Seasonality in the community structure of plankton ecosystem in the epipelagic layer of the subtropical water off Kuroshio

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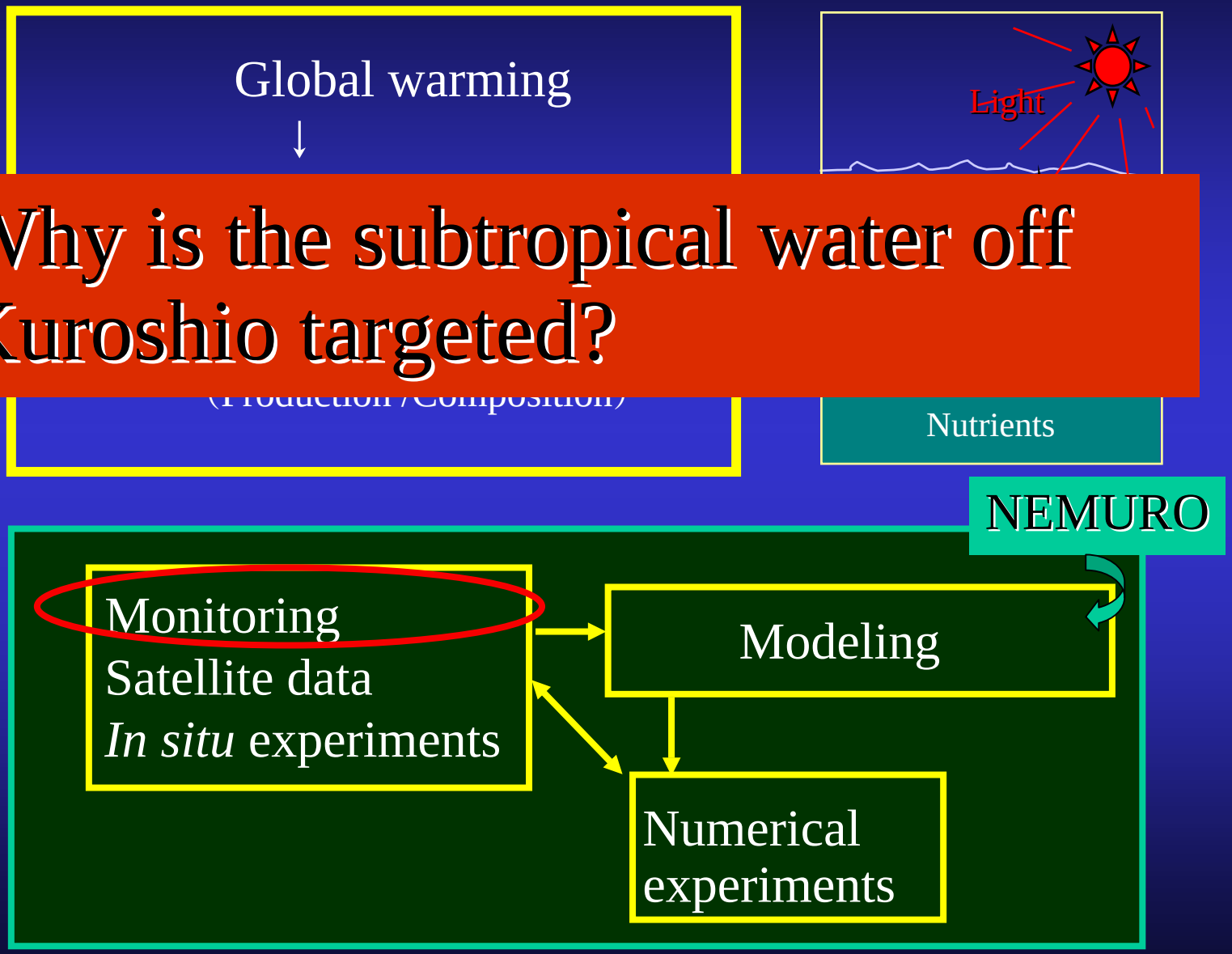
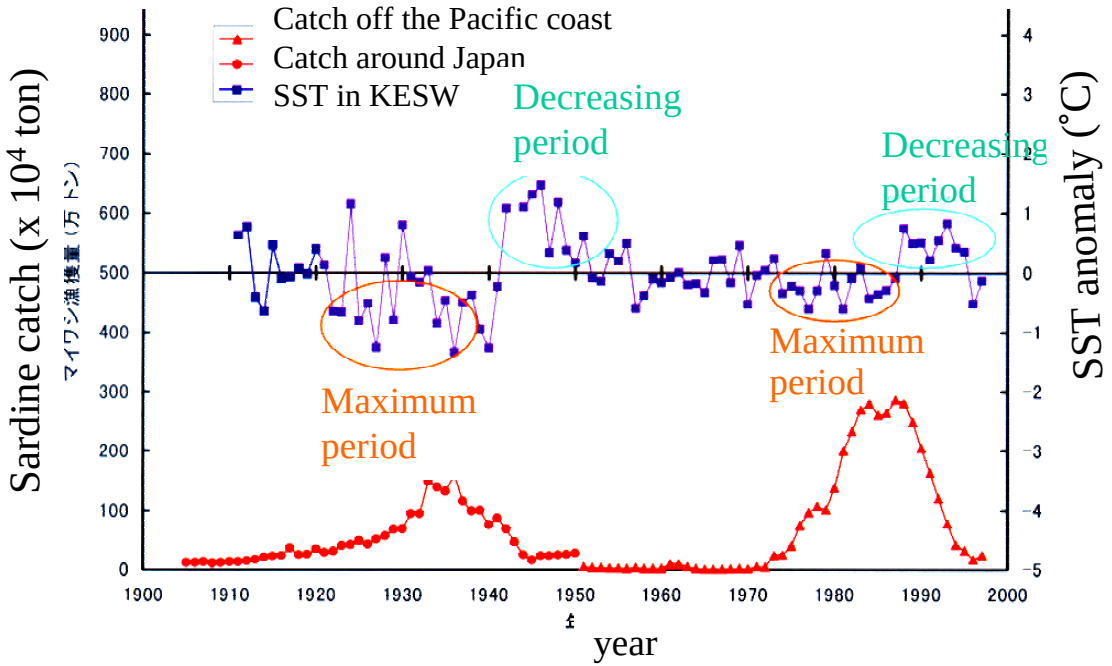
RV.SOYOMARU

Global warming project by Ministry of Agriculture, Forestry & Fisheries (2002-2006)



