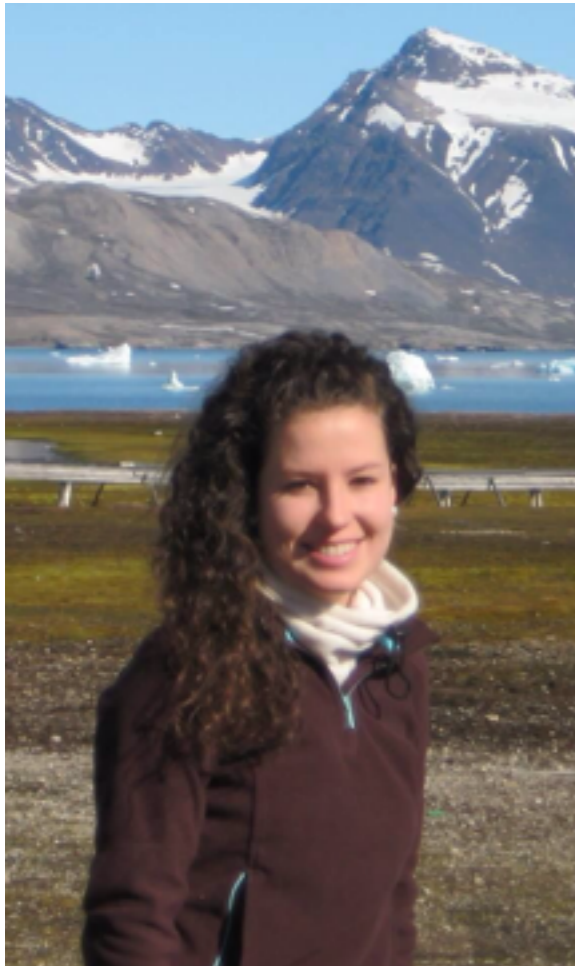


# Kongsfjorden Ecosystem Workshop



Interactive effects of elevated **CO<sub>2</sub>** and **temperature** on growth and C physiology of several Arctic **seaweeds**

