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Understanding the food selectivity of *Euphausia pacifica* in YS: in-situ live feeding experiment w/ natural prey assemblages

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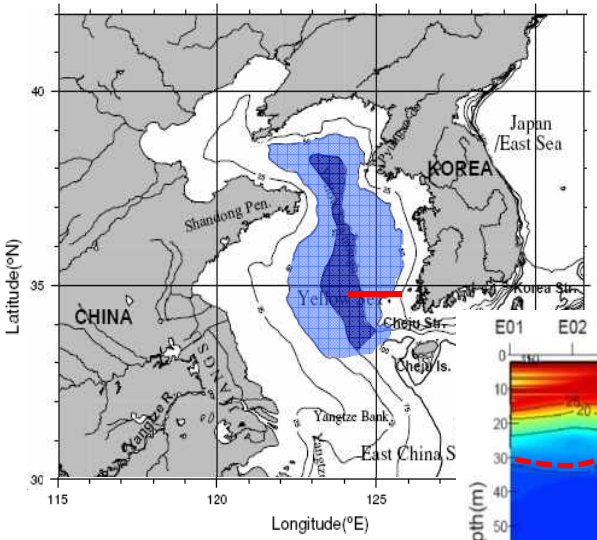
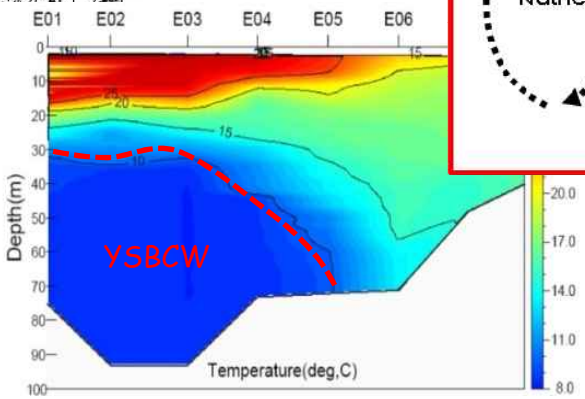
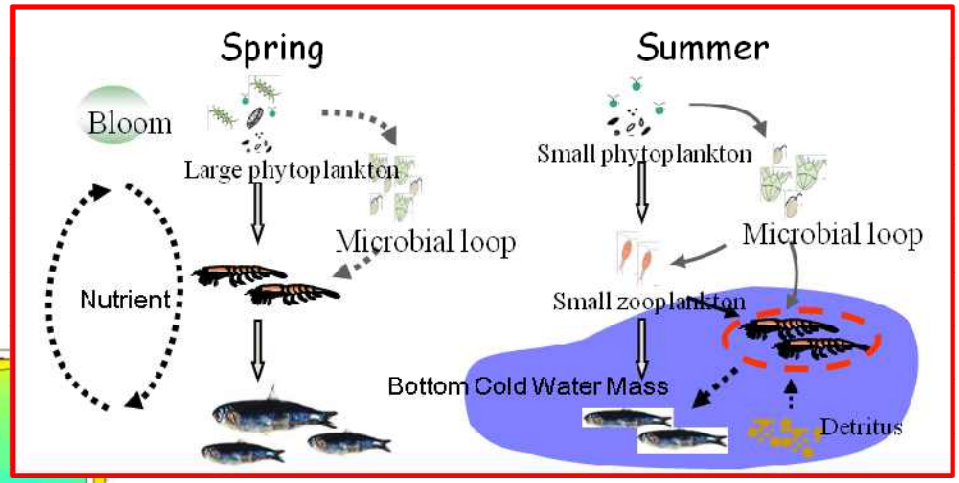
KIOST

