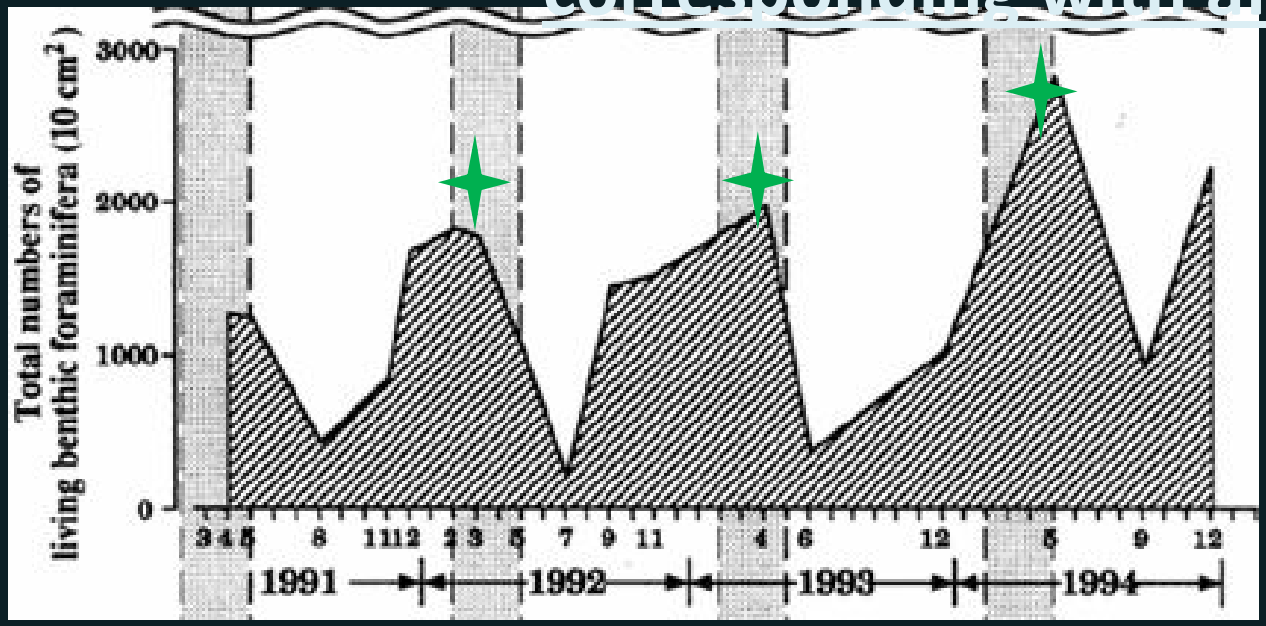
Marine Night: Russian activities

- **Olga Knyazeva, PhD student, SPBSU**
  Foraminifera's life during the polar night

- **Alina Goudkova, PhD student, SPBSU**
  Sponge photosymbionts during the polar night

- **Daria Nikishina, PhD student, SPBSU**
  Fauna associated with *Saccharina latissima*: seasonal changes

Deep-sea foraminiferal populations show seasonal dynamics corresponding with algal blooms

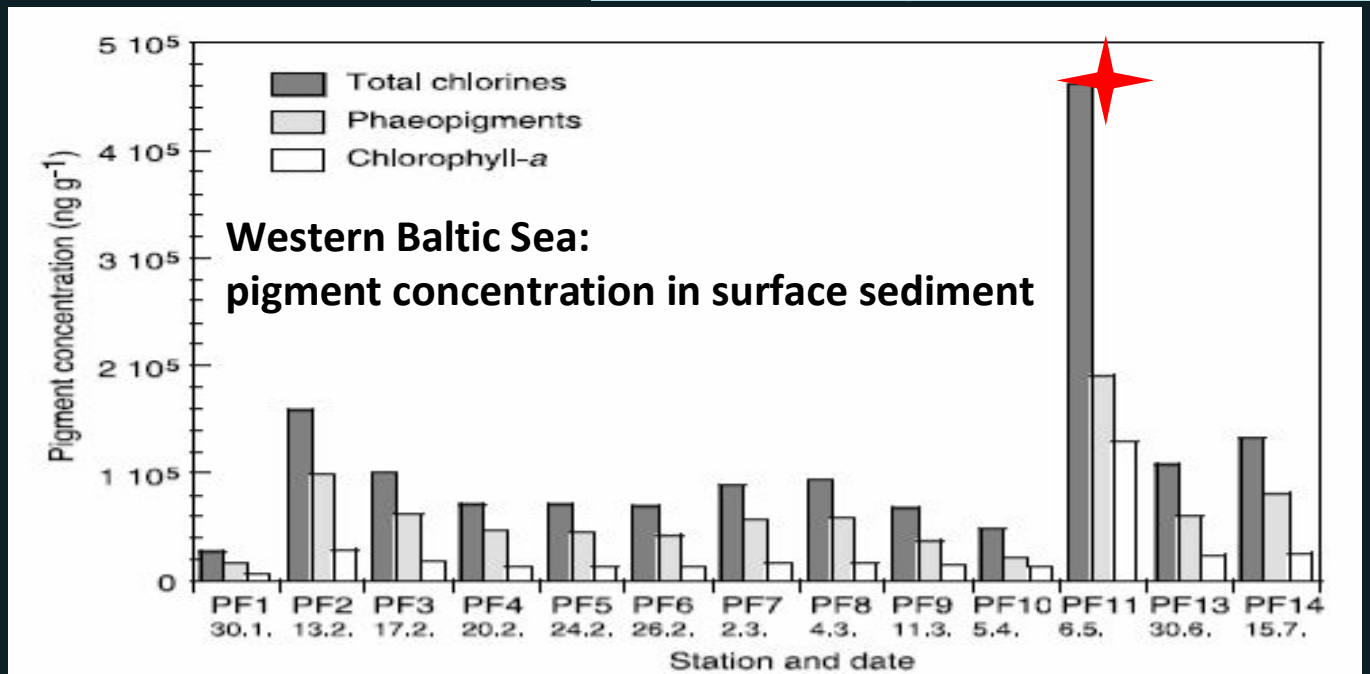


Total abundance of living benthic forams in Sagamyi Bay, Japan

spring blooms

Ohga, Kitazato, 1997

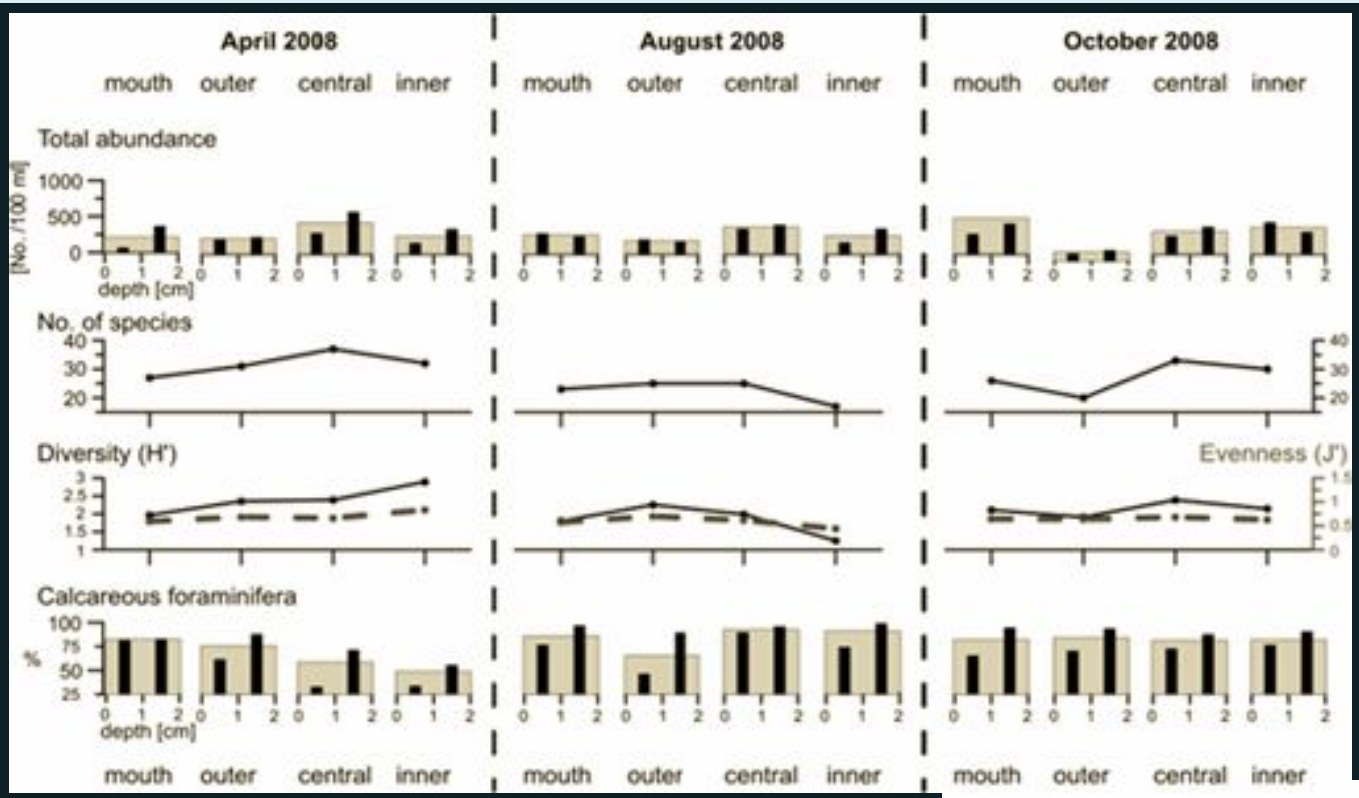
Reproduction of shallow water species times with organic matter input to the sea bottom