Fran JL Gordillo

and

**Conchi Iñiguez**

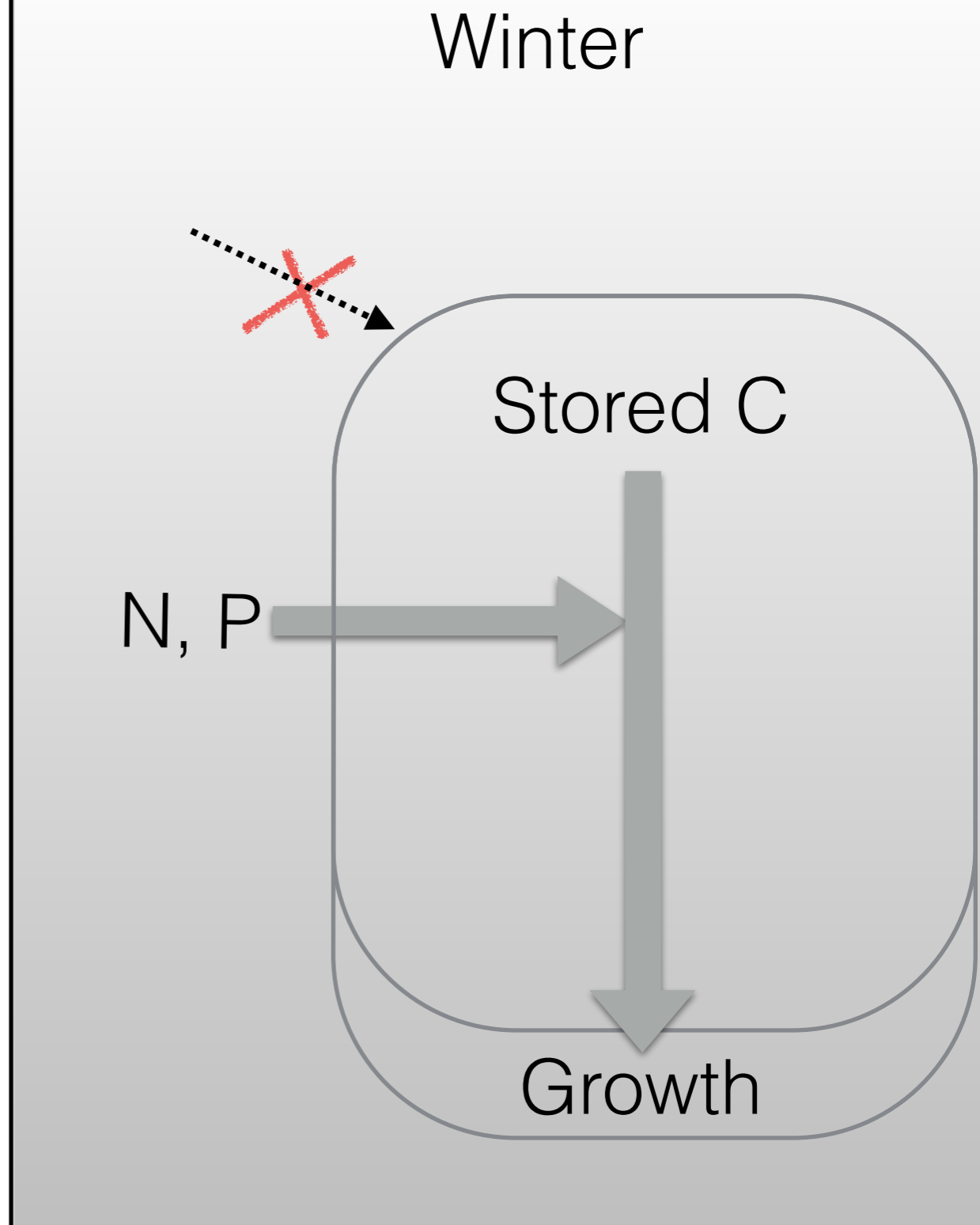
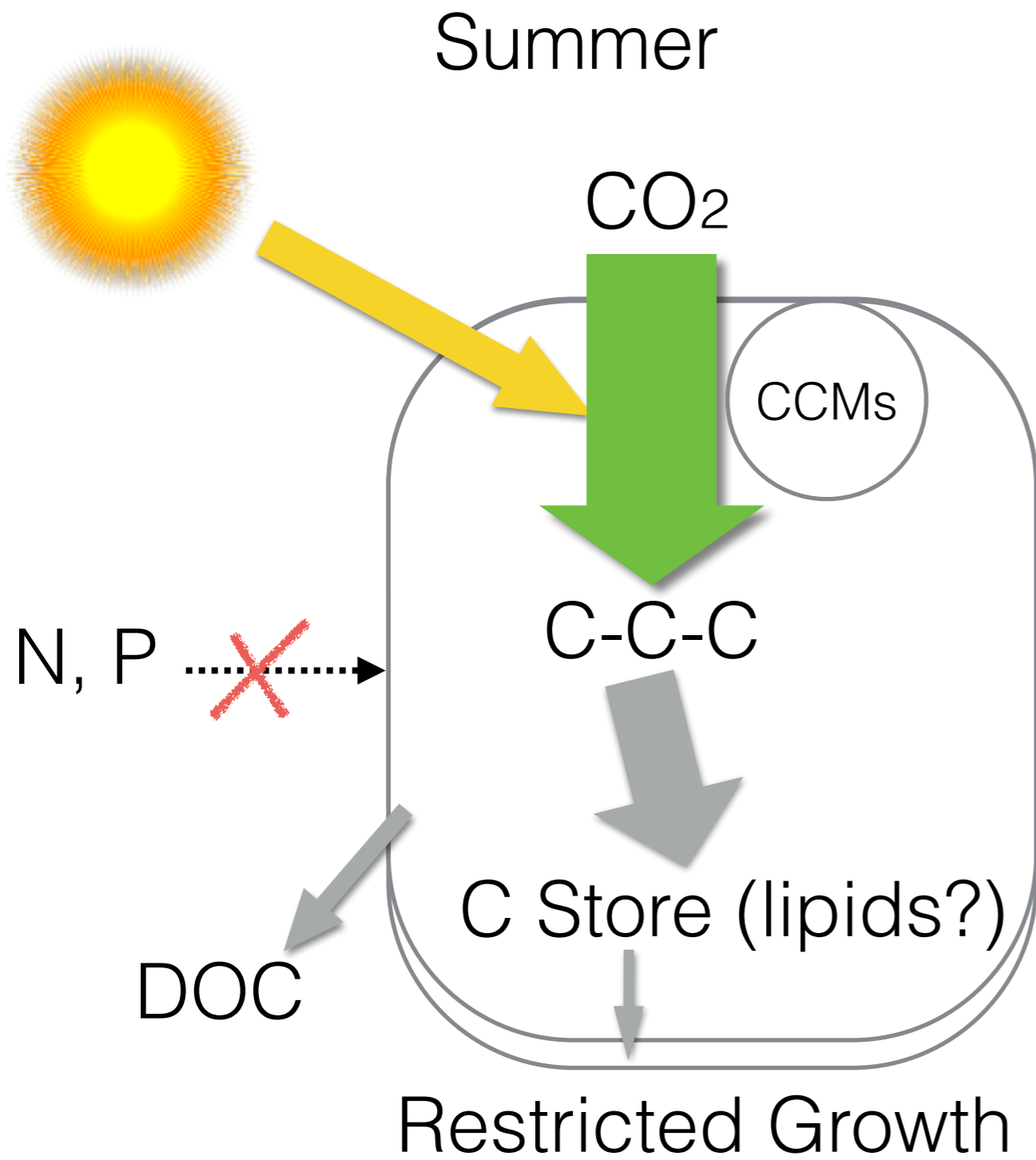
Carlos Jiménez, Raquel Carmona, Benjamin Viñegla, Charo Lorenzo,  
Christian Wiencke