Unique features of YS

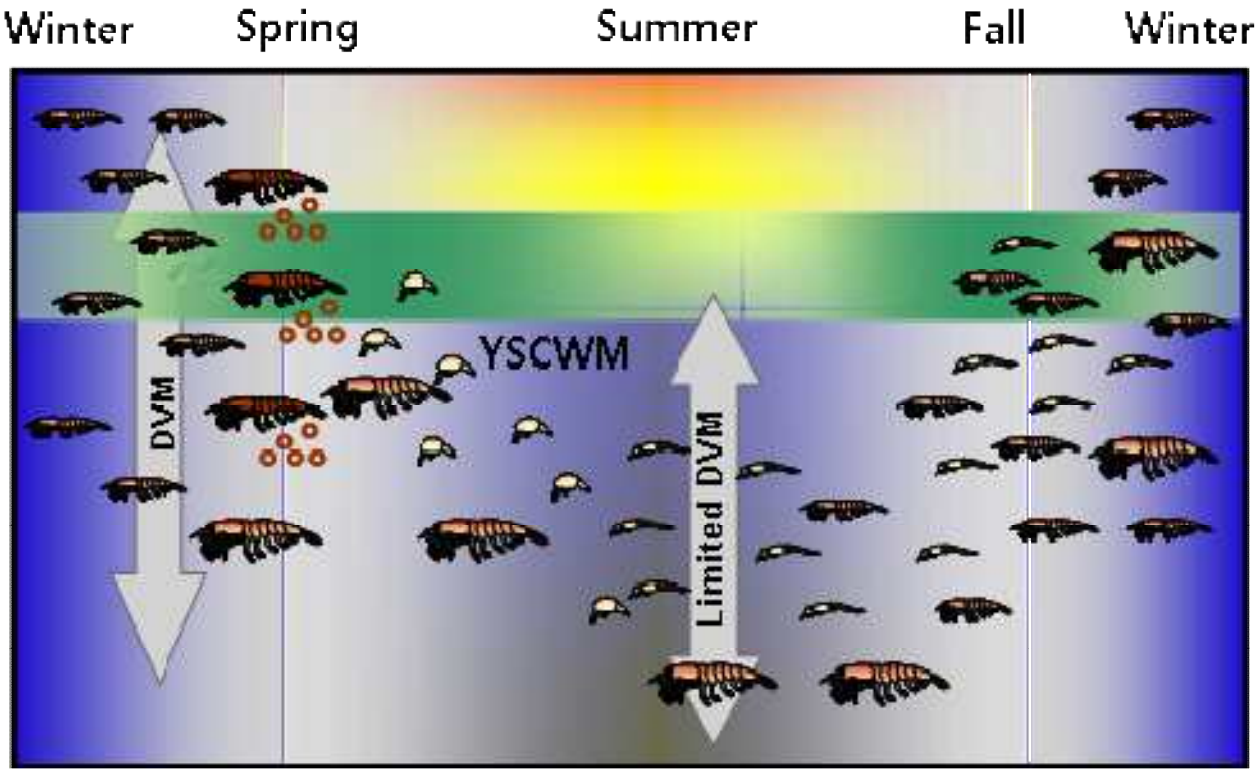
- Yellow Sea is one of highly productive Large Marine Ecosystems in the world
  - total catch is 5% (3 million tons/yr) of global catches (FAO)
  - *Euphausia pacifica* is one of key players because their biomass and major prey for fisheries
- Yellow Sea has a unique physical feature called YSBCW (≤10˚C) during summer
  - It plays a key role to maintain YS ecosystem







Life cycle of krill in YS



- Major spawning occurs in spring (diatom bloom).
- Life cycle of *E. pacifica* in YS is almost one year.
- They actively do DVM but do limited DVM during the summer.

