

Polar Seaweeds Facing a Climate Change

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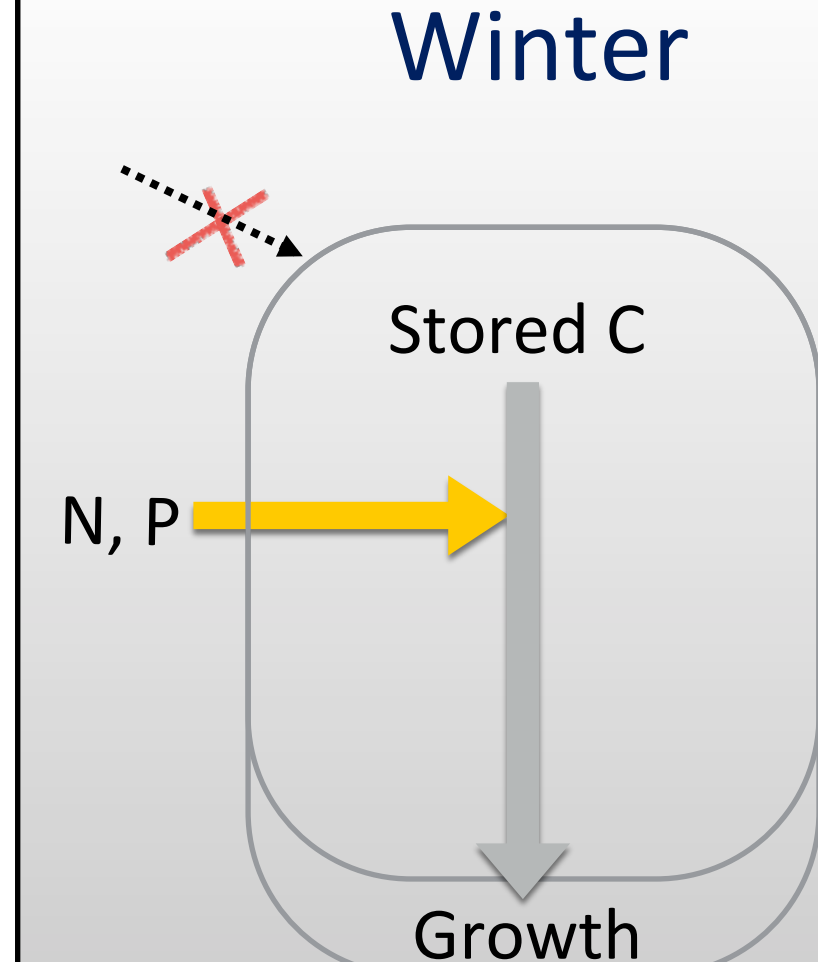
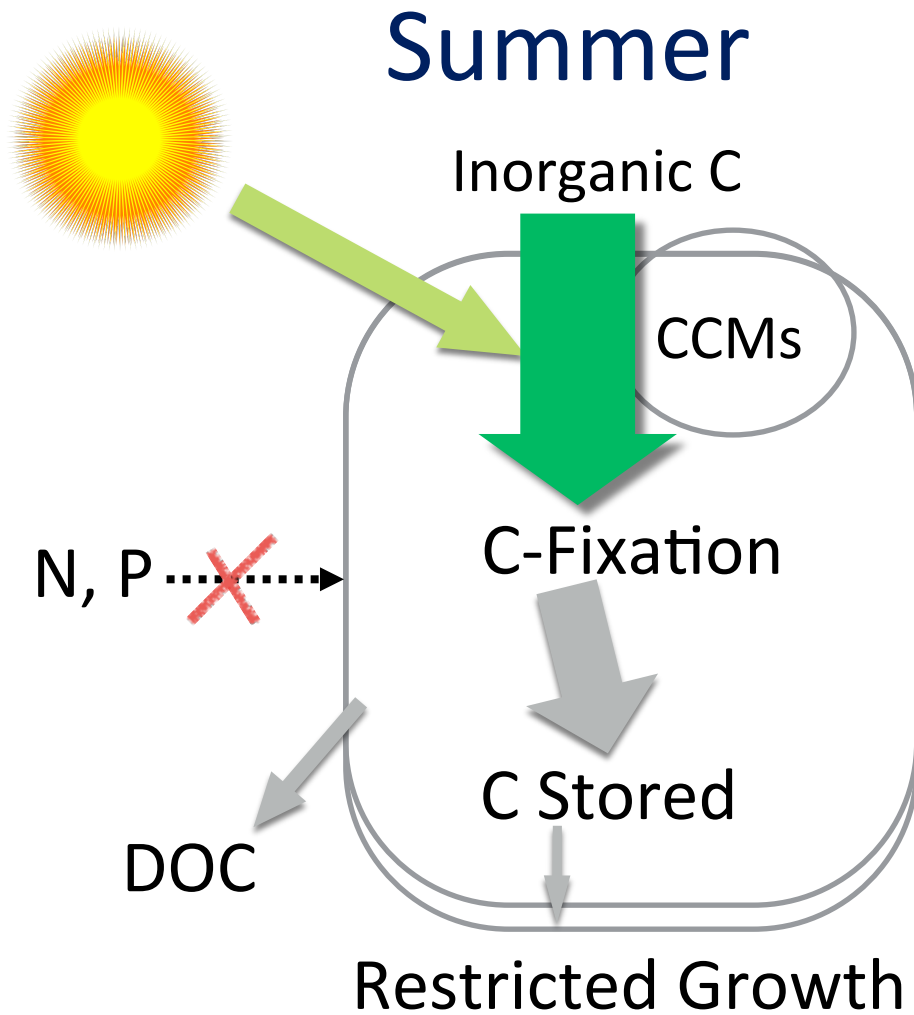
What is Global Change bringing to the Arctic?

