

# Body chemical contents and gut pigments of copepods in the western Arctic Ocean during summers of 2008 and 2010



*Calanus hyperboreus*  
C6F



*Calanus glacialis*  
C6F&C5



*Metridia longa*  
C6F

1 mm

Kohei Matsuno, Atsushi Yamaguchi and Ichiro Imai  
(Hokkaido University)

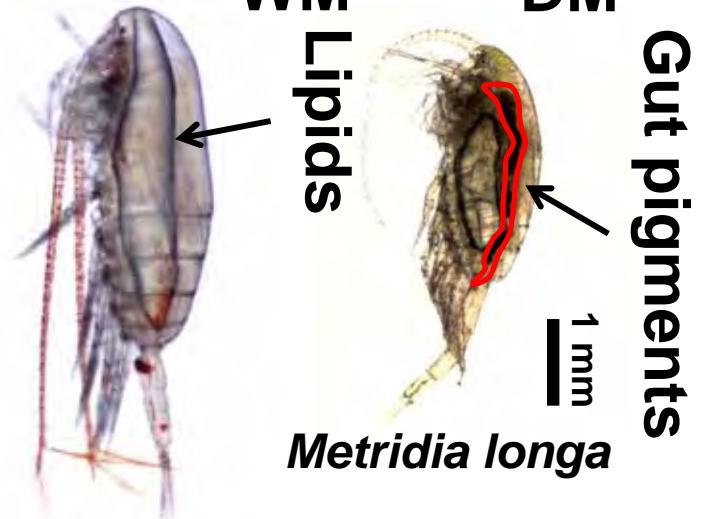
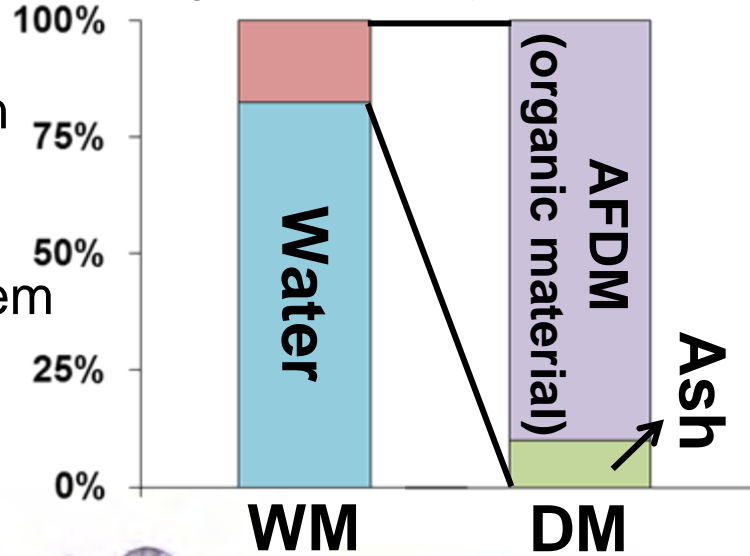
# Introduction

- Western Arctic Ocean: drastic sea ice reduction effects to marine ecosystem is concerned
- Copepods: key components of marine ecosystem  
While their importance, little information is available on regional and annual changes in body chemical contents.

Measured parameters:

- Water content: index of body nutrition
- AFDM: index of lipid accumulation
- Gut pigment: index of grazing activity