UNIVERSIDAD  
DE MÁLAGA



# Working Hypothesis



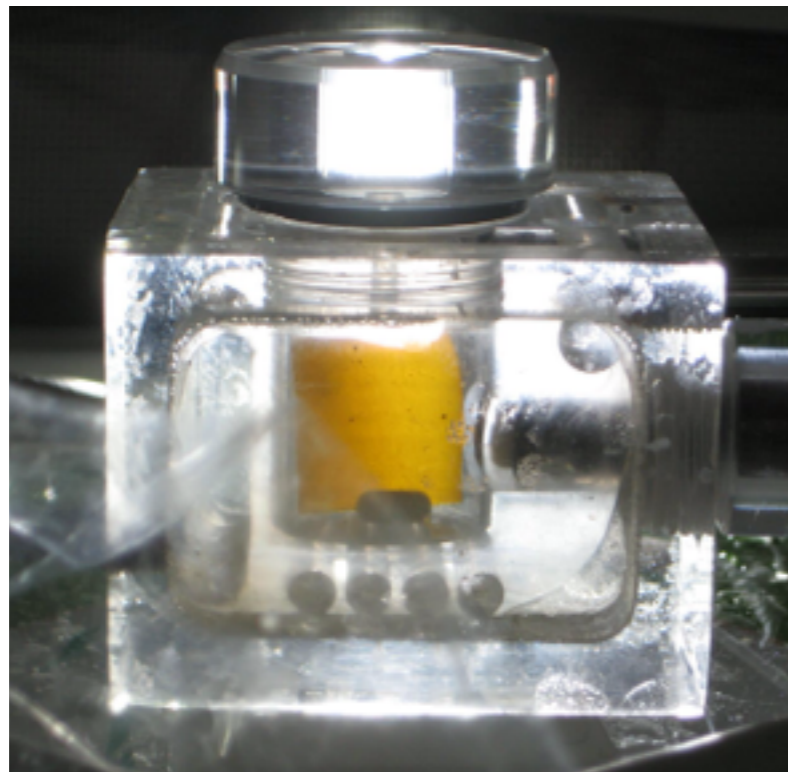


# Experimental Setup

Typically 1.5 to 3 g FW in 1.2 L PESW

Extra CO<sub>2</sub> supplied through the bubbling

3 days pre-acclimation to CO<sub>2</sub> condition





# Experimental Setup



**Low CO<sub>2</sub>:**  
**ca. 390 ppm**

**High CO<sub>2</sub>:**  
**ca. 1000 ppm**



# Statistics

## Two-Way ANOVA

	Low CO <sub>2</sub>	High CO <sub>2</sub>
4 °C	n = (3 - 6)	n = (3 - 6)
10 °C	n = (3 - 6)	n = (3 - 6)

## Nested ANOVA

	Low CO <sub>2</sub>			High CO <sub>2</sub>		
Culture	1	2	3	1	2	3
Data	(2-3)	(2-3)	(2-3)	(2-3)	(2-3)	(2-3)

