Response of genetic diversity levels of early life-stage *Fucus vesiculosus* on two climate change parameters

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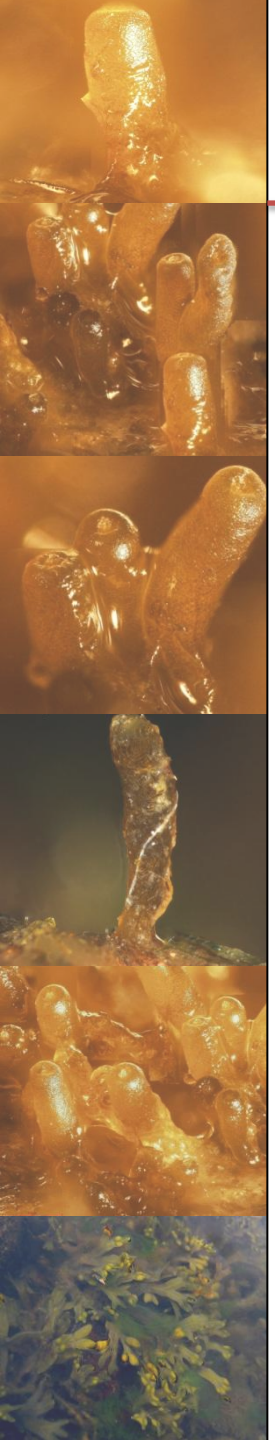
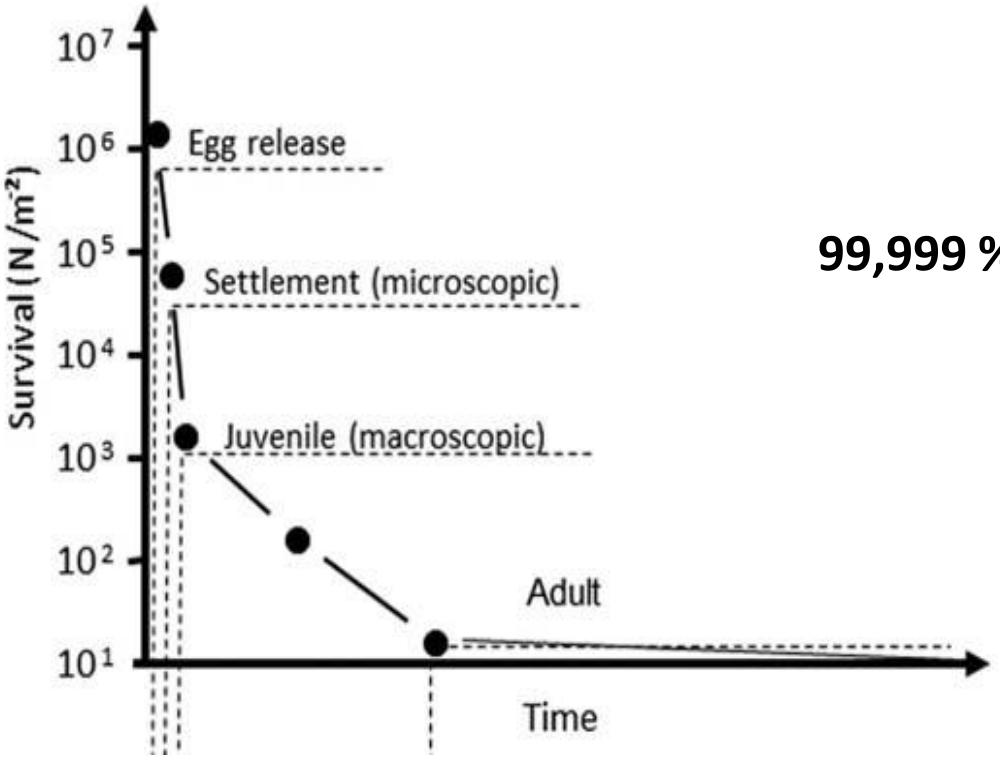


High mortality under young fucoid life-stages

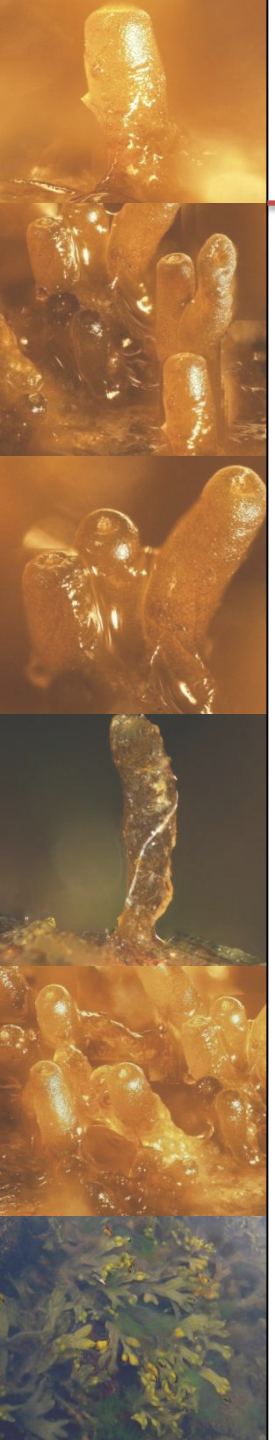
Fucus germlings most susceptible to environmental stress

Using mortality analysis: a good tool to examine for directed selection.



99,999 % Mortality

Wahl et al. 2011



Genetic diversity

Baltic Sea < Atlantic

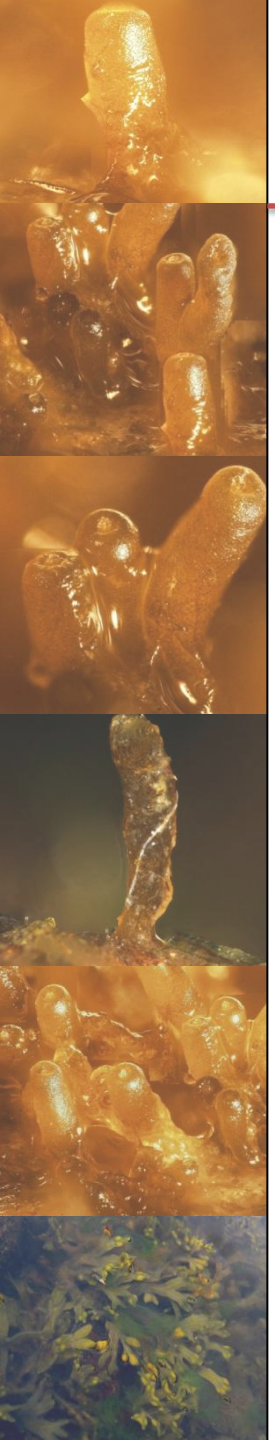
(Johanneson 2006)

Confers potential for adaptation through selection

Allows for resilience and ecosystem services

Hypothesis:
Populations of high genetic diversity perform better on environmental stress.