Elphidium excavatum f. *clavata*

Schonfeld, Numberger, 2007

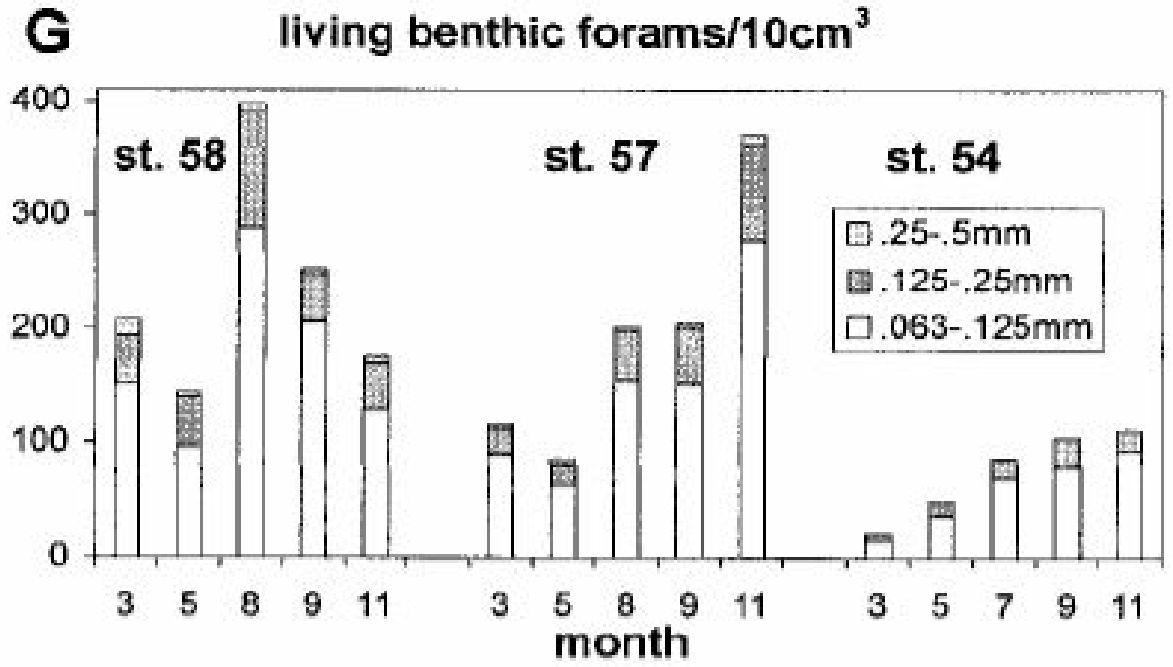
Seasonal dynamics of foraminiferal communities in Svalbard



Jernas et al., in press

Just two works regarding the problem

No obvious seasonal dynamics



Korsun, Hald; 2000

Possible explanations:

1. Artifact => Hypothesis 1: most part of the foraminiferal population is eliminated during the winter season;

2. Dormancy => Hypothesis 2: total abundance remains stable during the winter but most part of the community is dormant.

Aim of the study: to comprehend the structure of foraminiferal community during the Polar night by testing hypotheses stated above.

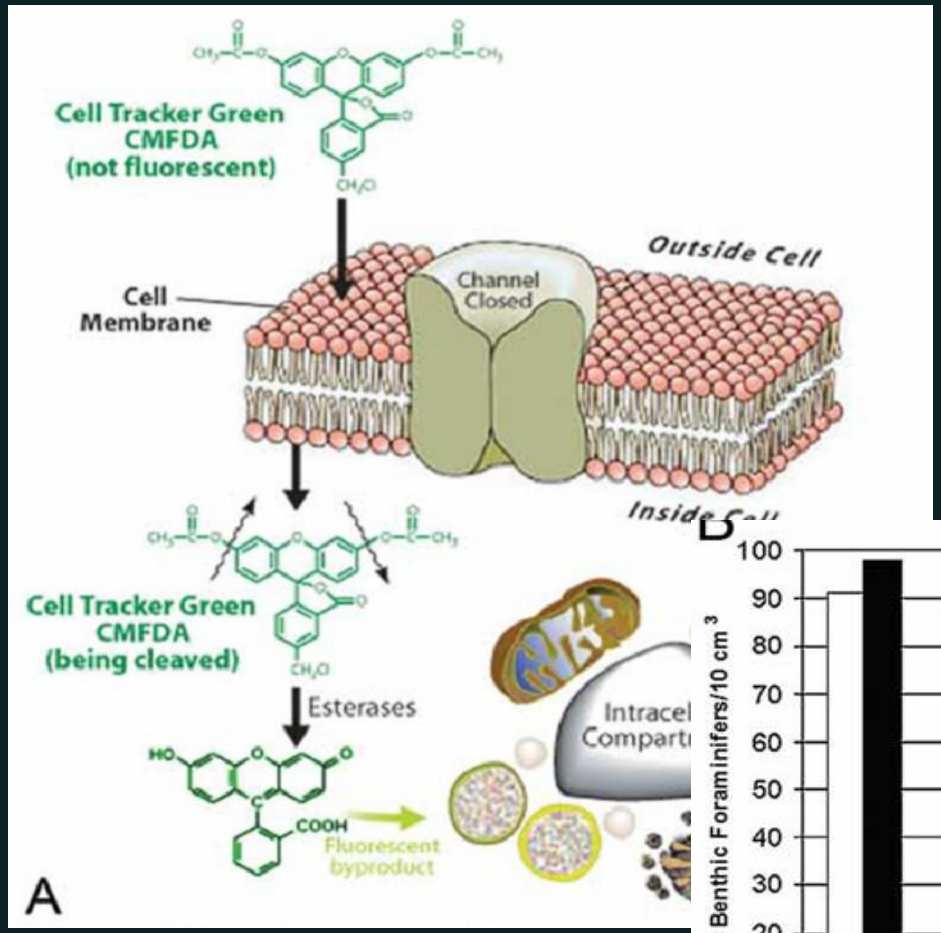
Hypothesis 1: most part of the foraminiferal population is eliminated during the winter season

- In previous studies samples were treated with classical Rose Bengal dye
  => stains cytoplasmic proteins non-specifically

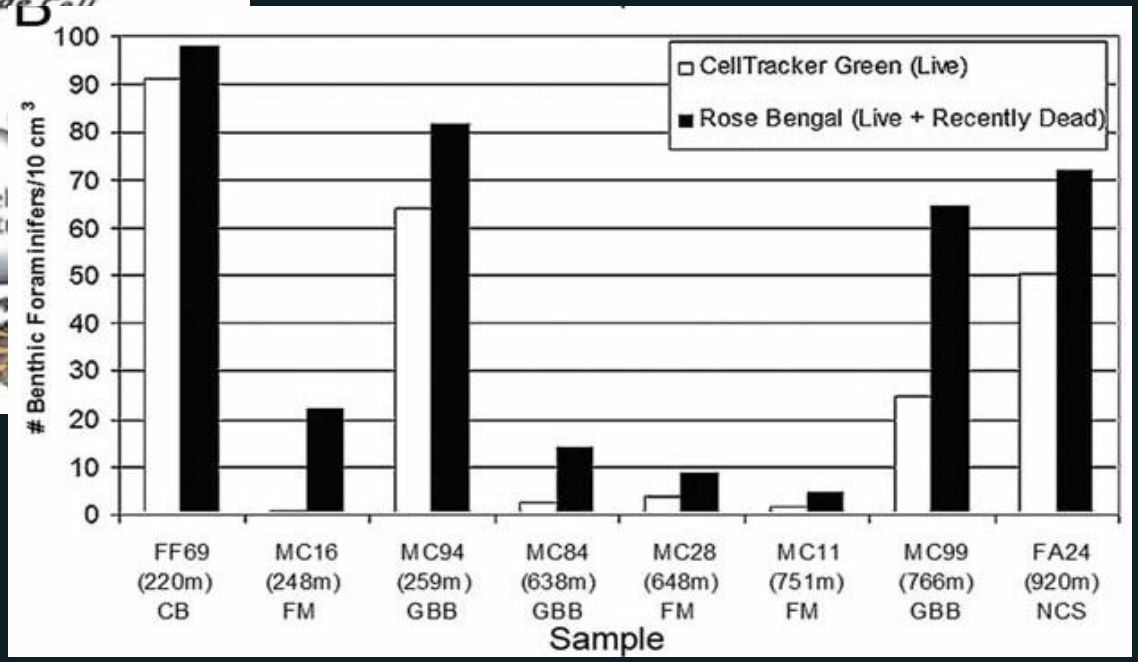
- Cold water prevents cytoplasmic body from decay

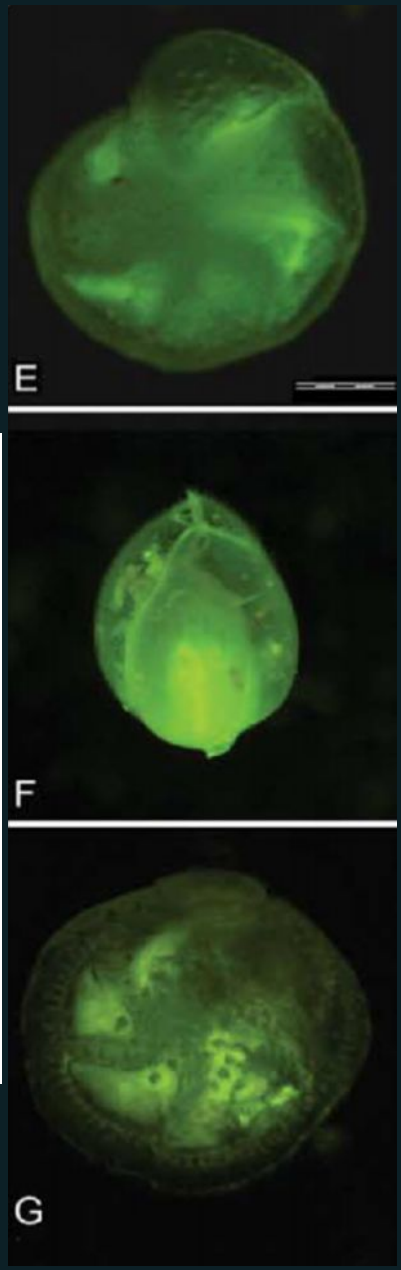
→ Most individuals are actually dead at the moment of fixation

Cell Tracker Green 5-chloromethylfluorescein diacetate (CellTrackerTM Green CMFDA)