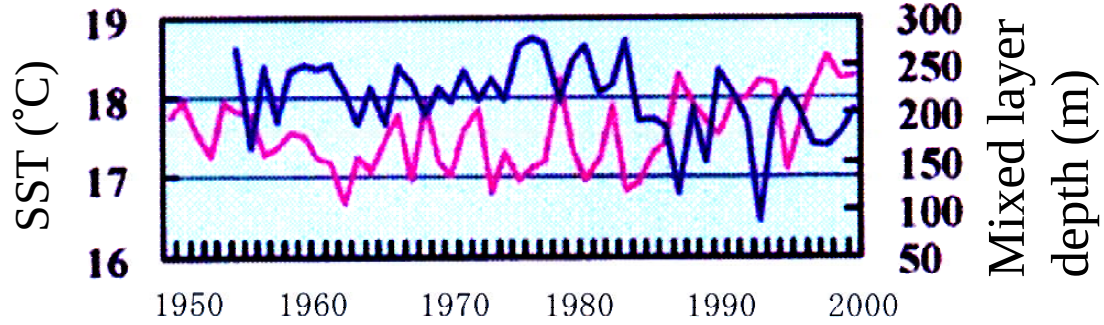
Why is the subtropical water off Kuroshio targeted?

Relationship between sardine catch and SST in the Kuroshio Extension and the subtropical water off the Kuroshio Extension (30-35°N, 145-180°E)



Relationship between SST and mixed layer depth in the Kuroshio Extension

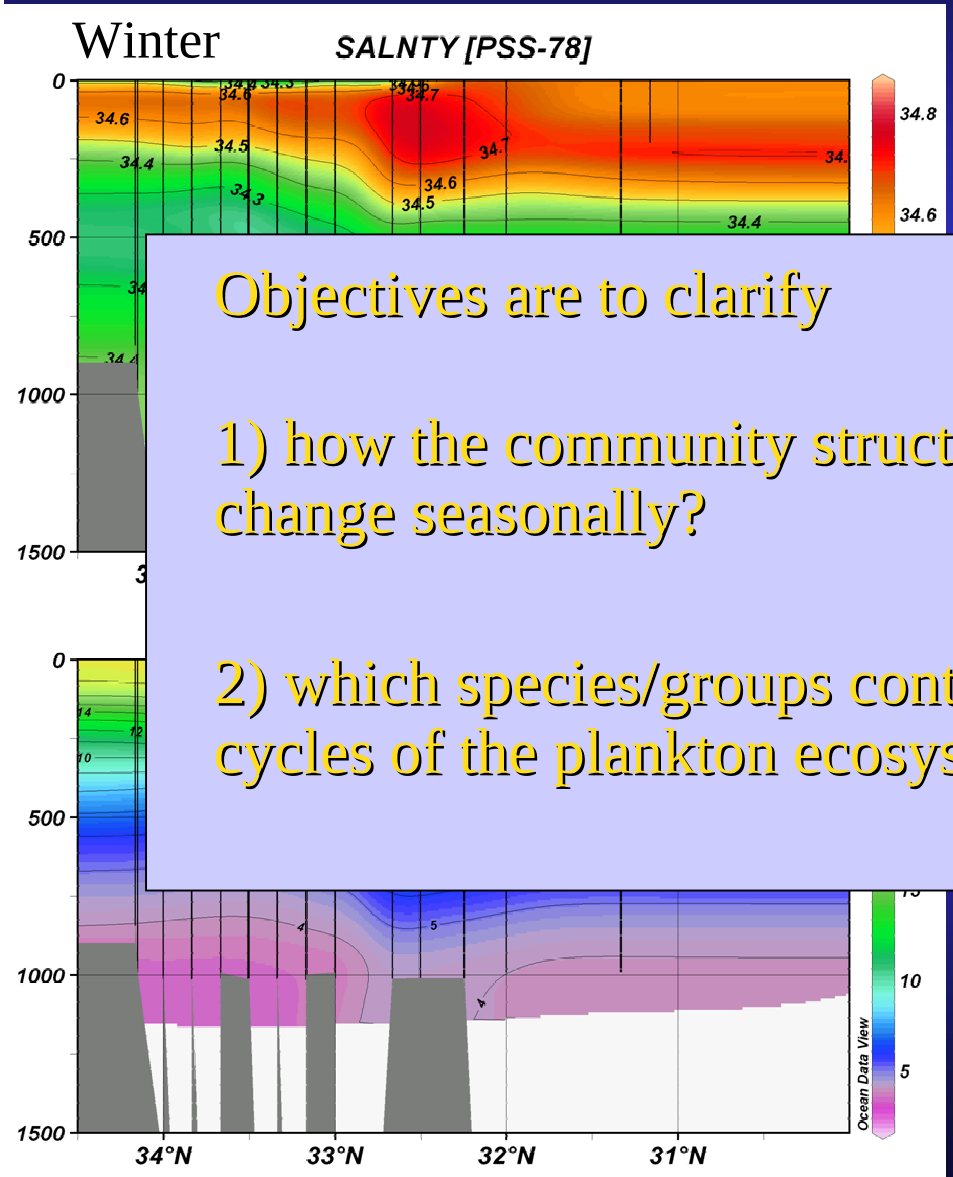
(Noto, M. and I. Yasuda 1999)



Blue line; mixed layer depth
Pink line; SST

(Noto & Yasuda, 1999)

- Deep mixed layer depth in winter
- Quick development of stratification after winter