Diagram of body contents



*Calanus glacialis*

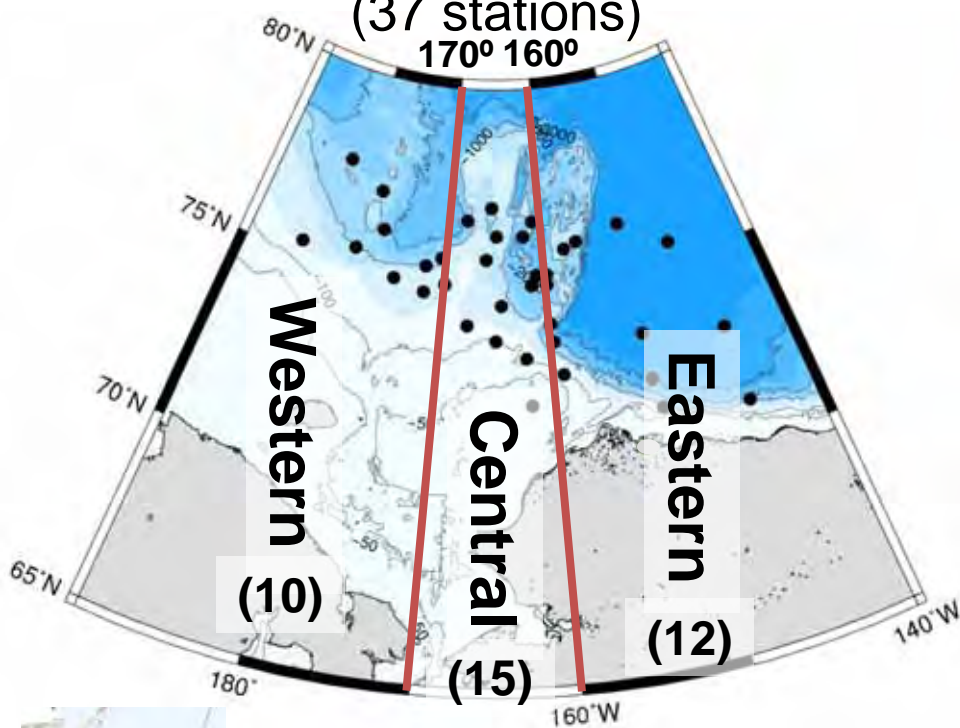
## Purpose of this study:

Inter-species, regional and annual (2008 and 2010) changes of body contents of copepods in the western Arctic Ocean during summer were evaluated.

# Materials and Methods: Sampling, measurement and data analysis

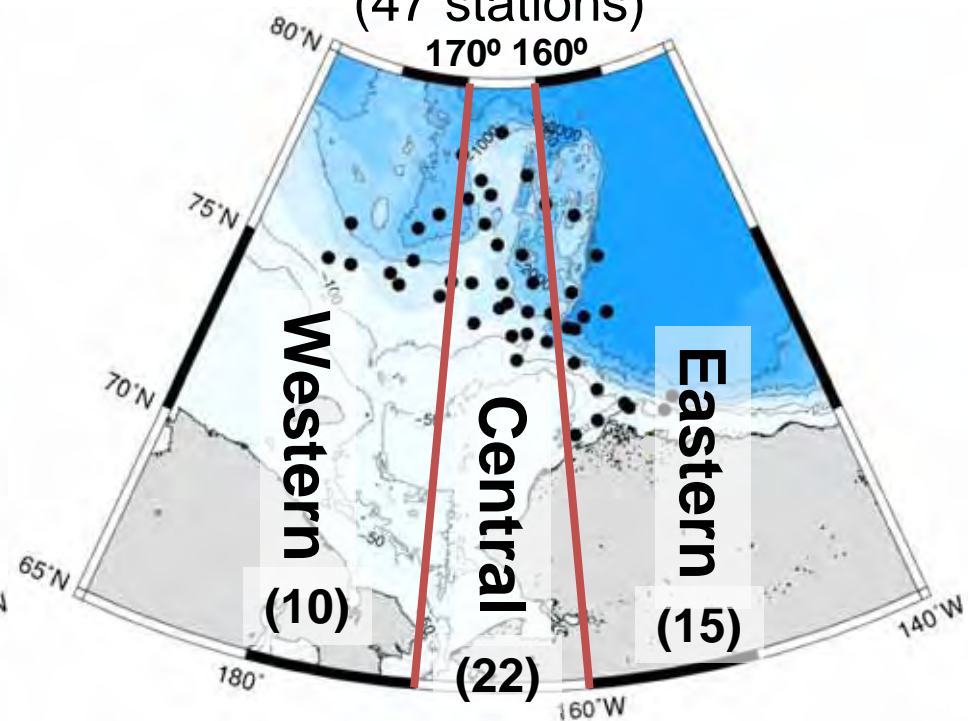
1 Sep. - 4 Oct. 2008

(37 stations)



7 Sep. - 9 Oct. 2010

(47 stations)