Genetic diversity level exposed to climate change

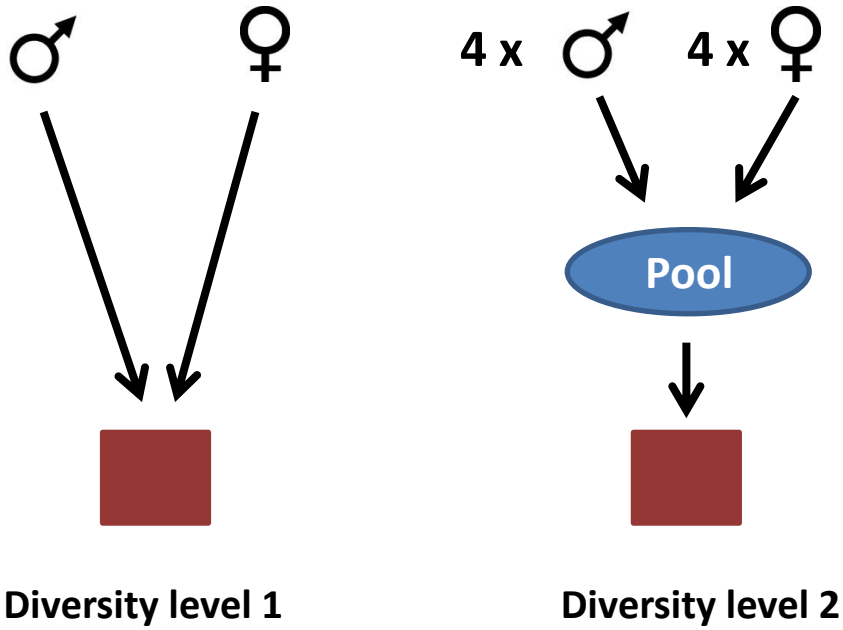


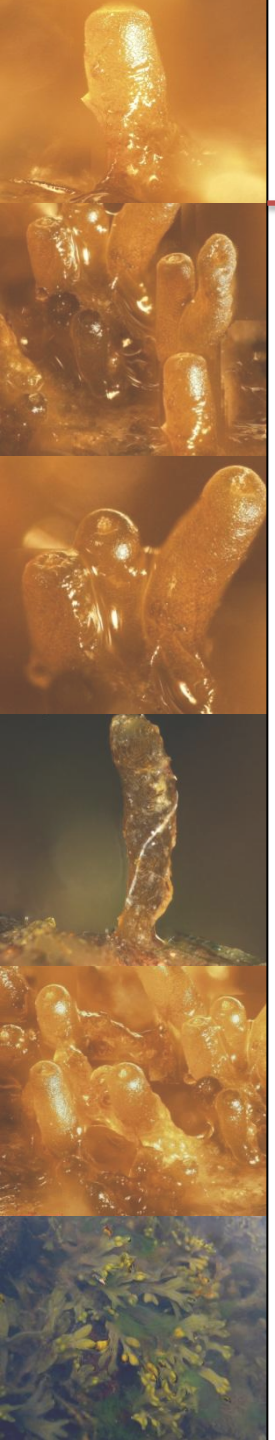
Settlement of germlings

Highly mature adult *Fucus* were collected.

Release of gametes was induced.

Settling of germlings on limestones cubes: edge length 2 cm.





Experimental design

Two diversity levels of Fucus germlings

Low diversity level: offsprings of 1 parental pair each

1x1	2x2	3x3	4x4	5x5	6x6	7x7	8x8

versus

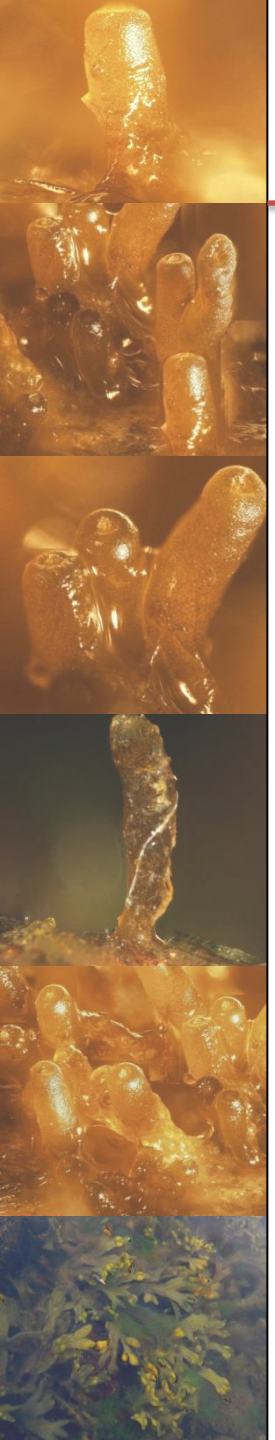
High diversity level: pool of 4 parental pair‘s offspring

1x1	1x2	1x3	1x4
2x1	2x2	2x3	2x4
3x1	3x2	3x3	3x4
4x1	4x2	4x3	4x4

16 possible combinations

5x6	5x7	5x8	5x9
6x5	6x6	6x7	6x8
7x5	7x6	7x7	7x8
8x5	8x6	8x7	8x8

16 possible combinations



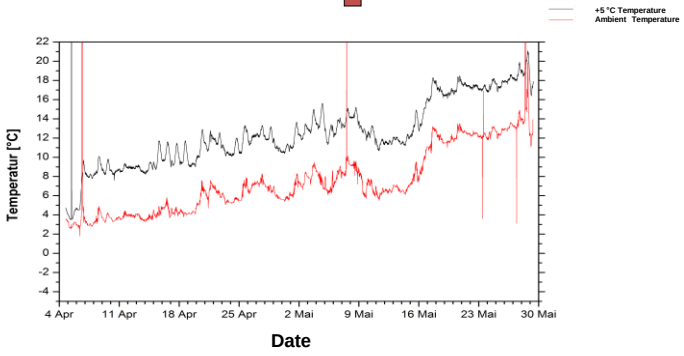
BIOACID
Biological Impacts of Ocean ACIDification

