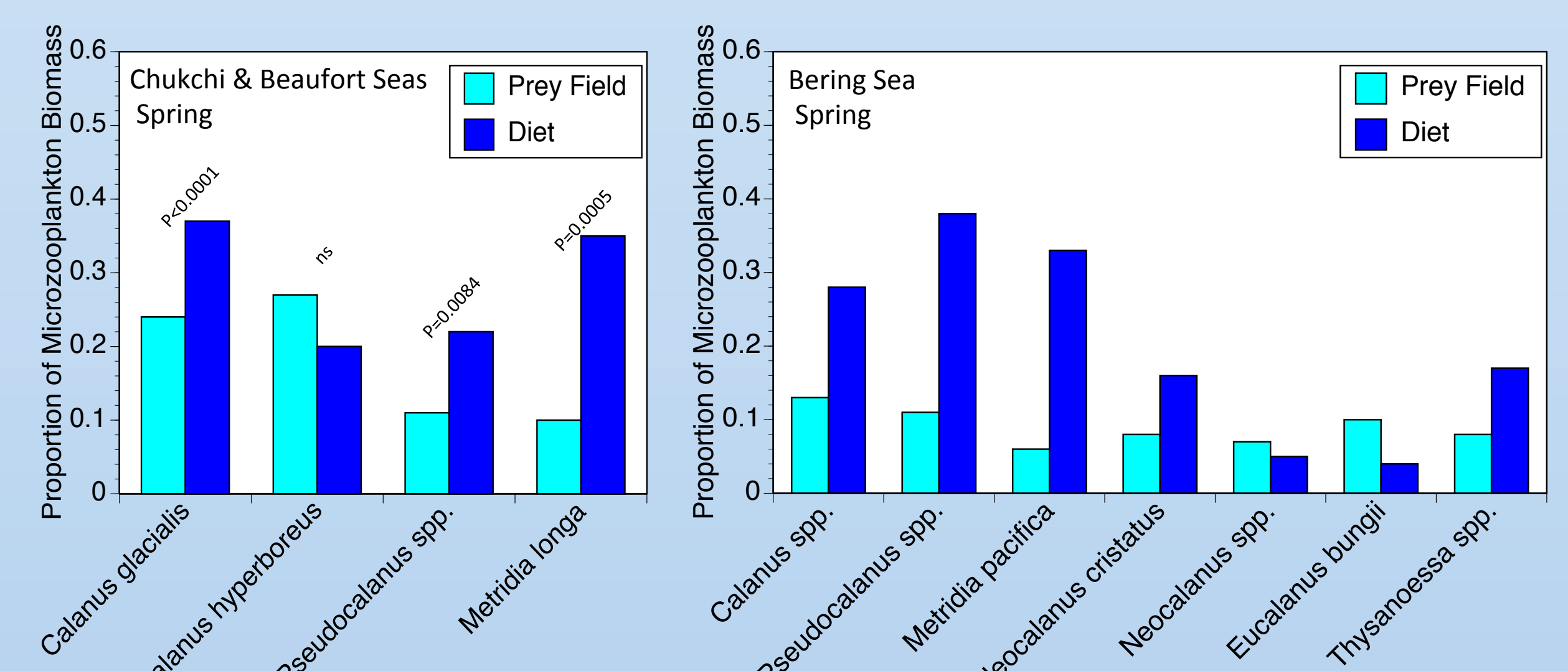
- The same incubation water, usually from chlorophyll maximum
- Triplicate control and experimental bottles
- 24 hour incubation at ambient light and temperature conditions using water baths and plankton wheel and film wrapping
- Incubation water sampled at time zero and following incubation for chlorophyll a and microzooplankton concentrations; mesozooplankton retained for carbon determination

Mesozooplankton Preferentially Grazed on Microzooplankton and on Large Phytoplankton