# Species



*Monostroma arcticum*



*Phycodris rubens*



*Ptilota plumosa*



*Alaria esculenta*



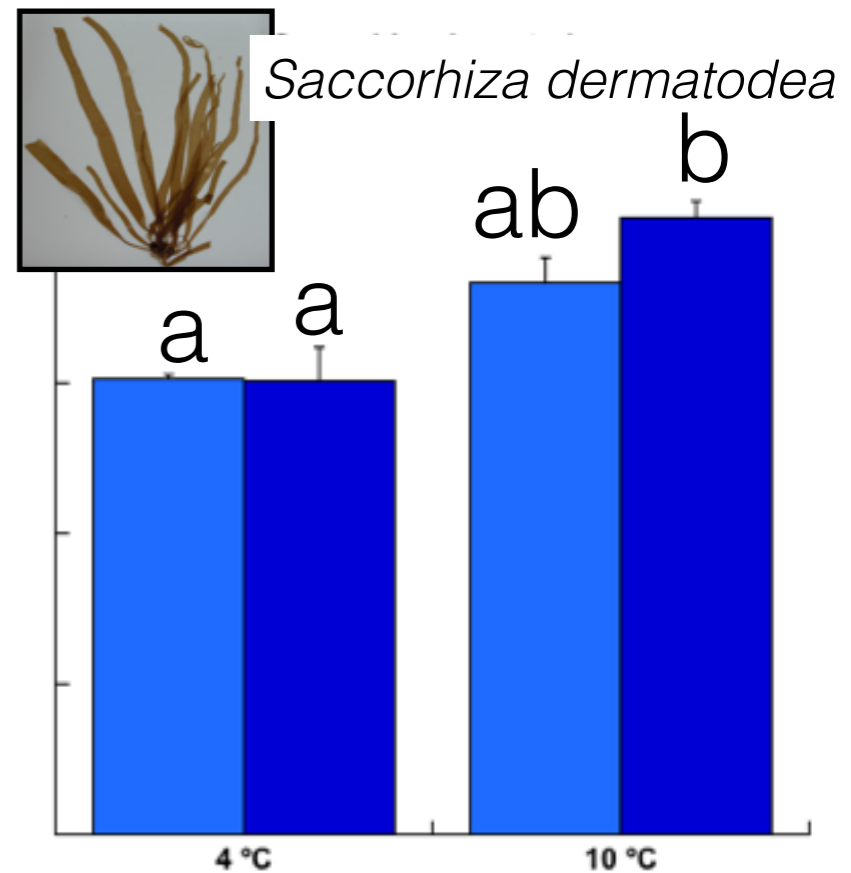
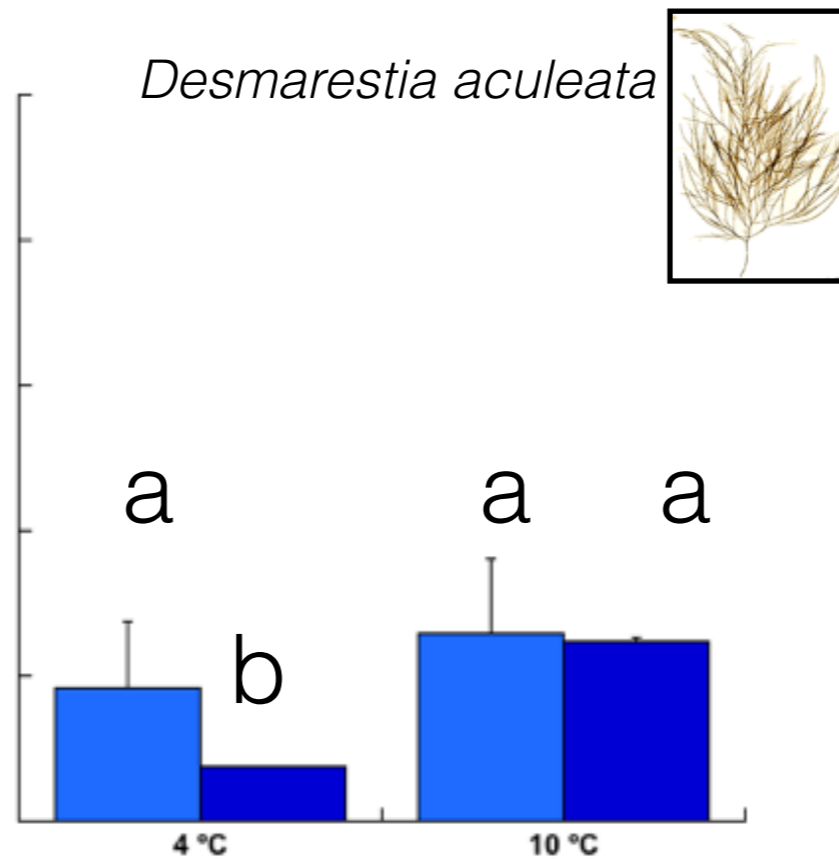