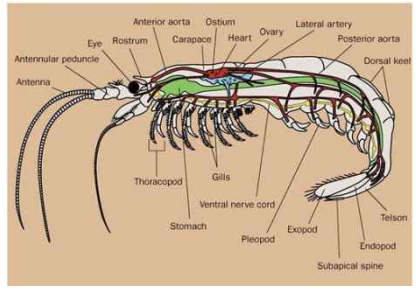
Feeding ecology of *E. pacifica*

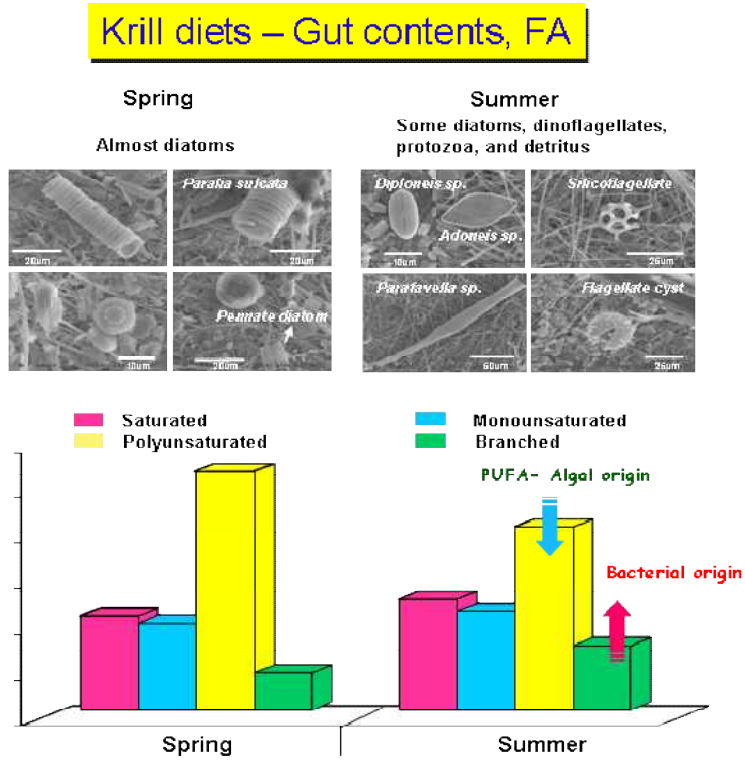
Euphausia pacifica can eat anything?

- Diatoms (Parsons et al., 1967)
- Ciliates (Nakagawa et al., 2004)
- Copepods (Ohman, 1984; Nakagawa, 2001)
- Marine snow (Dilling et al., 1998)
- Copepod carcasses (Park et al., 2011)

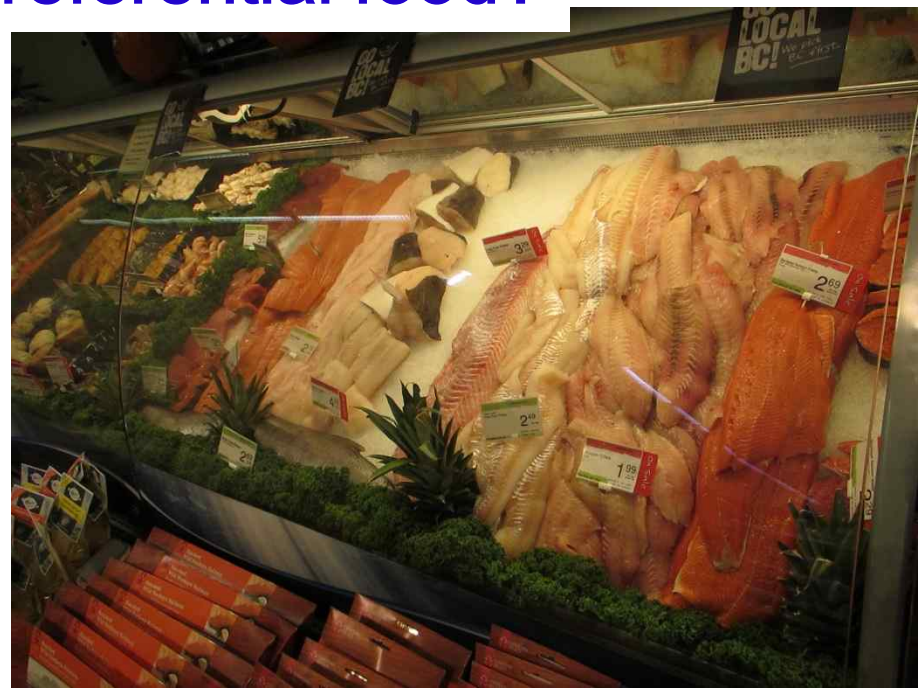
- Our previous study findings based on Gut content, dietary FA signatures
  - Diatom (in spring bloom)
  - Dinoflagellates, Protozoa, Detritus (in summer)

* It provide the limited information and unc ertainties with spatial and seasonal variati ons.





What's krill's preferential food?



Diverse approaches - feeding ecology of zoopl.

