Phytoplankton chains at the Ushant tidal front using video fluorescence analysis: size and abundance variability

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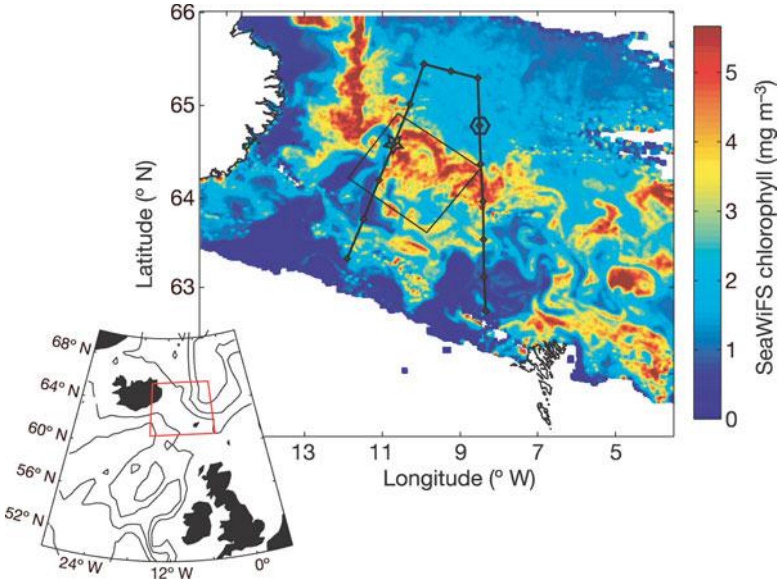
Postdoctoral fellow

18th June

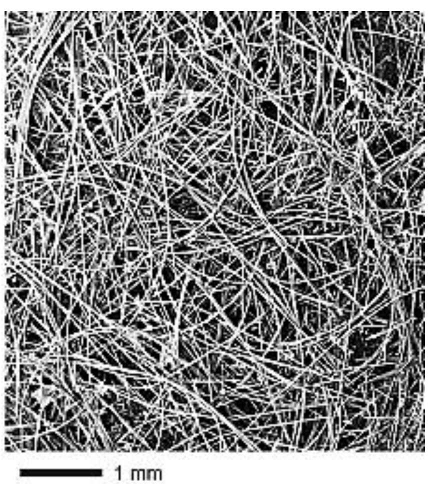
Statement of the problem

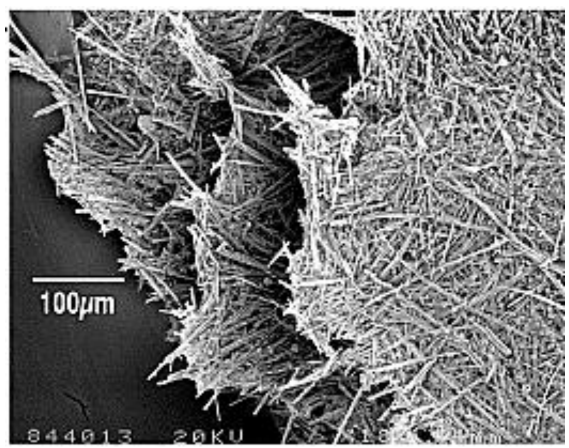


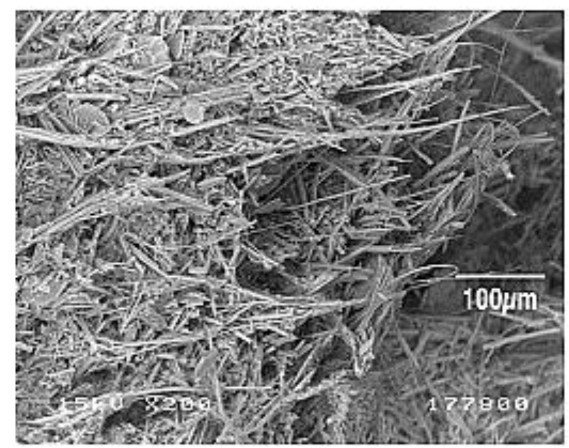
Phytoplankton chains (> 200 μm) are strongly uncommon.