## Sampling and measurement

NORPAC net: vertical tow from 150 m depth or bottom -5 m to surface

Dominant copepods stored at -80°C WM, DM and AFDM

↳ immerse to DMF gut pigment measurement by Turner fluorometer

## Data analysis

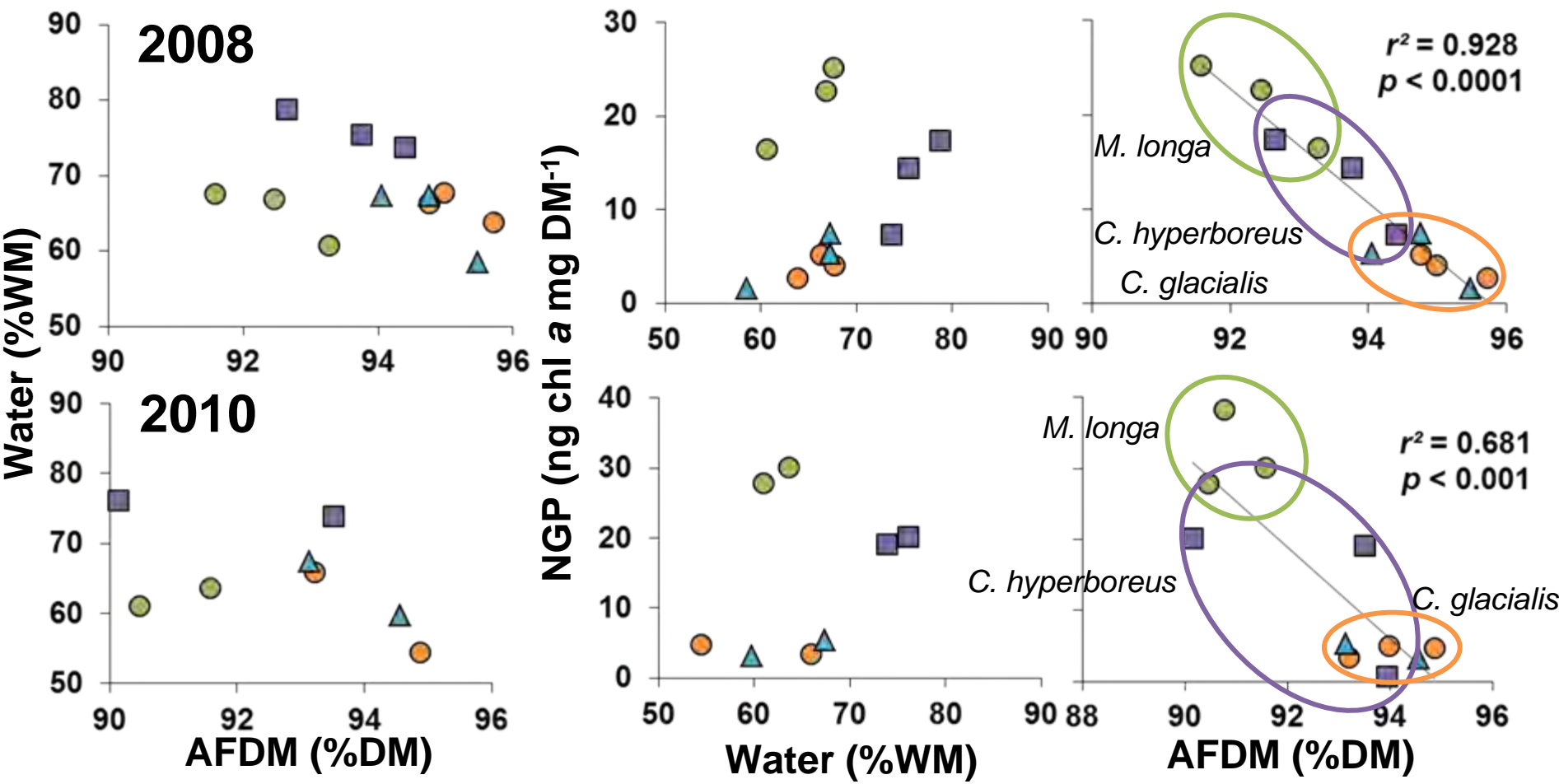
Western (~170°W), Central (160~170°W), Eastern (~160°W)

Body content parameters were tested by one-way ANOVA and *U*-test in terms of inter-species, regional and annual changes





# Results: Inter-species comparison (relationships between parameters)



NGP and AFDM negative relationship

- *C. glacialis* C5
- ▲ *C. glacialis* C6F
- *C. hyperboreus* C6F
- *M. longa* C6F

	<i>M. Longa</i>	<i>C. hyperboreus</i>	<i>C. glacialis</i>
AFDM, Lipid accumulation	Less ←————→ More		
Grazing activity	High ←————→ Low		