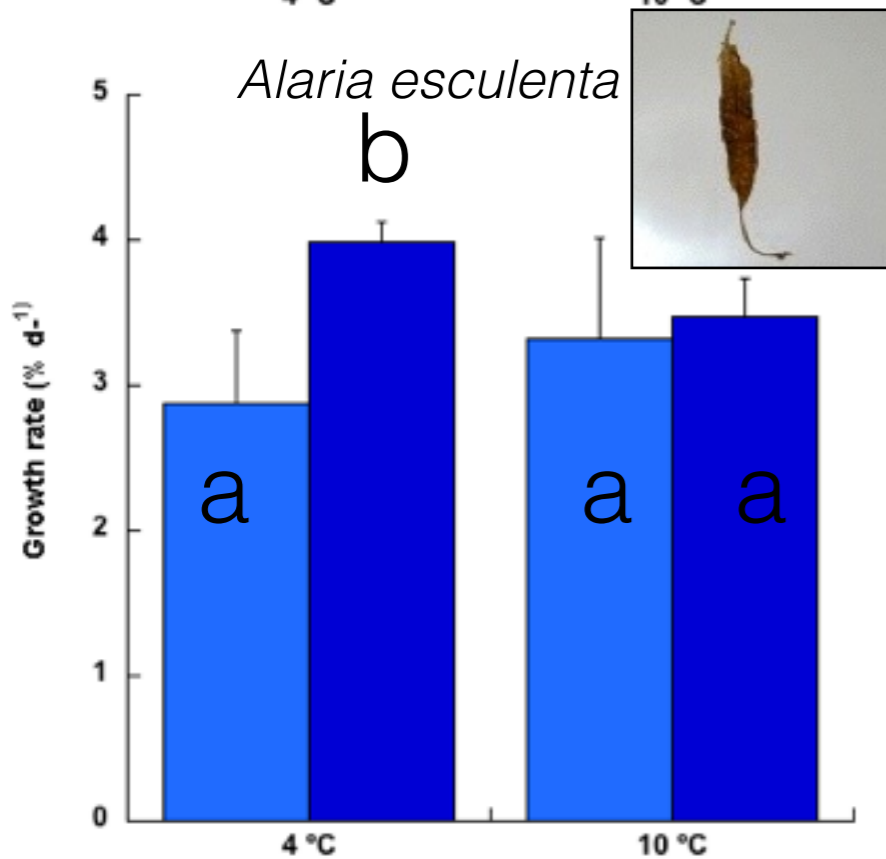
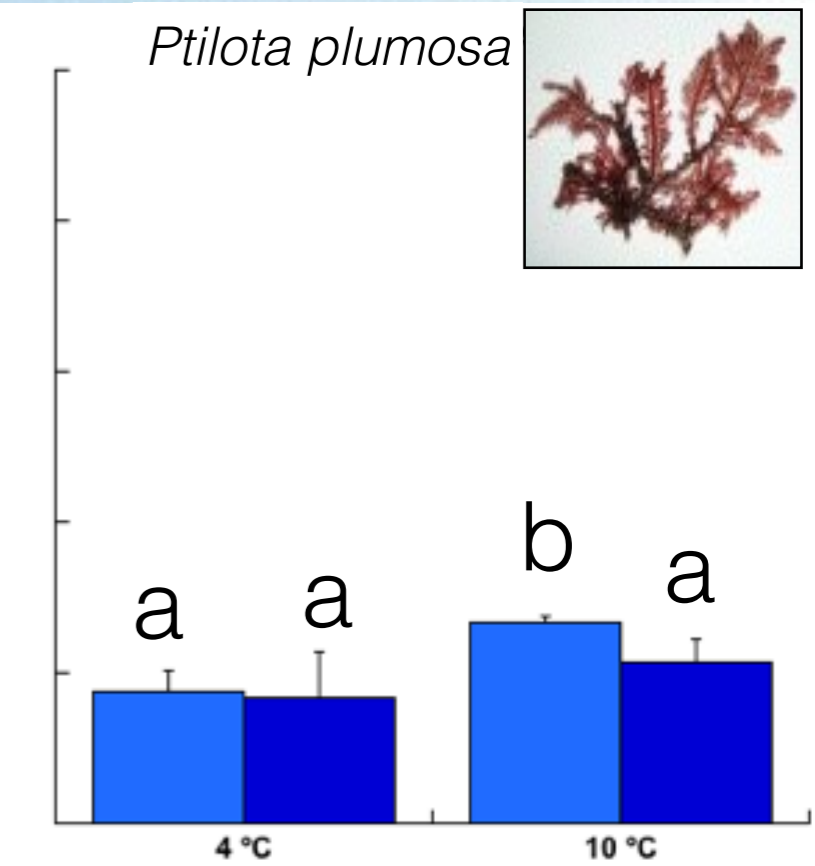
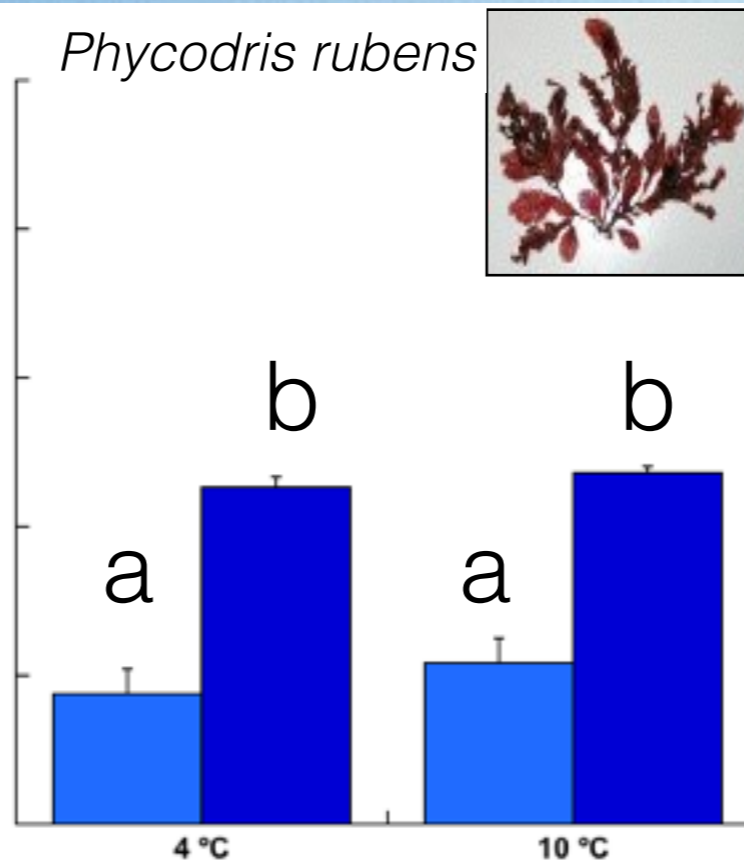
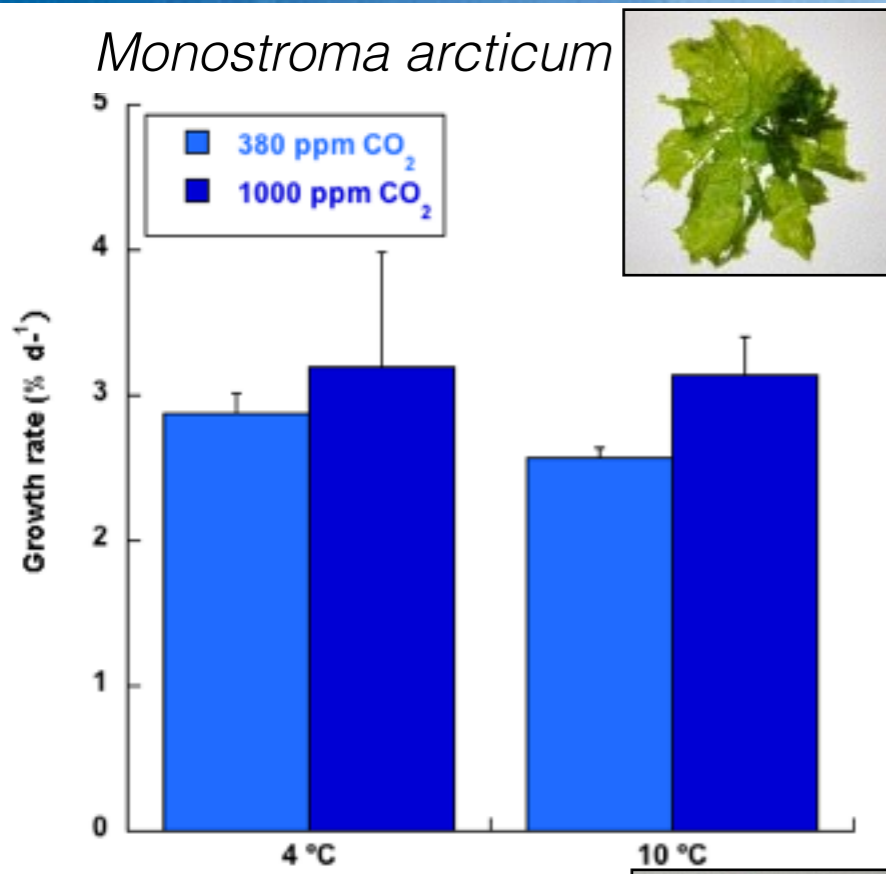
*Desmarestia aculeata*