Evidences of giant diatoms around fronts

Ancient sediments



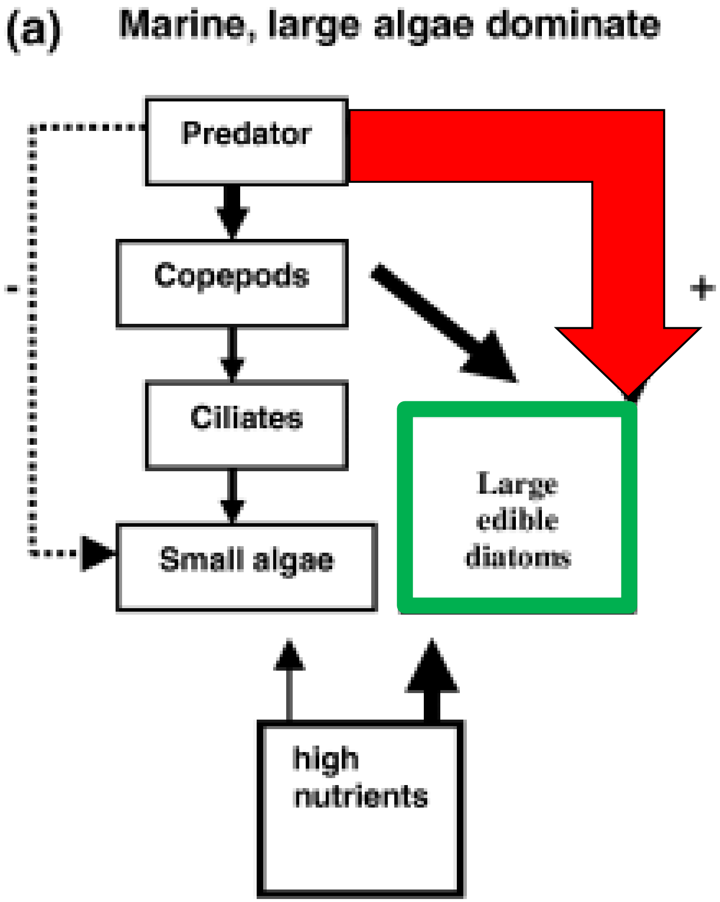




Allen *et al.*, Nature 2005

Kemp *et al.*, Global Biogeoch. Cycles 2006

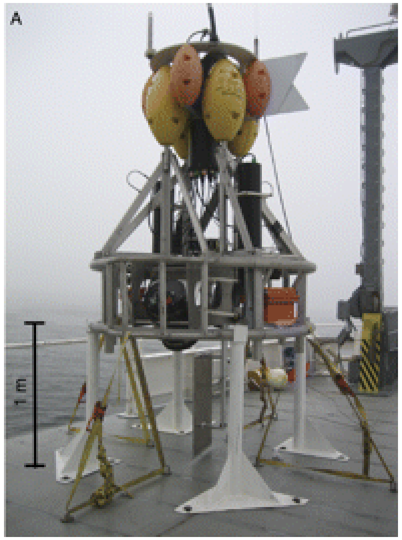
Statement of the problem



Stibor *et al.*, Ecol. Lett. 2004

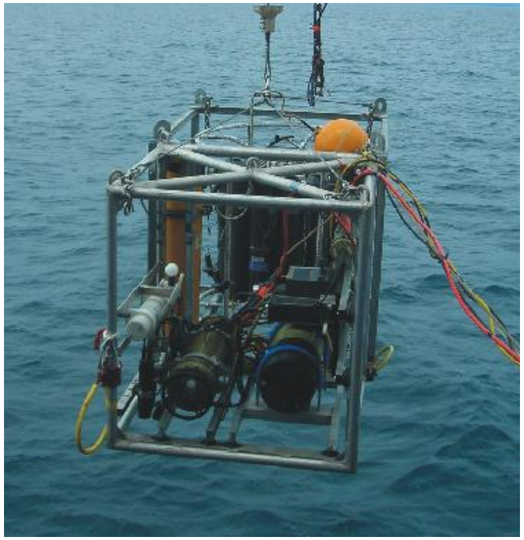
Video Fluorescence Analysis

FIDO-φ

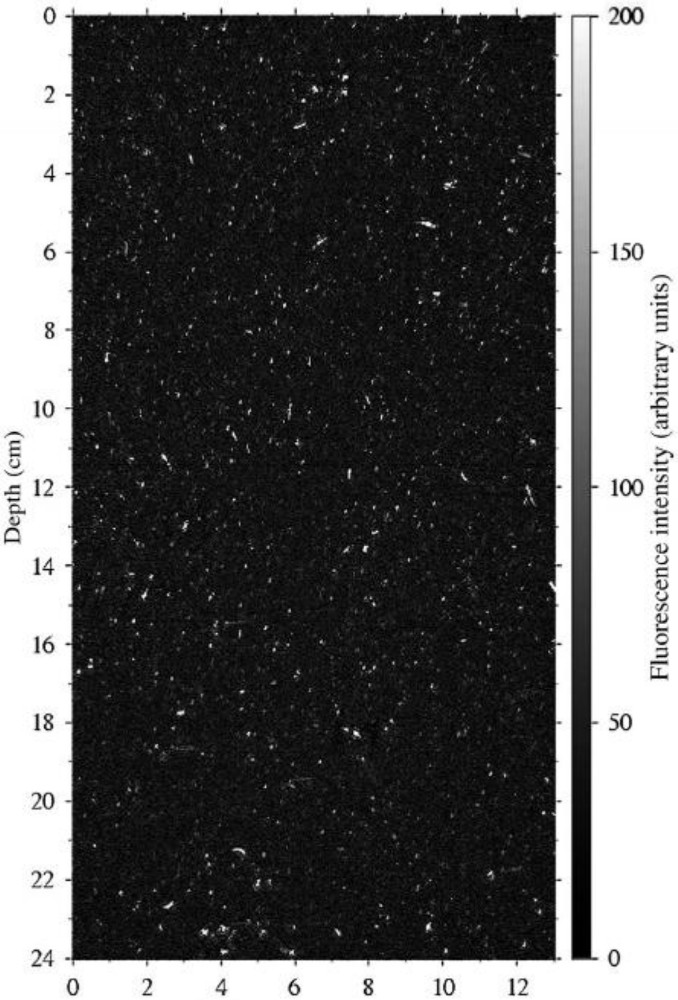


Franks and Jaffe, 2008

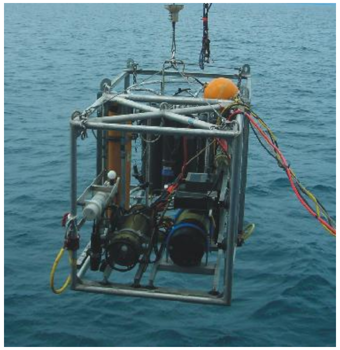
VFA

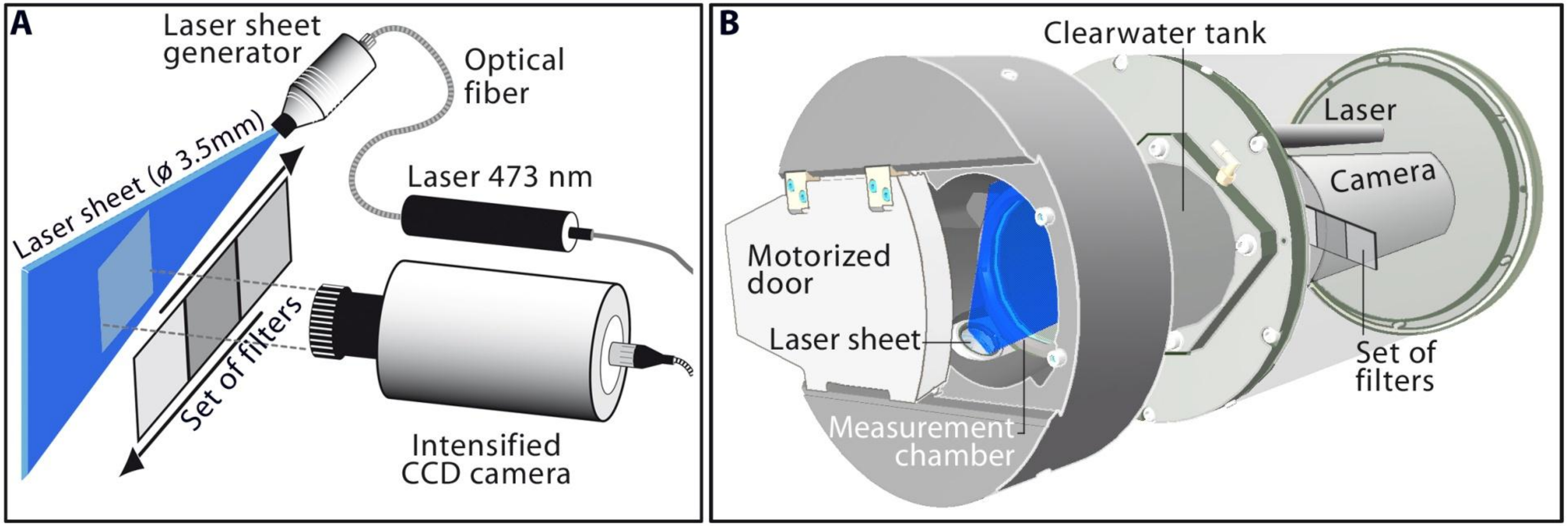


Lunven *et al.*, 2012



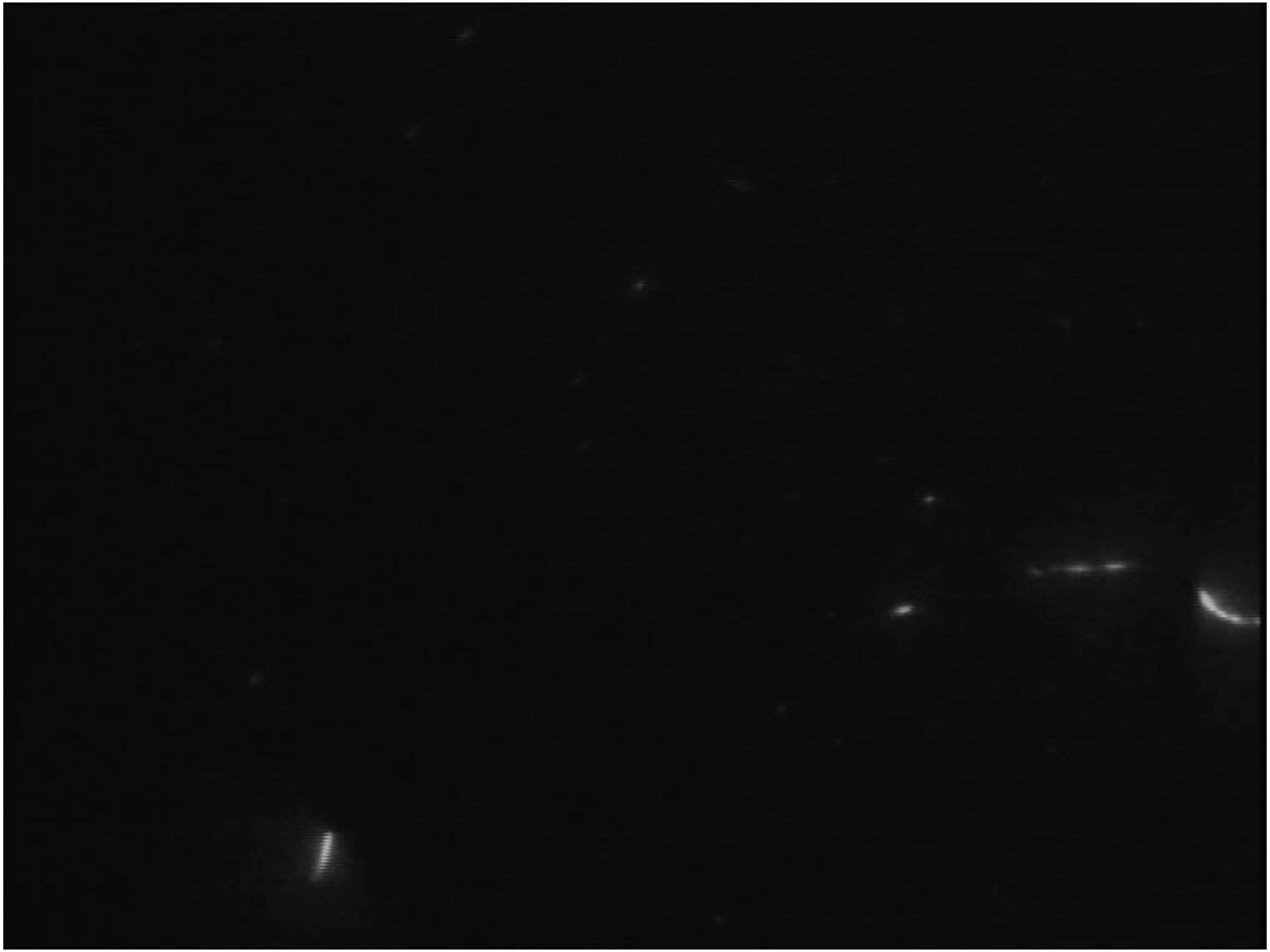
Video Fluorescence Analysis





Lunven *et al.*, Limnol. Ocean.: Meth. 2012

Video Fluorescence Analysis



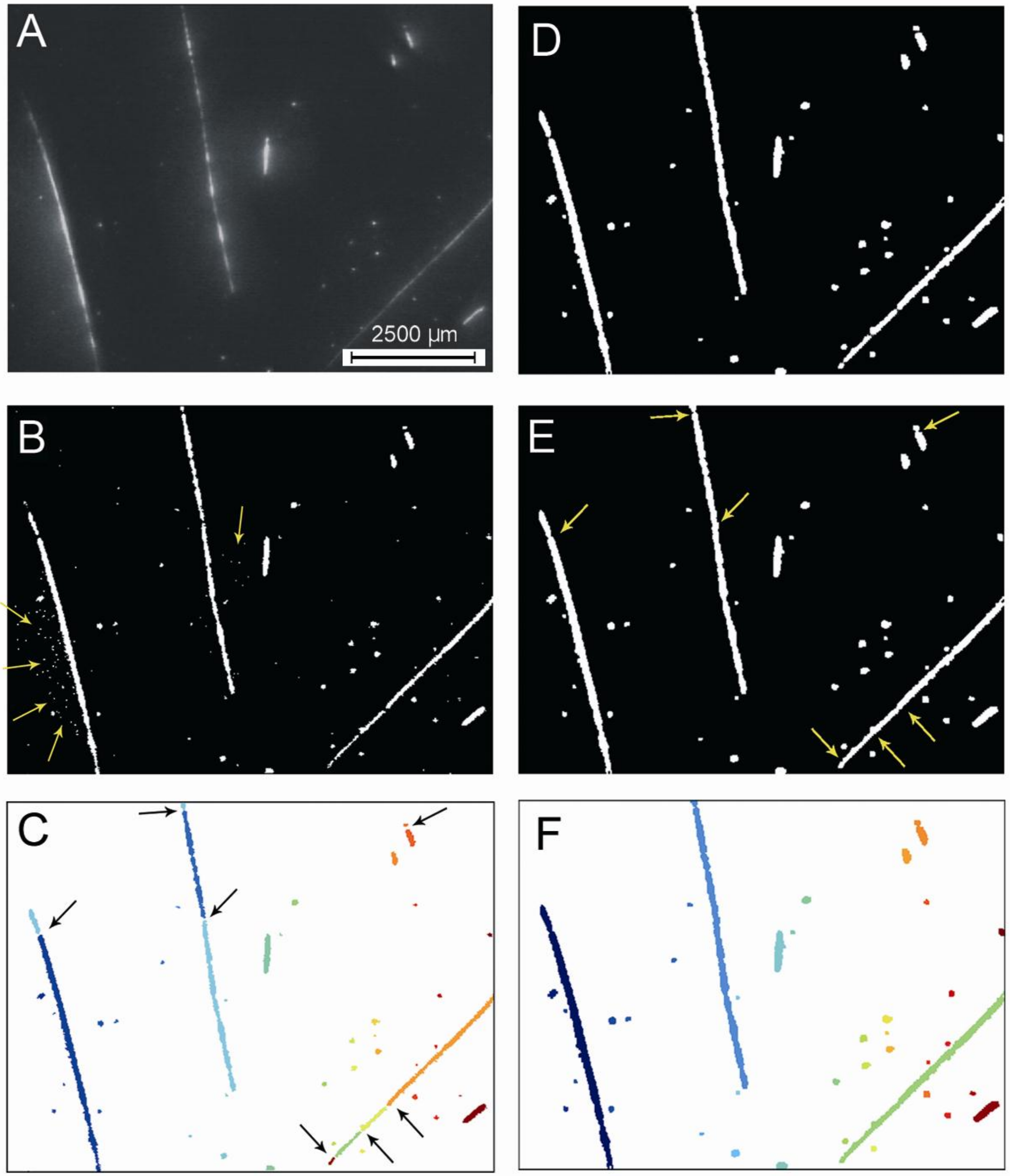