# Discussion: Inter-species changes in body chemical contents

## Characteristics of each species

### *C. hyperboreus* C6F

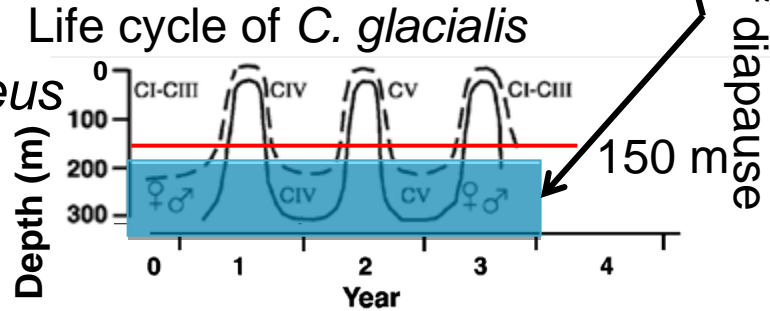
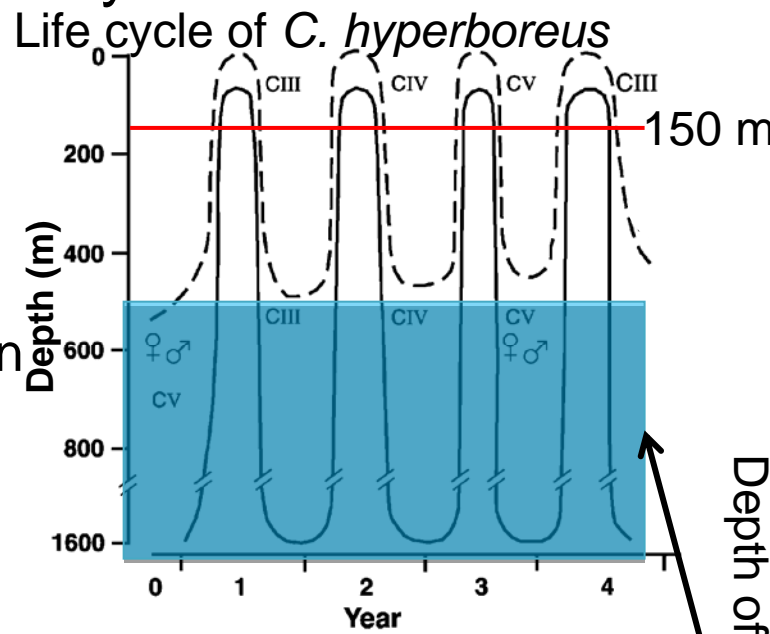
- high water content: little lipid accumulation
- development and reproduction in deep layer
- surface individual had less lipid accumulation

### *C. glacialis* C5 and C6F

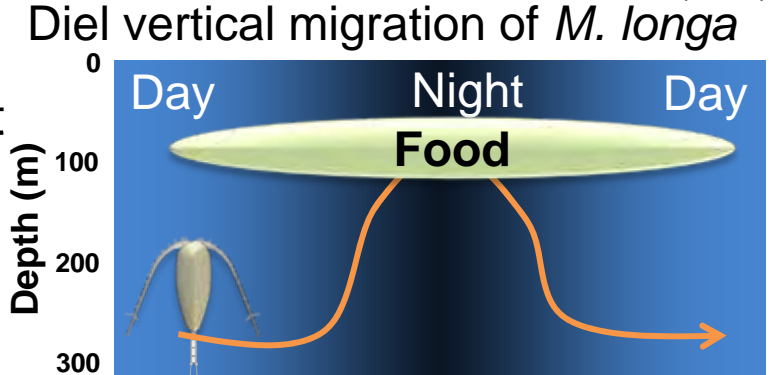
- high AFDM: much lipid accumulation
- diapause and molt to adult in deep layer
- reproduction at surface in next spring
- shallower diapause depth than *C. hyperboreus*
- diapausing individual stored much lipid