Method	Advantage	Disadvantage	Integration time
Gut content analysis	No incubation artifacts, Informs on size selectivity	Biased on findings (soft vs. hard; rapidly vs. slowly digested; full vs. empty)	Hours to a day?
Feeding incubations	Direct calculation of feeding rates, shows what animals can eat, food selectivity	Confinements (size of bottles), hard to recreate natural turbulence/prey conditions	Hours
Fatty acid trophic markers	No artifacts, Assimilated foods	Not always taxon-specific, metabolism	Days to Weeks
Stable isotopes (C and N)	No artifacts, Assimilated foods	Only trophic levels (not specific diets), Value varied in food	Weeks to Months

Questions

- Does krill really preferentially feed on diatom as we seen through the gut content and FA signature?

- *If no,* does it's preferential prey(s) also seasonally change?

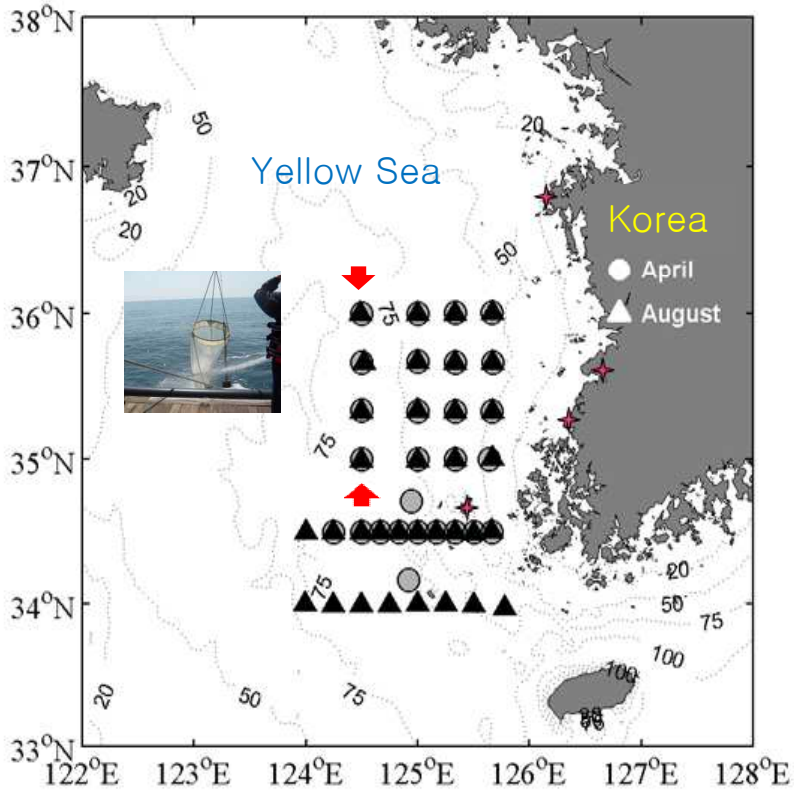
Sampling

Field samplings – April & August ’13

- *E. pacifica* sampling
  : vertical live tow from the max. backscattering layer using a conical net (mouth dia.- 1 m, mesh - 333 μm)

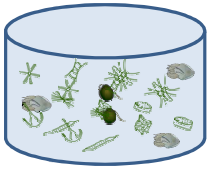
- Water collected from SCM through CTD casting

Study area w/ sampling stations



Feeding Experiment

Natural prey assemblages from SCM



Incubations (Conditions under dark & ~ 10℃)

Control

Treatment

Healthy adults

Acclimation for a couple hrs. before incubations.

Incubation (8~ 10hrs)