Lunven *et al.*, Limnol. Ocean.: Meth. 2012

Video Fluorescence Analysis

Image Processing:

- Subtract the background
- Binarization
- Remove the noise
- ***Bad*** *detection of chains*

<u>Chain reconstruction</u>:
- Dilatation
- Bridge proxy pixels
- ***Good*** *detection of Chains !!!*



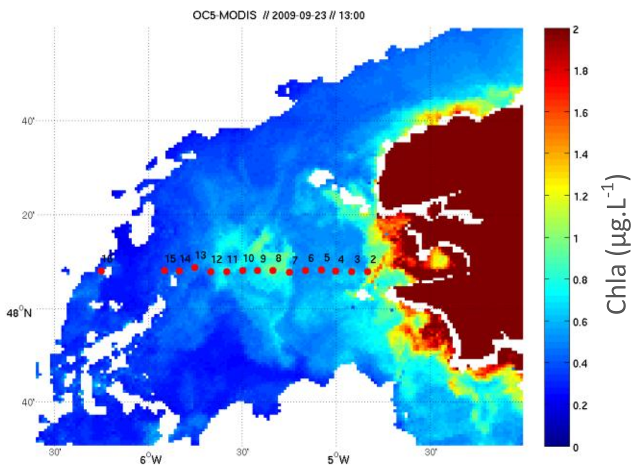
Lunven *et al.*, Limnol. Ocean.: Meth. 2012

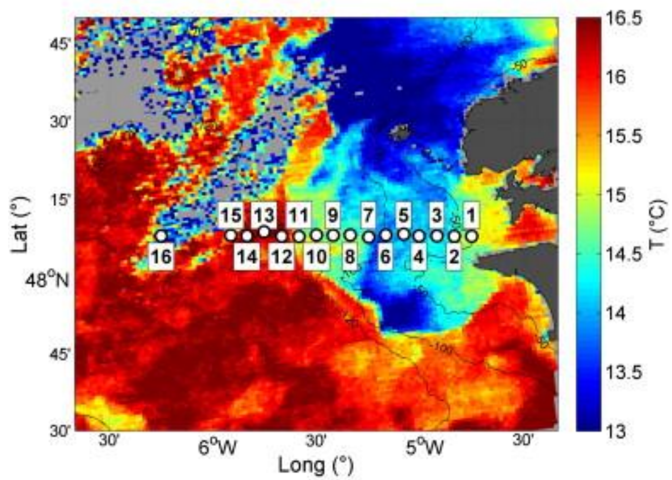
Objectives

- ✓ To study the community of phytoplankton chains in the Ushant tidal front.
- ✓ To assess the variability in abundance and size structure of the large chains, associated with spring–neap tidal cycle.
- ✓ How does the turbulence-nutrient dynamic control the observed pattern?