Kiel Benthocosms

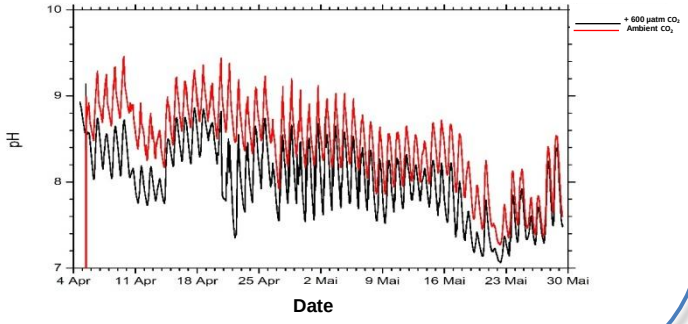
Benthic Consortium

Delta Treatment

Temperature ↑ 5°C



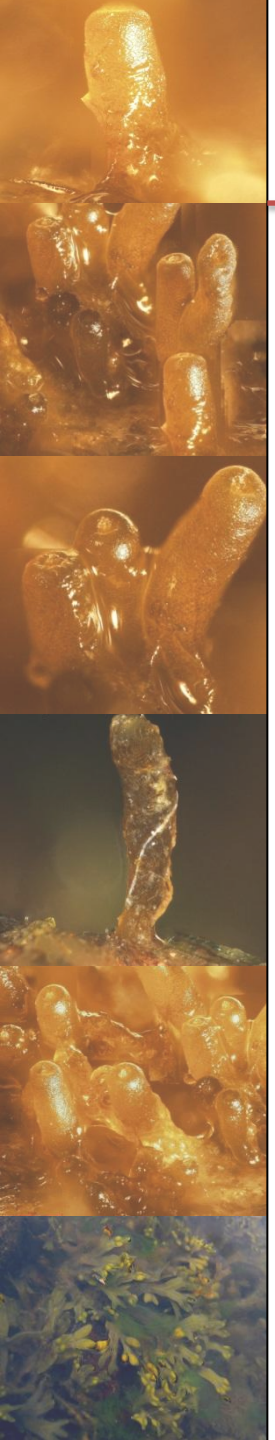
pCO_2 ↑ 600 µatm

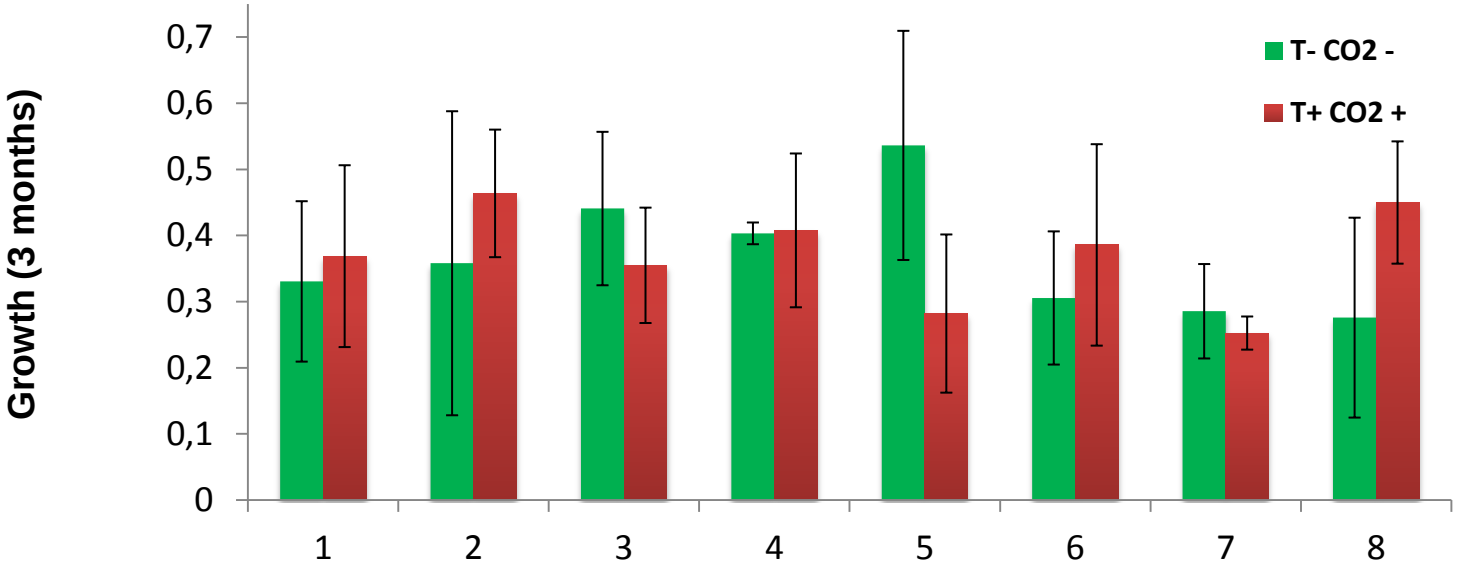


Phenotypic traits were analysed in different seasons.

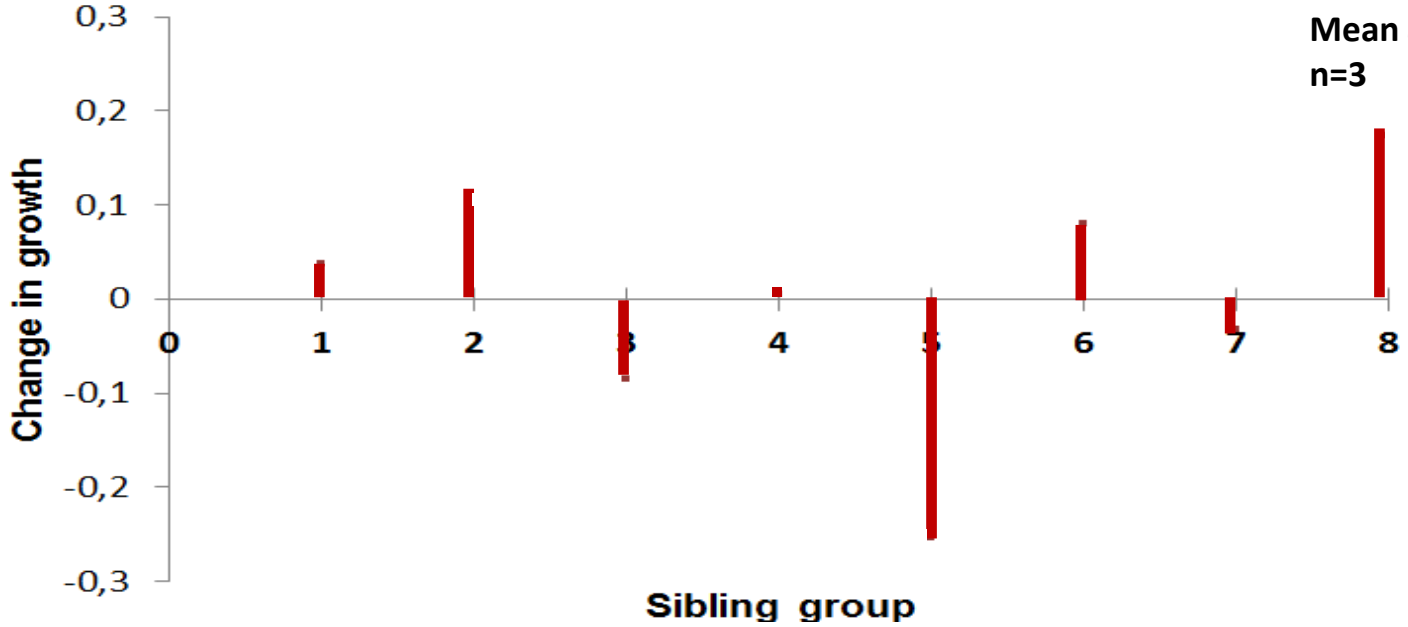
8 separate sibling groups ***vs*** **2 pools of high diversity**