1. Higher CO₂
2. Higher temperature
3. Less ice cover (changed hydrodynamics)
4. Changed light field (ice and turbidity)

What will still make it special: constant light/ darkness (summer/winter)

Specific adaptation to polar conditions may influence macroalgal response to CO₂ and temperature

Overcoming Extreme Photoperiods



Experimental Setup



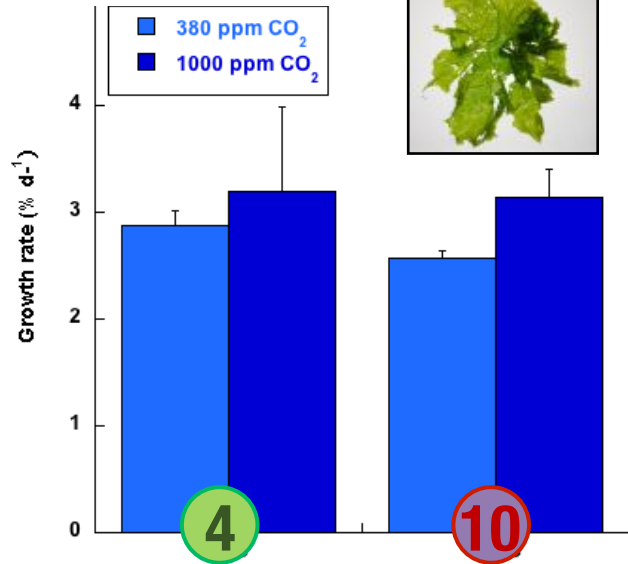
Low CO₂:
390 ppm

High CO₂:
1000 ppm

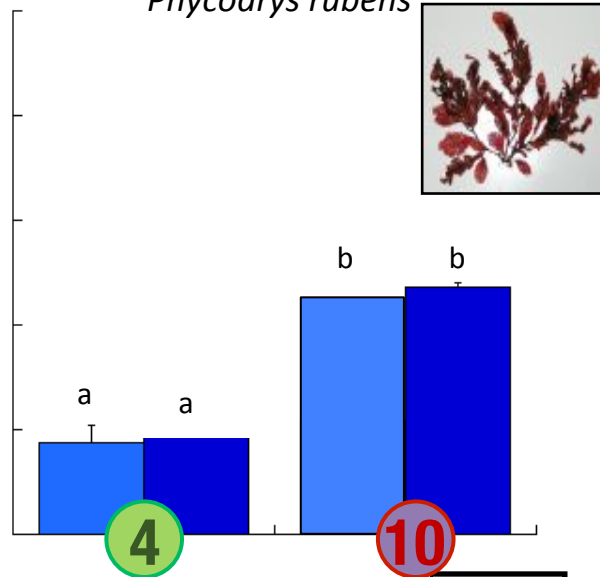


Growth Rate

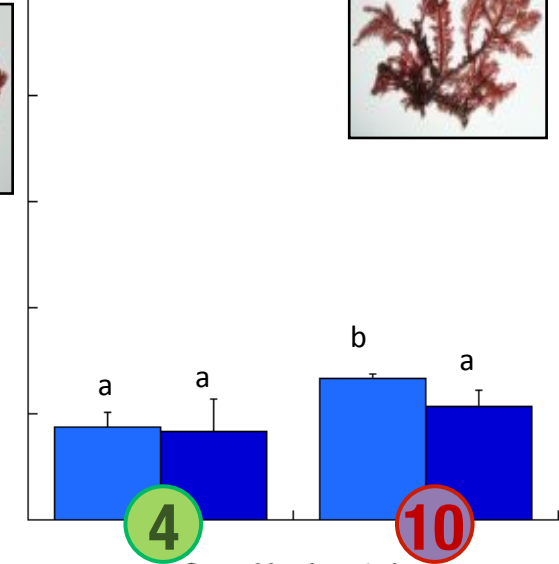
Monostroma arcticum