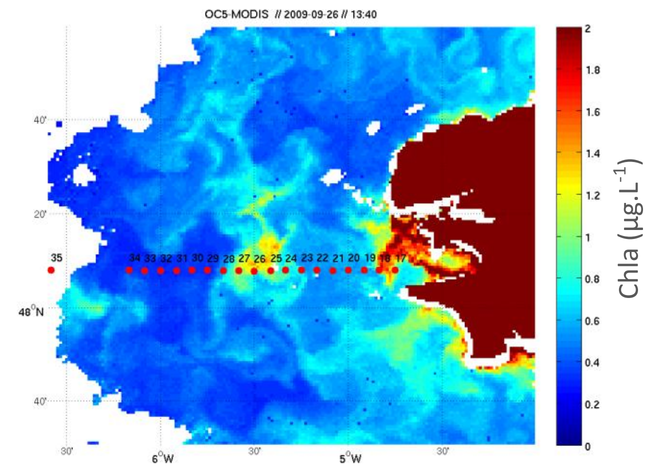
FroMVar cruise

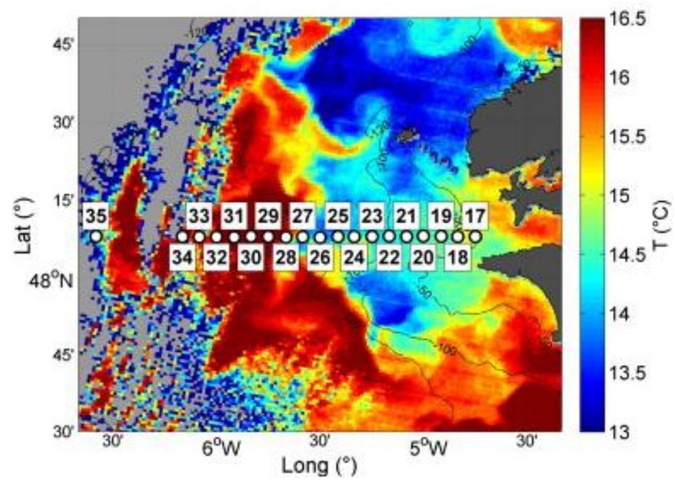
Spring tide



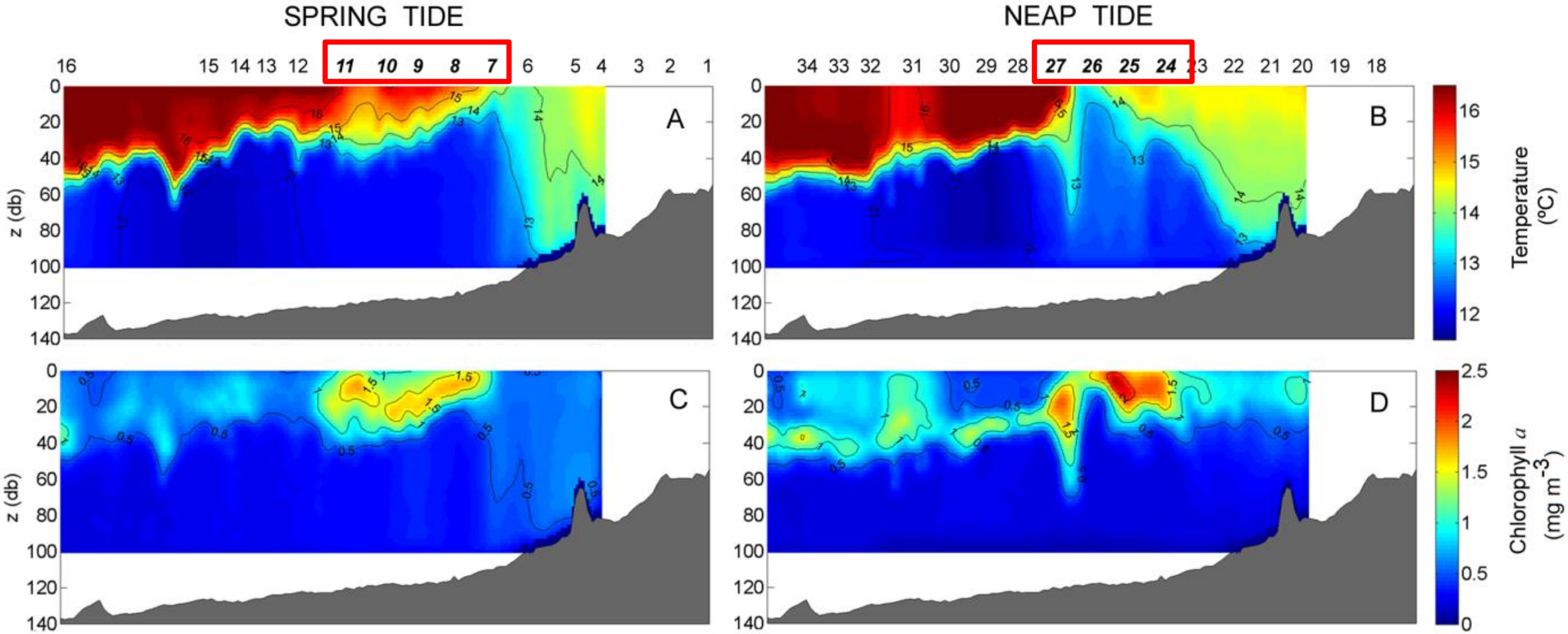


Neap tide

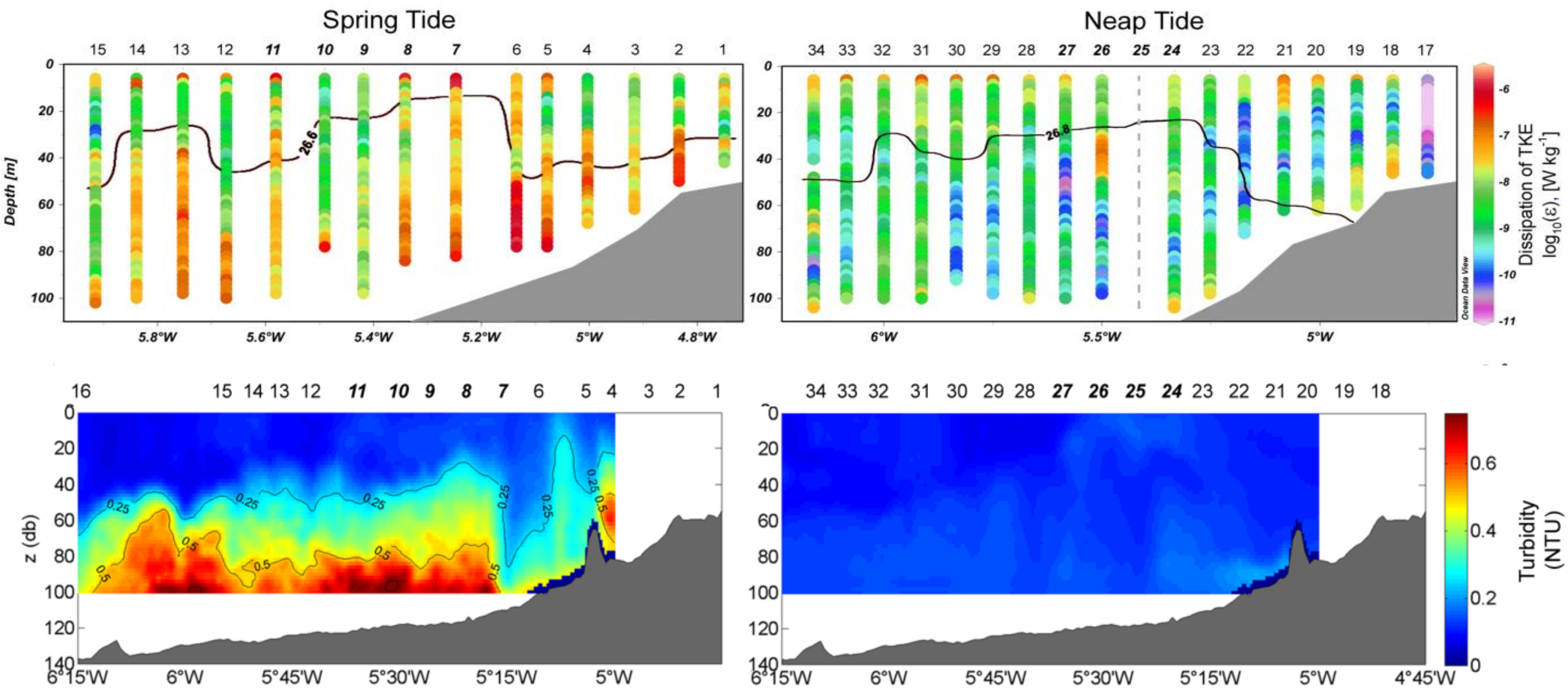




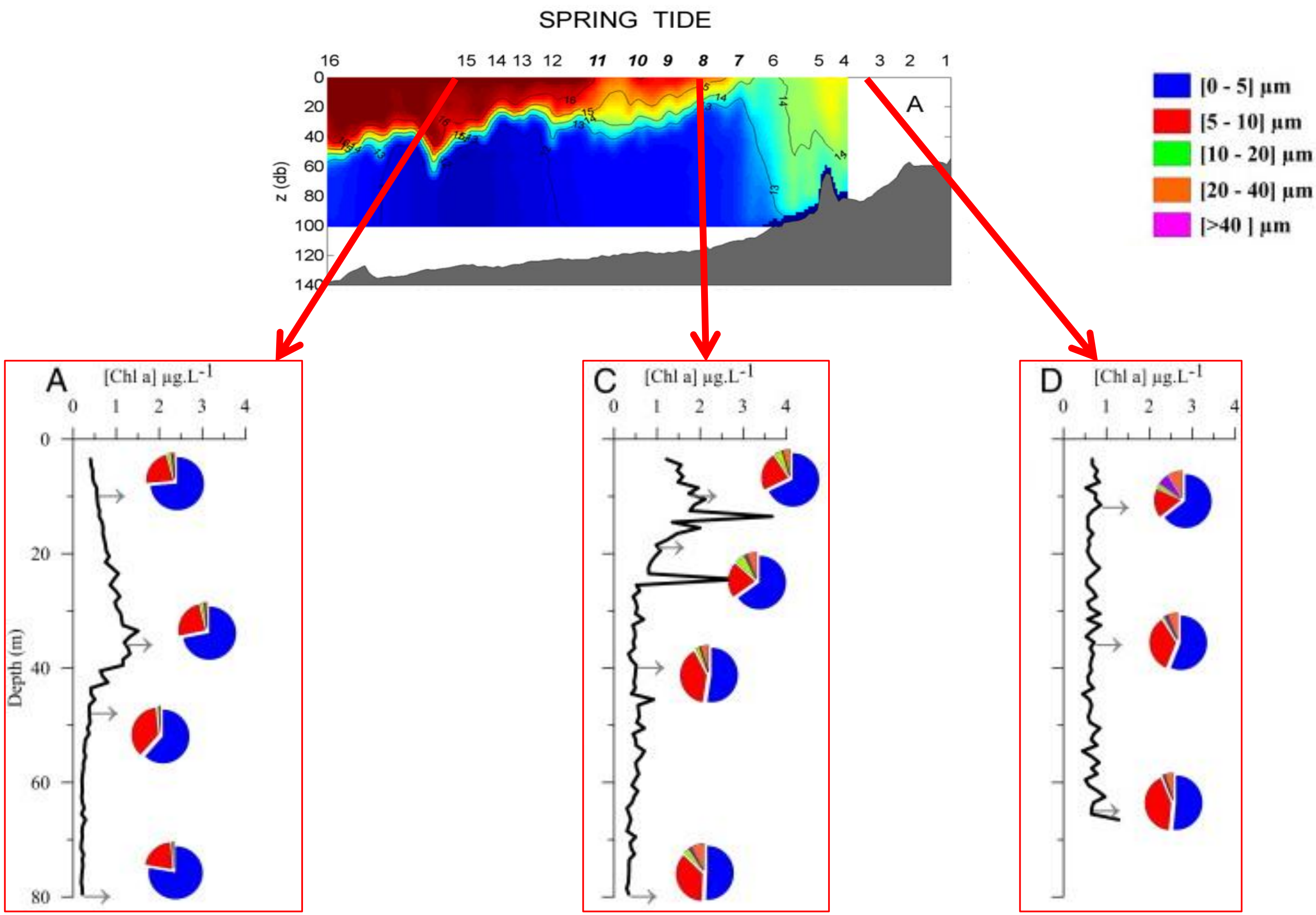
Environmental conditions



Environmental conditions



Preliminary results: size structure