Measurements

Chemical measures

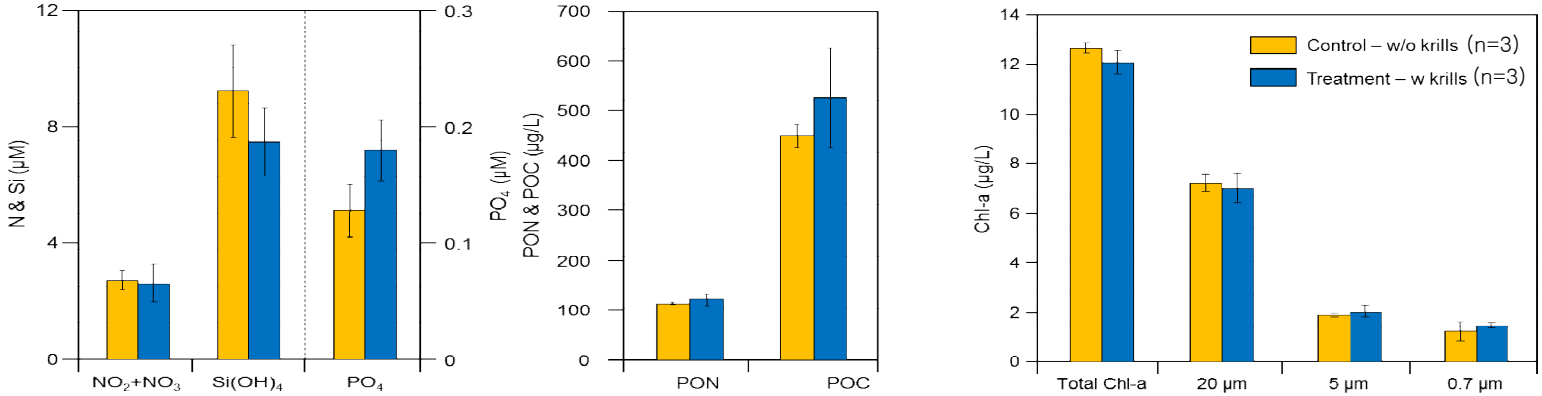
POC, Nutrient, Chl-*a*

Microscopic examination

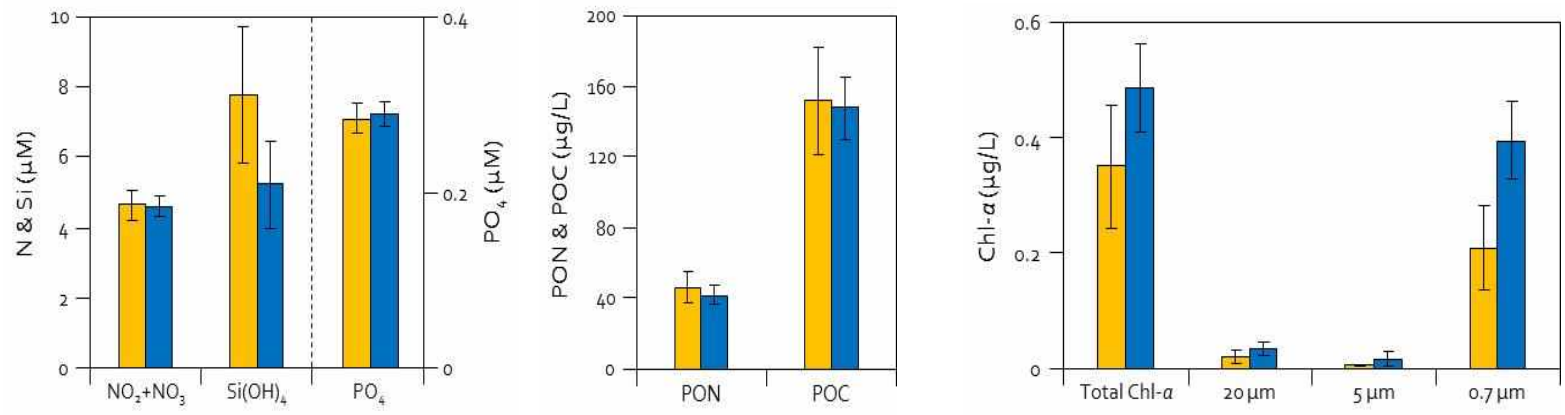
Prey Comp., Conc.