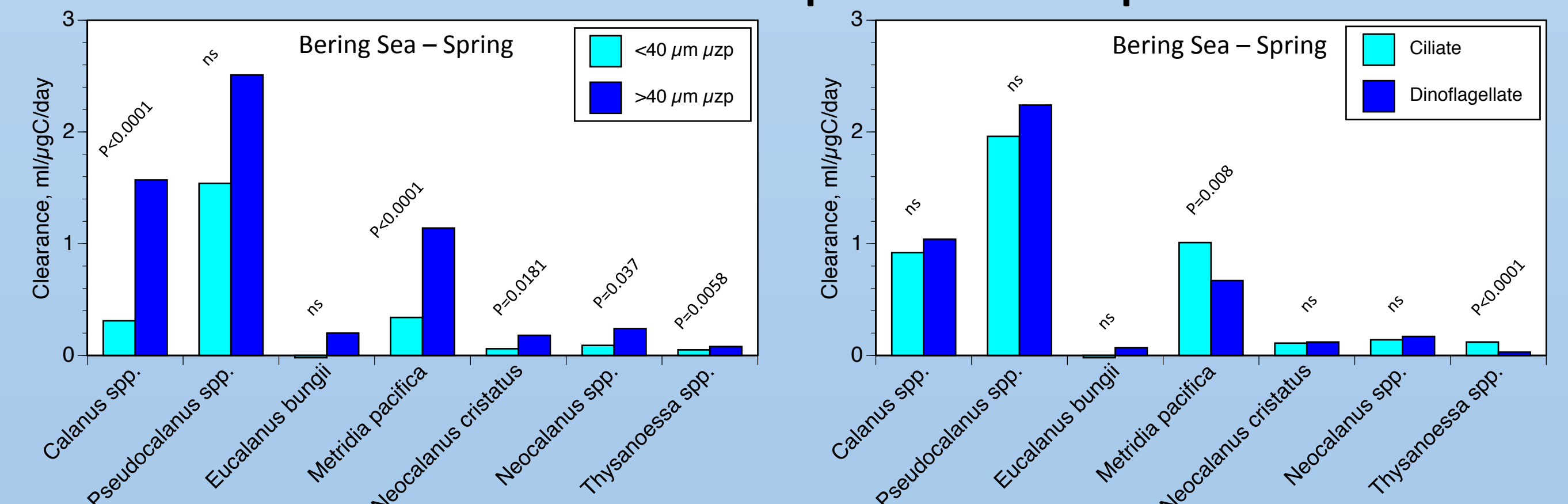


- Mesozooplankton preferred large phytoplankton cells and also had a strong preference for microzooplankton even when in low proportion in the prey field
- The microzooplankton proportion of the prey field and the strength of the mesozooplankton preference for microzooplankton were greater in summer when phytoplankton were small and less abundant