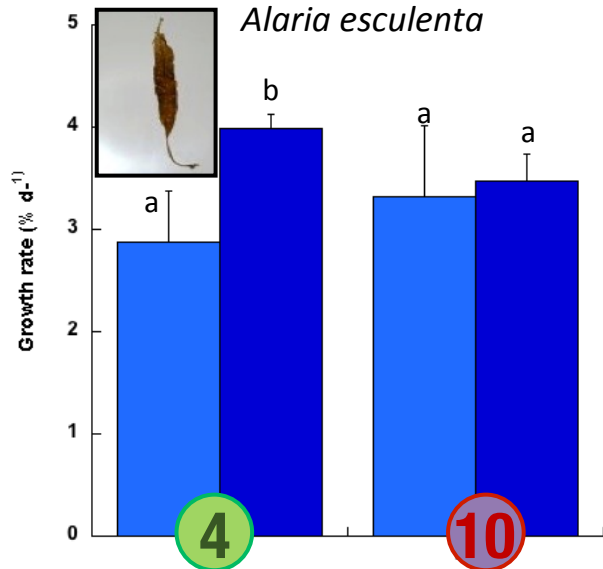
Phycodrys rubens



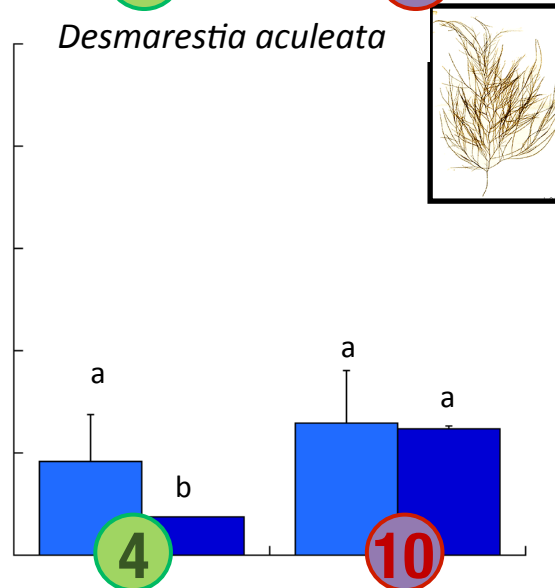
Ptilota plumosa



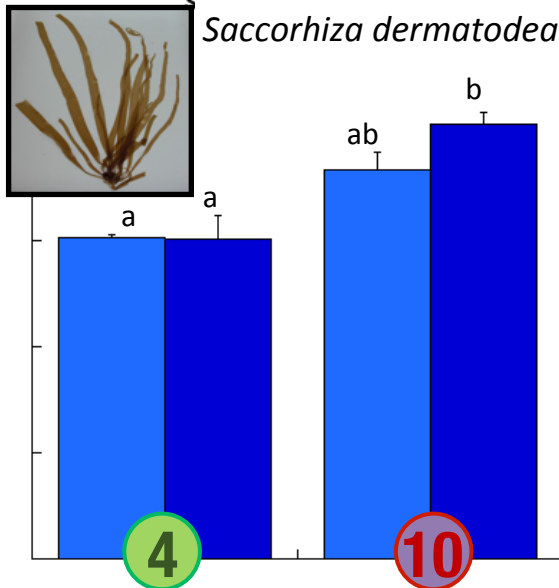
Alaria esculenta



Desmarestia aculeata

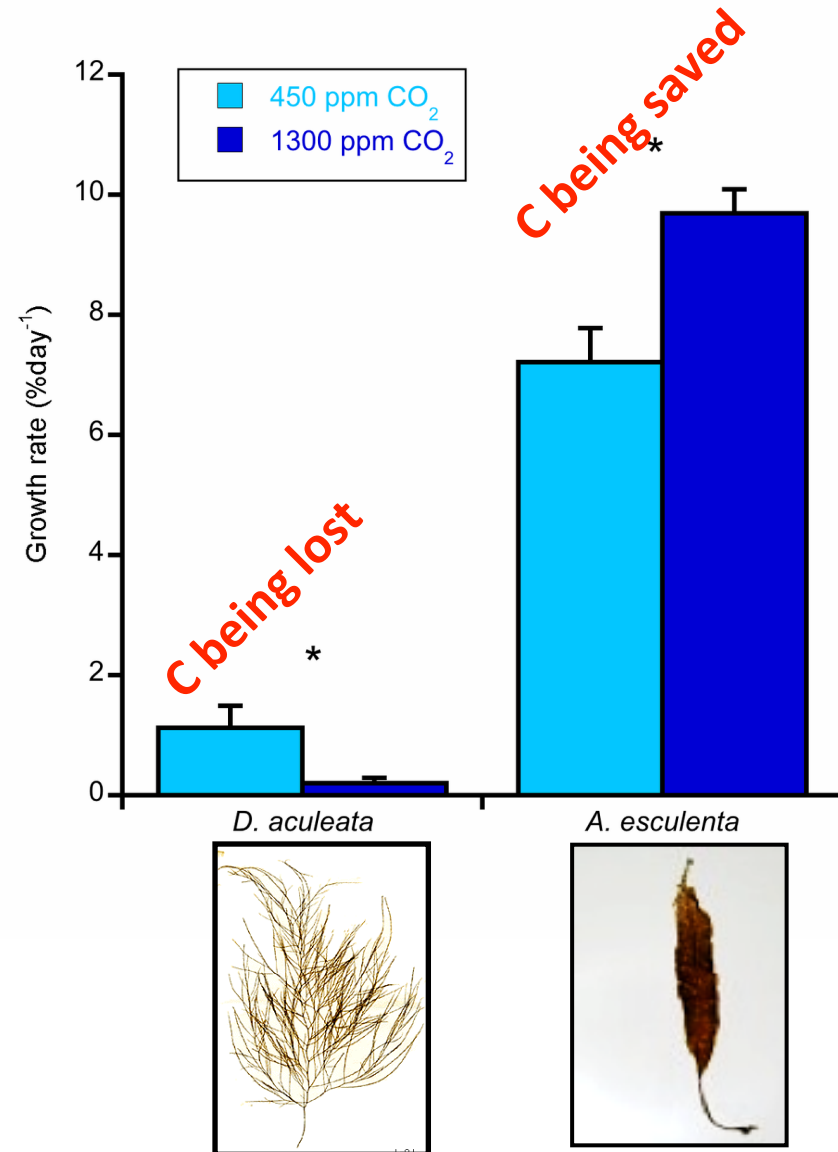
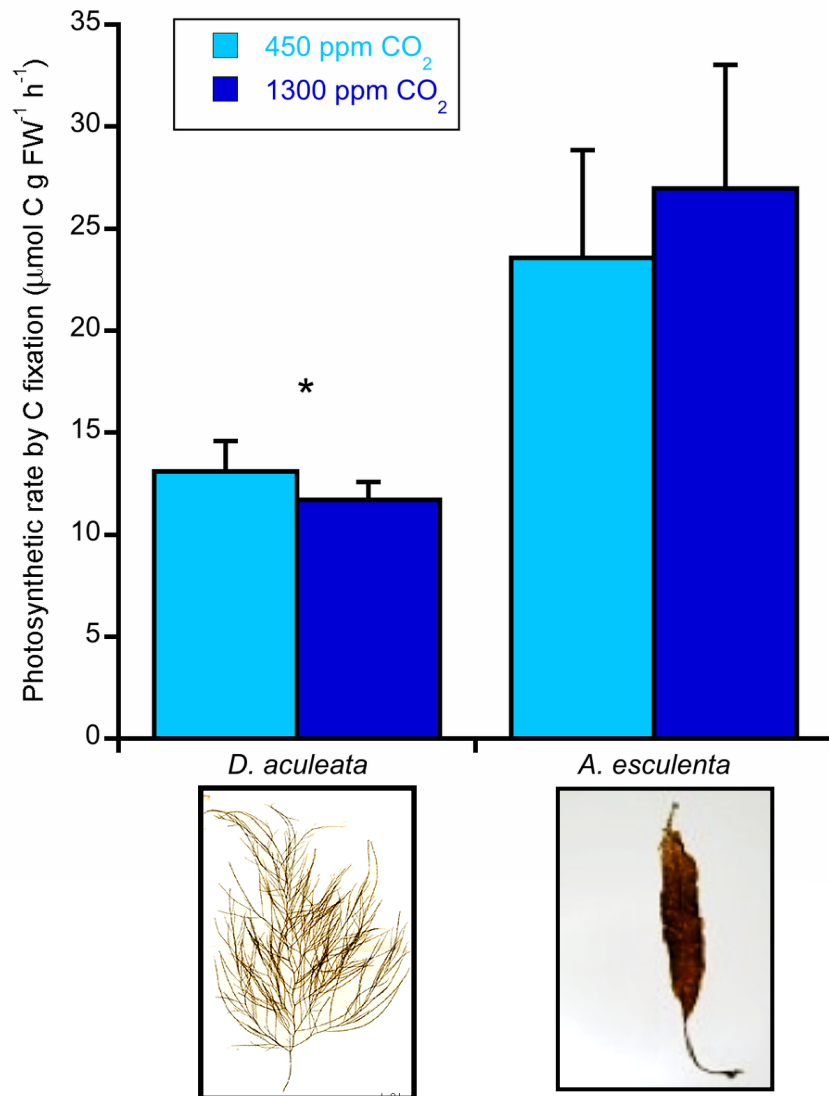