100% sure ONLY living cells give fluorescence





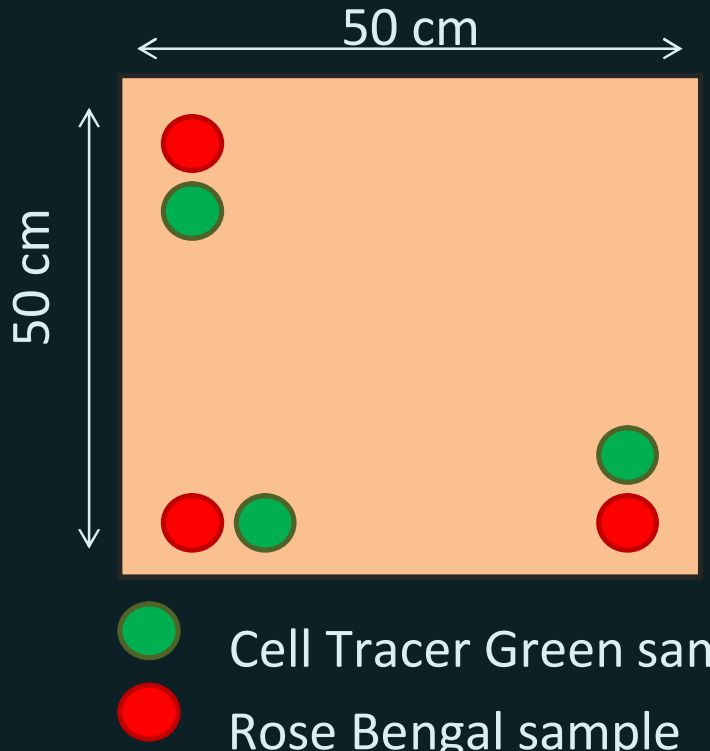
Bernhard et al., 2006

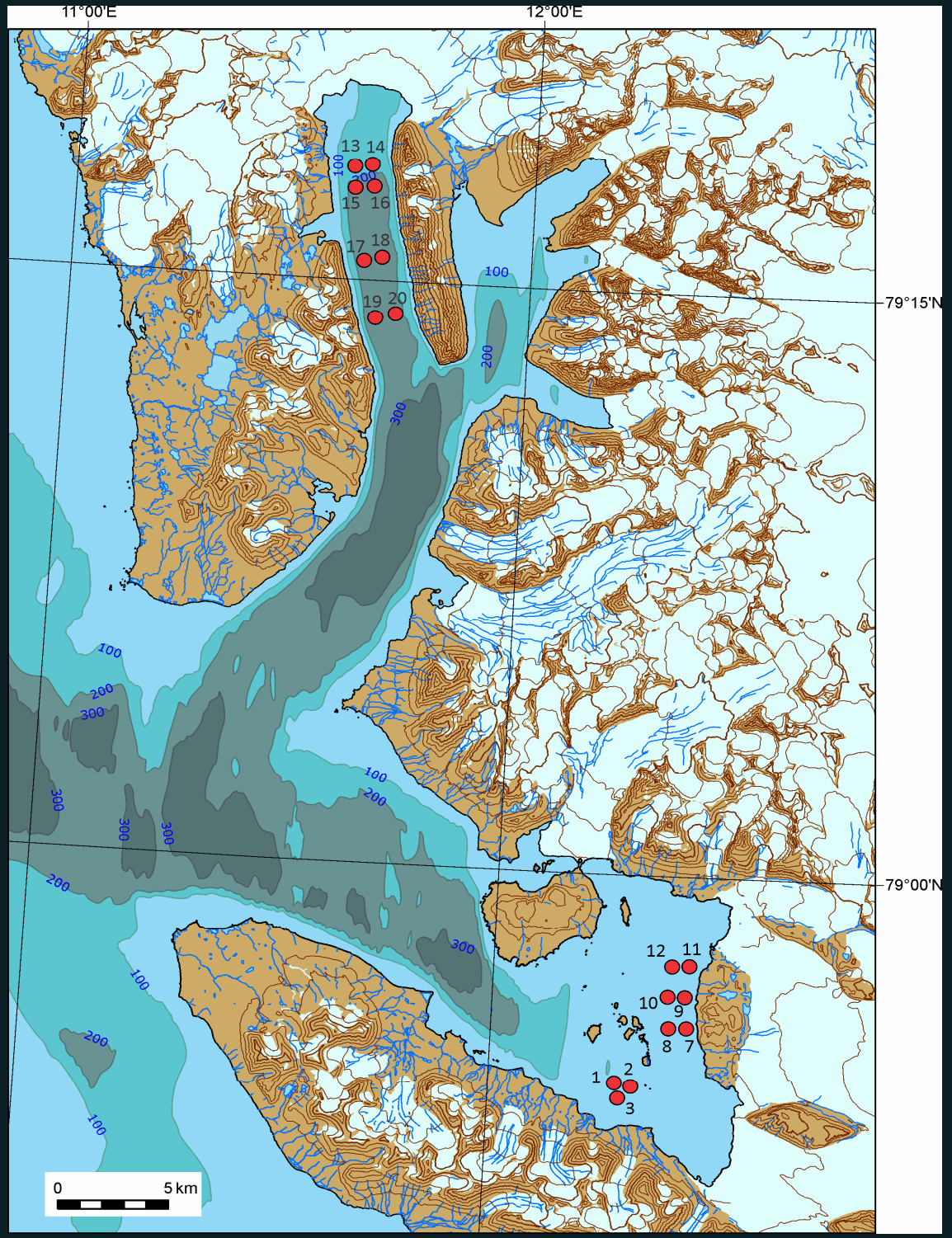
January 2015 sampling

Box-core

Surface sediment samples:

- quantitative samples;
- upper cm of sediment taken for both dyes.





Hypothesis 2: total abundance remains stable during the winter but most part of the community is dormant.

Foraminiferans are not metabolically active during the cold period

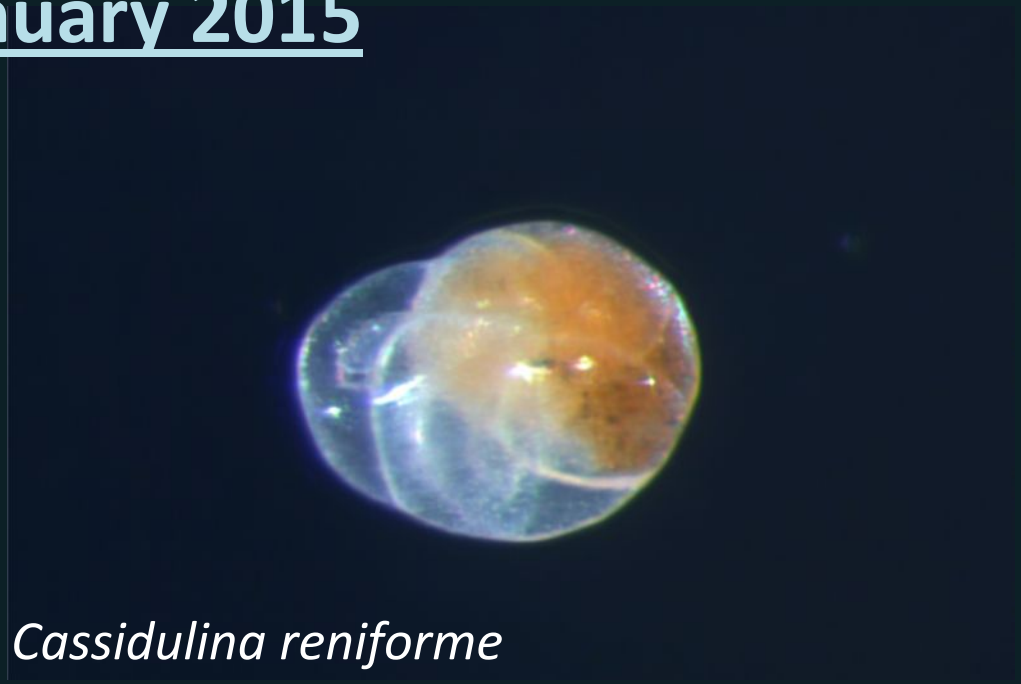
⇒ATP concentration:
Winter values should be significantly lower than during another season.

- in January ATP was extracted with citrate-phosphate buffer (with following Luciferin-luciferase reaction)
- Need to be repeated in September

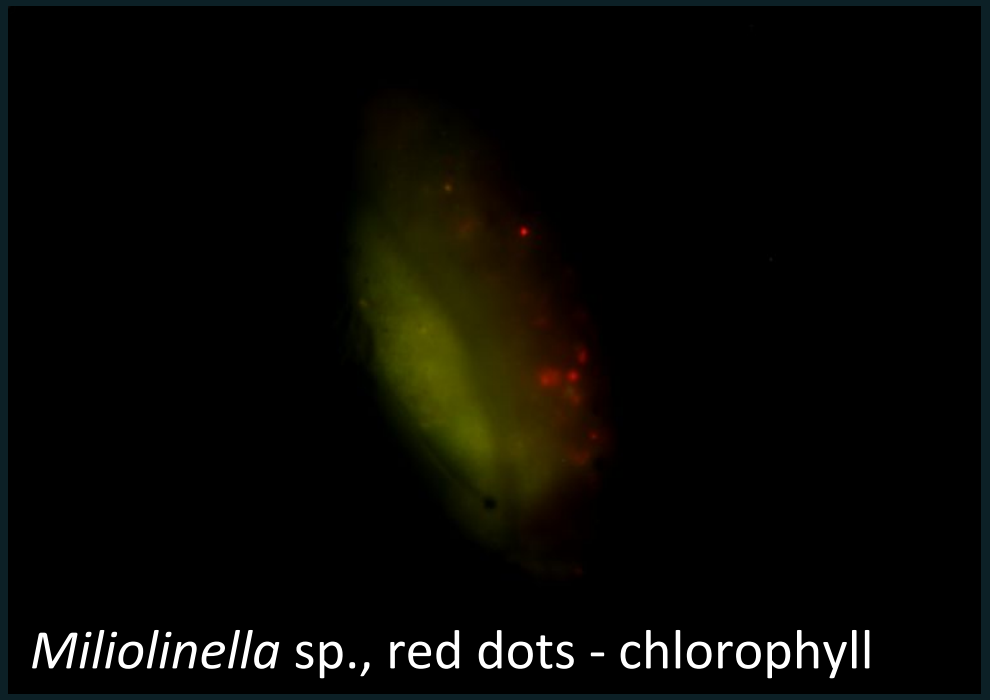
=> Tubulin paracrystals in cytoplasm as an evidence for disassembled locomotive apparatus

- Specimens were fixed with glutaraldehyde for TEM
- Following methods of decalcination and embedding is under consideration