### *M. longa* C6F

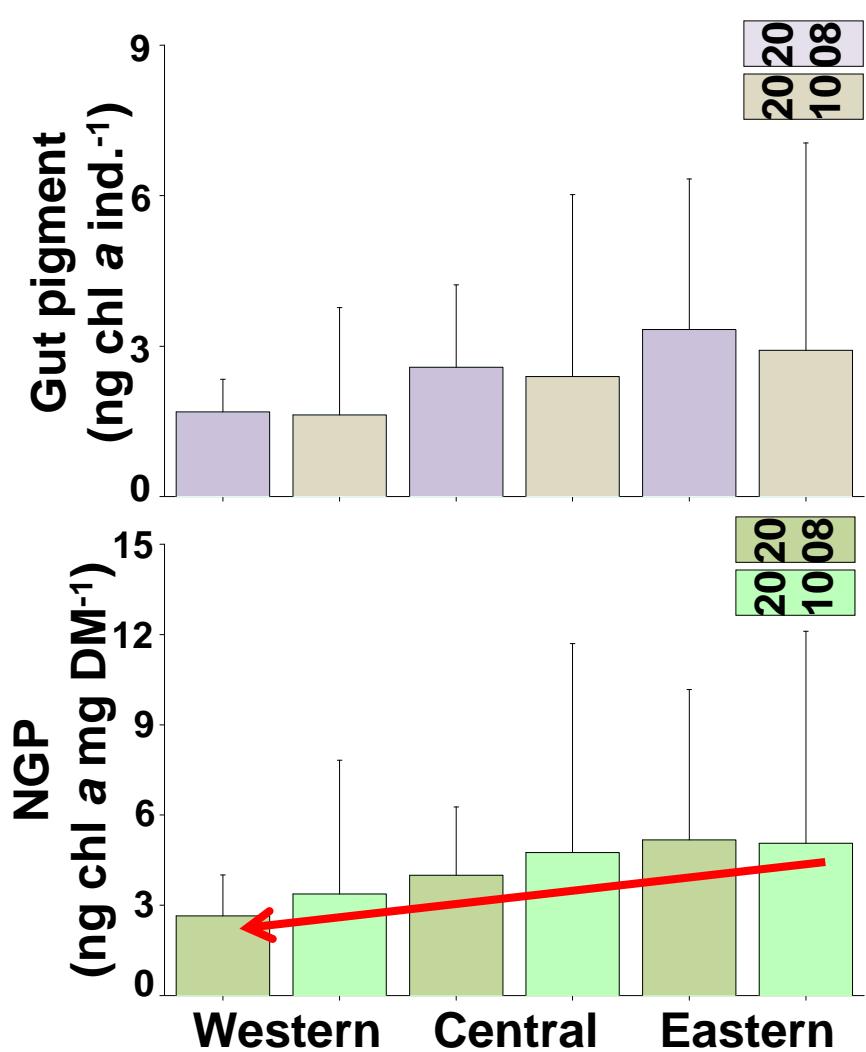
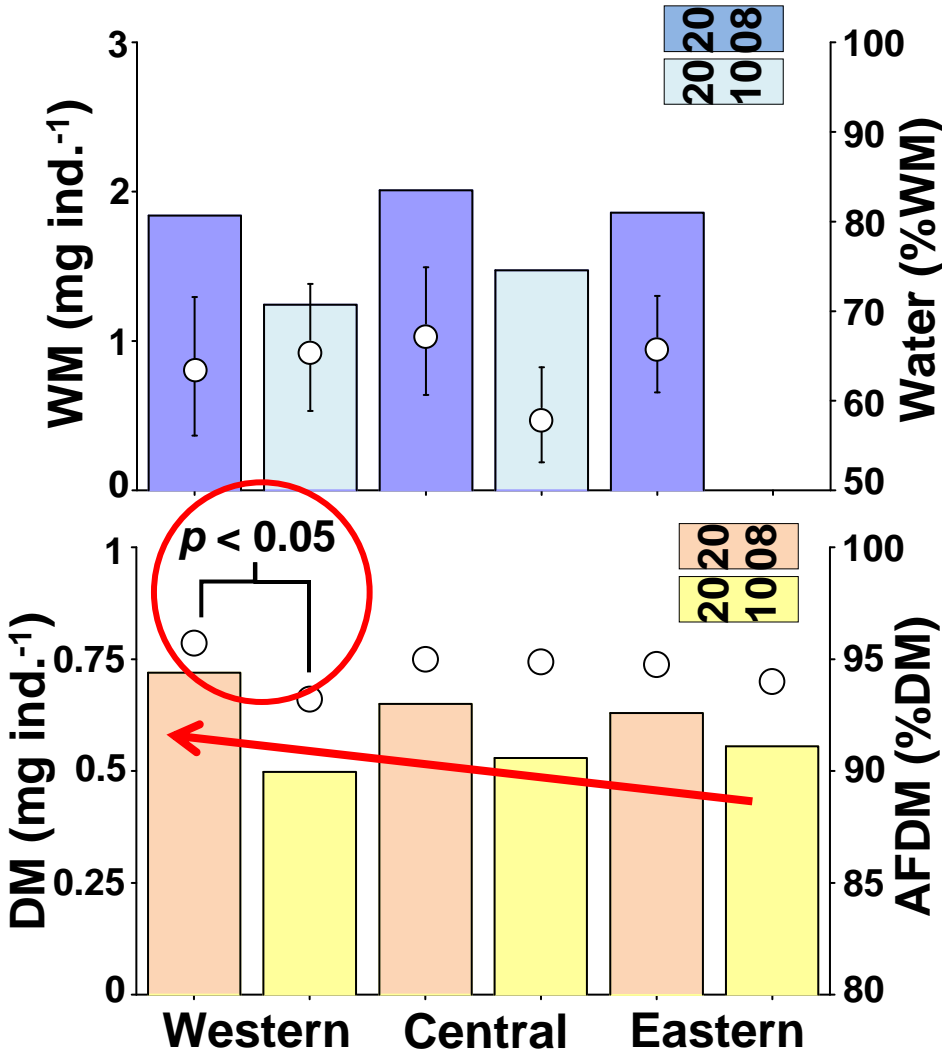
- high gut pigment: high grazing activity
- Metridia* species has no diapause in life cycle
- Diel vertical migration, graze in surface at night
- actively feeding without diapause