Ecosystem in the subtropical water

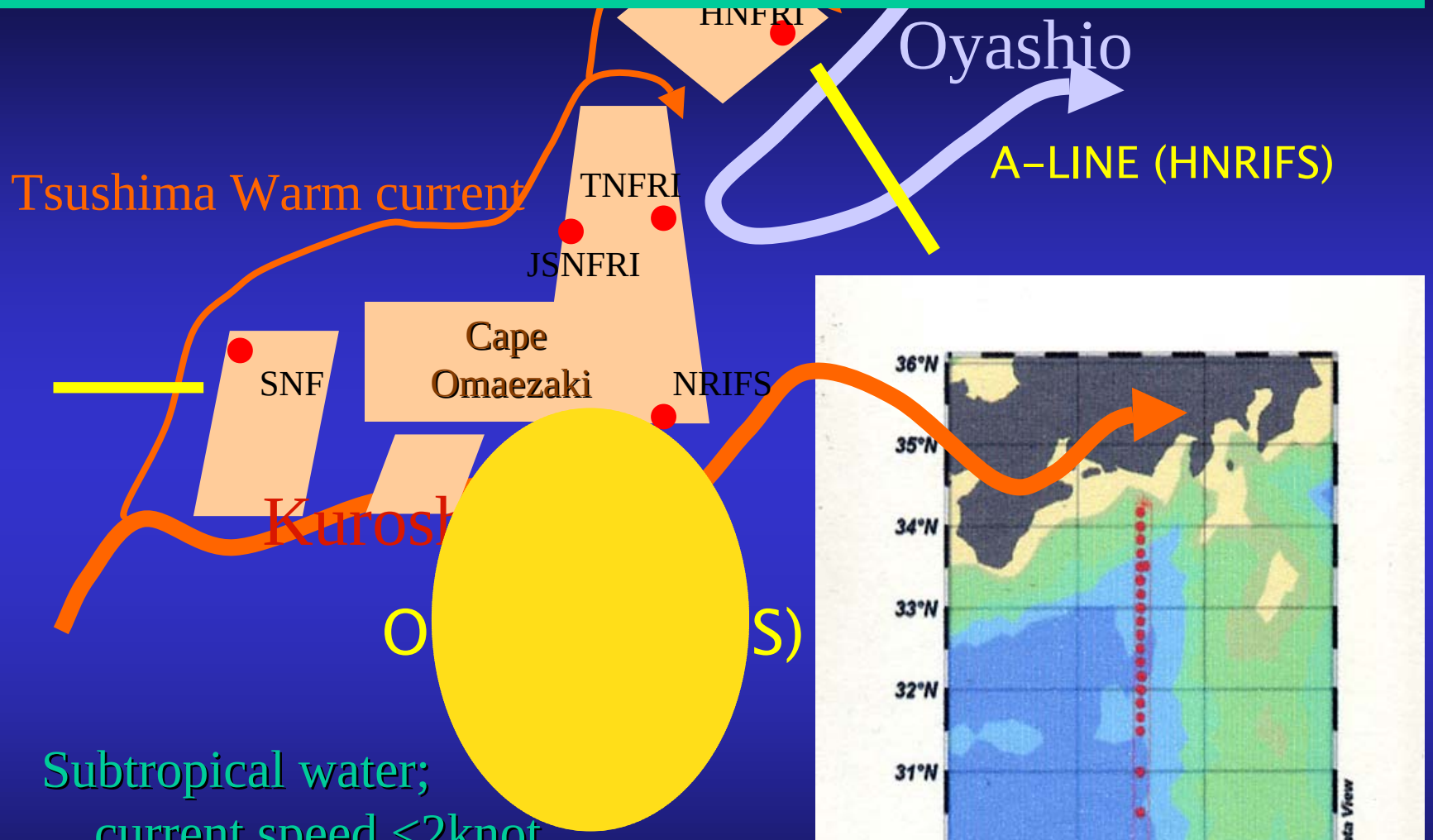
- High diversity
- High stability

Objectives are to clarify

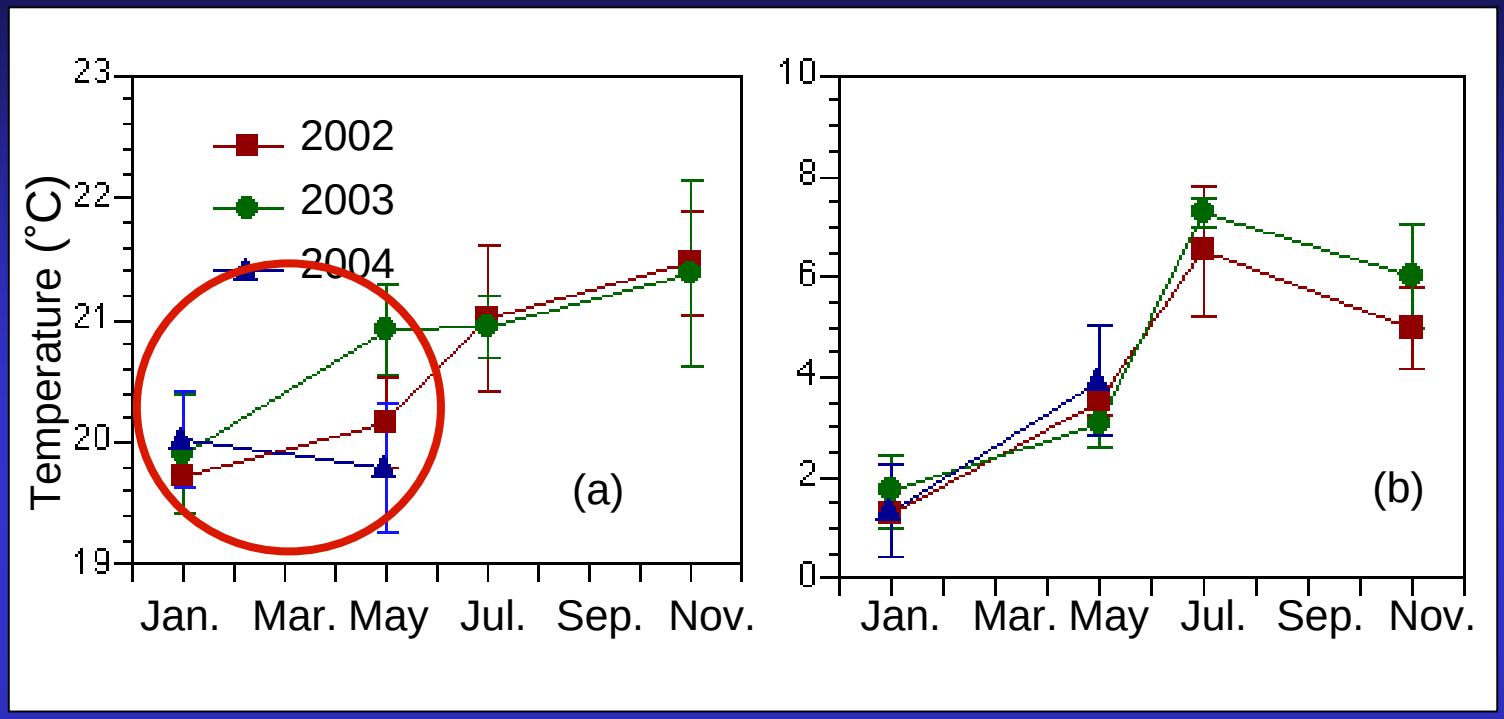
1) how the community structure of lower trophic level change seasonally?

2) which species/groups contribute to the seasonal cycles of the plankton ecosystem?