January 2015



Cassidulina reniforme

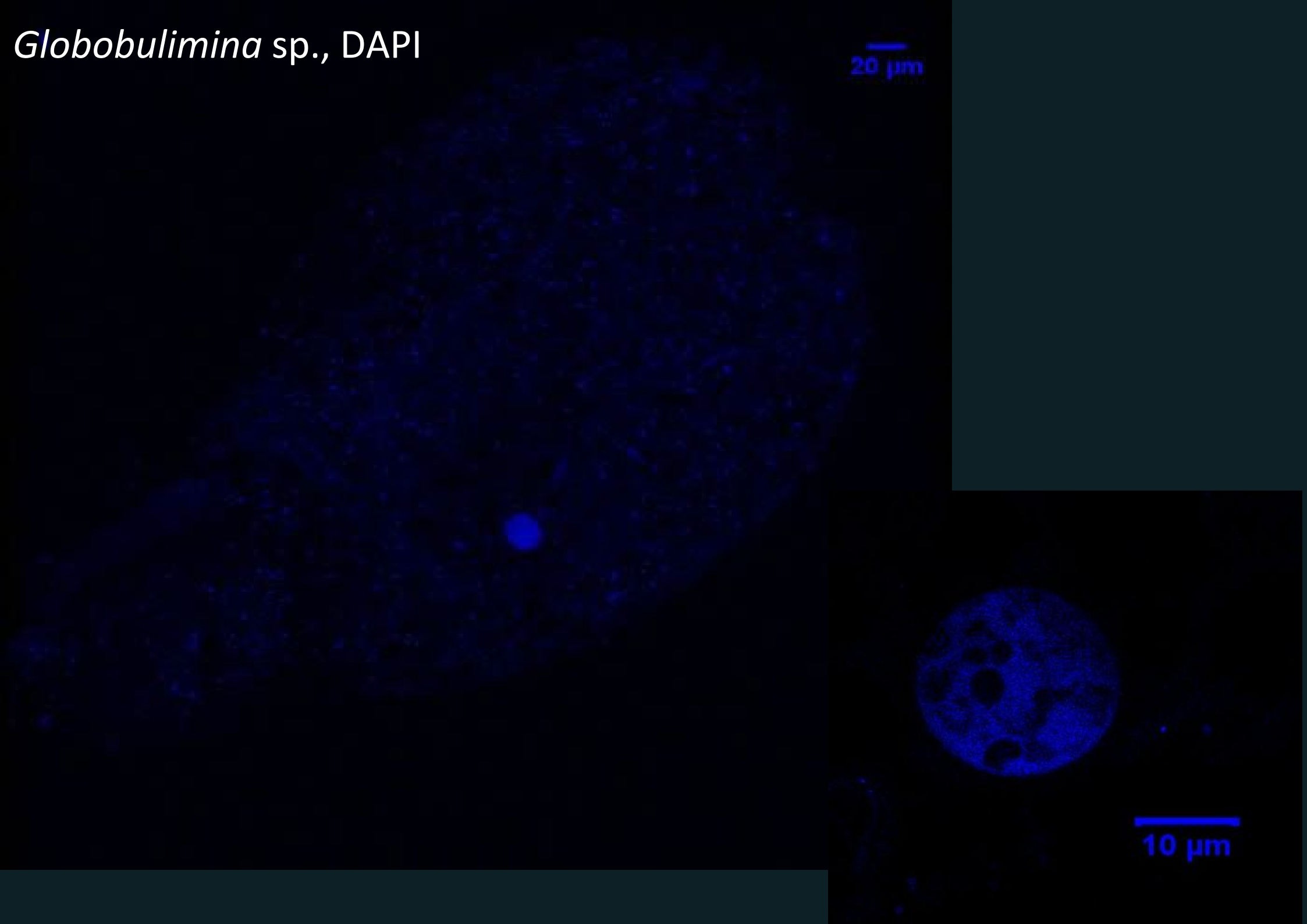


Miliolinella sp., red dots - chlorophyll

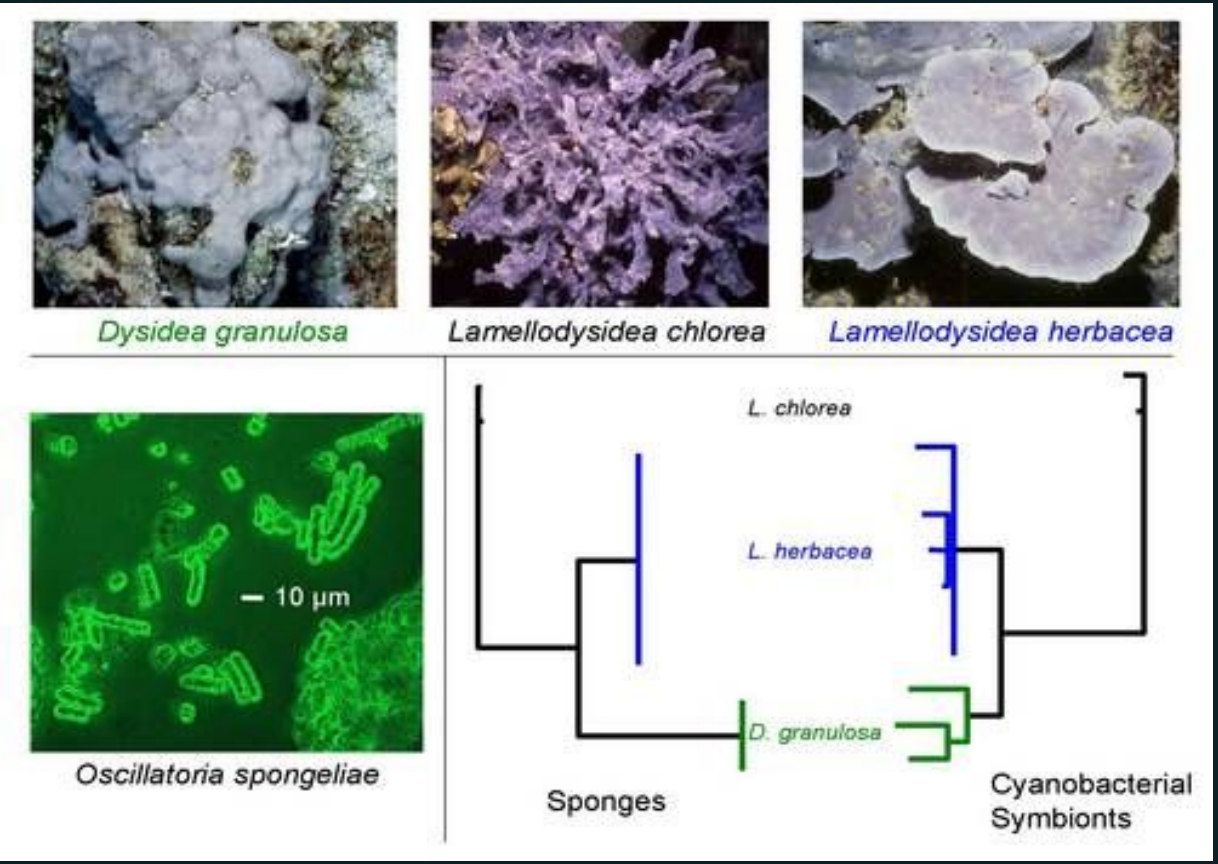
Islandiella helenae

Elphidium excavatum f. *clavata*

Globobulimina sp., DAPI



Sponge photosymbionts during the polar night



- Some tropical sponges gain up to 80% of nutrients from their photosymbionts
- Sponge-cyanobacteria associations in tropics are so stable, that can even demonstrate coevolution of host and symbiont

R. Thacker

Sponge photosymbionts during the polar night:

- The role of sponge photosymbionts in the higher latitudes remains largely unknown

Do temperate sponges depend on the assimilated solar radiation?

OR they just give their photosymbionts a safe shelter?

OR they feed on the symbionts when running out of other food sources?

Ny-Ålesund sponge experiment, January 2015: *Halichondria panicea*

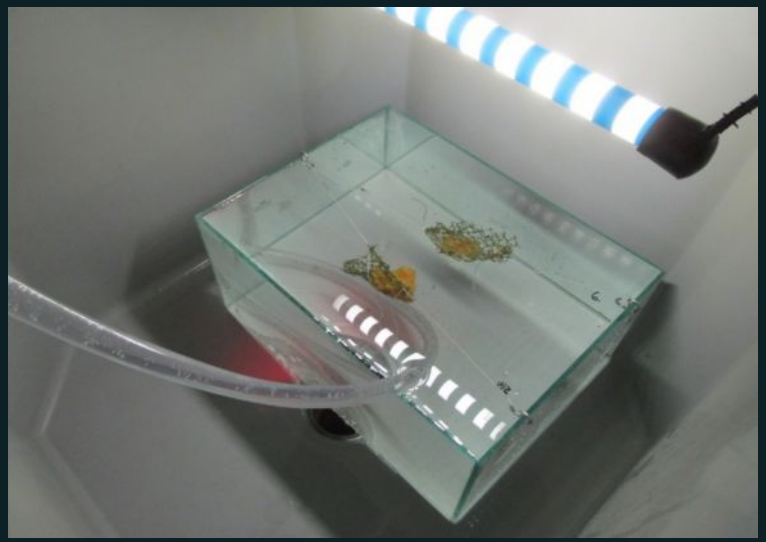
Halichondria panicea sponges of differing colors on the rocky substrate in the Barents Sea

- A wide spread, mainly temperate, marine sponge species
- Known to harbor symbiotic unicellular green algae
- Sponge color varying from yellowish to greenish could be attributed to the number of symbiotic green algae

To find out, whether symbiotic green algae are:

1. maintained in the sponge's body during the polar night;
2. become active when exposed to light in-between the polar night

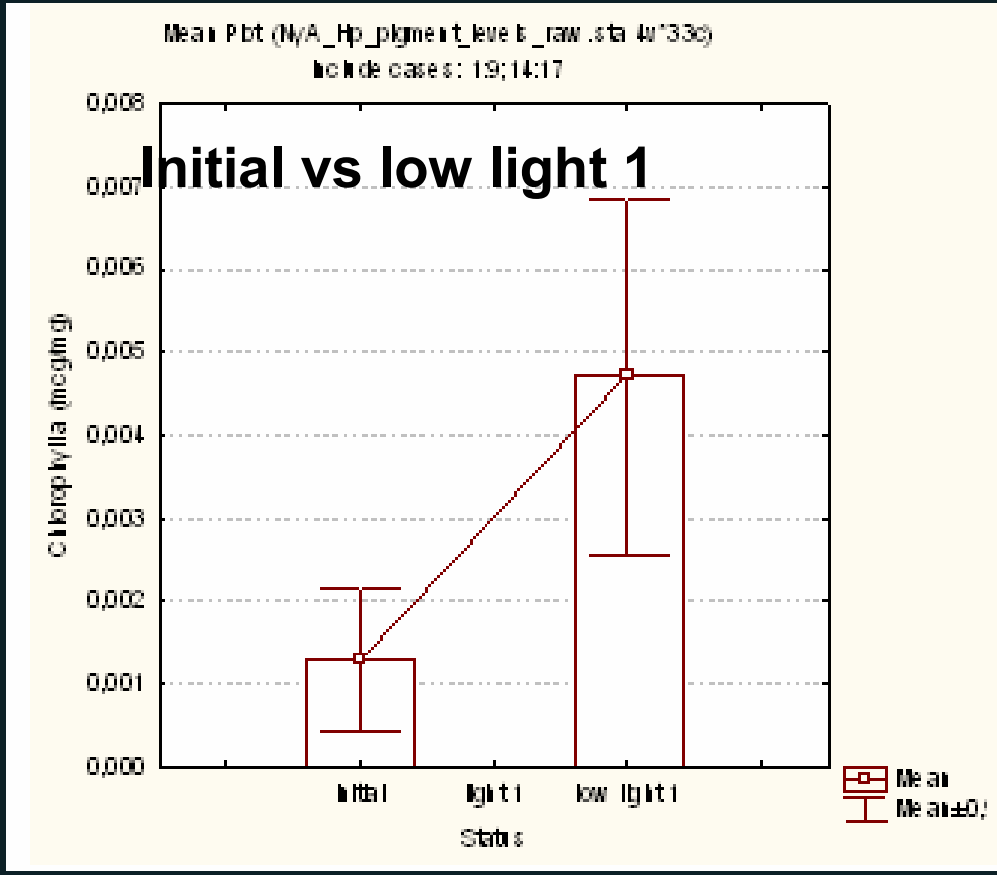
Ny-Ålesund sponge experiment, January 2015: experiment design