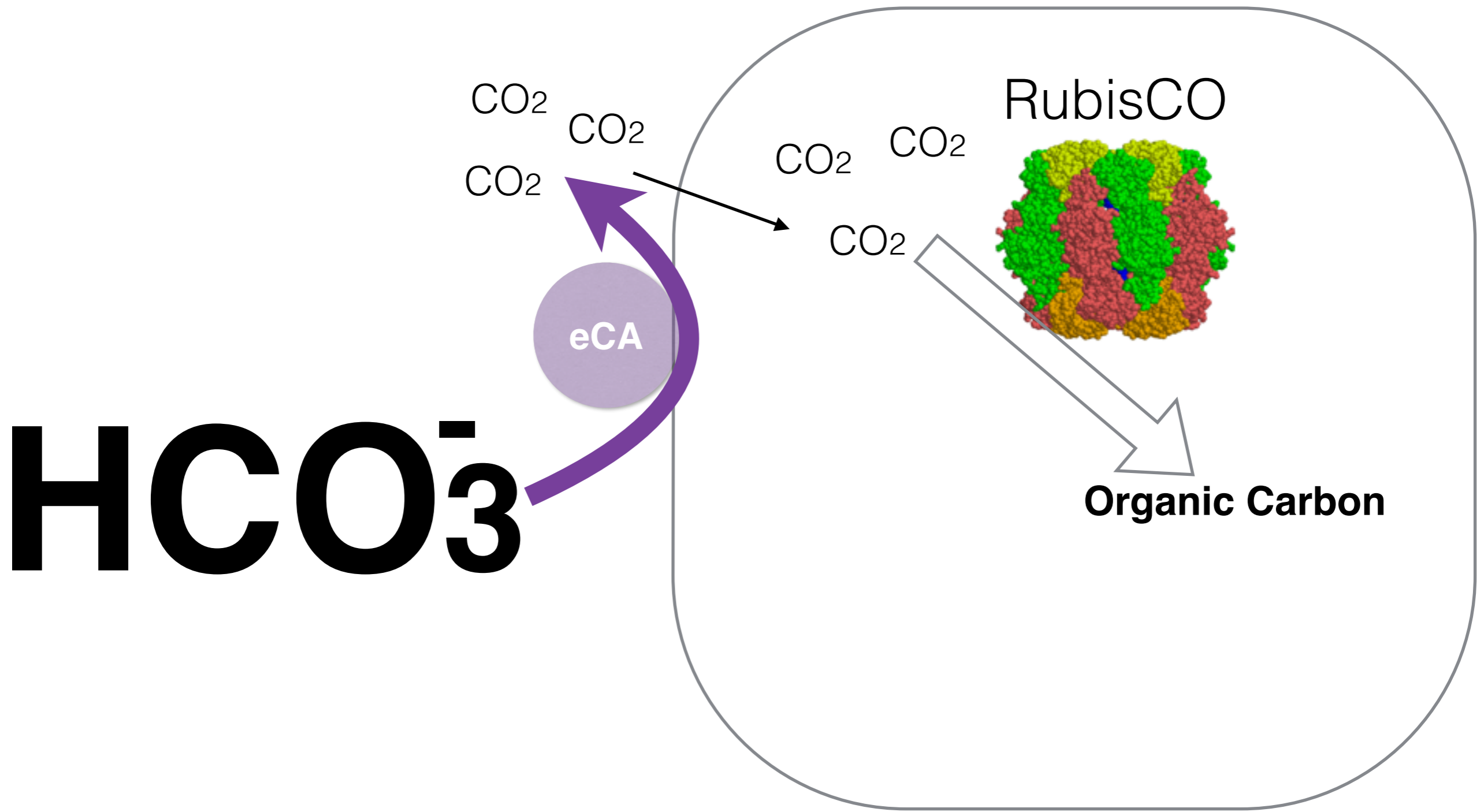
*Saccorhiza dermatodea*



# Growth Rate