Three monitoring lines of the global warming project by Ministry of Agriculture, Forestry and Fisheries



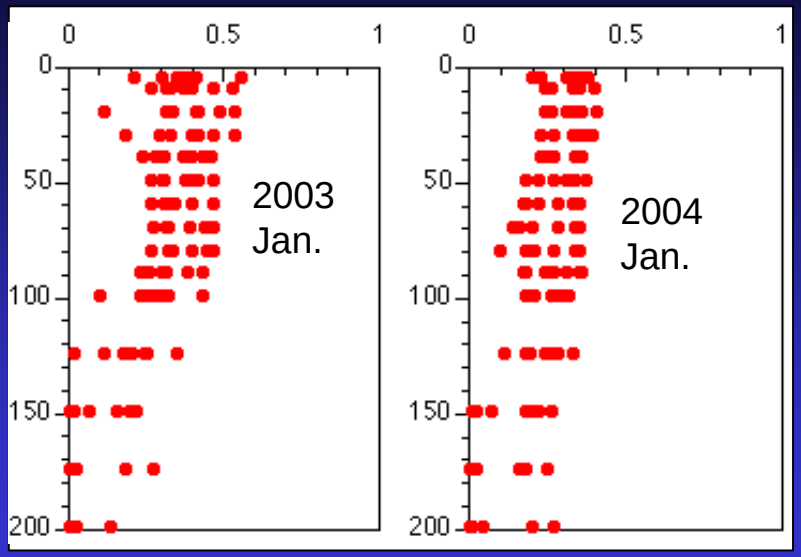
Temperature & stratification



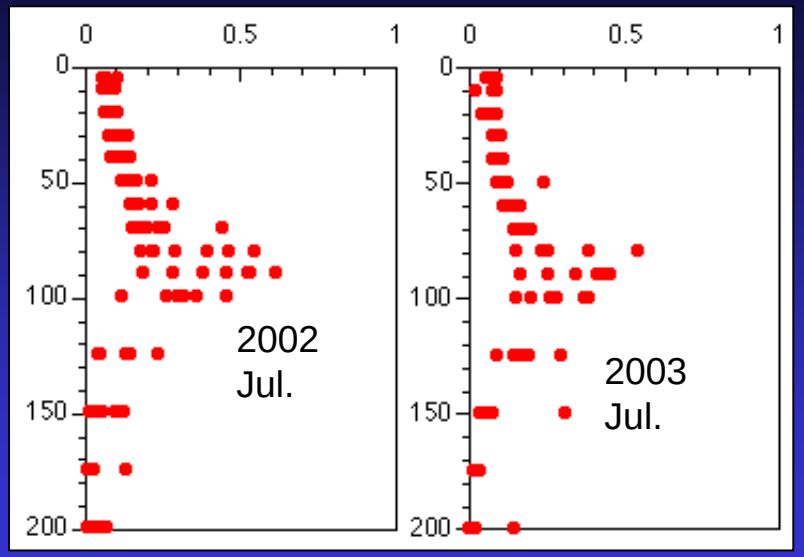
Seasonal changes in the mean temperature above 200m depth (a) and the temperature difference between 10 and 200m (b) in the subtropical water off Cape Omaezaki.