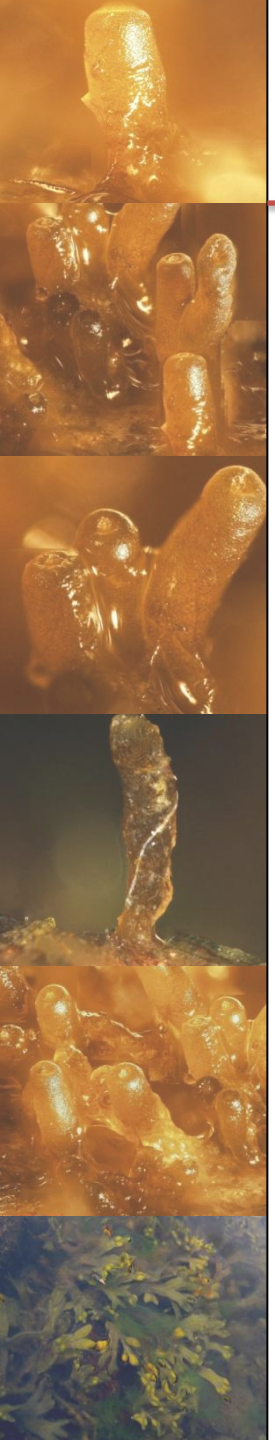
Growth of germlings - early summer



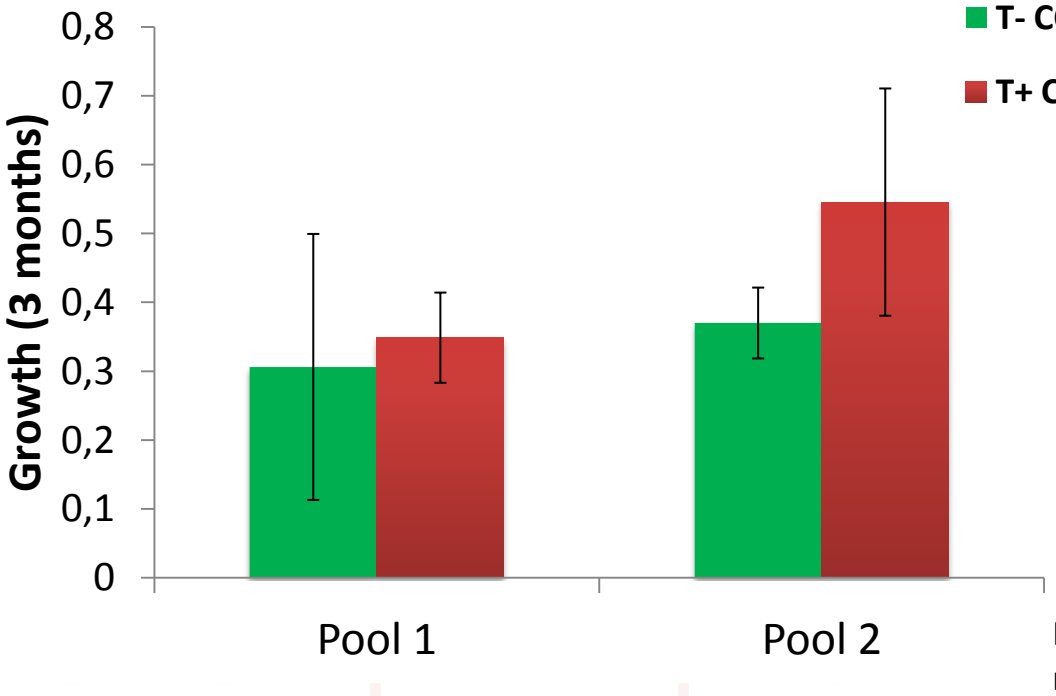


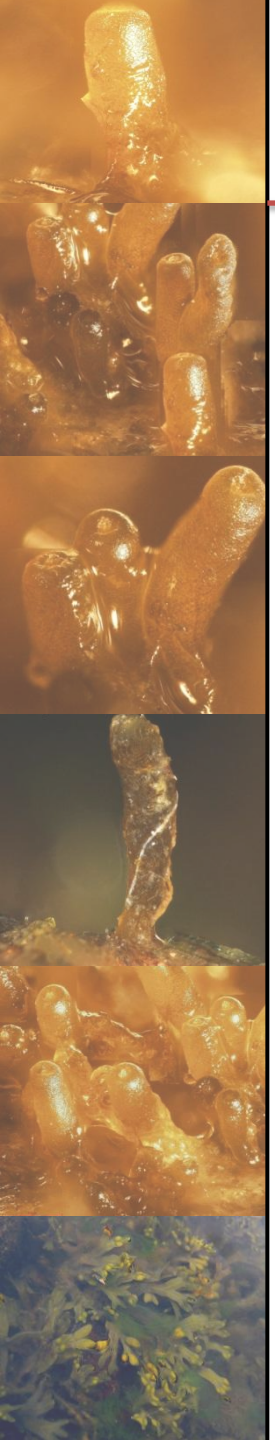
Mean and ± SD
n=3



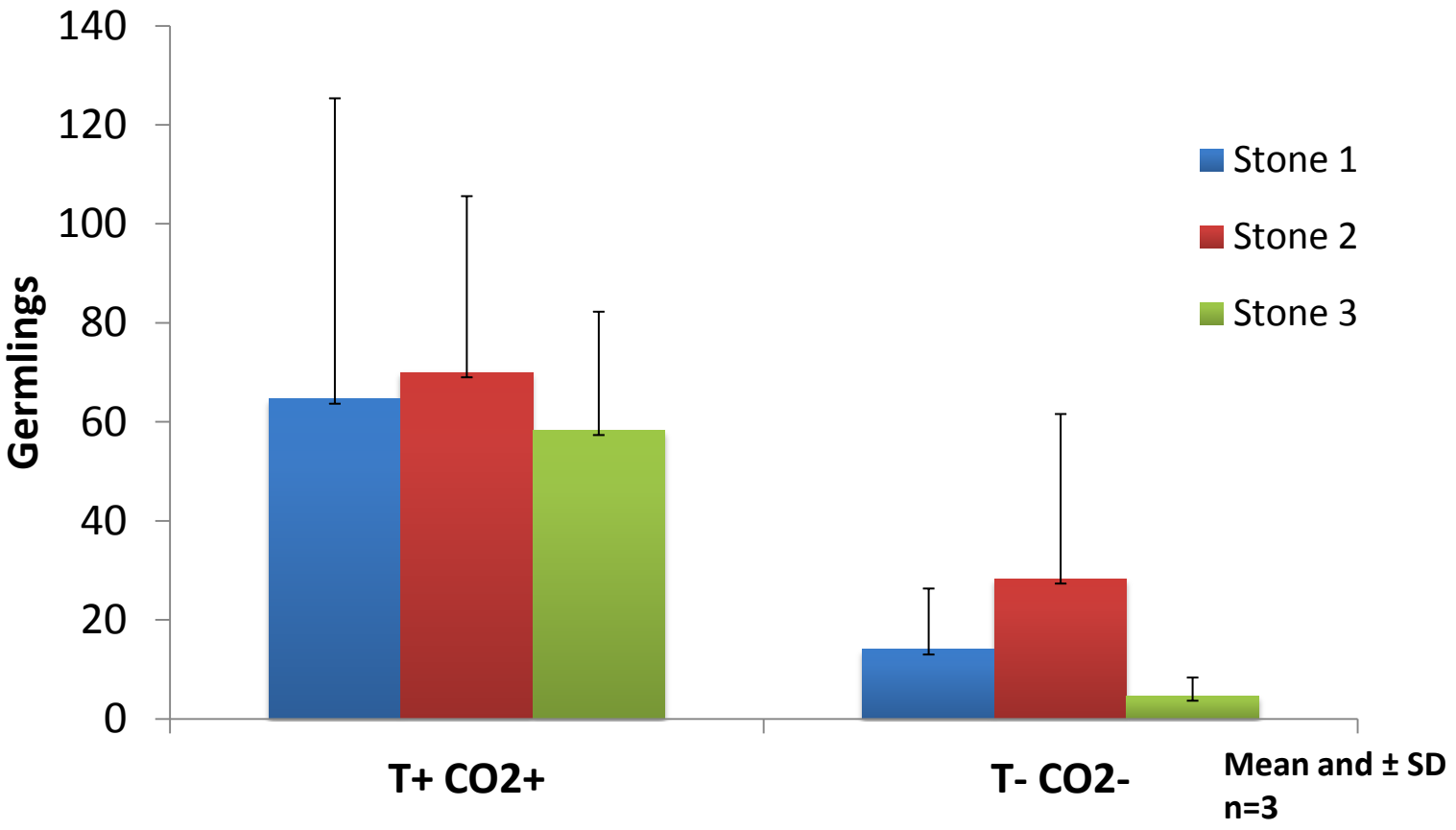