Falk-Petersen et al. (2009)



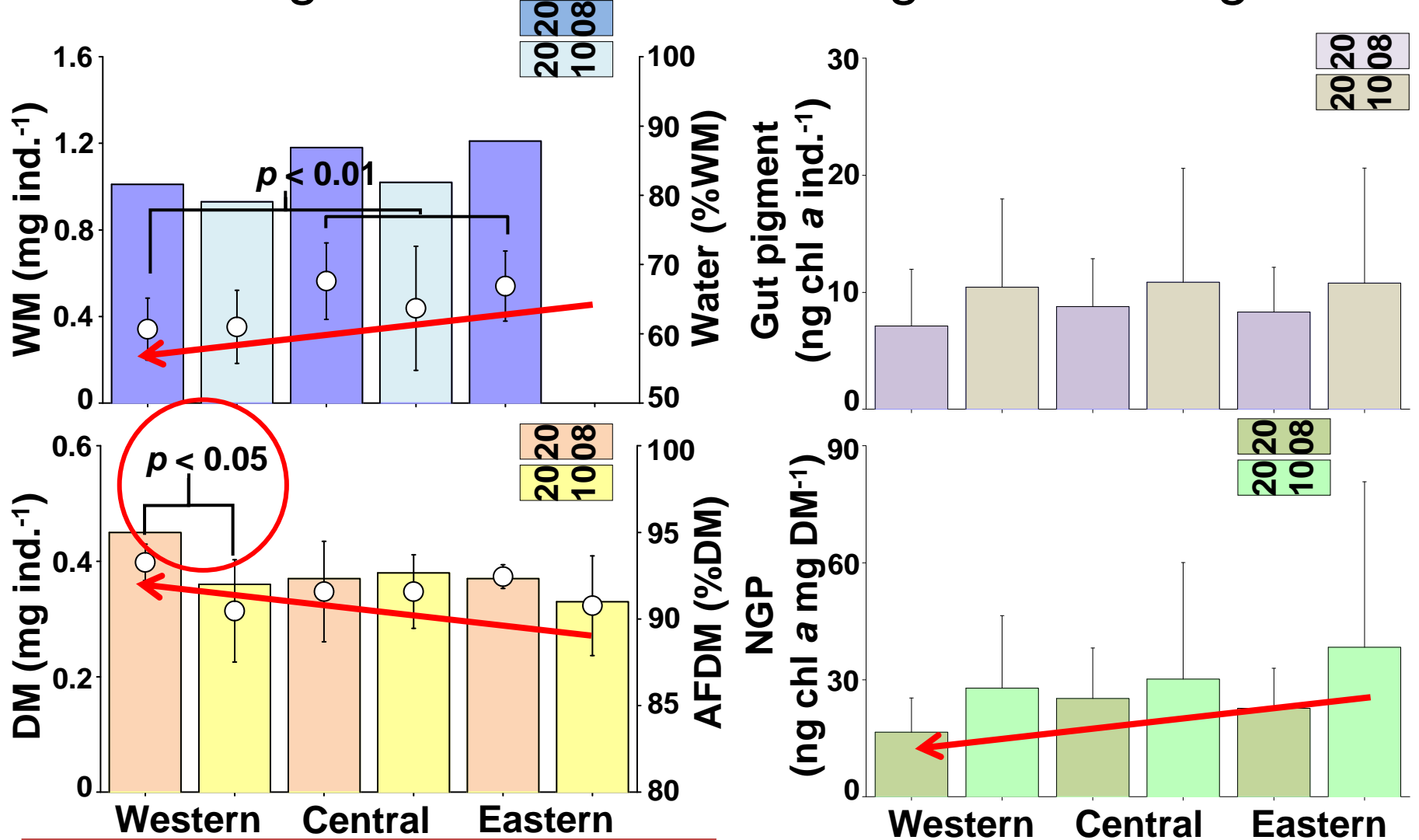
# Results: Regional and annual changes in *C. glacialis* C5