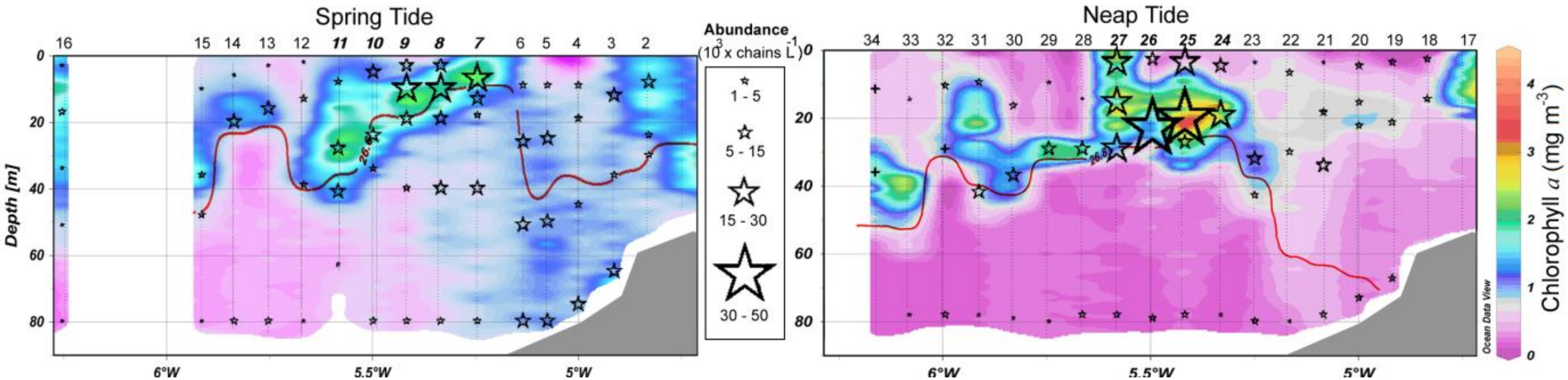
Schultes *et al*., J. Mar. Syst. 2012

Chain-forming species

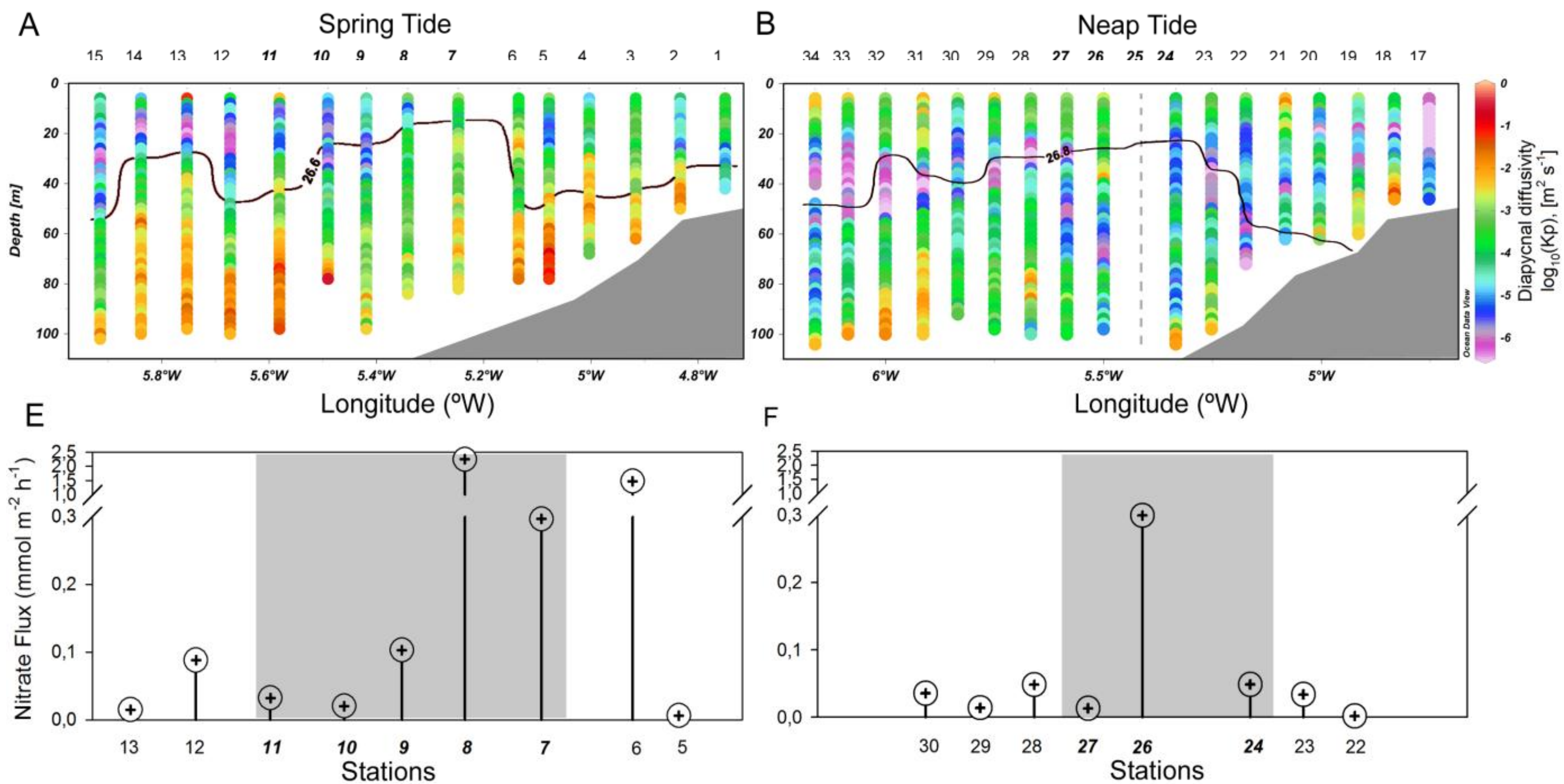
Abundance (10^3 x cells L^{-1} ± SD)

	Mixed	**Frontal**	Stratified
***Pseudonitzschia* sp.**	15.4 ± 17.4	60.0 ± 49.3	7.2 ± 6.8
***Guinardia* sp.**	16.1 ± 16.6	13.6 ± 14.8	2.6 ± 3.6
Leptocylindrus sp.	7.7 ± 9.6	10.2 ± 7.7	3.3 ± 4.8