Several Species had a Strong Preference for Microzooplankton; All Grazed on Them

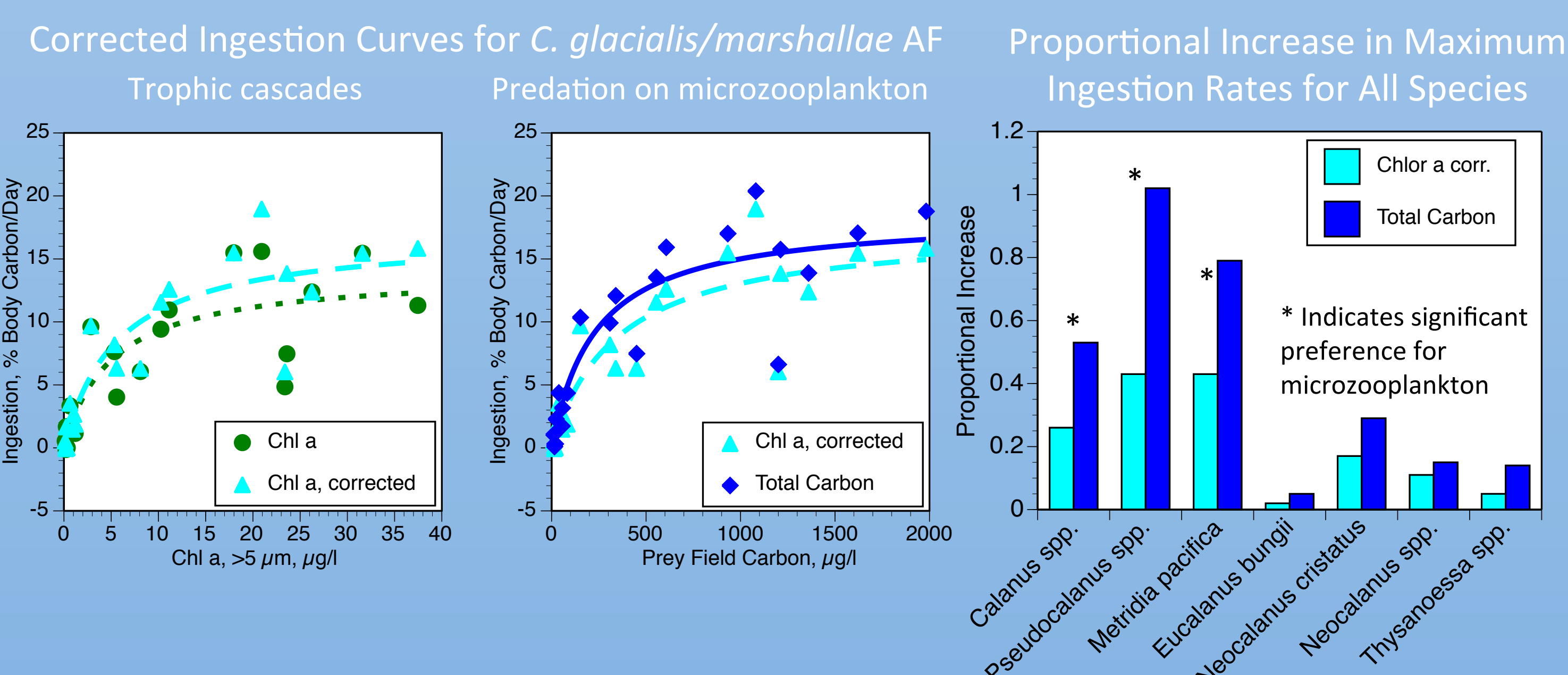


Preferences for Microzooplankton Type and Size Varied between Mesozooplankton Species



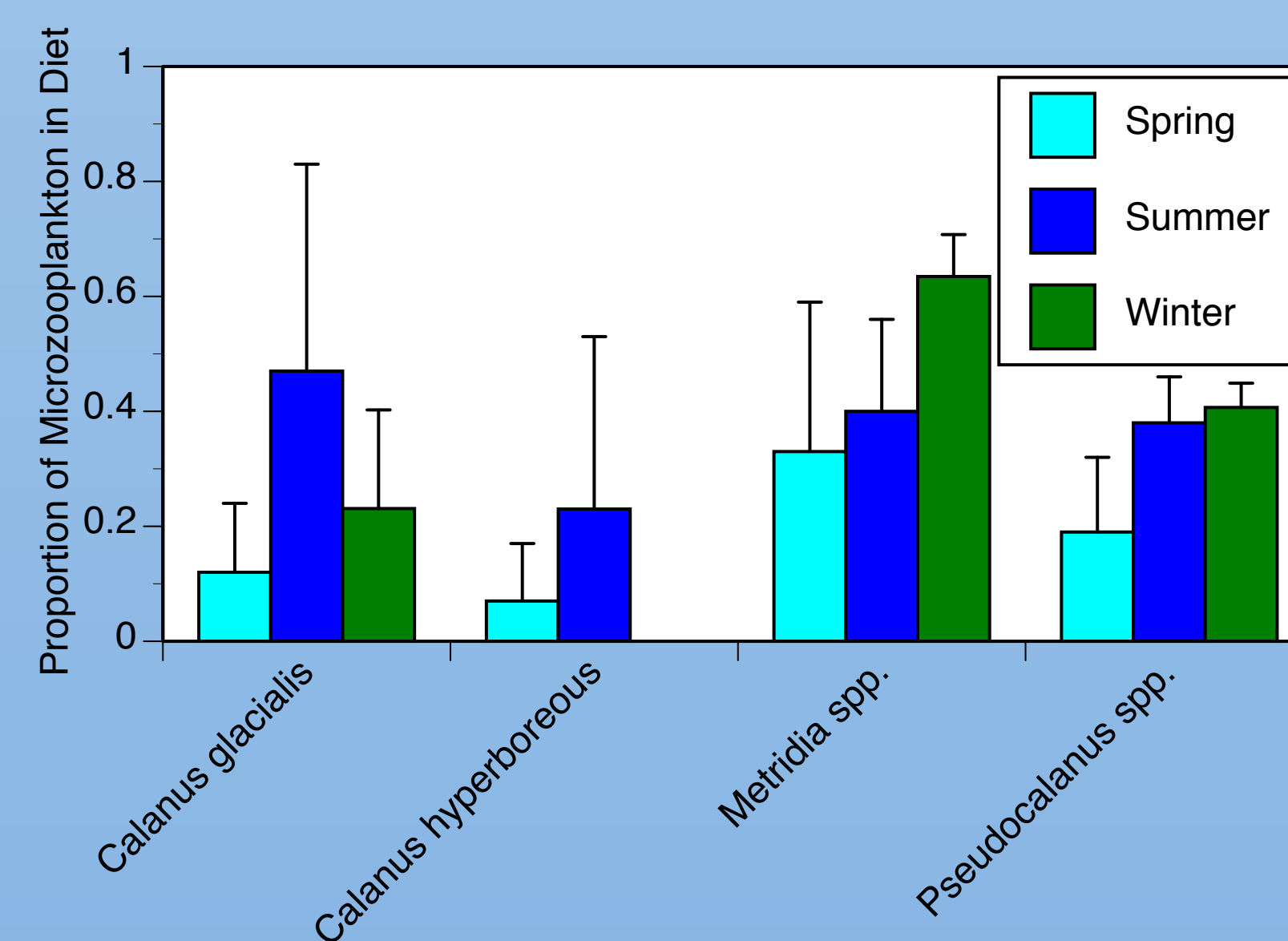
- Most mesozooplankton preferred larger microzooplankton
- *Metridia* spp. and *Thysanoessa* spp. had strong preferences for ciliates over dinoflagellates; other species had no preference for one over the other