Regional pattern: West { High AFDM  
Low NGP

Annual pattern: AFDM  
2008 > 2010

# Results: Regional and annual changes in *M. longa* C6F

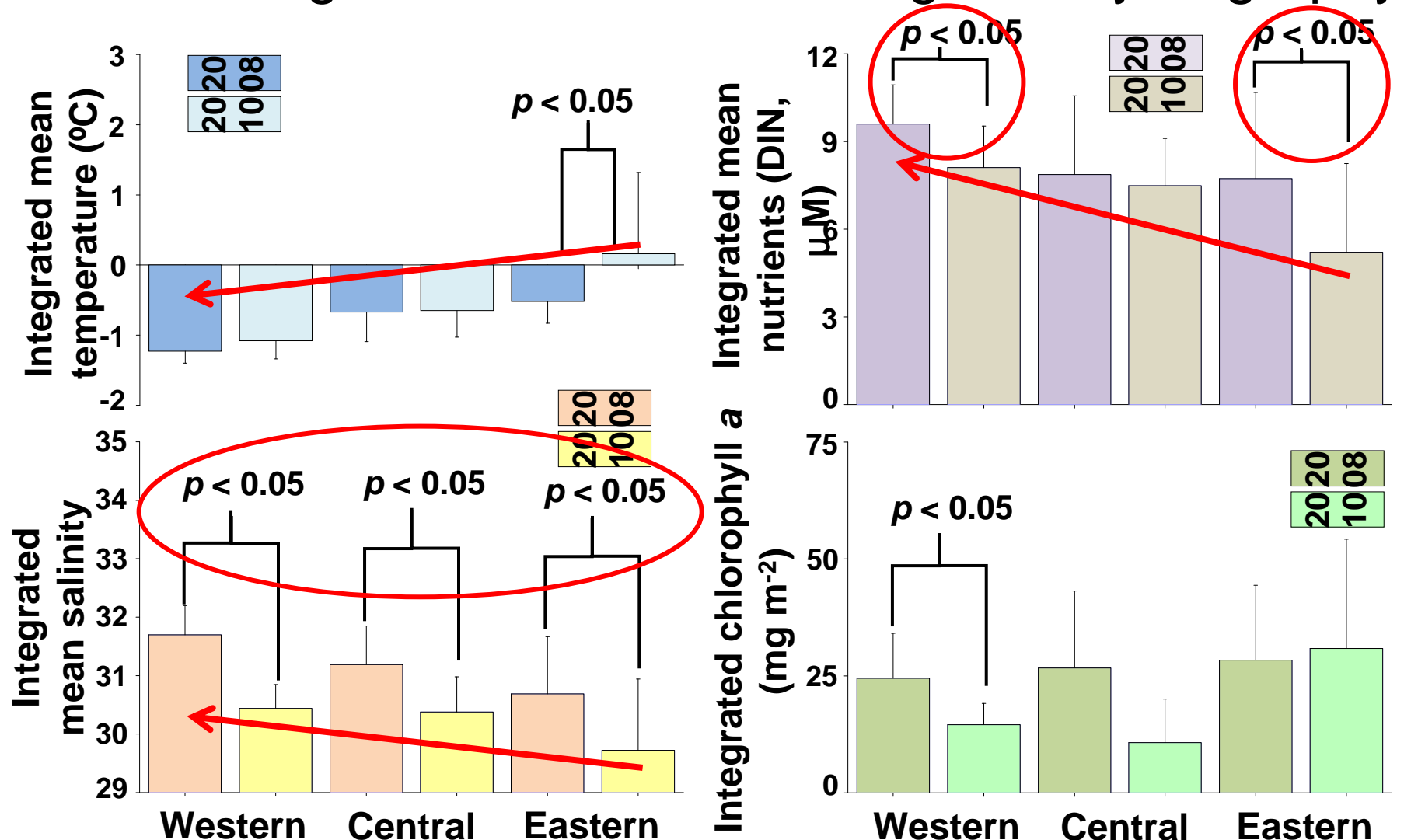


Regional pattern: West { Low Water  
High AFDM  
Low NGP

Annual pattern: AFDM  
2008 > 2010



# Results: Regional and annual changes in hydrography



Regional pattern: West { Low temperature  
High salinity  
High DIN

Annual pattern: salinity and DIN 2008 > 2010

# Discussion: Regional and annual changes

	Regional pattern	Annual pattern
Ice melt water	West < Central, East	2008 < 2010
Nutrients	West > Central, East	2008 > 2010
Primary productivity	West > Central, East	2008 > 2010
AFDM of copepods	West > Central, East	2008 > 2010
Lipid contents of copepods	West > Central, East	2008 > 2010