Biochemical measurements – nutrients, POC/N, Chl-a

Spring



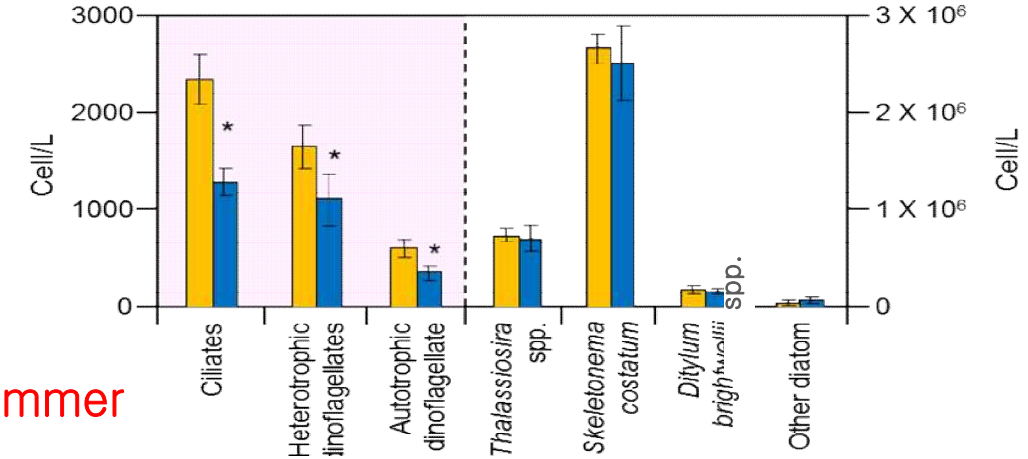
Summer



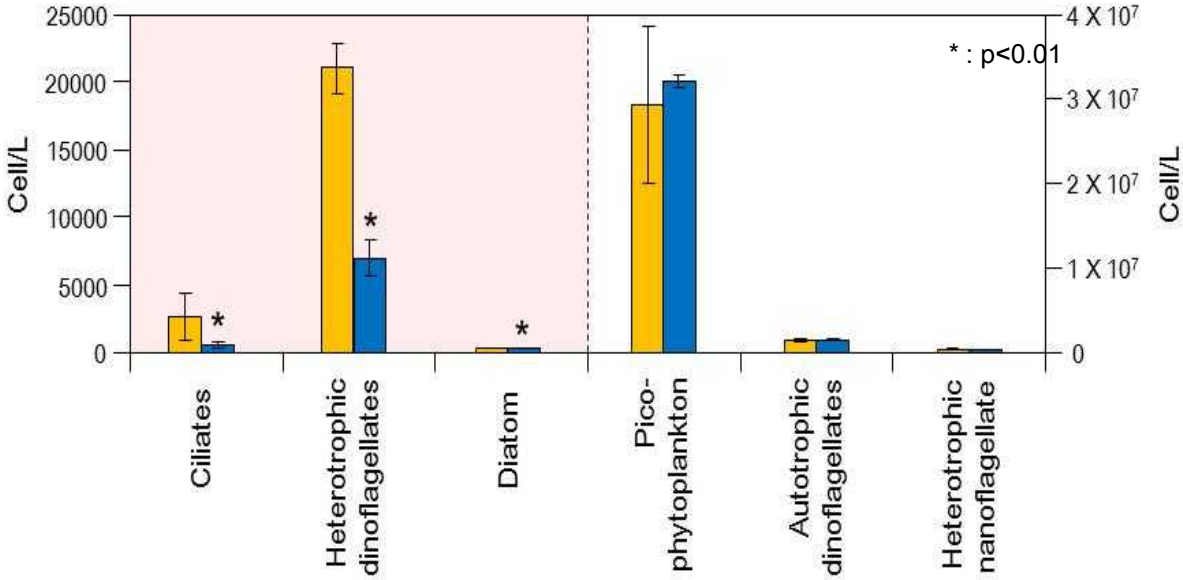
- No incubation volume effect (2 vs. 4L)
- No differences of nutrients, Chl-a, POC/N appeared b/w control and treatment