Growth of germlings - early summer



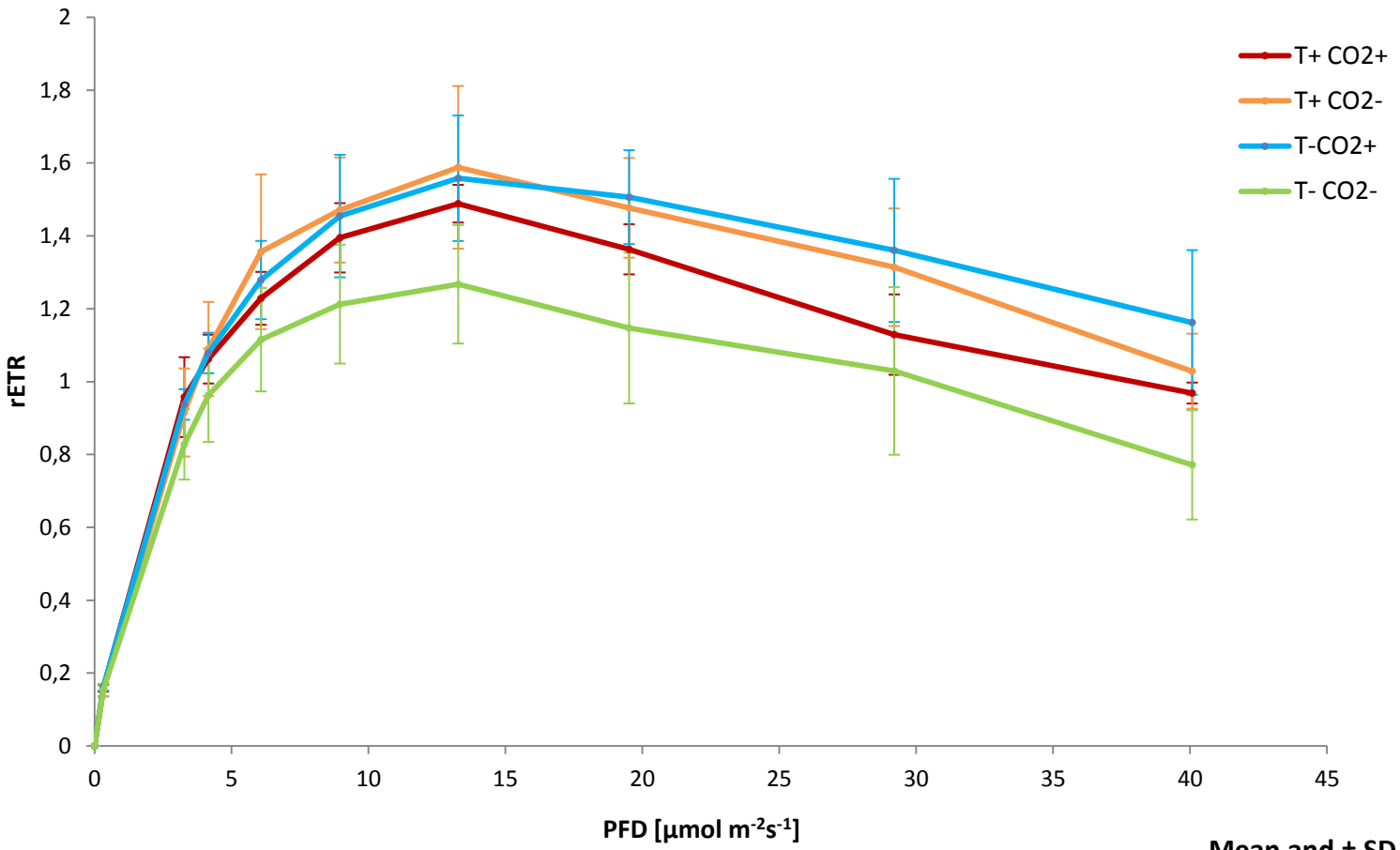


Settlement success of *Fucus* germlings



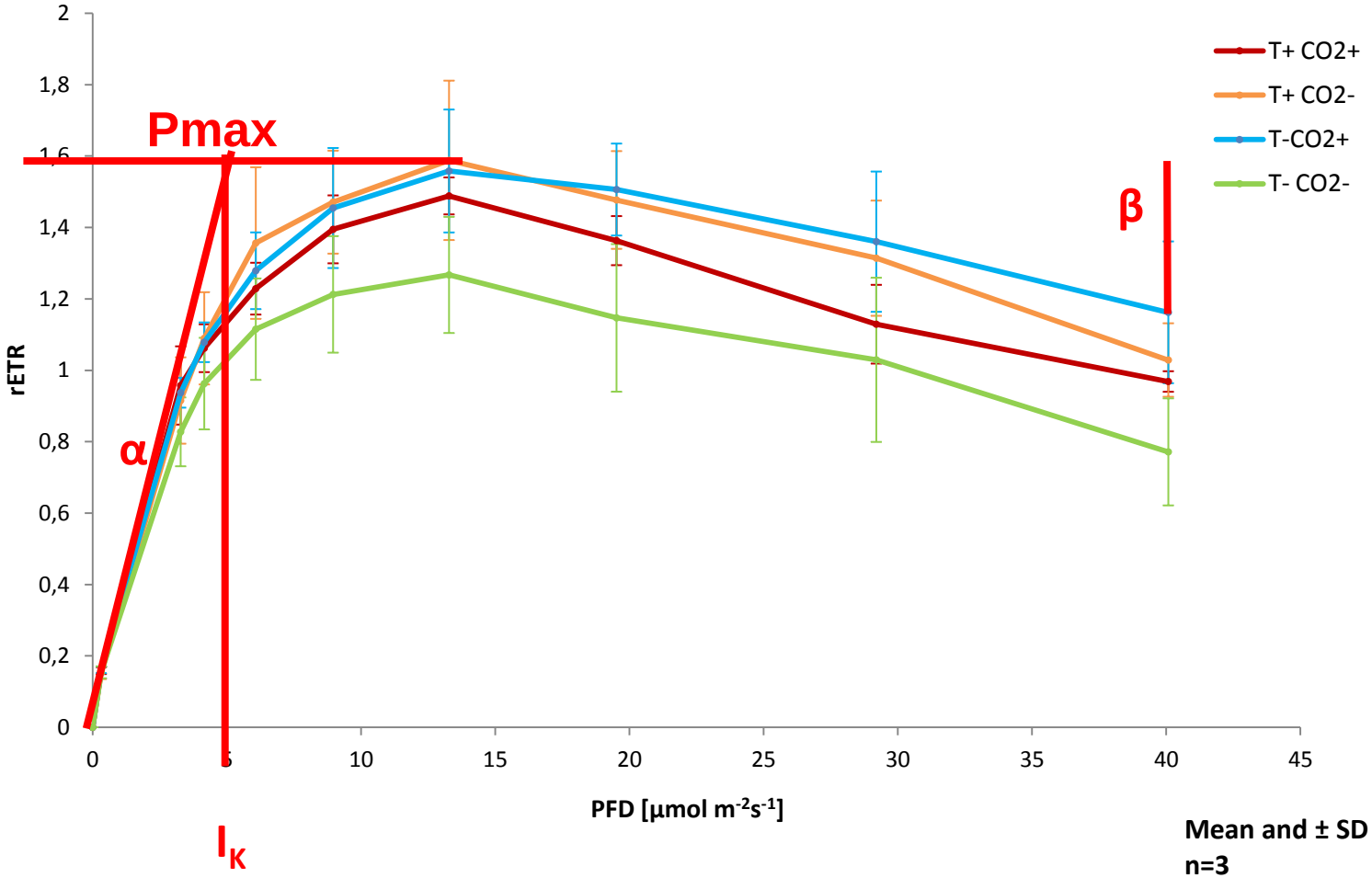
Higher temperature: higher germlings' new settlement (p-value < 0,001)