High lipid accumulation of copepods in the western region and in 2008 might be caused by the high primary productivity which supported by less ice melt water and high nutrients concentration.

# Summary

Inter-species changes in chemical contents are reflect of their life cycle

*C. hyperboreus*: less lipid accumulation

*C. glacialis*: much lipid accumulation

differences in diapause depth  
within *Calanus* species

*M. longa*: high grazing activity  
feeding without diapause

Regional and annual changes

Western region and 2008

Less ice melt water

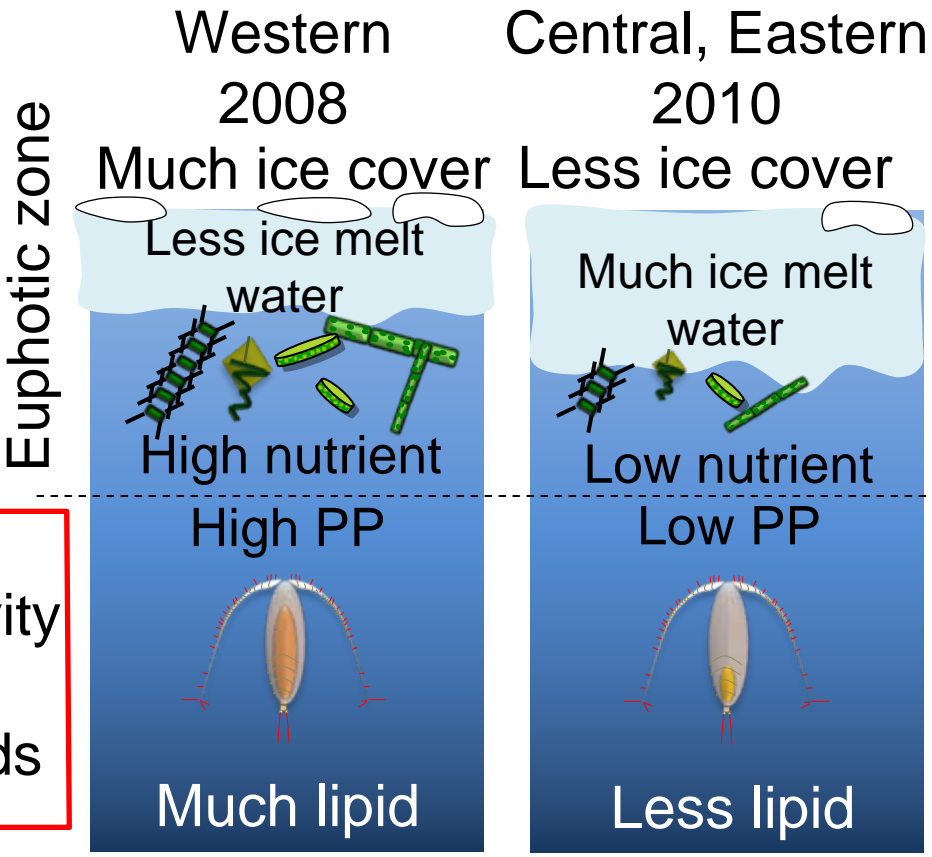


High nutrients and primary productivity



Much lipid accumulation of copepods

Schema on regional and annual changes



Sea ice reduction is considered to decrease lipid accumulation of copepods  
The effects of sea ice reduction on marine ecosystem