Mesozooplankton Carbon Ingestion Estimates Increase when Corrected for Trophic Cascades and Predation on Microzooplankton



- Paired microzooplankton/mesozooplankton grazing assays permits correction of the total carbon ingestion for grazing of microzooplankton on phytoplankton in controls (trophic cascade; Nejstgaard et al., 2001) and for predation by mesozooplankton on microzooplankton
- Maximum ingestion estimates increased when corrected for trophic cascades and for predation on microzooplankton especially for those mesozooplankton species with a strong preference for microzooplankton

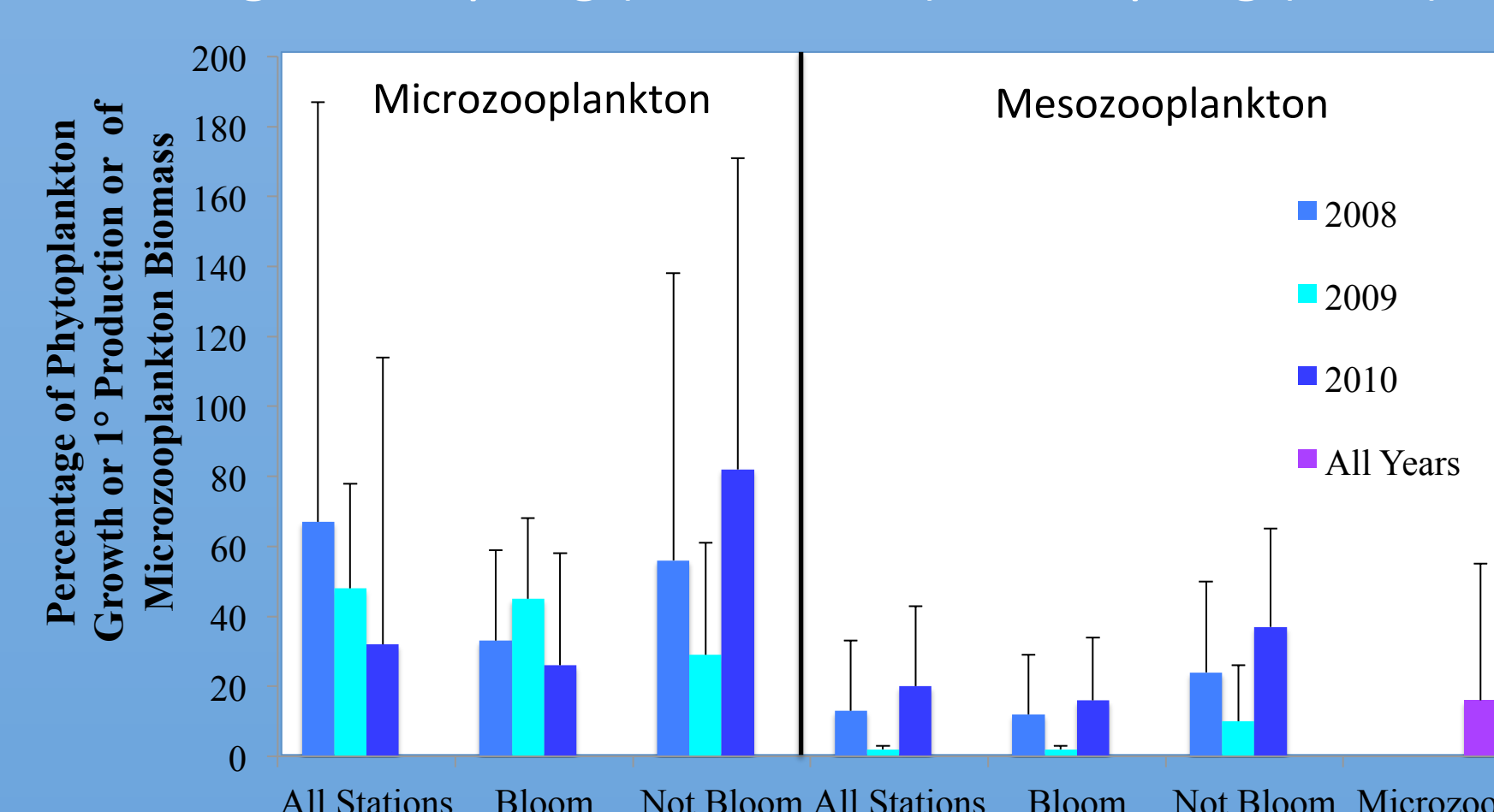
Preference for Microzooplankton was Greater in Summer