Light curves under climate change conditions



Mean and ± SD
n=3

Light curves under climate change conditions



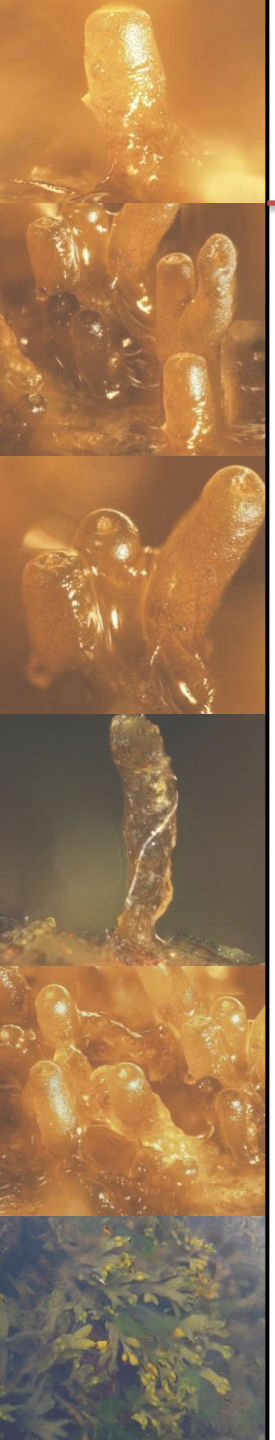
Mean and ± SD
n=3

Pmax Maximum ETR

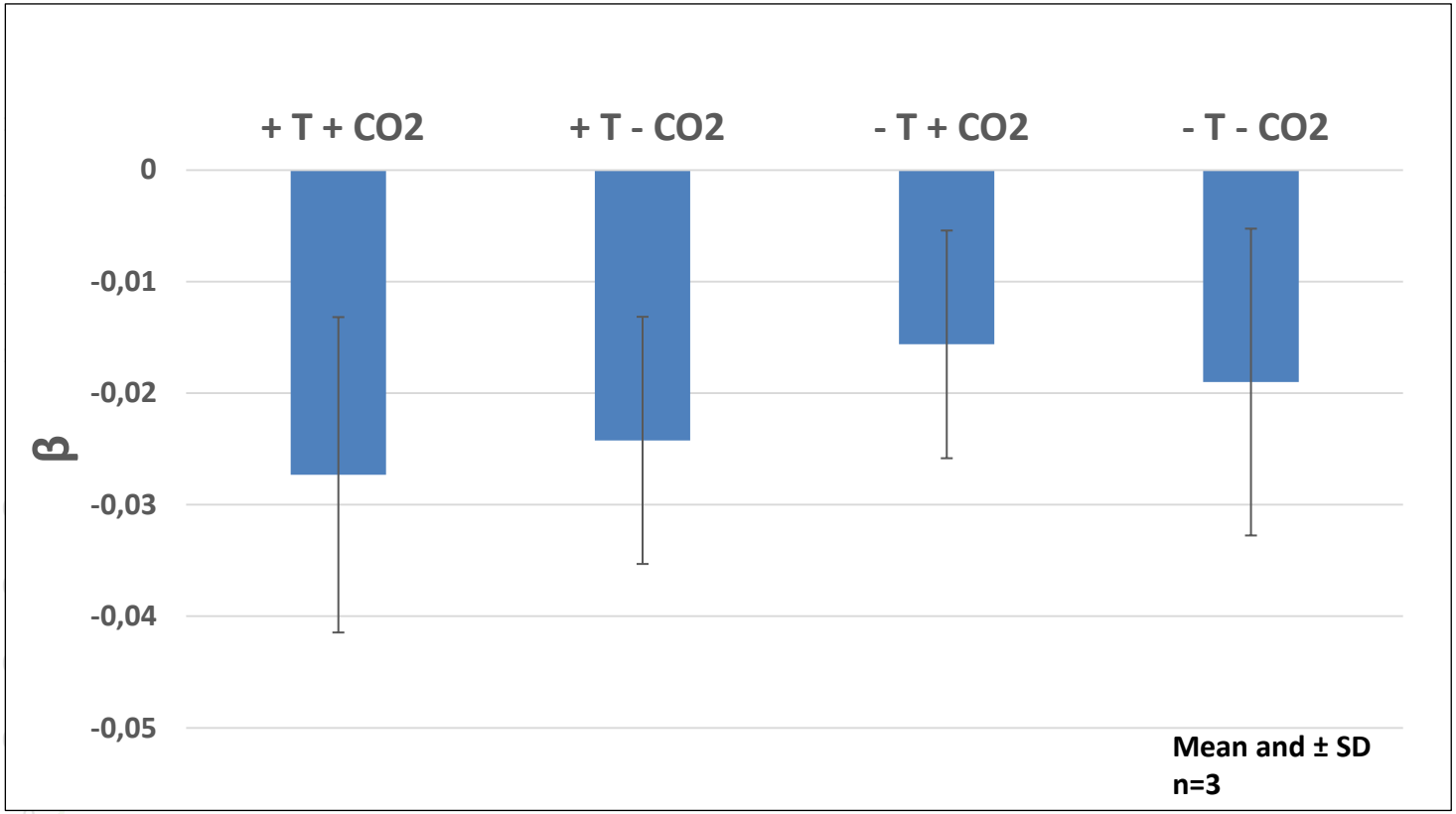
Ik Saturation intensity

α Initial slope

β photoinhibition constant



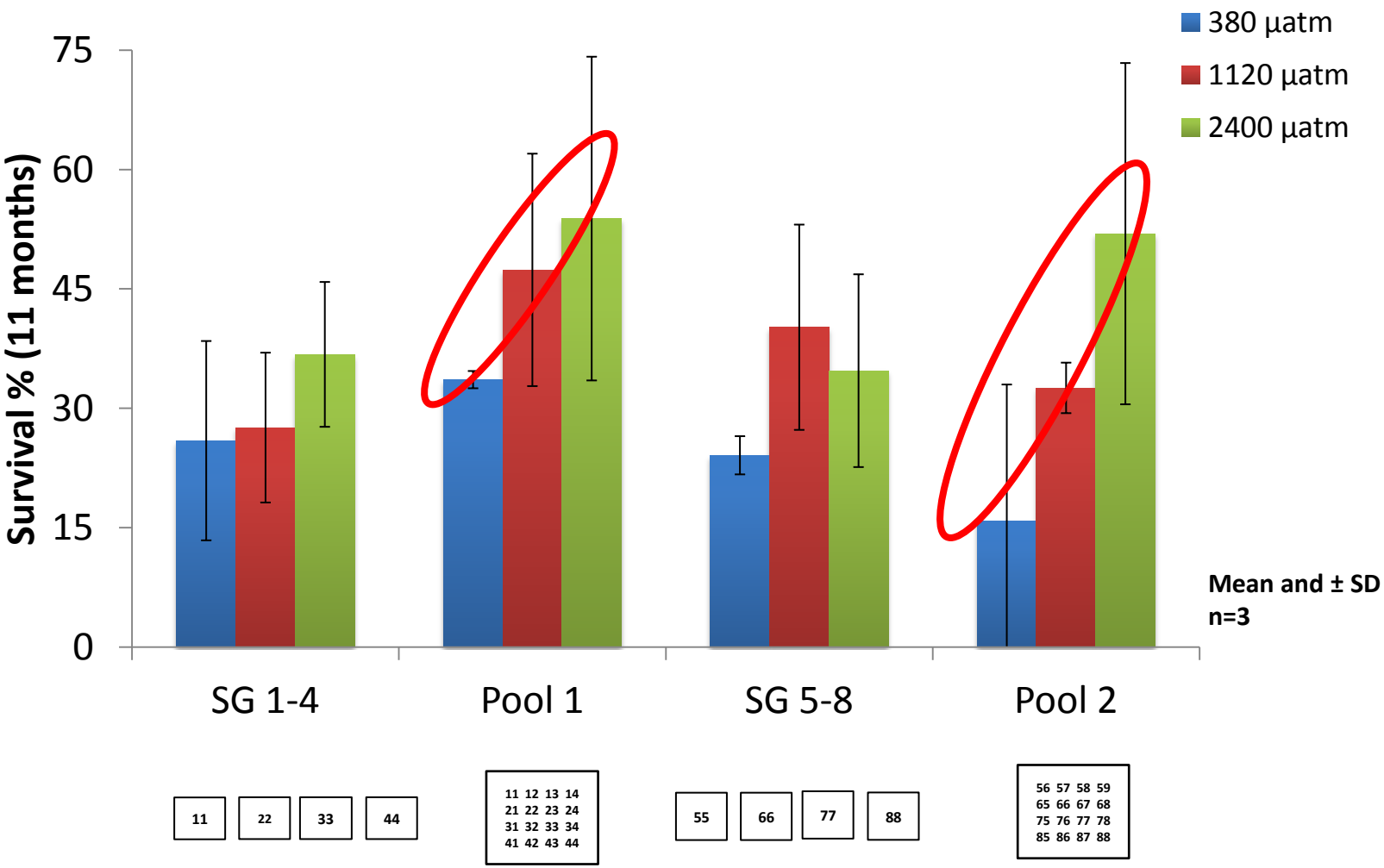
Photoinhibition constant β



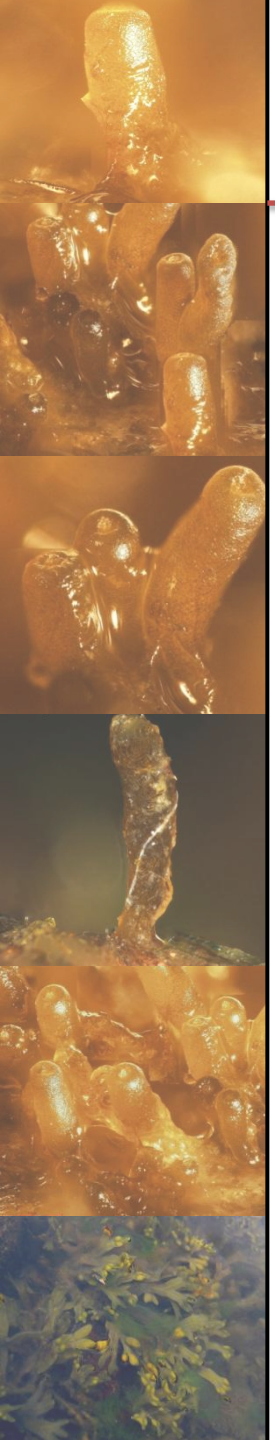
Higher temperature increase significantly the photoinhibition of *Fucus* germlings (p-value < 0,001)

Pmax Maximum ETR | Ik Saturation intensity | α Initial slope | β photoinhibition constant

Survival of different diversity level



Survival of high diversity level > low diversity level.



Genotyping of *Fucus* germlings