Saccorhiza dermatodea

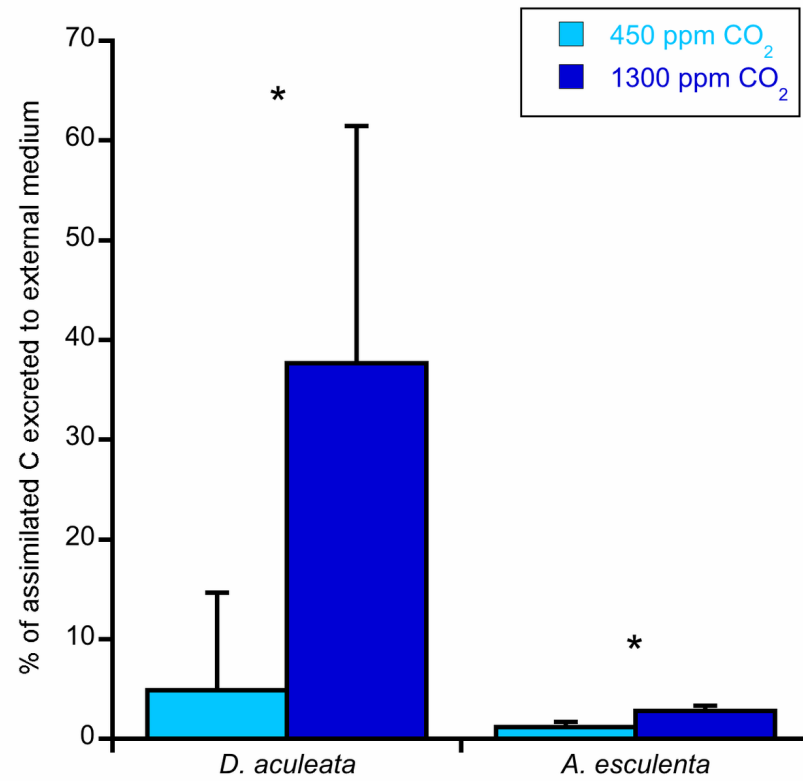
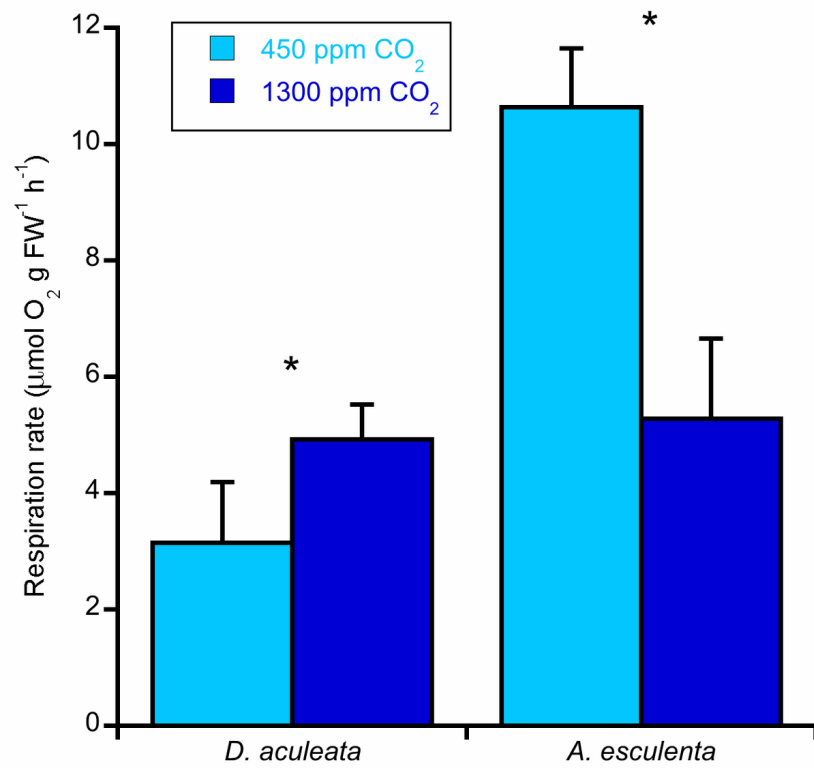