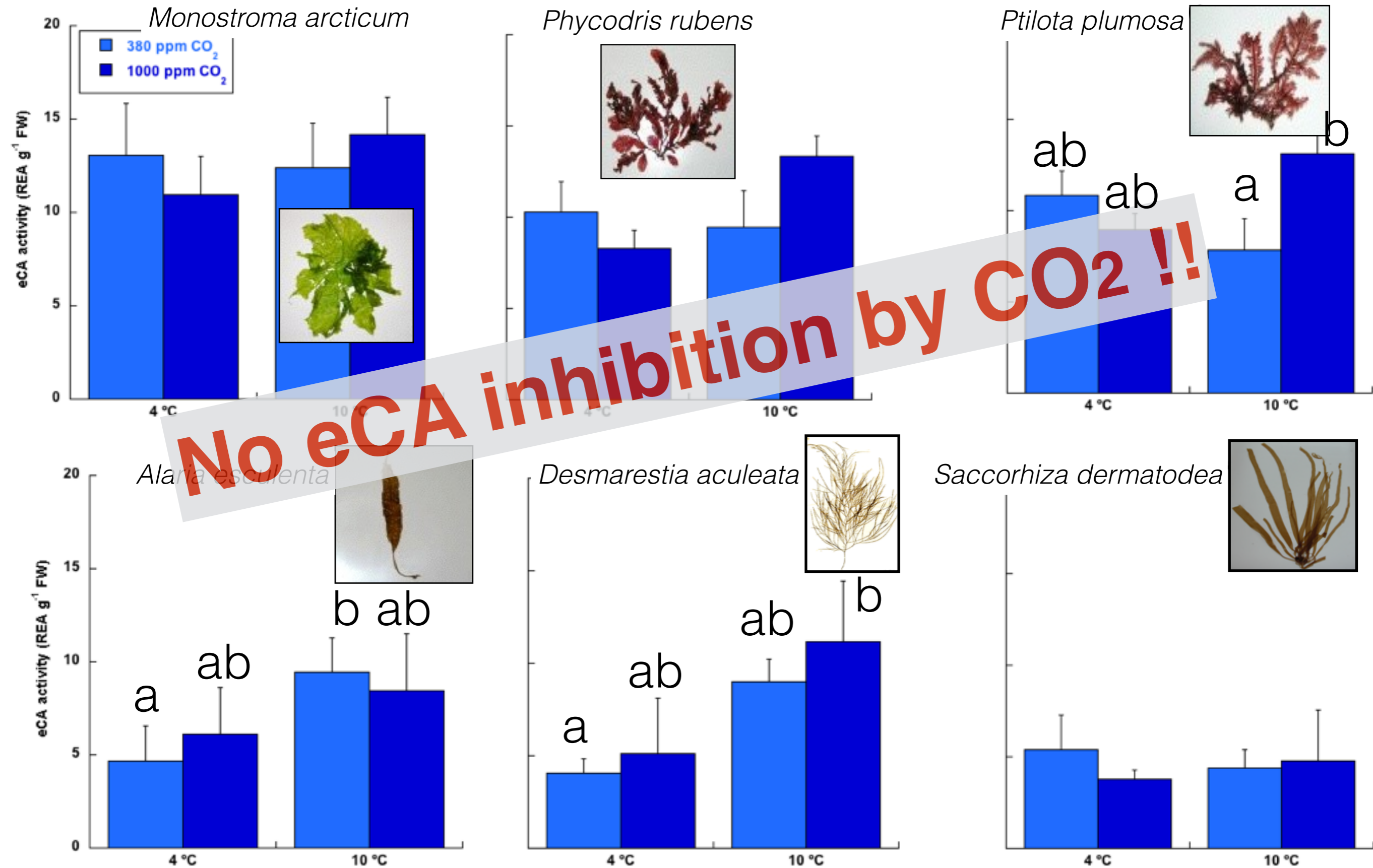


# Carbon Acquisition

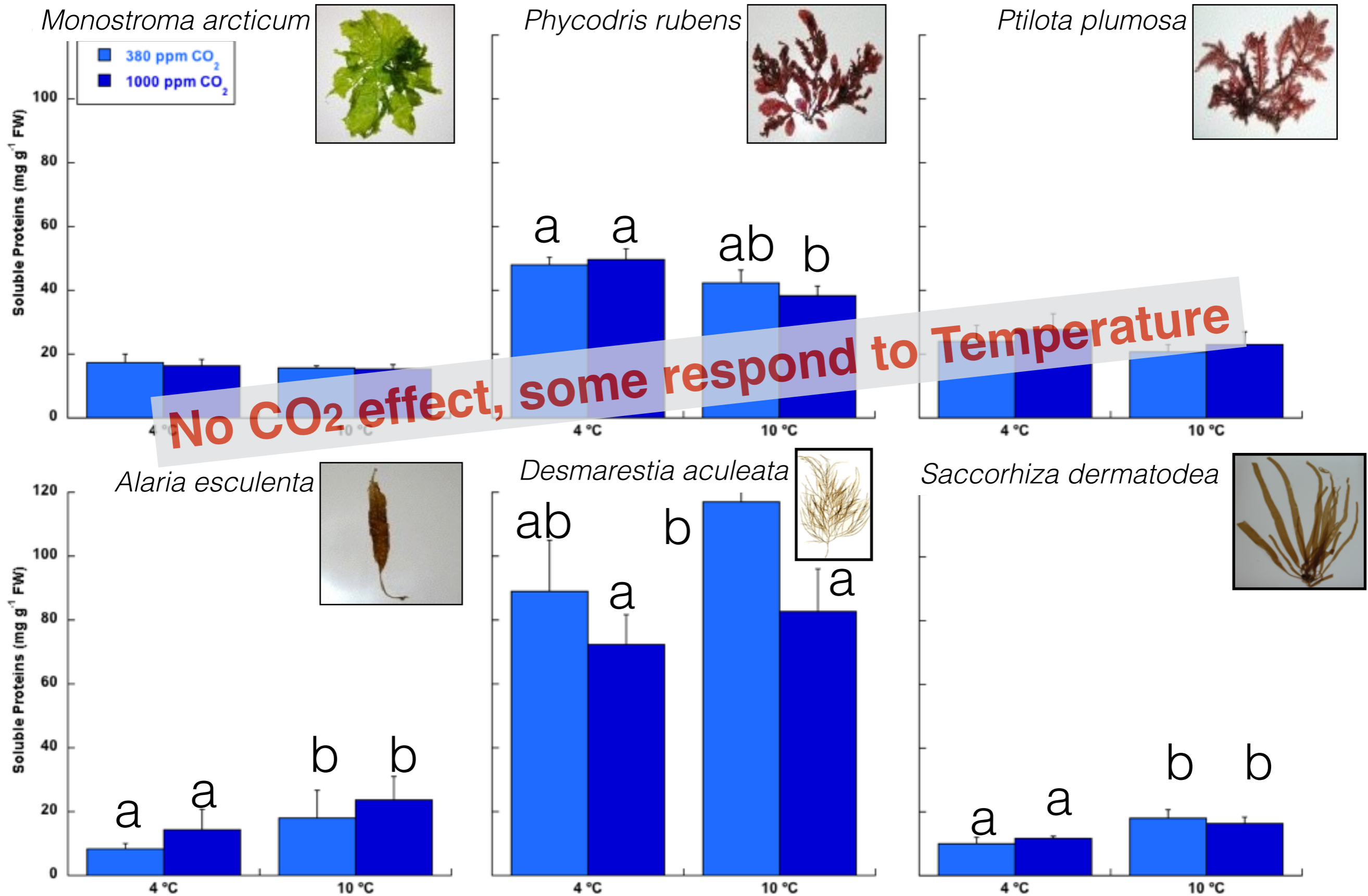