Follow the fate of the parent‘s allels in the next generation.

Determine to which degree **genetic diversities** are maintained in high diversity levels

Compare if allel combinations **survive the same way** in the pools

Microsatellites: Repeated regions of 2-6 base pairs of DNA.

Simple sequence repeats with high polymorphisms

Conclusion:
Higher genetic diversity level perform better under climate change.

Indication for selection processes towards stronger genotypes

Thank you for your attention

Foto: I. Lastumäki

Foto: B. Al-Janabi

Foto: I. Kruse

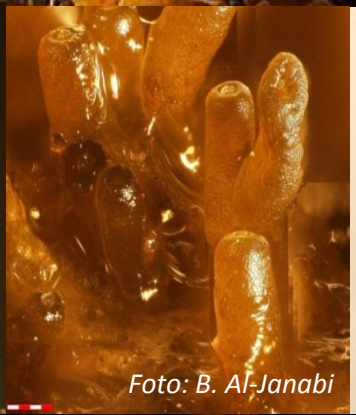


Foto: B. Al-Janabi

Foto: K. Maczassek

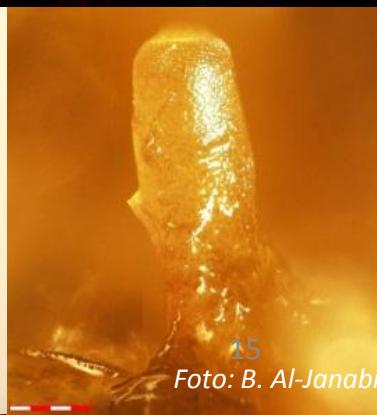
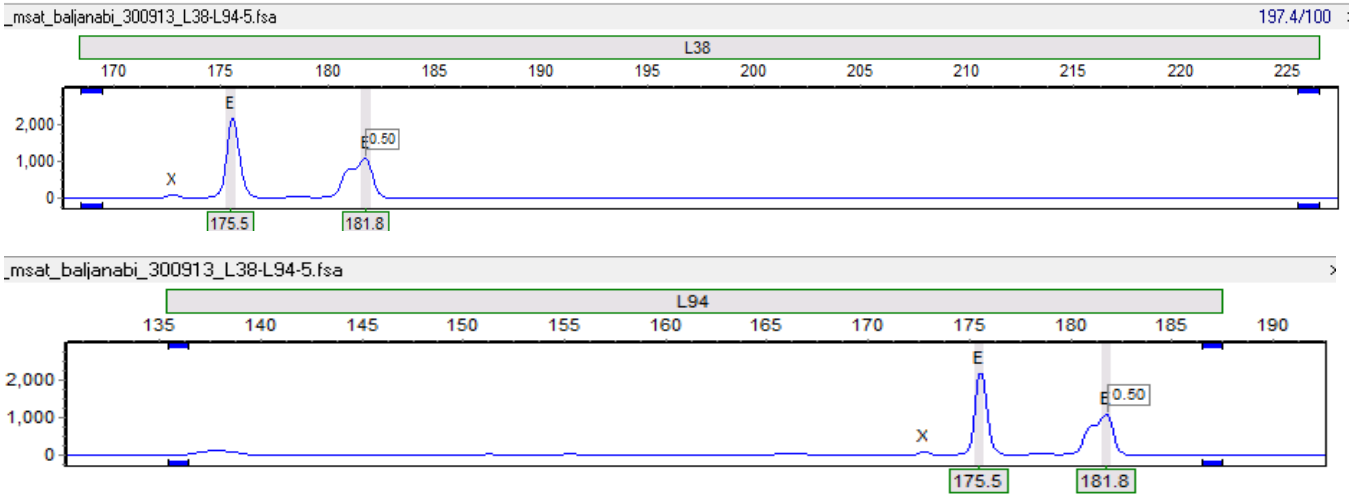