Chlorophyll a

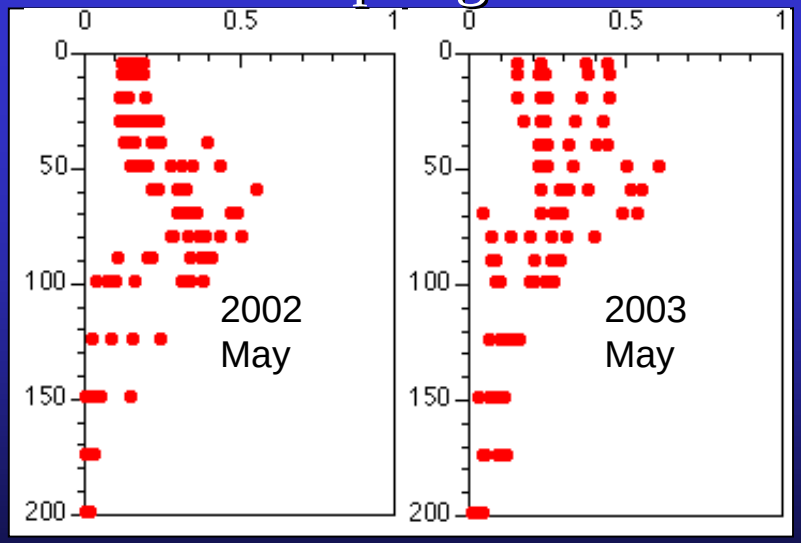
Winter



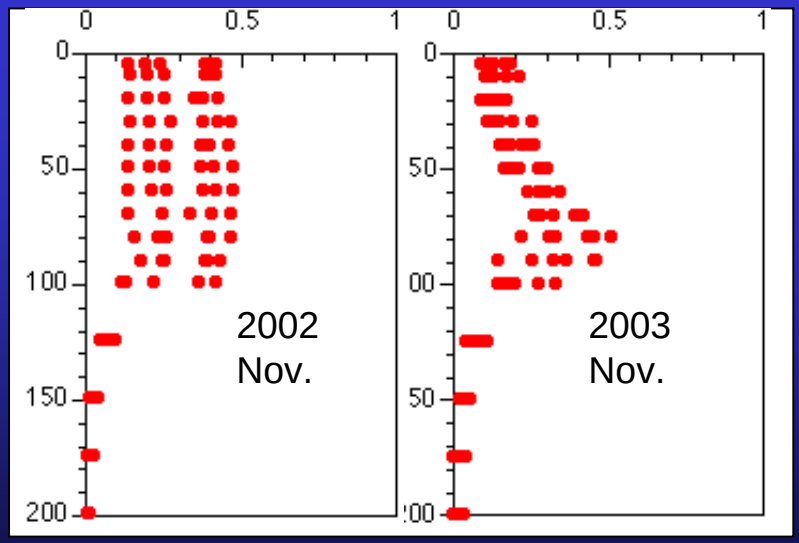
Summer



Spring

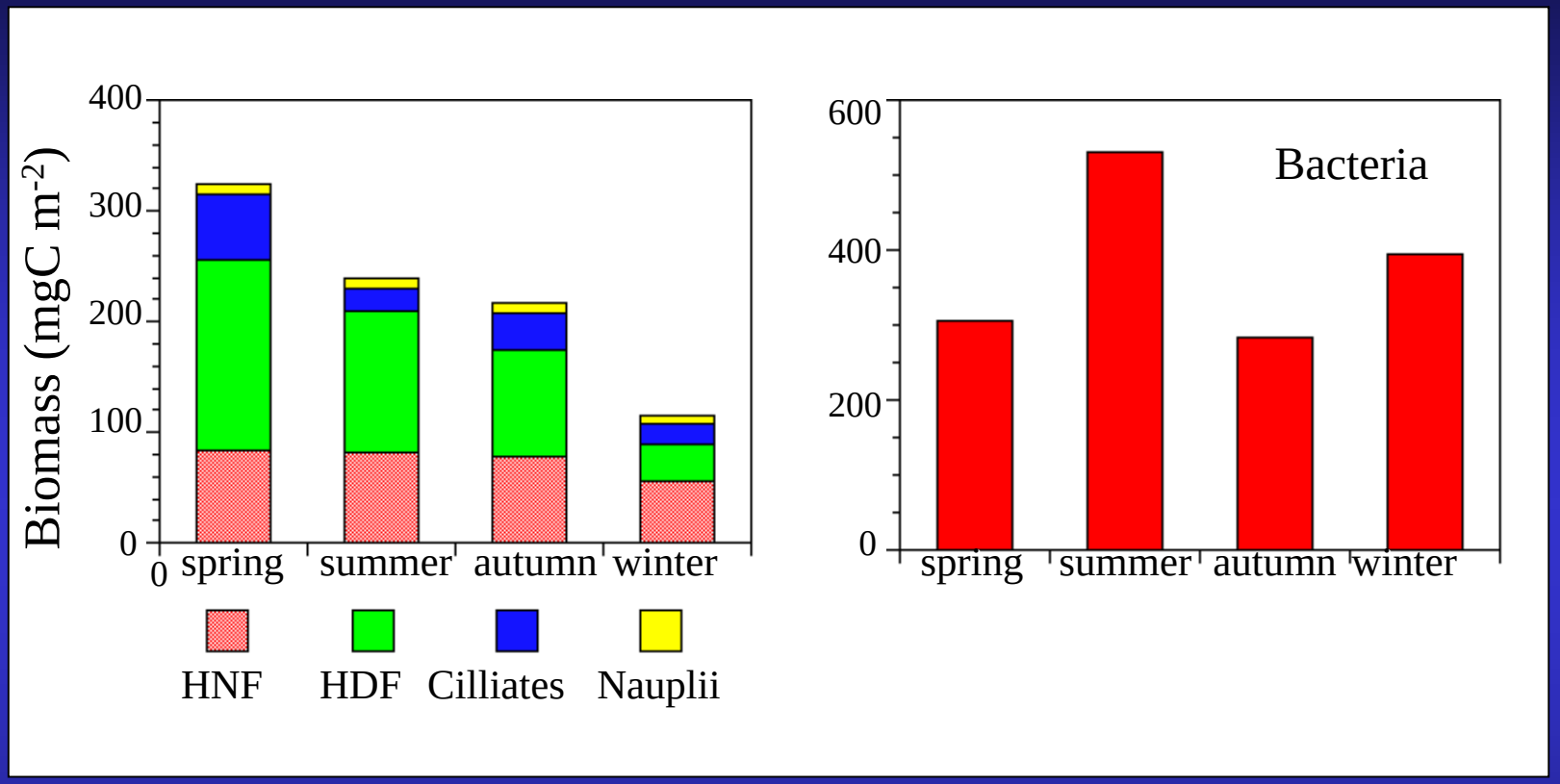


Autumn



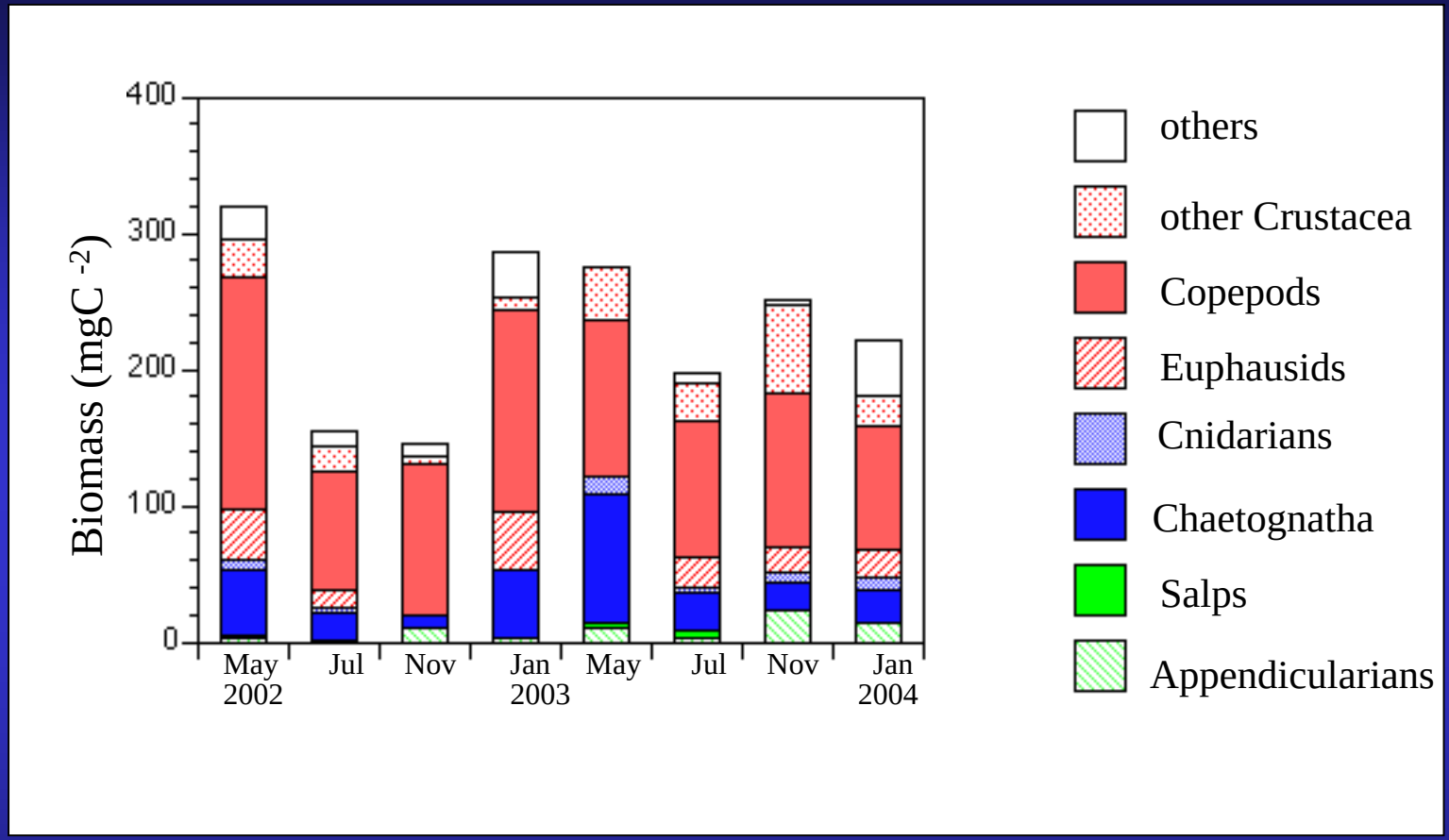
Seasonal changes in the vertical distribution of chlorophyll a concentration (μg-chl*a* l^{-1}) in the subtropical water.