Thalassiosira sp.	2.7 ± 3.3	1.4 ± 2.1	1.5 ± 2.3
Chaetoceros sp.	0.9 ± 0.9	2.1 ± 2.7	-
Rhizosolenia sp.	0.3 ± 0.4	0.7 ± 1.1	0.1 ± 0.1
Skeletonema sp.	0.1 ± 0.4	-	-
Total	43.4 ± 39.6	80.0 ± 90.0	14.7 ± 27.2

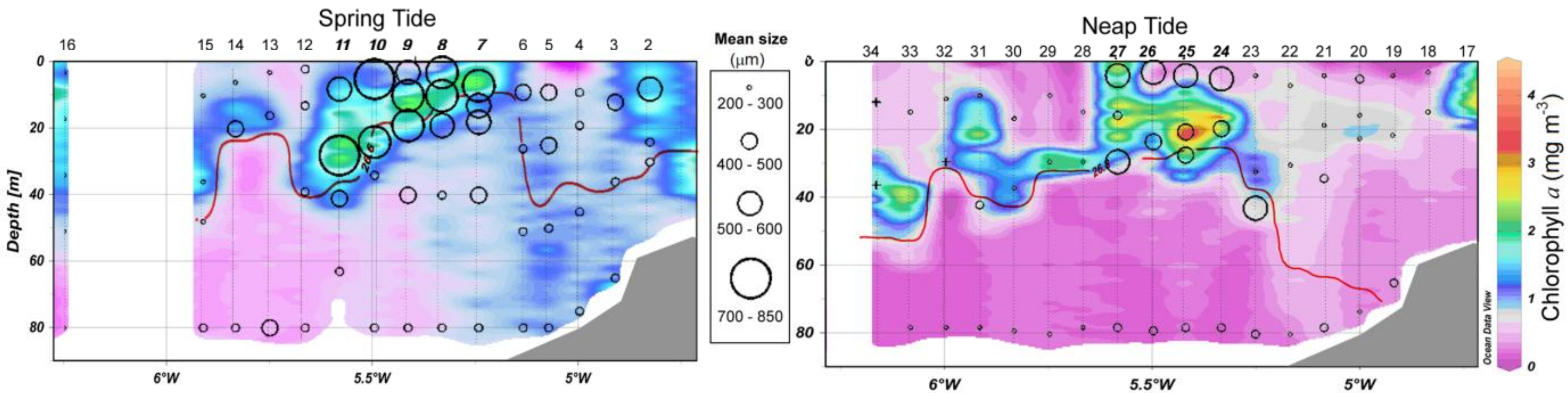
Chains [abundance]



Vertical diffusion of nitrate

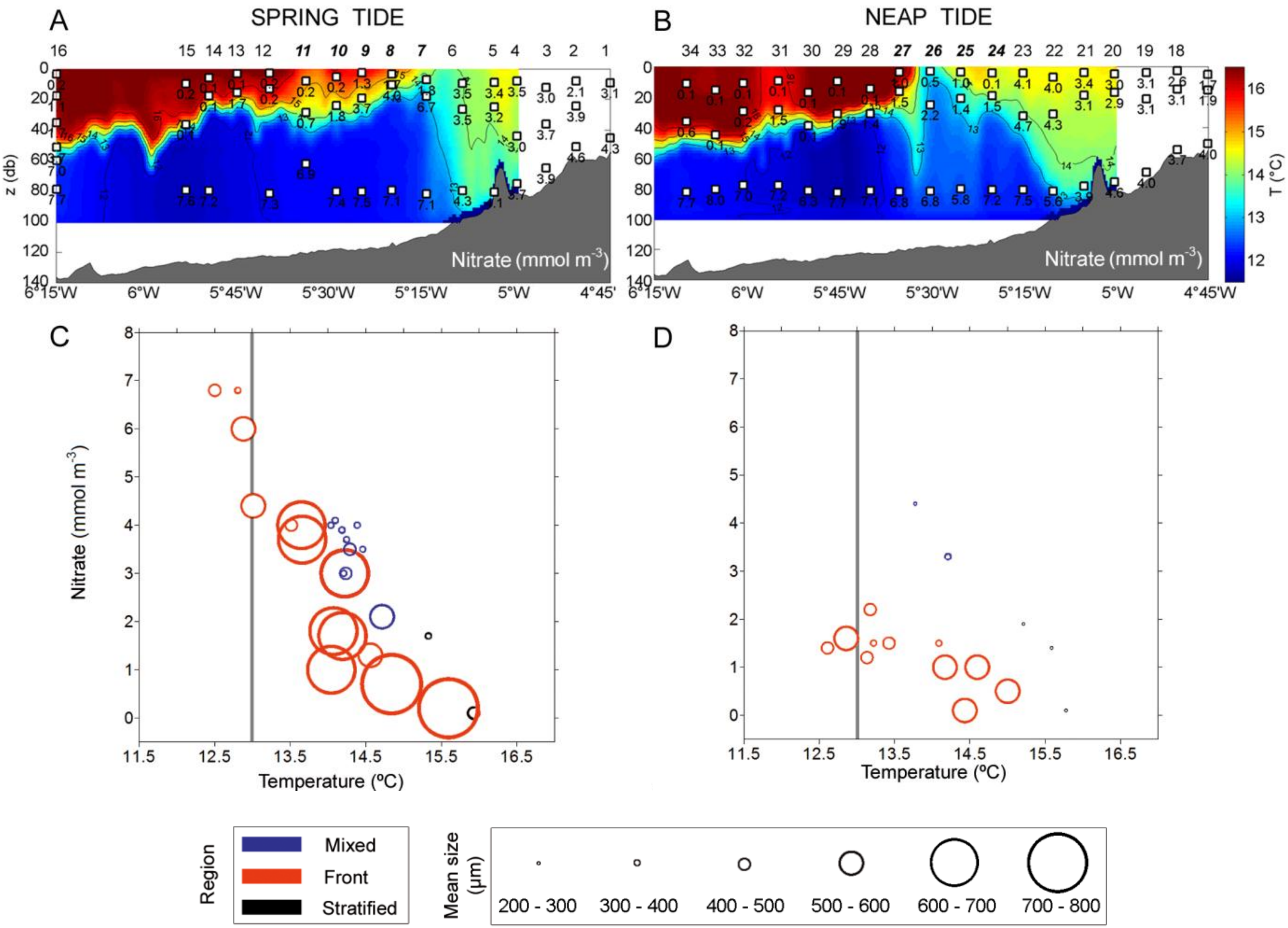


Chains [size]