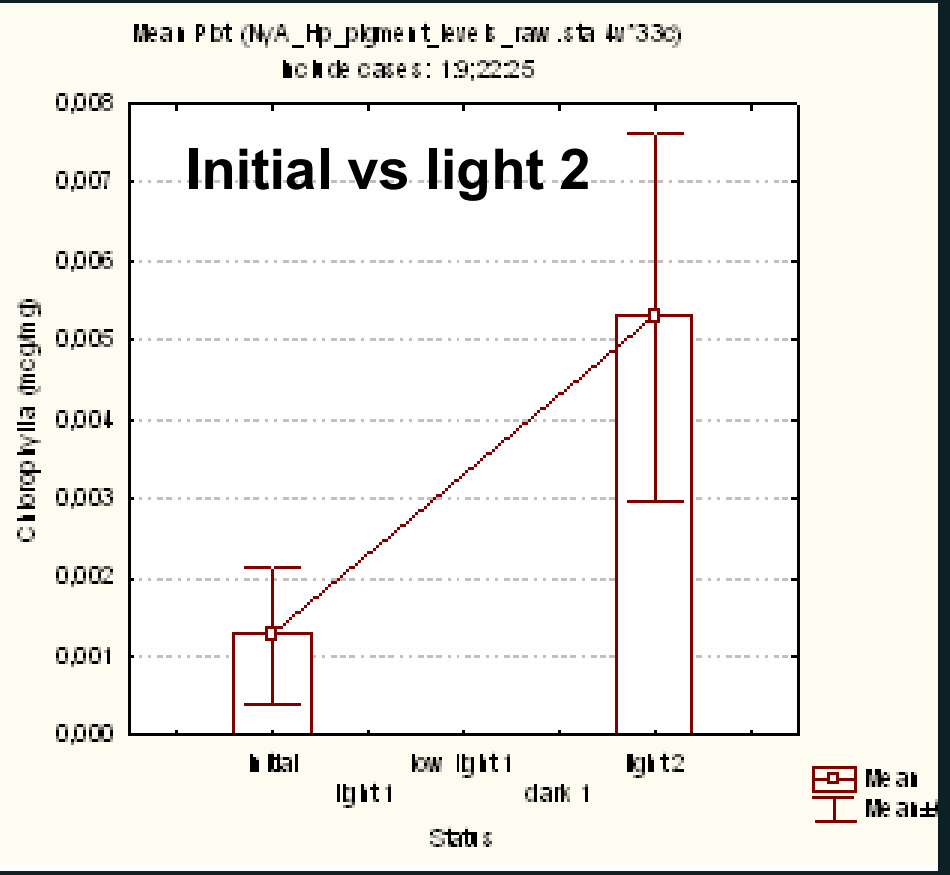


- 12 sponges of Halichondria panicea sp. from Kapp Guissez
- 3 light regimes: “light” , “low light” and “darkness”
- Fixations were made before and on the 5th and 7th days of the experiment
- Spectrophotometric analysis of pigment levels was made in the beginning of February
- Statistics: non-parametric Mann-Whitney U-test

Ny-Ålesund sponge experiment, January 2015: preliminary results

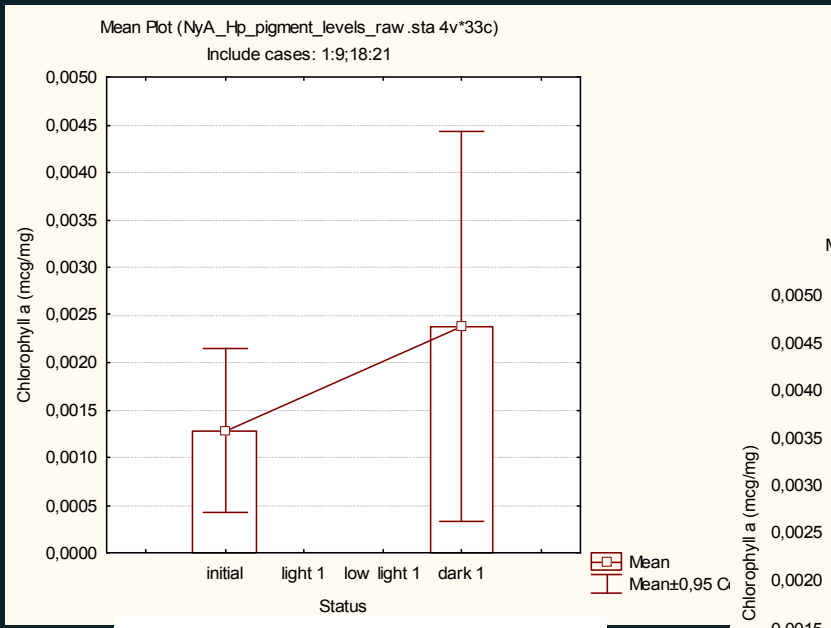
In both “low light” and “light” groups *chlorophyll a* levels got consistently higher in the course of the experiment compared to the initial average chlorophyll a level.



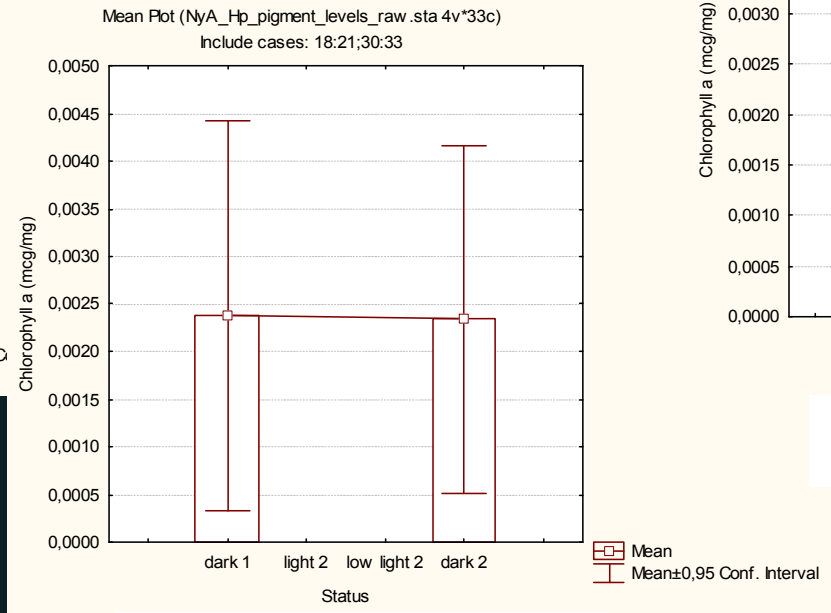


Ny-Ålesund sponge experiment, January 2015: preliminary results

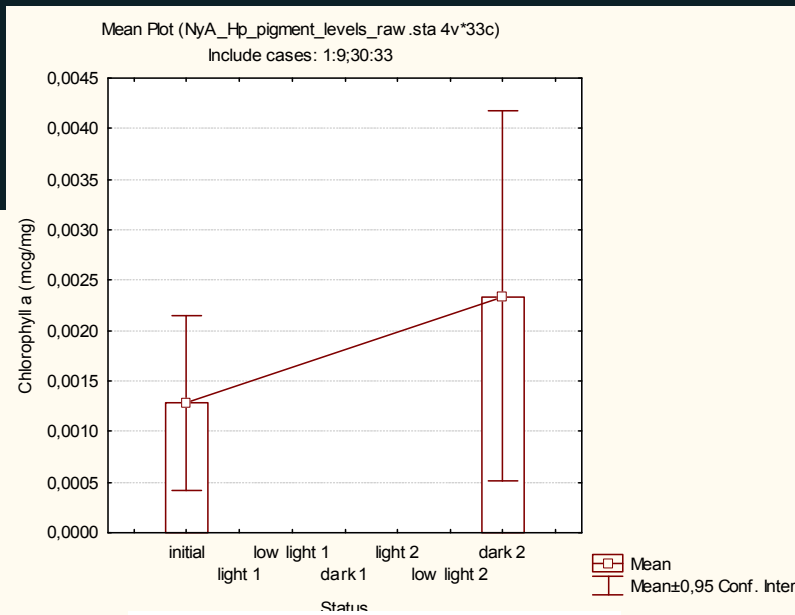
No consistent differences in *chlorophyll a* levels were detected in the following groups:



initial vs dark 1



dark 1 vs dark 2

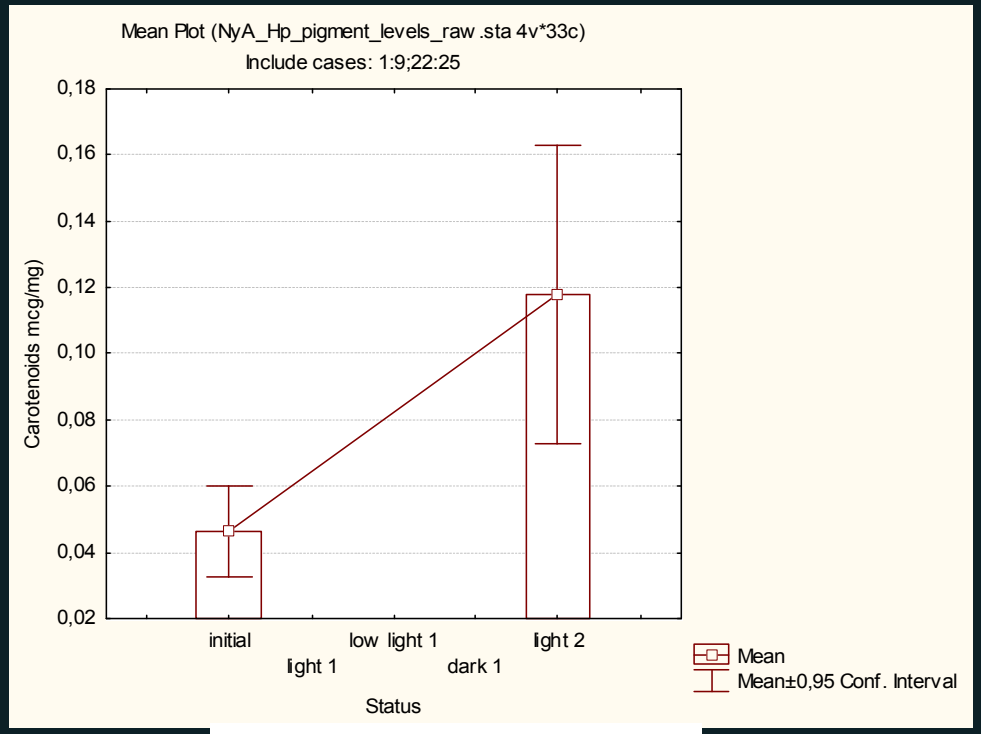


initial vs dark 2

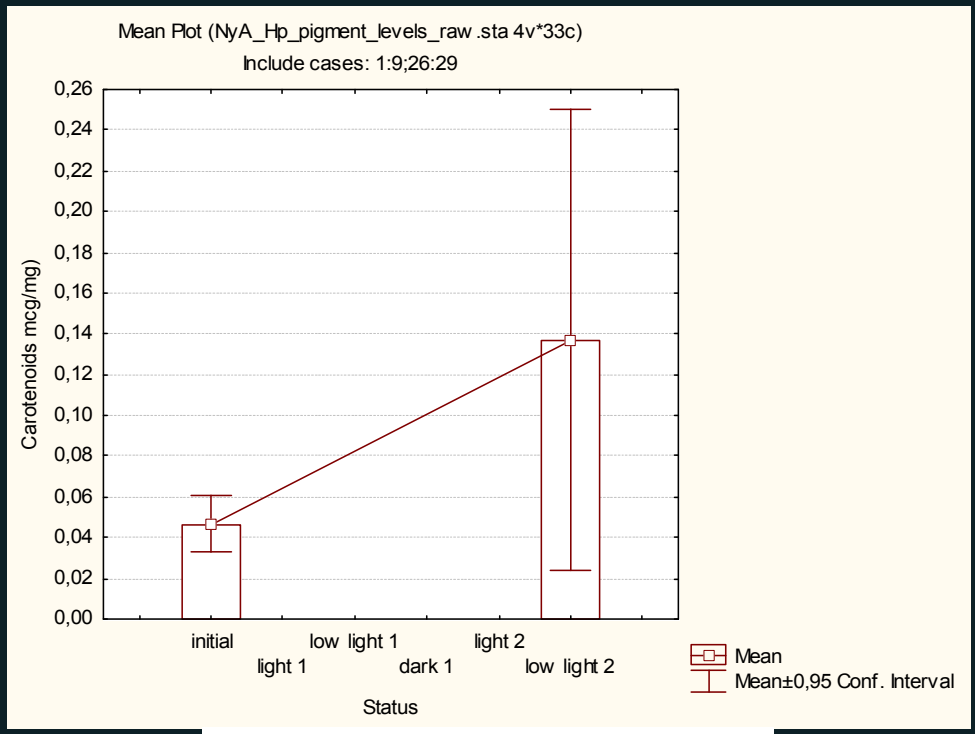
Ny-Ålesund sponge experiment, January 2015: preliminary results