Carbon Gain

Iñiguez et al. Polar Biol.(2015)



Carbon Losses



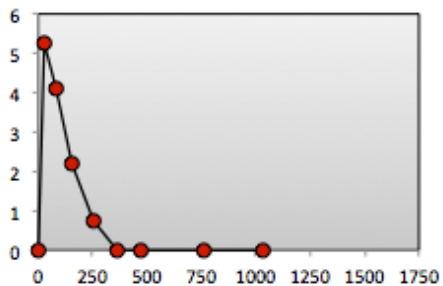
Does CO₂ prevents photoinhibition of Fv/Fm?

	Fv/Fm higher under +CO₂?
ARCTIC (79° N)	
<i>Monostroma arcticum</i>	YES
<i>Alaria esculenta</i>	YES
<i>Desmarestia aculeata</i>	YES
<i>Saccharina latissima</i>	YES
<i>Saccorhiza dermatodea</i>	YES
<i>Phycodrys rubens</i>	YES
<i>Plocamium cartilagineum</i>	NO
<i>Ptilota plumosa</i>	YES

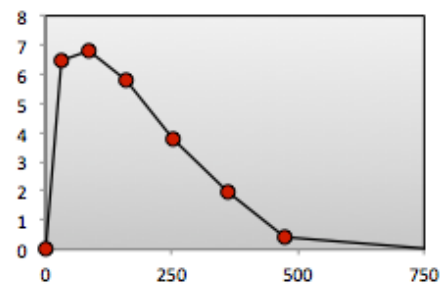
ETR CURVES REVEALED THAT NIGHT MATTERS !!

JULY

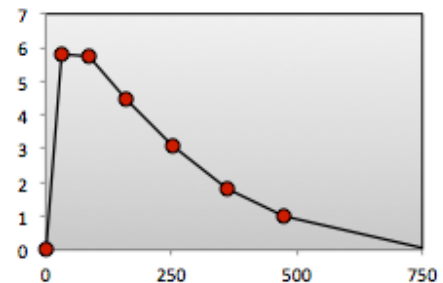
ETR ($\mu\text{mol m}^{-2} \text{s}^{-1}$)



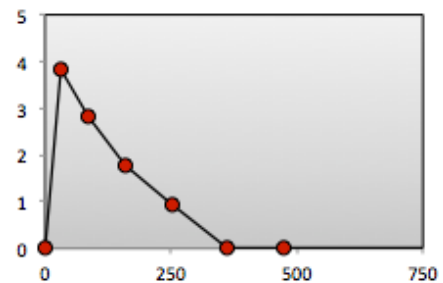
Alaria esculenta



Laminaria digitata



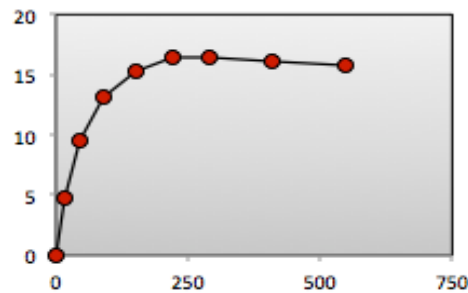
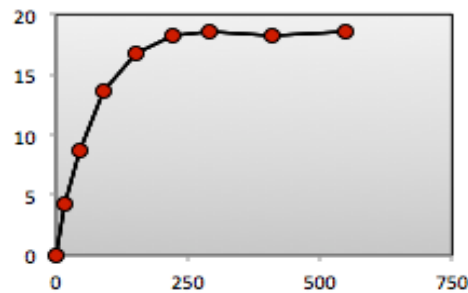
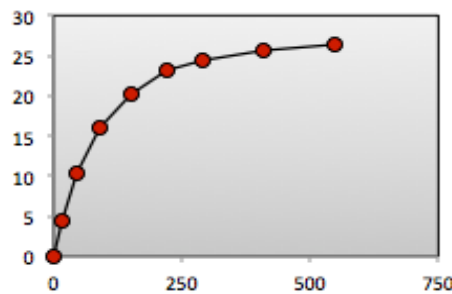
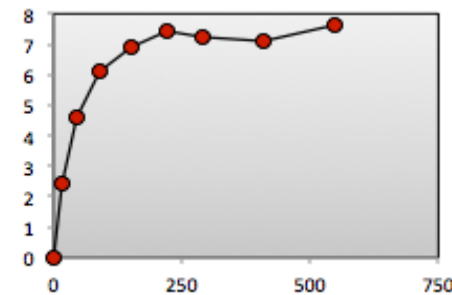
Laminaria solidungula