Micro & Nano-size heterotrophs



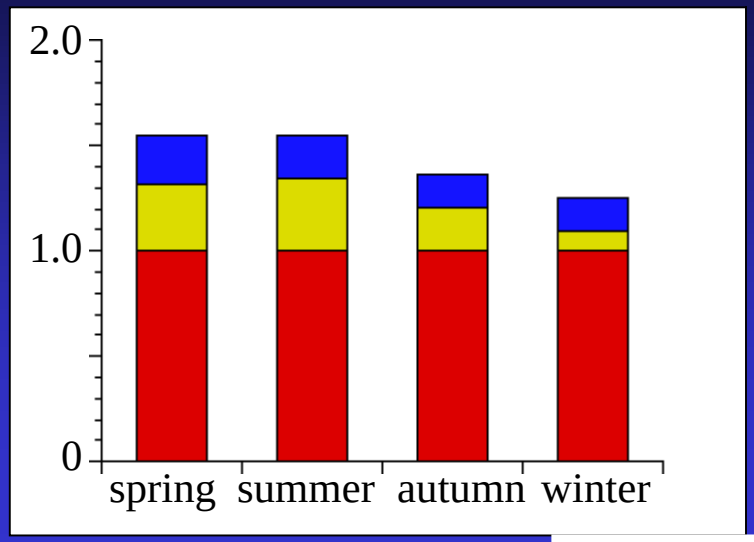
Seasonal changes in the biomass of heterotrophic microbial loop members in the euphotic layer in the subtropical water.
(HNF; heterotrophic nanoflagellates, HDF; heterotrophic dinoflagellates)
Data on the cilliates and nauplii were supplied by courtesy of Dr. M. Nakamachi.

Mesozooplankton



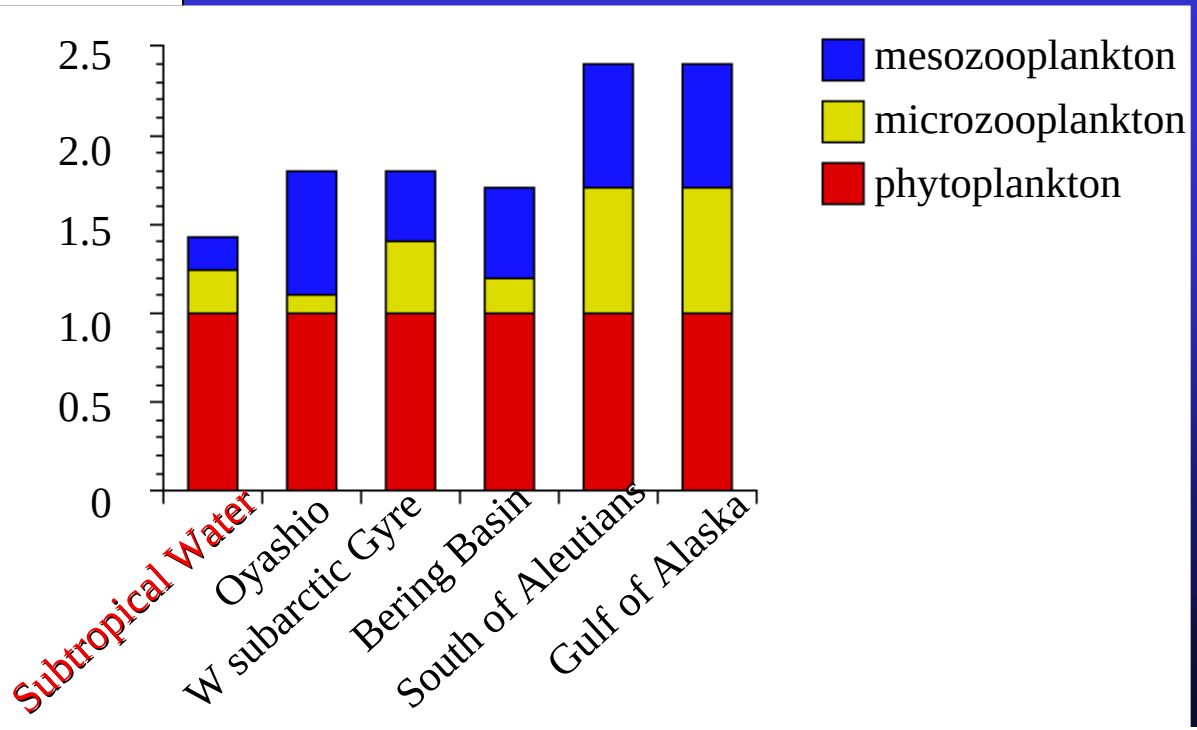
Changes in the biomass and composition of mesozooplankton in the upper 200m in the subtropical water.