Consistent differences in carotenoid levels:
the same groups of comparison as with chlorophyll a levels (except for “initial – low light 1” pair).

Protection of chlorophyll a?



initial vs light 2



initial vs low light 2

Ny-Ålesund sponge experiment, January 2015: preliminary results

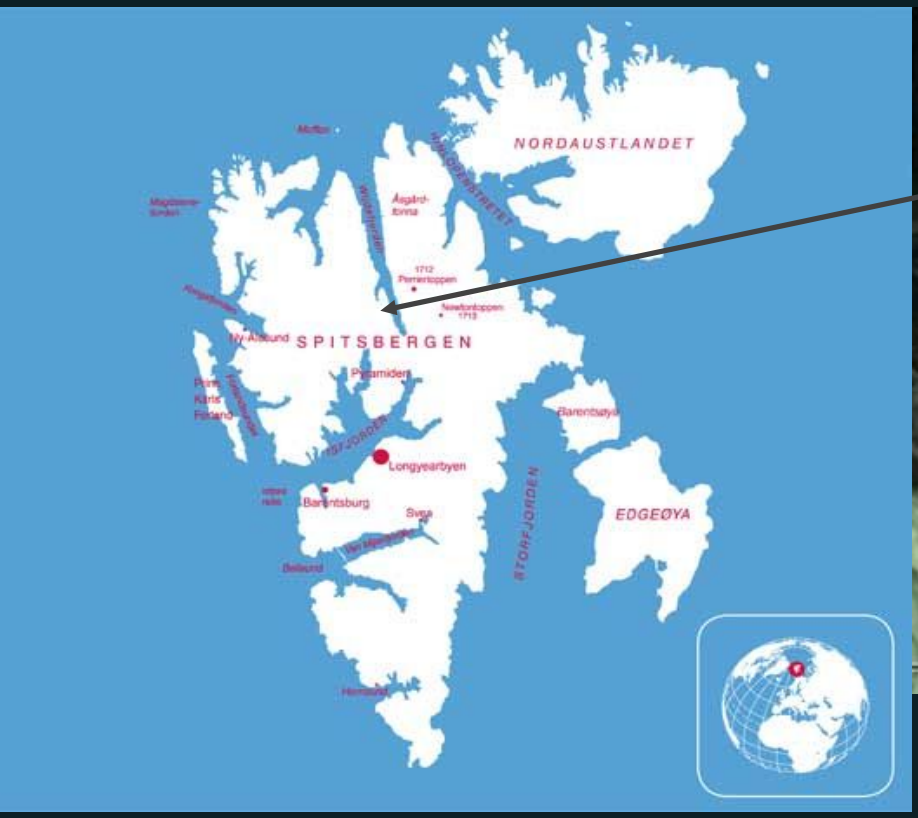
- In sponges from the “light” and “low light” groups consistent differences between the initial and final levels of chlorophyll a have been detected
- Fluorescent microscopy studies - held to visualize distribution of symbionts in the sponge’s body - are now underway
- TEM studies are planned for the summer 2015
- For the autumn 2015 submission of a paper is planned – the exact format and the journal being not clear by now

Fauna associated with Saccharina latissima: seasonal changes

- Foundation species
- Demostrates highly pronounced seasonal dynamics
- Occurs at different latitudes

Aim: to trace seasonal changes in macrobenthic community associated with Saccharina latissima

- Svalbard (79 N)
- Barents Sea (69 N)
- White Sea (66 N)



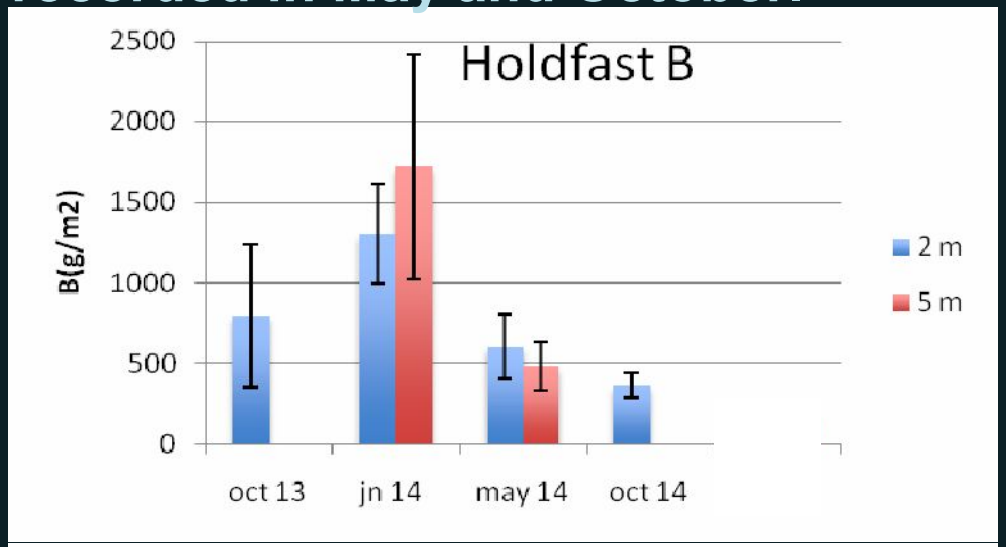
Sample set:

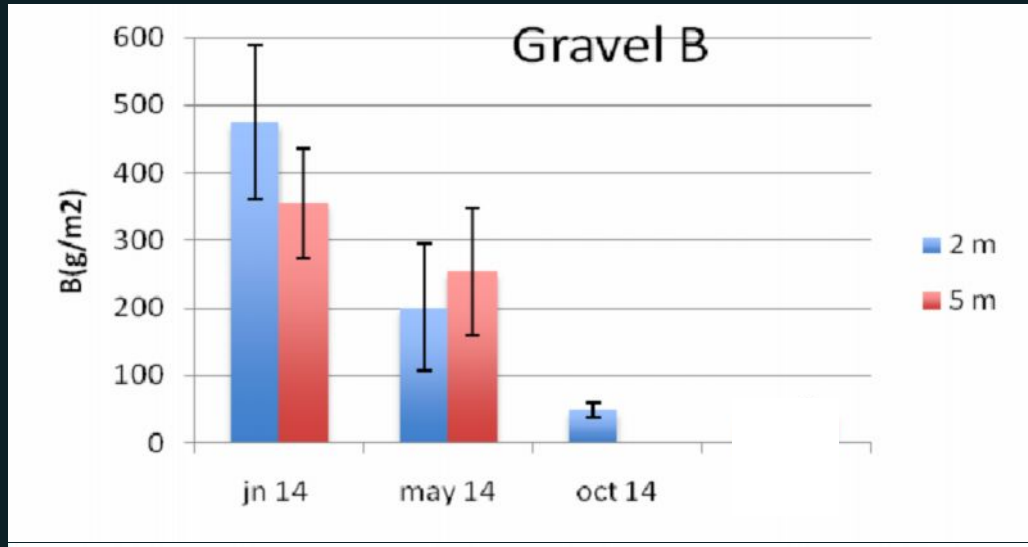
- the whole individual of S.latissima (together with the stone)
- sediment sample taken by cogged grab sample (S = 0.025 sq.m)

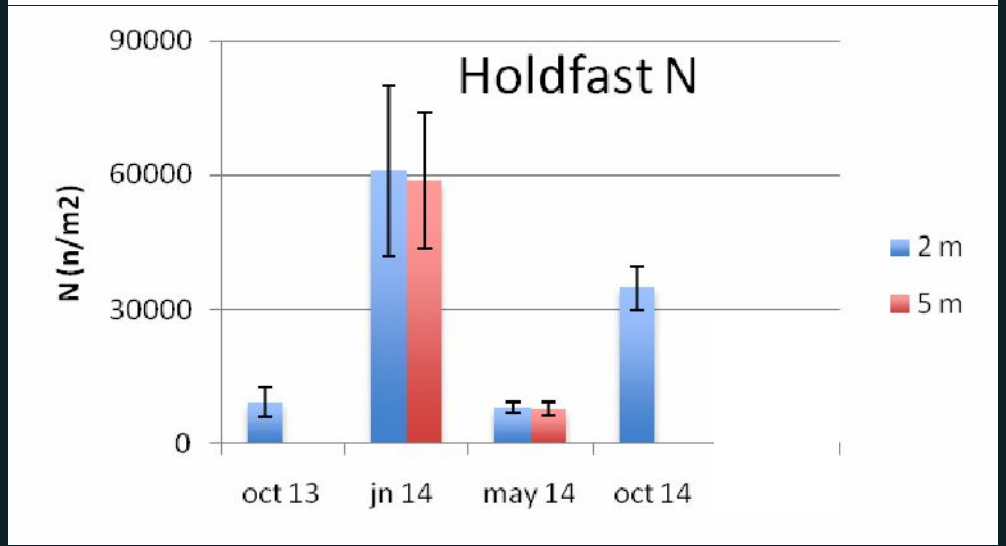
	2 meter depth		5 meter depth	
Sample	S.latissima	Grab	S.latissima	Grab
Oct 13	10	-	-	-
Jan 14	10	6	6	6
May 14	10	10	6	6
Oct 14	10	10	-	-
Jan 15	10	10	6	6