Microscopic examination – prey composition & abundance

Spring

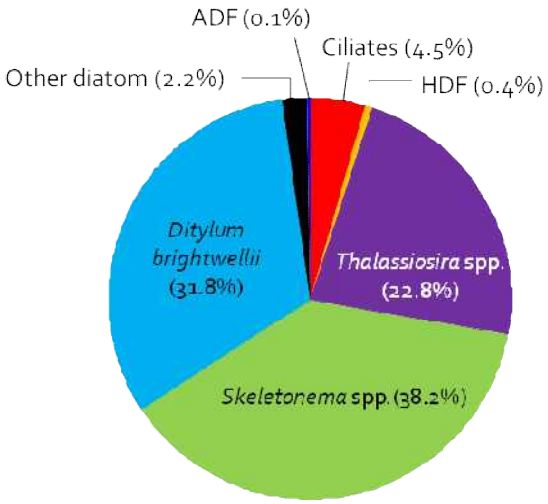


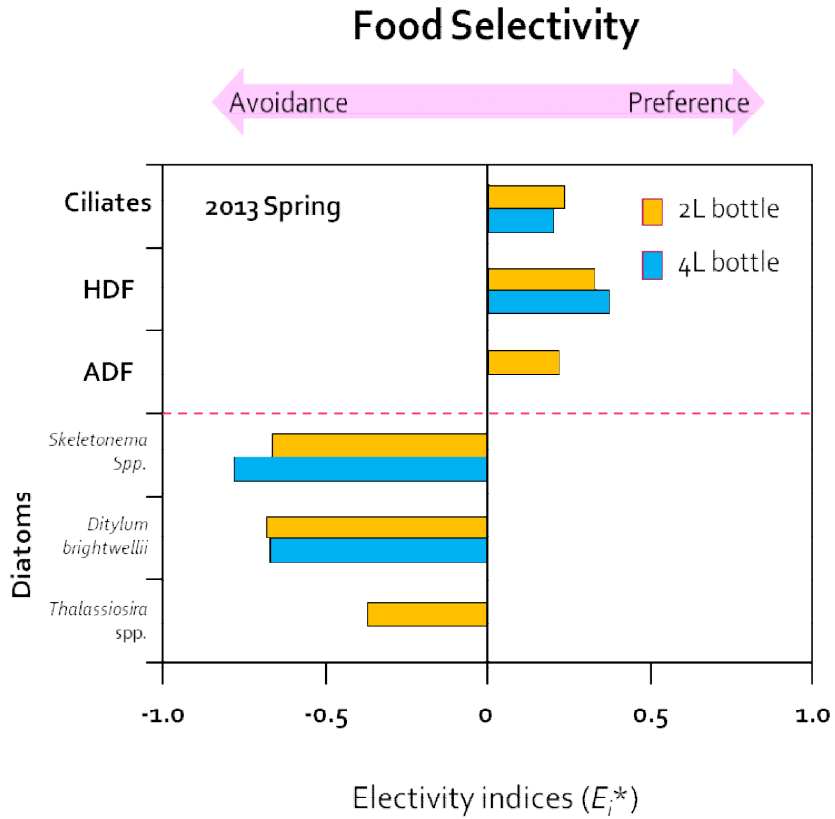
Summer



- The cell number of micro-zoopl. (ciliates, dino-) in treatment (w krills) were significantly less than those in control for both seasons.
- But the abundance of micro-phytopl. were not significantly different between control and treatment.

Food Selectivity – spring





$E_i^* = [W_i - (1/n)]/[W_i + (1/n)]$

$W_i = F_i / \Sigma F_i$: the selectivity coefficient

F_i : the filtration rate of food item i

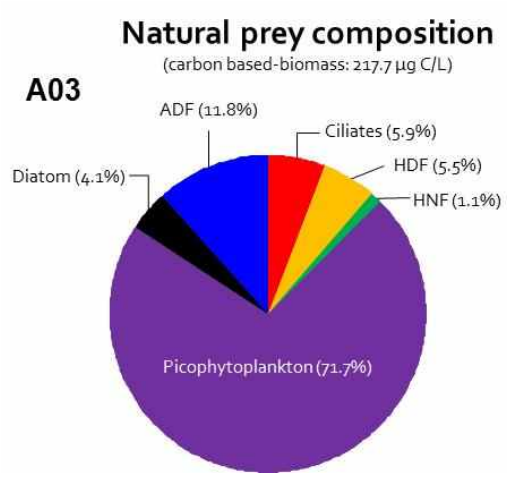
ΣF_i : the sum of all food items (n)