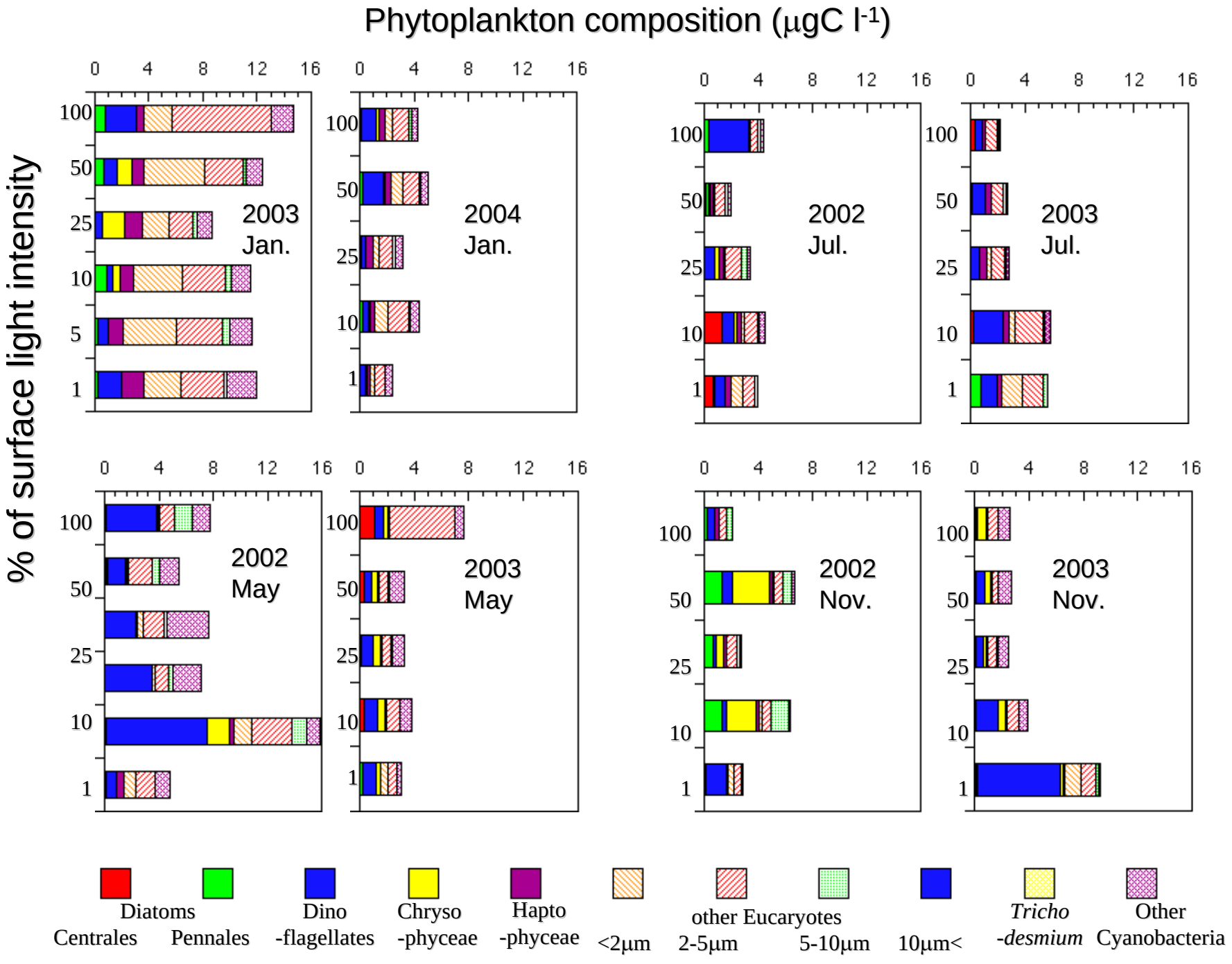
Structure of lower trophic levels



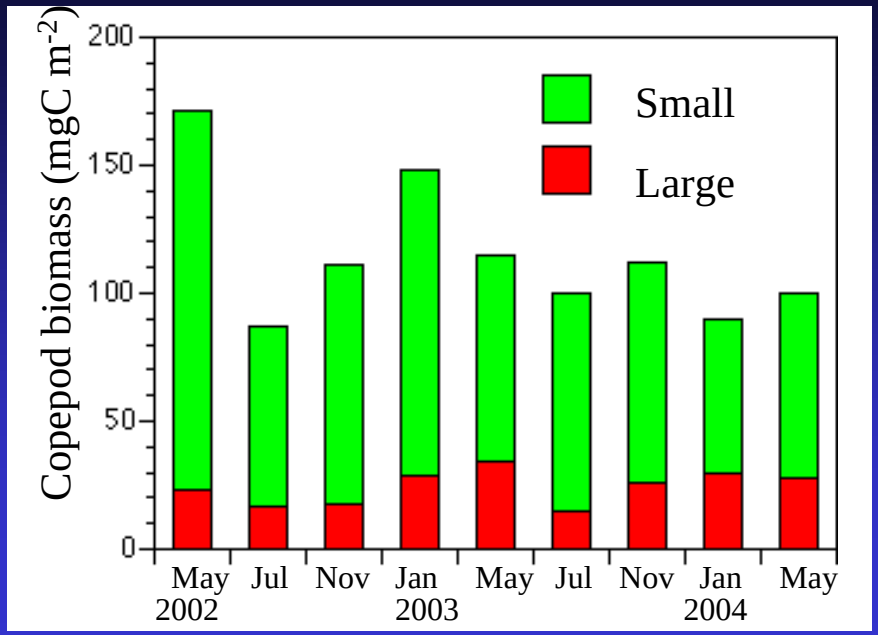
Seasonal differences in the structure of the lower trophic levels of the pelagic ecosystems in the subtropical waters. Biomass in weight of carbon are given as relative values to phytoplankton biomass.

Regional differences in the structure of the lower trophic levels of the pelagic ecosystems. Biomass in weight of carbon are given as a relative values to phytoplankton biomass. Values other than subtropical water was quoted from Taniguchi (1999)