- Greater preference for microzooplankton also seen in winter relative to spring
- Higher proportion of microzooplankton in diet in summer due to their higher biomass in the prey field and stronger preference of the mesozooplankton

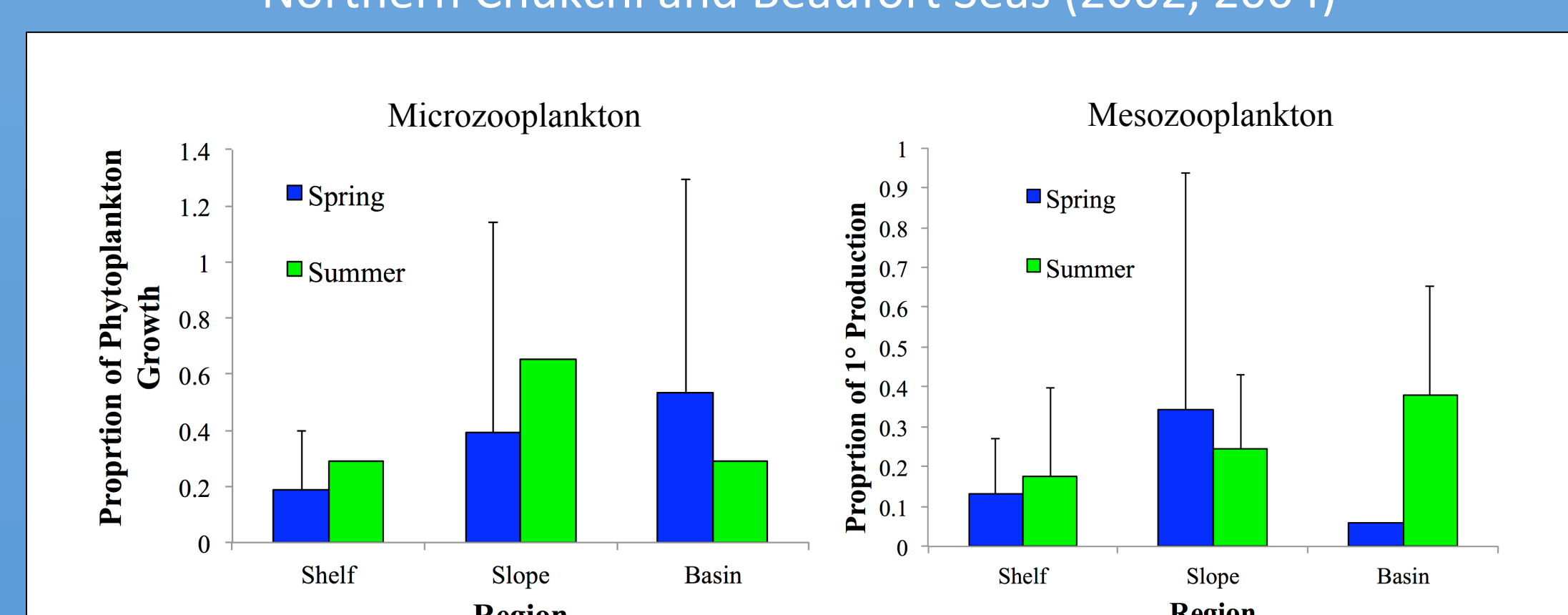
Grazing Impacts of Meso- and Micro- Zooplankton Varied With Season, Location, and Bloom Status

Bering Sea – Spring (2008, 2009), Late Spring (2010)



- Microzooplankton grazing impacts on PP were greater than by mesozooplankton
- Usually grazing impacts for both were greater during non-bloom situations
- Mesozooplankton grazed on average 16% of the microzooplankton biomass

Northern Chukchi and Beaufort Seas (2002, 2004)



- Little regional pattern in microzooplankton grazing impact
- Summer mesozooplankton grazing impacts were greater over the Slope and Basin

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