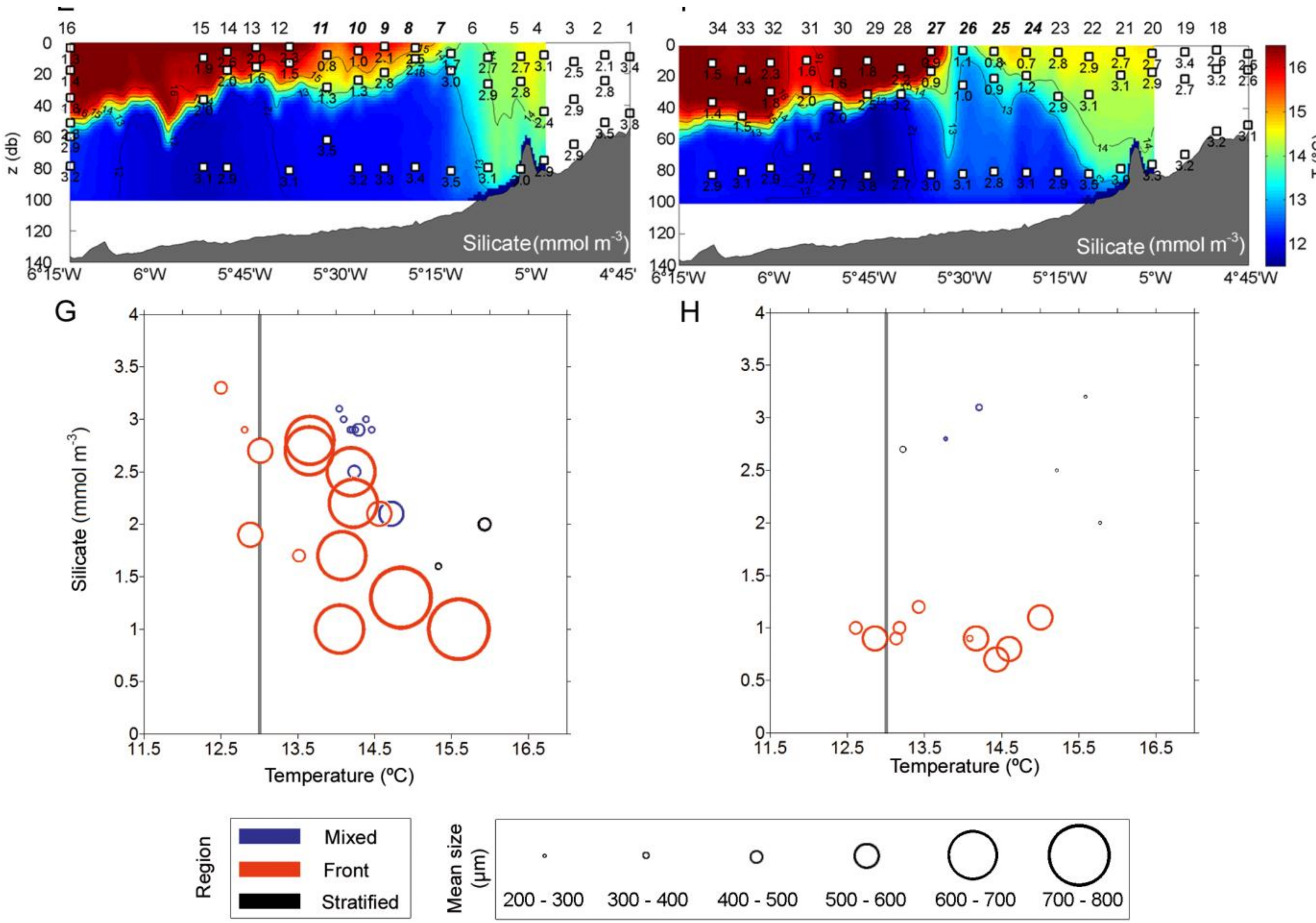


Spring Tide
Neap Tide
16 15 14 13 12 11 10 9 8 7 6 5 4 3 2
34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17
Depth [m]
Mean size (µm)
200 - 300
400 - 500
500 - 600
700 - 850
6°W
5.5°W
5°W
Chlorophyll a (mg m-3)
Ocean Data View