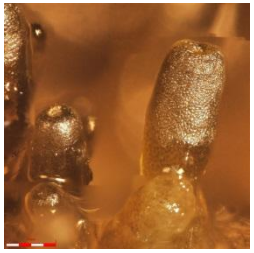
Foto: B. Al-Janabi

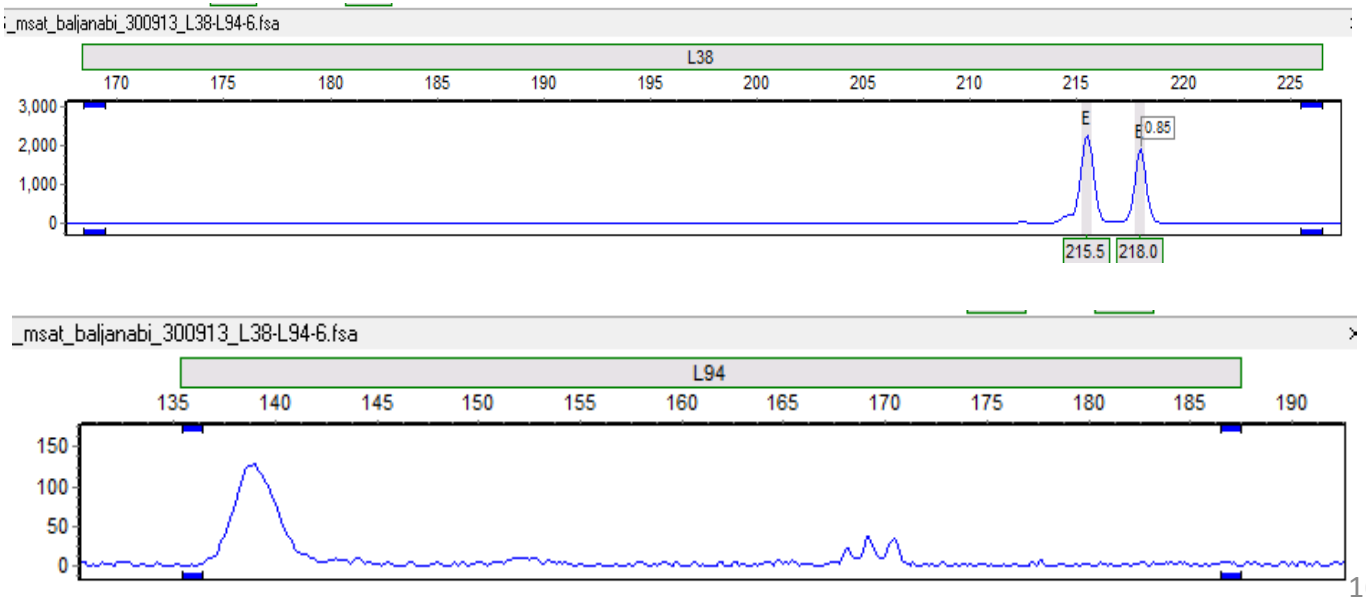
Genotyping of *Fucus*

Germling 1

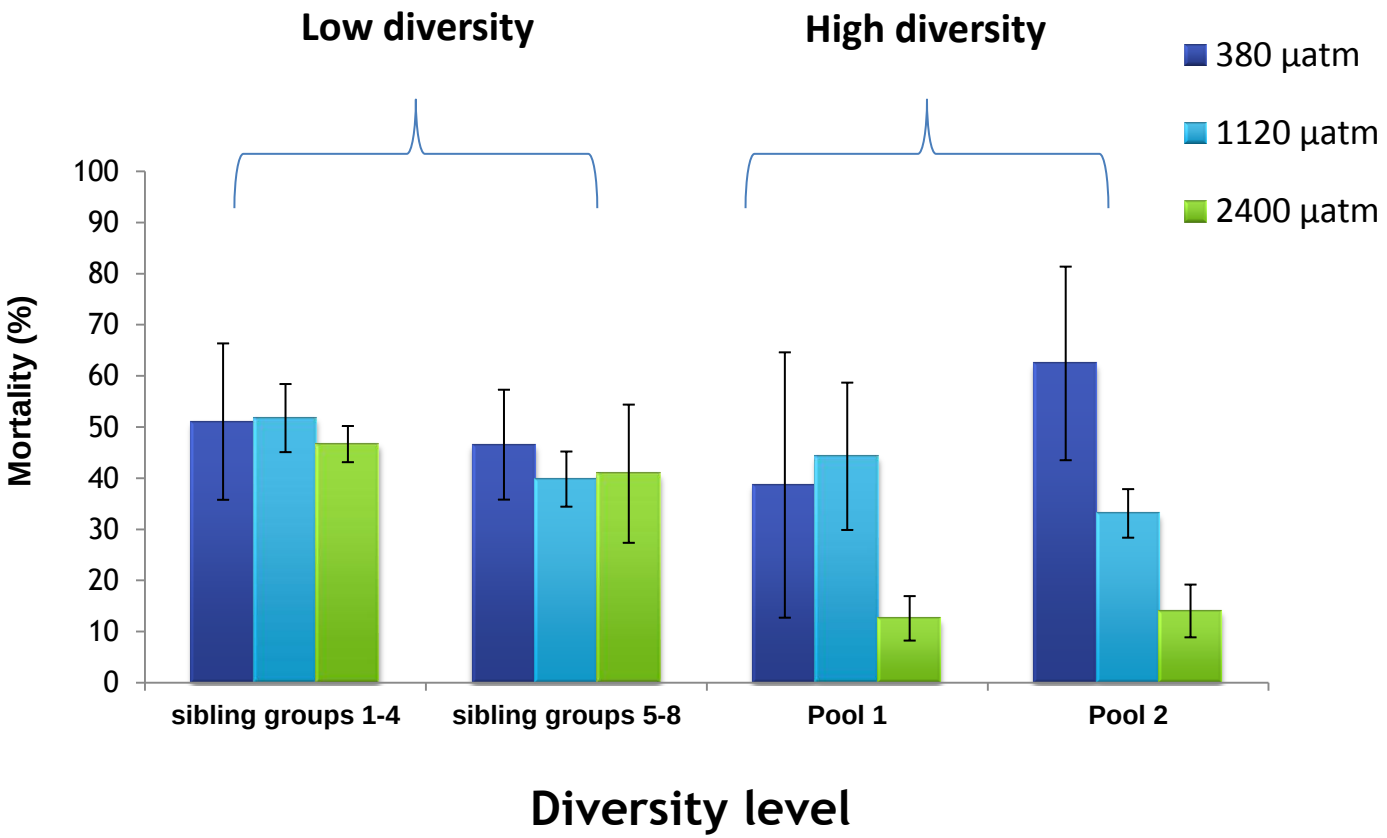


Germling 2





Indoor Experiment – Mortality



Diverse groups of *Fucus* germlings do have a **decreased mortality** under high pCO2 (p-value < 0,001)

Under high pCO2 conditions the **high diversity level reacts significantly** different than the low diversity level (p-value < 0,001)

Growth of germlings in the benthocosms. 3 Months in spring.