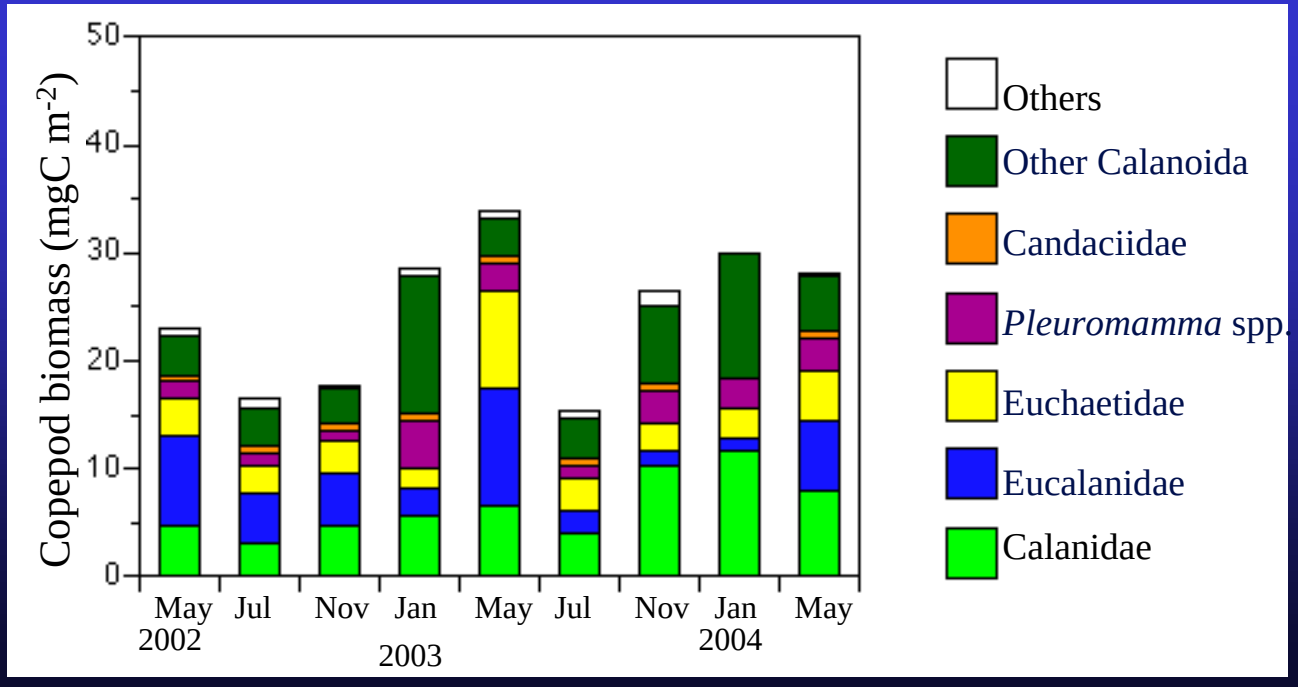

Phytoplankton composition (µgC l-1)
% of surface light intensity
0 4 8 12 16
100 50 25 10 5 1
2003 Jan.
2004 Jan.
2002 Jul.
2003 Jul.
2002 May
2003 May
2002 Nov.
2003 Nov.
Diatoms
Centrales
Pennales
Dino -flagellates
Chryso -phyceae
Hapto -phyceae
<2µm
other Eucaryotes
2-5µm
5-10µm
10µm<
Tricho -desmium
Other Cyanobacteria

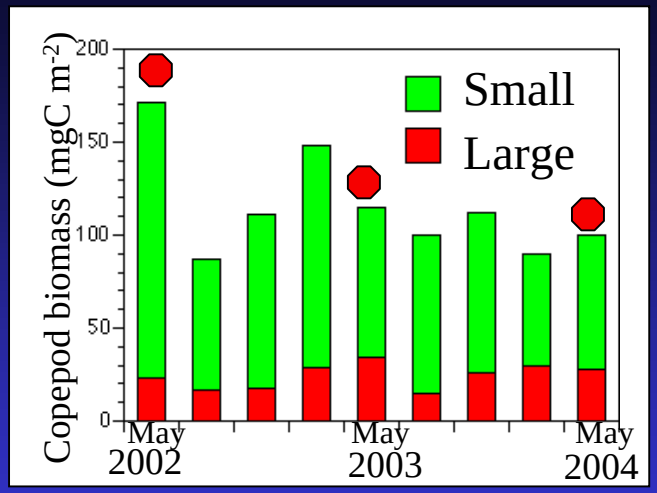
Copepods



Changes in the large and small copepod biomass in the subtropical water.

Changes in the composition of large copepods.



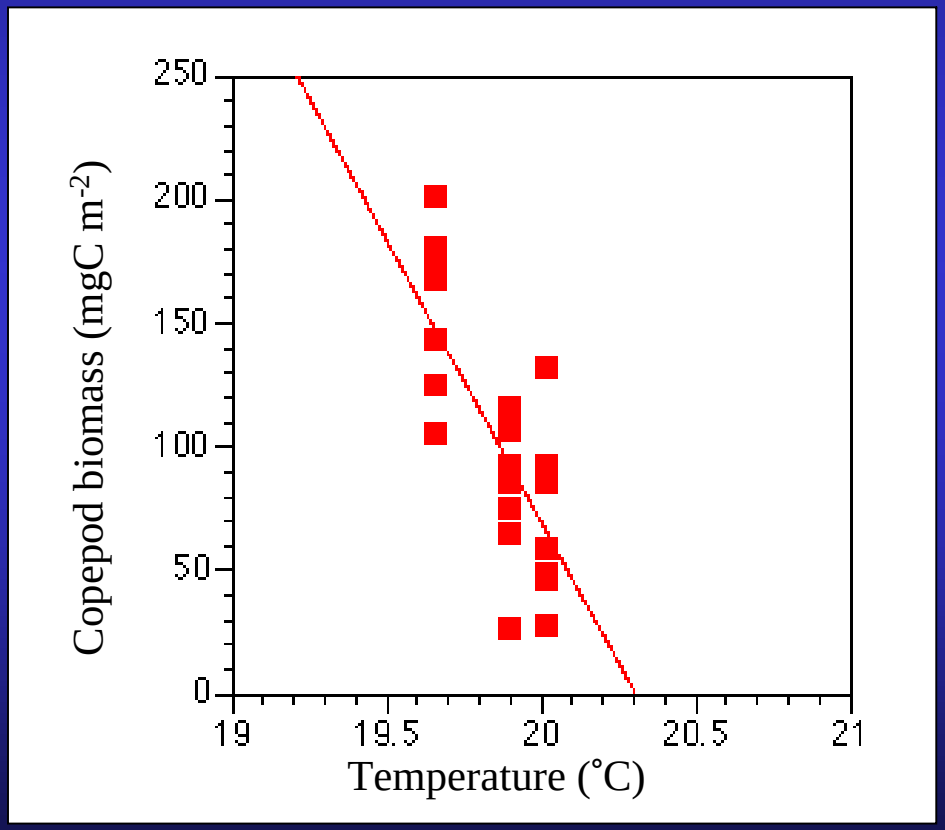


Biomass of small copepods in spring tended to decrease from 2002 to 2004.

Relationship between mean temperature in January and the small copepod biomass in May

$Y=4627.73 - 227.95X$

($r^2=0.538$, $p<0.0001$)



Conclusion

1. Characteristics of seasonal cycles of lower trophic level structures

*Phytoplankton biomass; small in summer, large in winter
------Nano & Pico-size phytoplankton
*Microzooplankton (+HNF); small in winter, large in spring
*Mesozooplankton biomass; small in summer
* In winter; Mesozooplankton > Microzooplankton (+HNF)
In other seasons; <

2. Interannual difference in temperature in the pelagic layer
-------large in winter to spring
winter temperature $\propto$ Spring biomass of small copepods