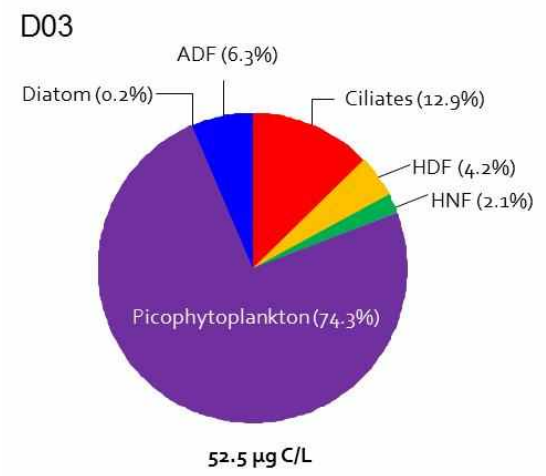
$-1 \leq E_i^* < 0$: avoidance

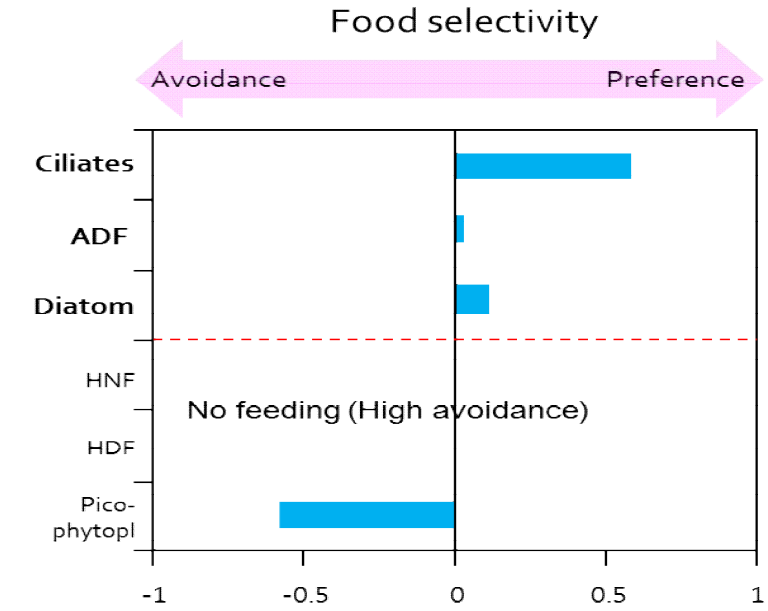
0: random selection

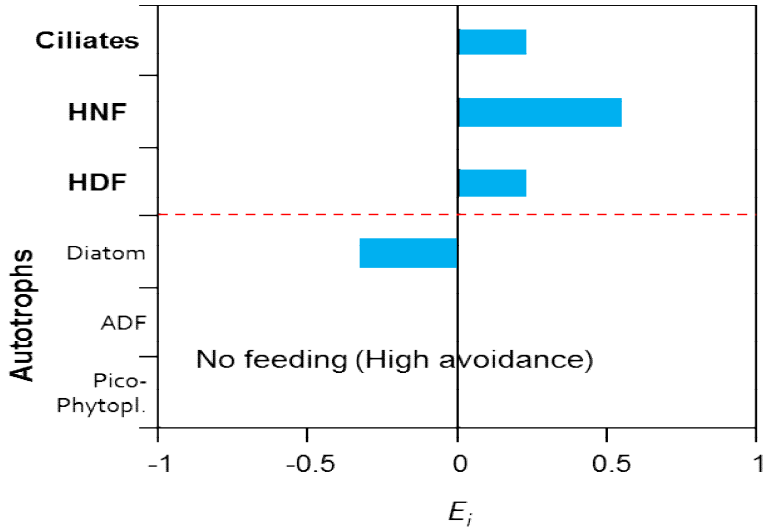
$0 < E_i^* \leq +1$: active selection

Food Selectivity – summer









Summary

- No bottle size effects (4 vs. 2L) were detected on krill feeding behavior.

- Based on gut content and biochemical trophic marker analysis, krill seems to mainly feed on diatom in spring but in summer their major preys switched to protozoa, dinoflagellates, and detritus.

- In contrast, *in-situ* feeding experiments w/ natural preys indicate that *E. pacifica* preferentially feeds on mesozoopl. (ciliates and flagellates) in spring (diatom blooming) and summer (picoplankton dominant).
  → similar prey preference (ciliates, HDF) were also found for *E. pacifica* in CCS w/ the same feeding incubation experiments.

- Krill food preference could be related with the nutritional quality & size of prey!

Future plans

- Feeding incubation with much larger volume (~ 10L) to make sure any volume effect on krill feeding experiments.
- Does krill feeding behavior change w/ the different concentration of prey(s) ?
- Does krill feeding behavior change through their development stages (furcilia, juvenile, adults)?
- Conduct feeding experiments w/ stable isotope-labelled preys which provides not only food selectivity but also assimilation efficiency of fed preys.


Thank you for your attention!
Rugby players' preferential food is Pizza ?
KIRKLAND
Fresh Baked
PIZZA
CUITE AU FOUR