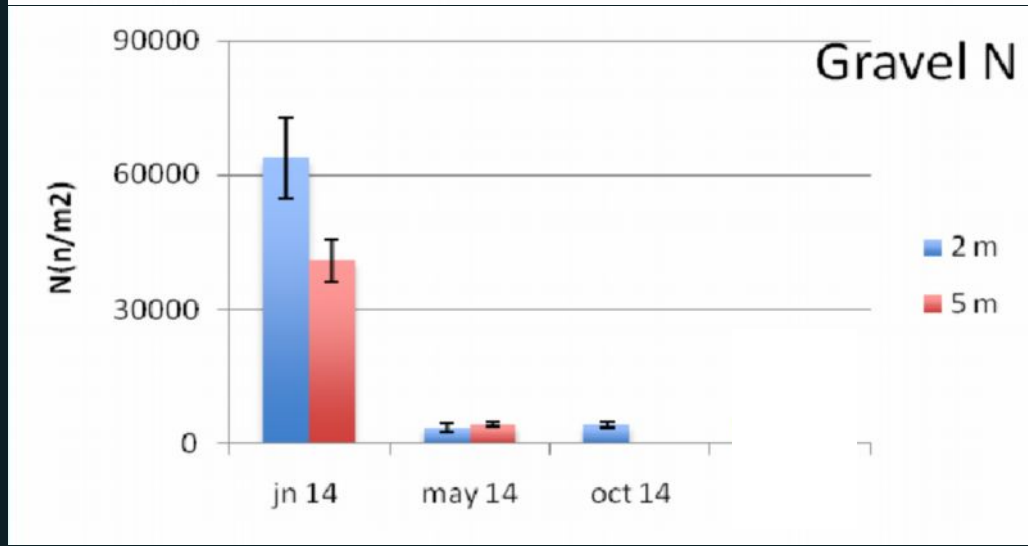
•Abundance and biodiversity of fauna associated with the kelp S.latissima and surrounding sediments were considerably higher in January then in October and May.

•Densities of invertebrates in January averaged more than 60,000 individuals m-2, approximately an order of magnitude greater than those recorded in May and October.

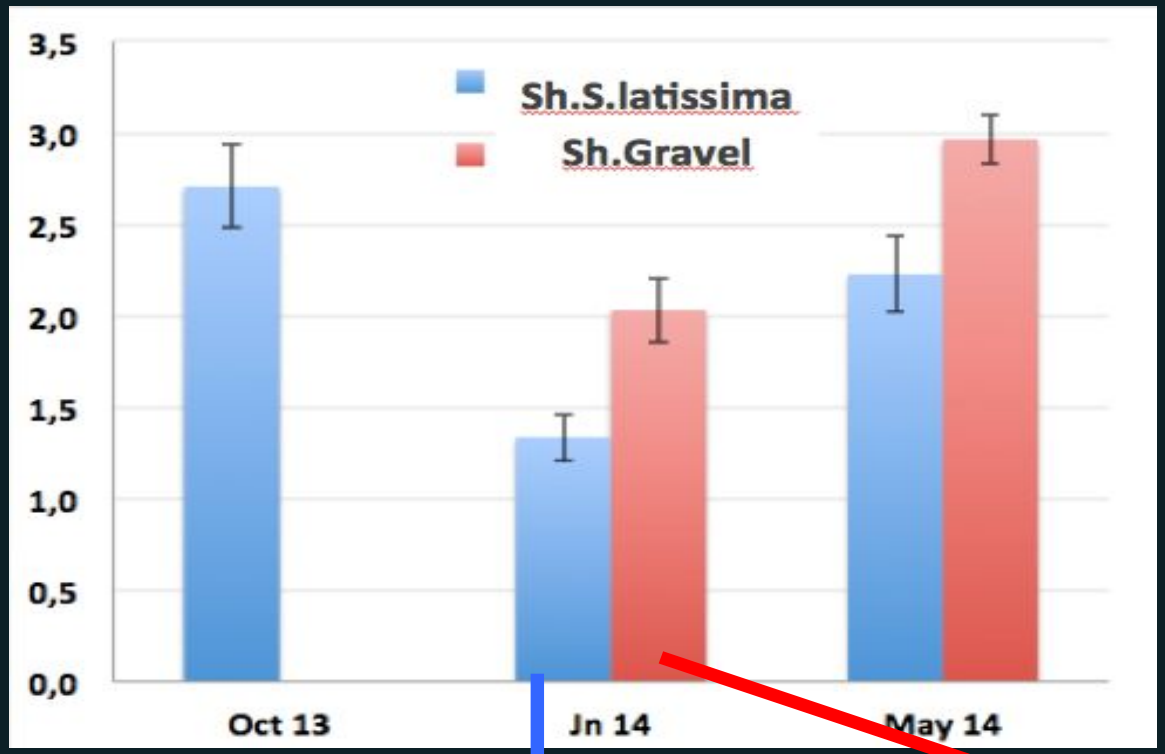








Shannon-Weaver index



Jaccard index

Holdfast	OCT 13	JN 14	MAY 14
JN 14	0,35		
MAY 14	0,27	0,32	
OCT 14	0,37	0,31	0,29