Nitrate – chain length

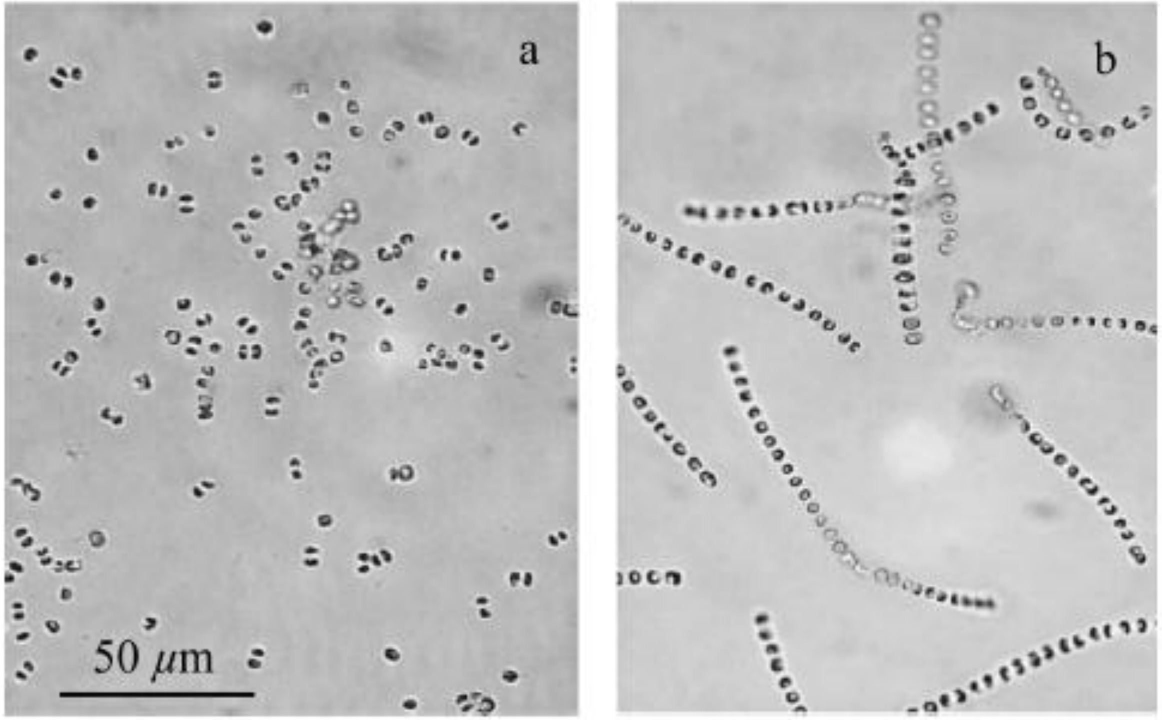


Silicate – chain length



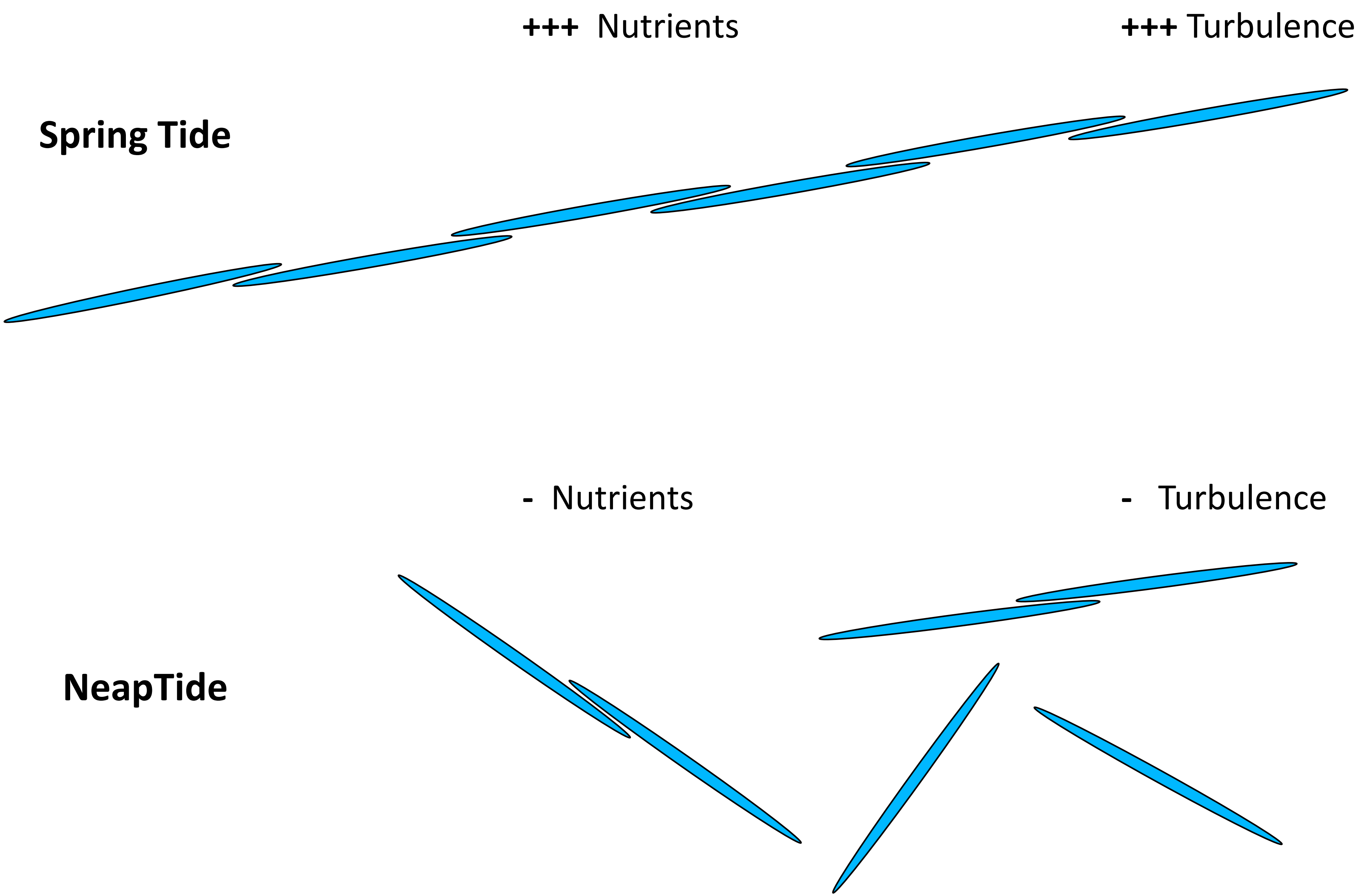
Size Plasticity

Depleted **High Nutrients**



Takabayashi et al., J. Plannkton Res. 2006
Smayda et al., Limnol. Oceanogr. 1966

Chain pattern around the front



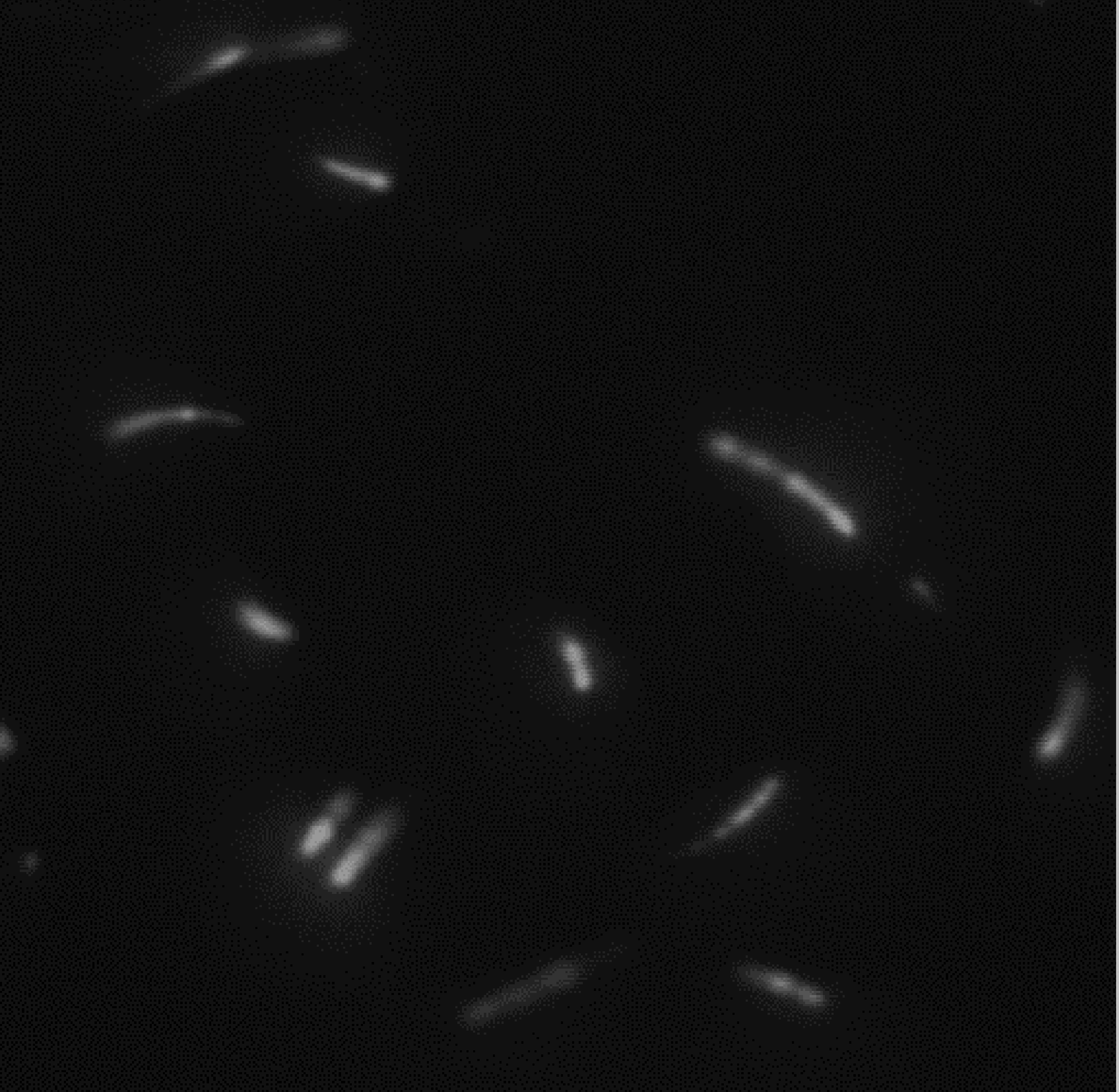
Conclusions

✓ Large diatom chains are more common than previously thought in marine environments.

✓ Diapycnal fluxes of nitrate across the pycnocline enable the maintenance of the diatom bloom in the frontal area throughout the spring/neap tidal cycle.

✓ Under nutrient depleted conditions the chains become disadvantageous, and they beak up in to shorter sizes.

Thank you!



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