Saccharina latissima

PAR ($\mu\text{mol m}^{-2} \text{s}^{-1}$)

SEPTEMBER

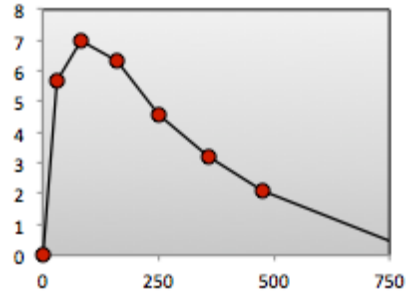


PAR ($\mu\text{mol m}^{-2} \text{s}^{-1}$)

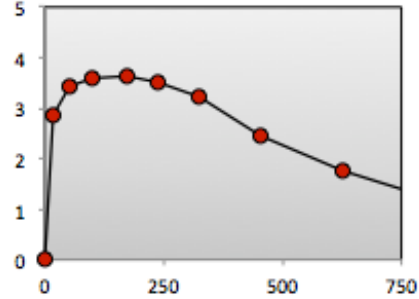
ETR CURVES REVEALED THAT NIGHT MATTERS !!

JULY

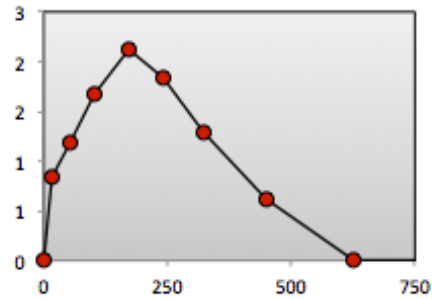
ETR ($\mu\text{mol m}^{-2} \text{s}^{-1}$)



D. aculeata

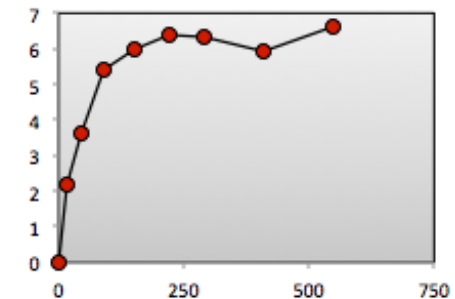
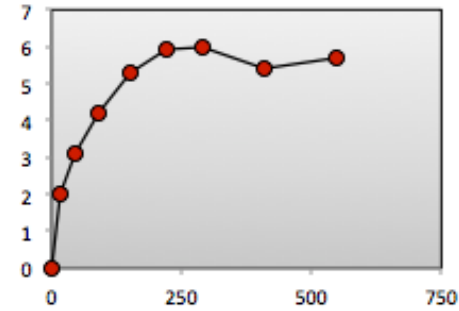
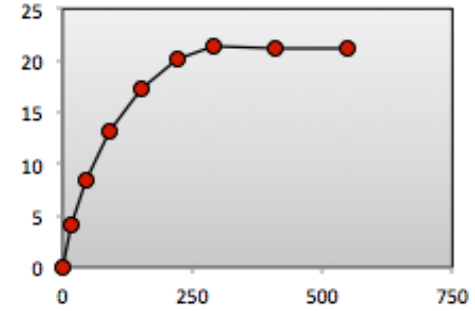


P. gunneri



P. rubens

PAR ($\mu\text{mol m}^{-2} \text{s}^{-1}$)