GR	JN 14	MAY 14	OCT 14
JN 14			
MAY 14	0,29		
OCT 14	0,31	0,29	

Capitella capitata

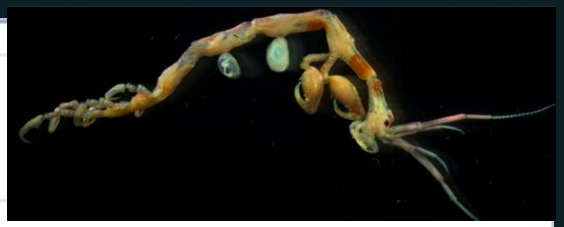
Harmathoe imbricata

Caprella septentrionalis

Margarites helicinus

Marenzelleria wireni

Caprella septentrionalis



Margarites helicinus

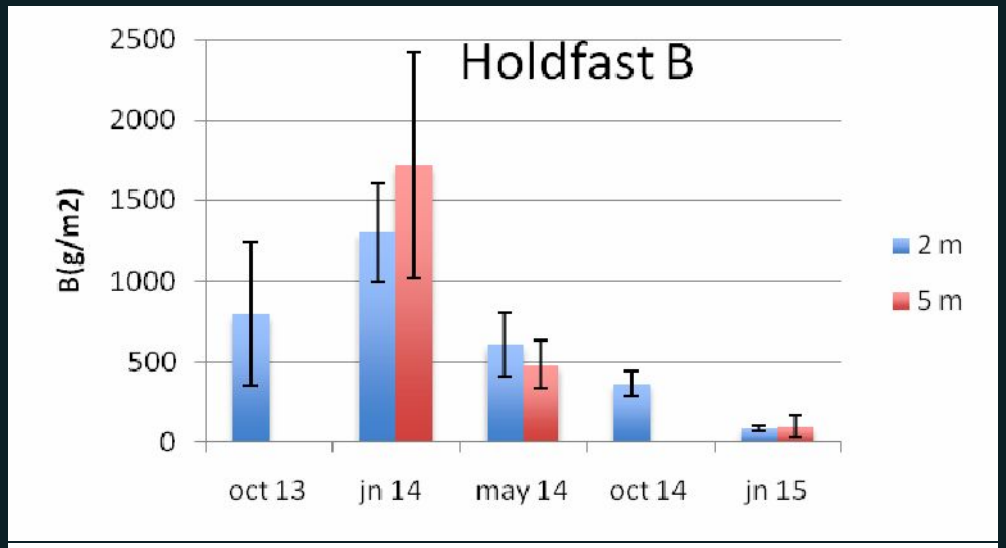
Capitella capitata

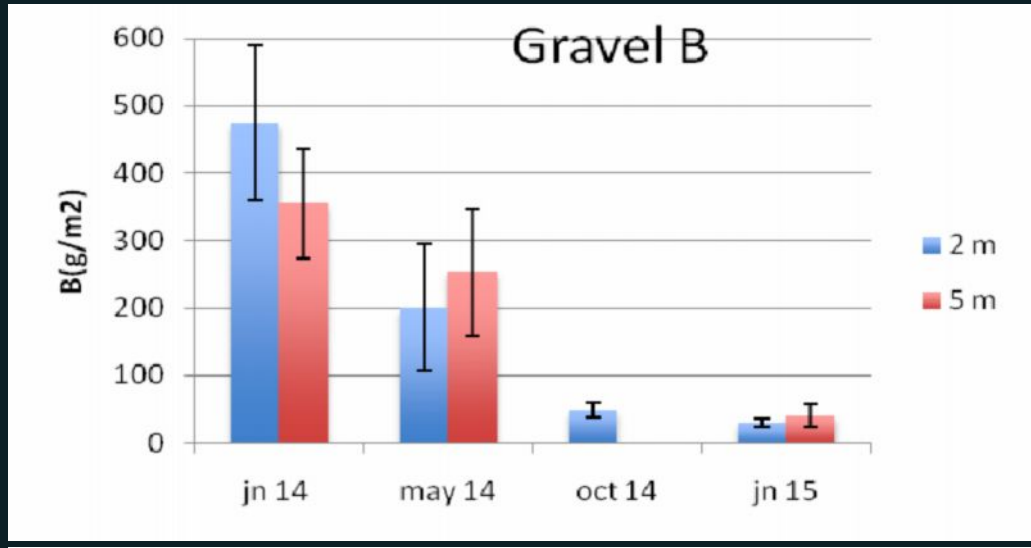
Marenzelleria wireni

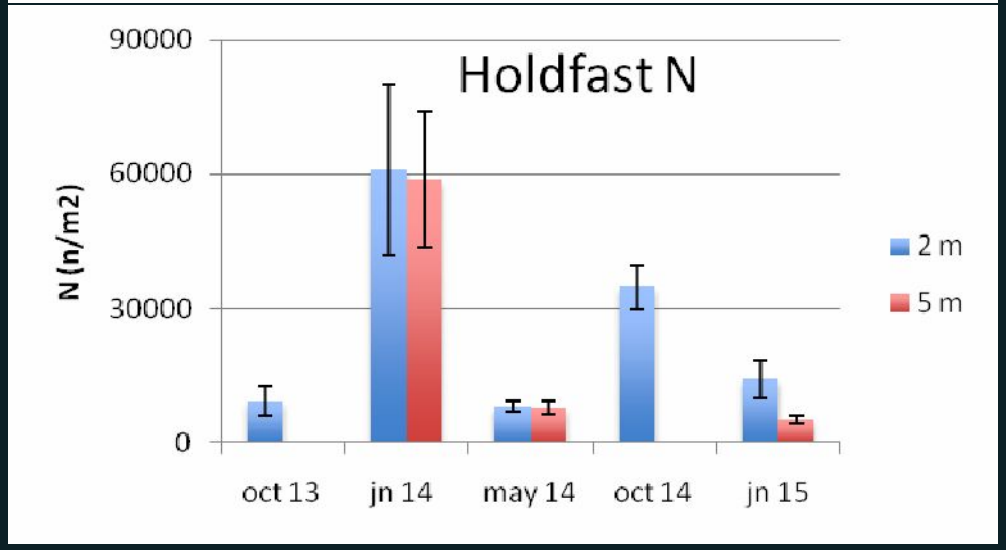
Har iotoe imbricata

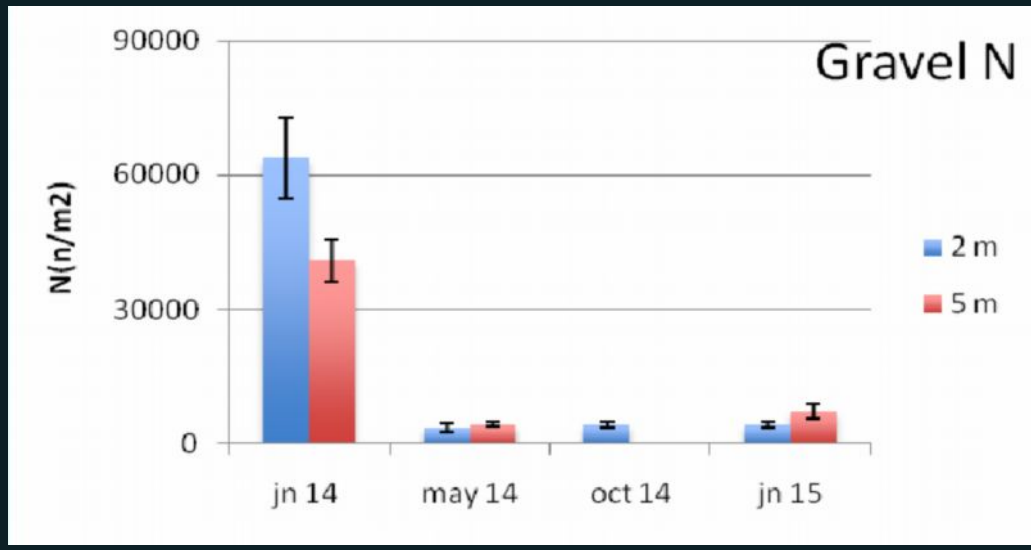
January, 2015 – never try to repeat…?

- Changes in species composition
- Abrupt decreasing of density and biomass

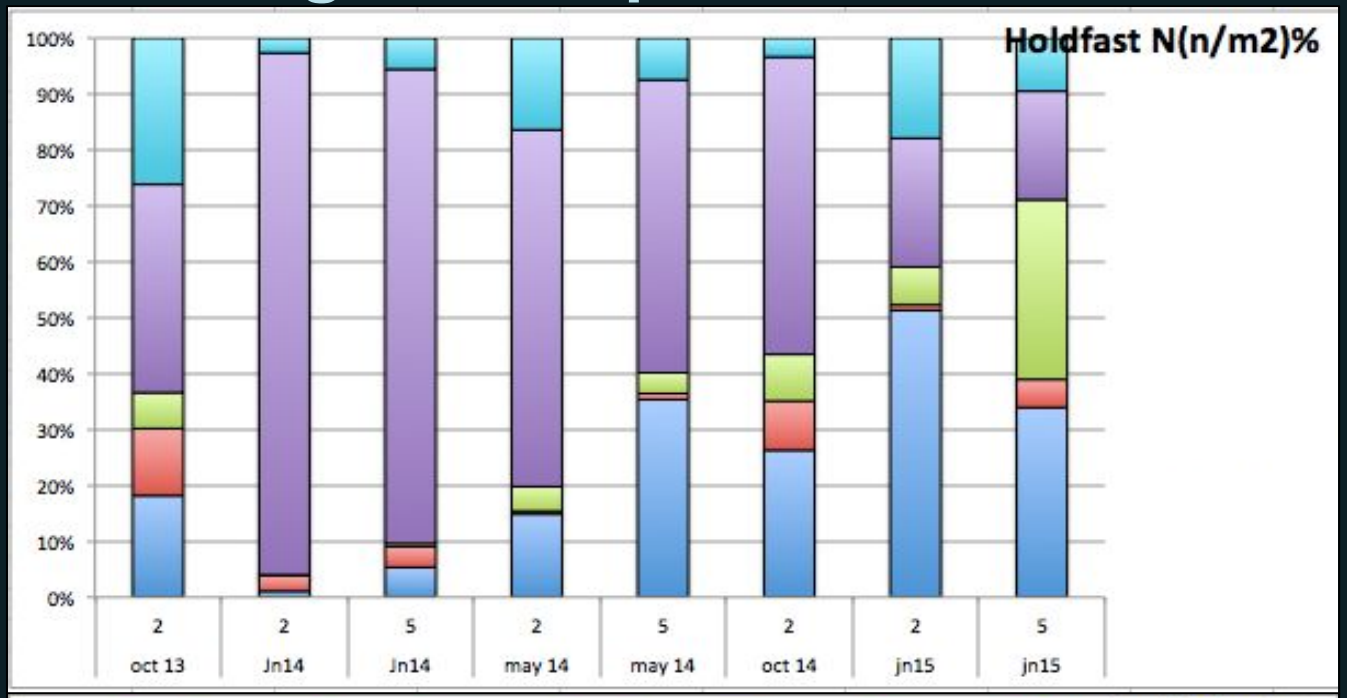


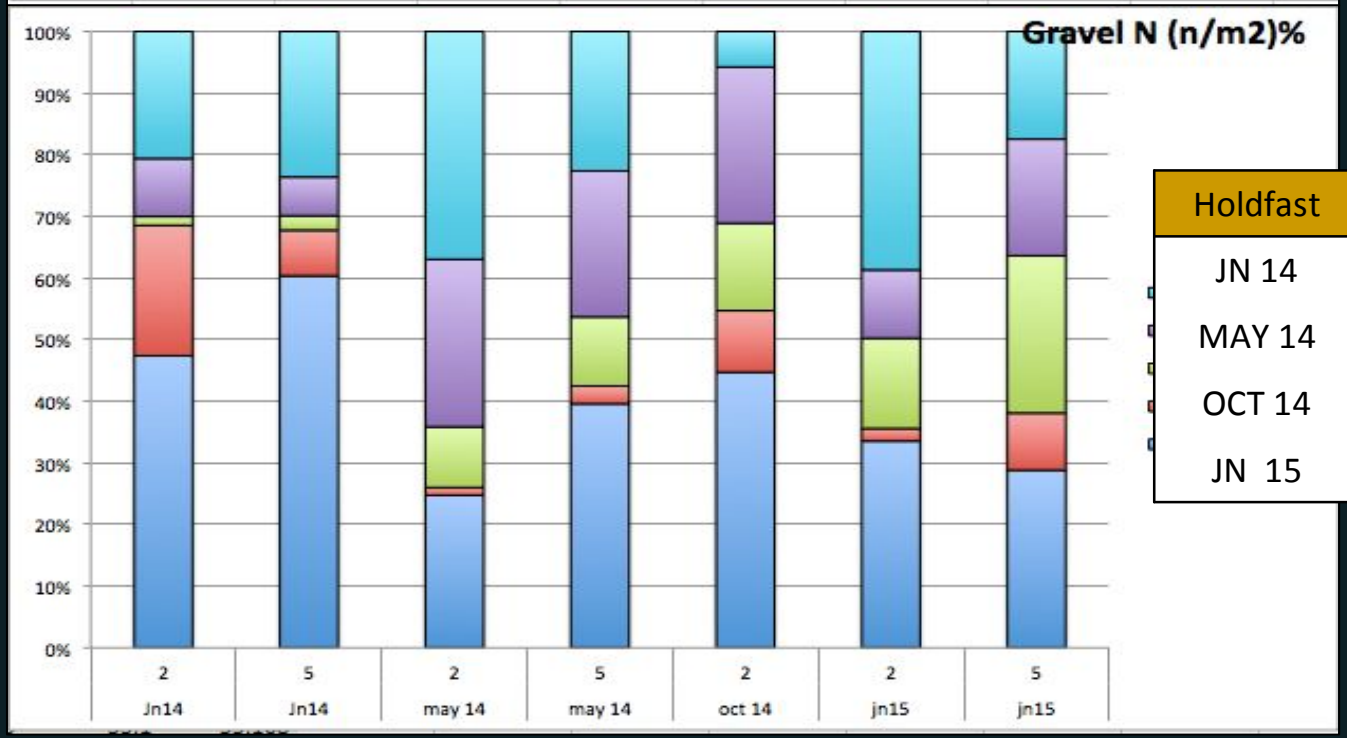






Changes in trophical structure





- predators
- grazers
- filter feeders
- suspension feeders
- deposit feeders

Jaccard index

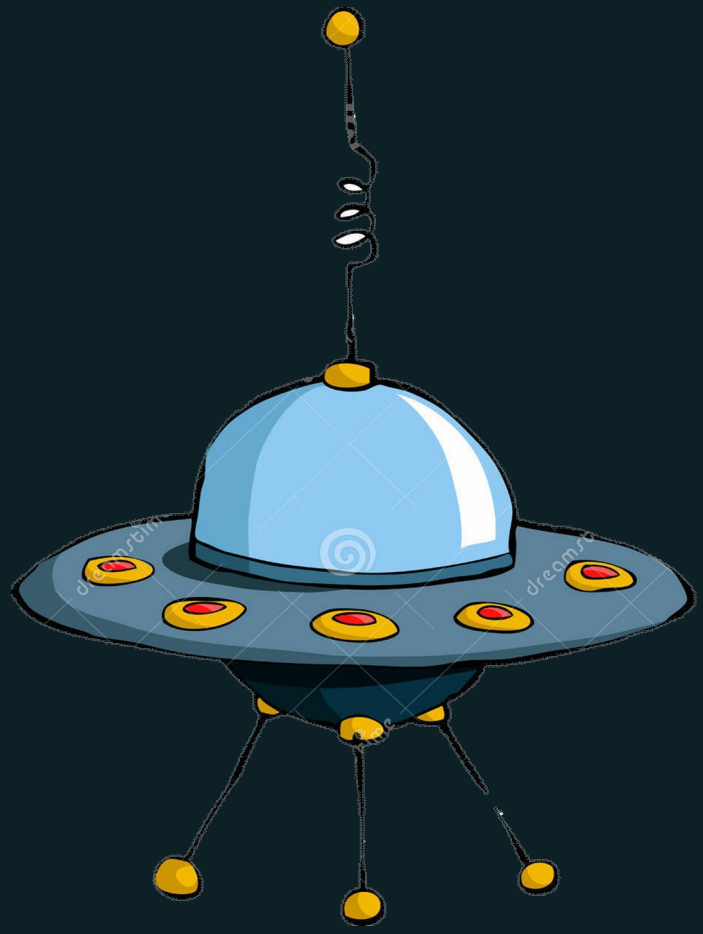
Holdfast	OCT 13	JN 14	MAY 14	OCT 14
JN 14	0,35			
MAY 14	0,27	0,32		
OCT 14	0,37	0,31	0,29	
JN 15	0,38	0,28	0,25	0,41

GR	JN 14	MAY 14	OCT 14
MAY 14	0,29		
OCT 14	0,31	0,29	
JN 15	0,31	0,27	0,48

Abiotic factors?

Biotic interactions?

or…



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