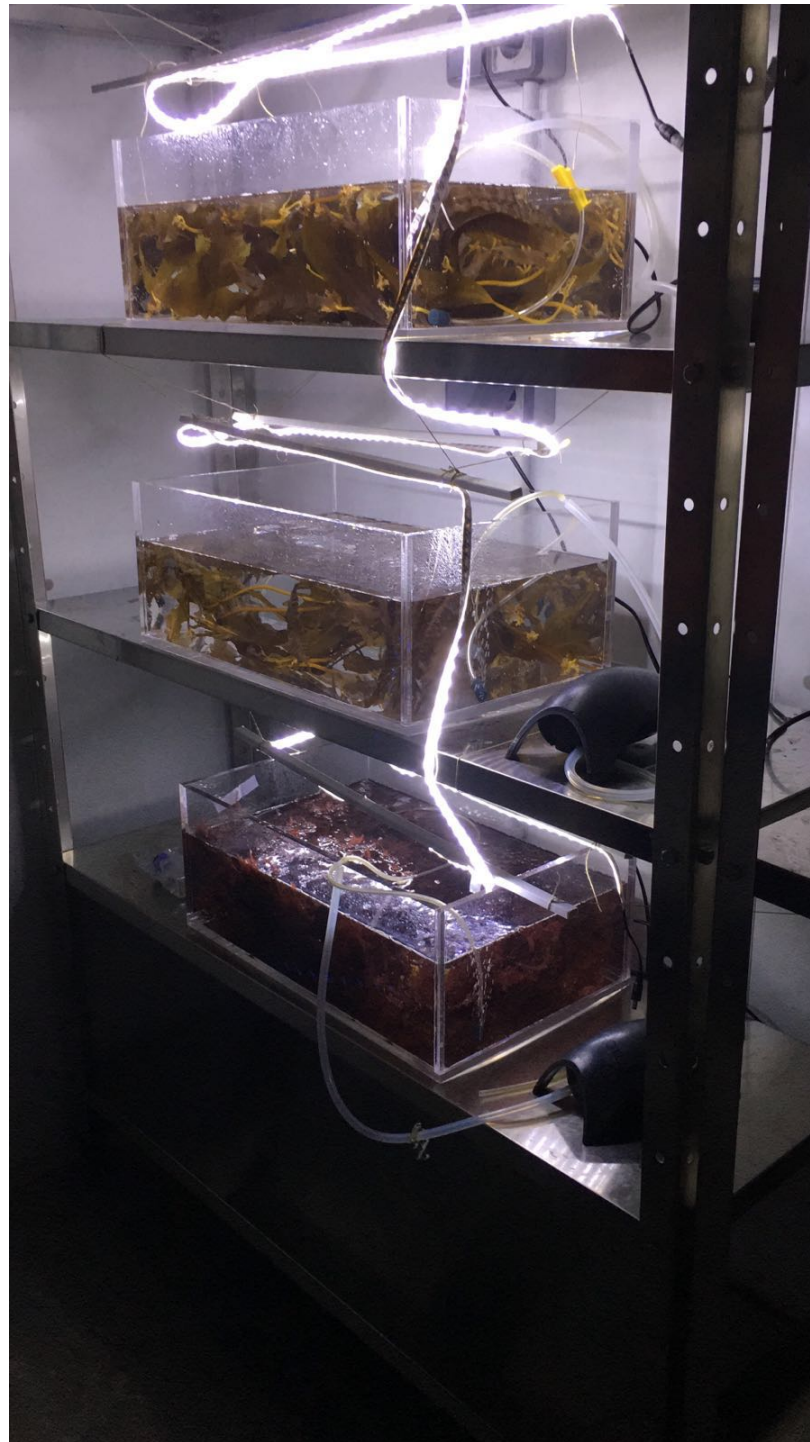
PAR ($\mu\text{mol m}^{-2} \text{s}^{-1}$)

SEPTEMBER

Coming next...



Dark incubation in
Málaga during the
winter period at two
temperatures



Summary:

- Different species show different acclimation
- Seasonal patterns may reveal more species-specific characteristics
- Special characteristics found in polar environments may restrict invading species

Future research interests (closing the gaps !!!!!)

1- Contribution of summer river run-off to N and P in the fjord:

Our main hypothesis stays **that increasing global temperature may lead to the release of different forms of inorganic N and P along with dissolved organic carbon (DOC) from the soil solution**, that can eventually drain to streamwaters and the ocean.

Under elevated temperature, soils from northern latitudes can achieve mineralization rates as high as those found in soils that undergo annual thawing processes (i.e., periglacial or discontinuous permafrost soils).

2- Linked to the previous hypothesis, **Growth and metabolic performances of selected species of macrophytes in a N- and P-enriched summer scenario (continuous light) should be estimated**. We already have some indications of potential response of several species of macrophytes in summer after N and P enrichment (Gordillo et al. 2004, 2006).