# External Carbonic Anhydrase

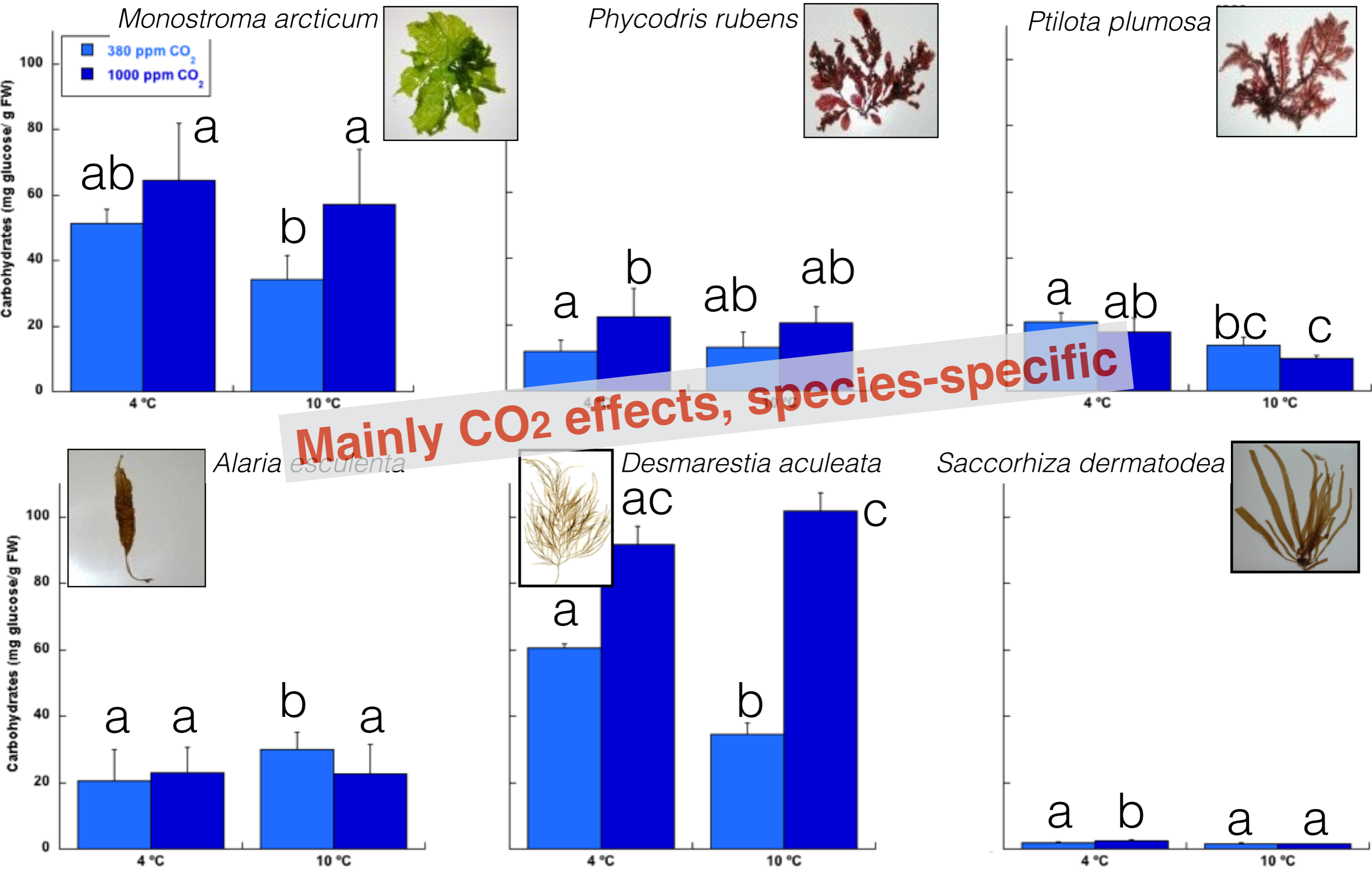


# Soluble Proteins

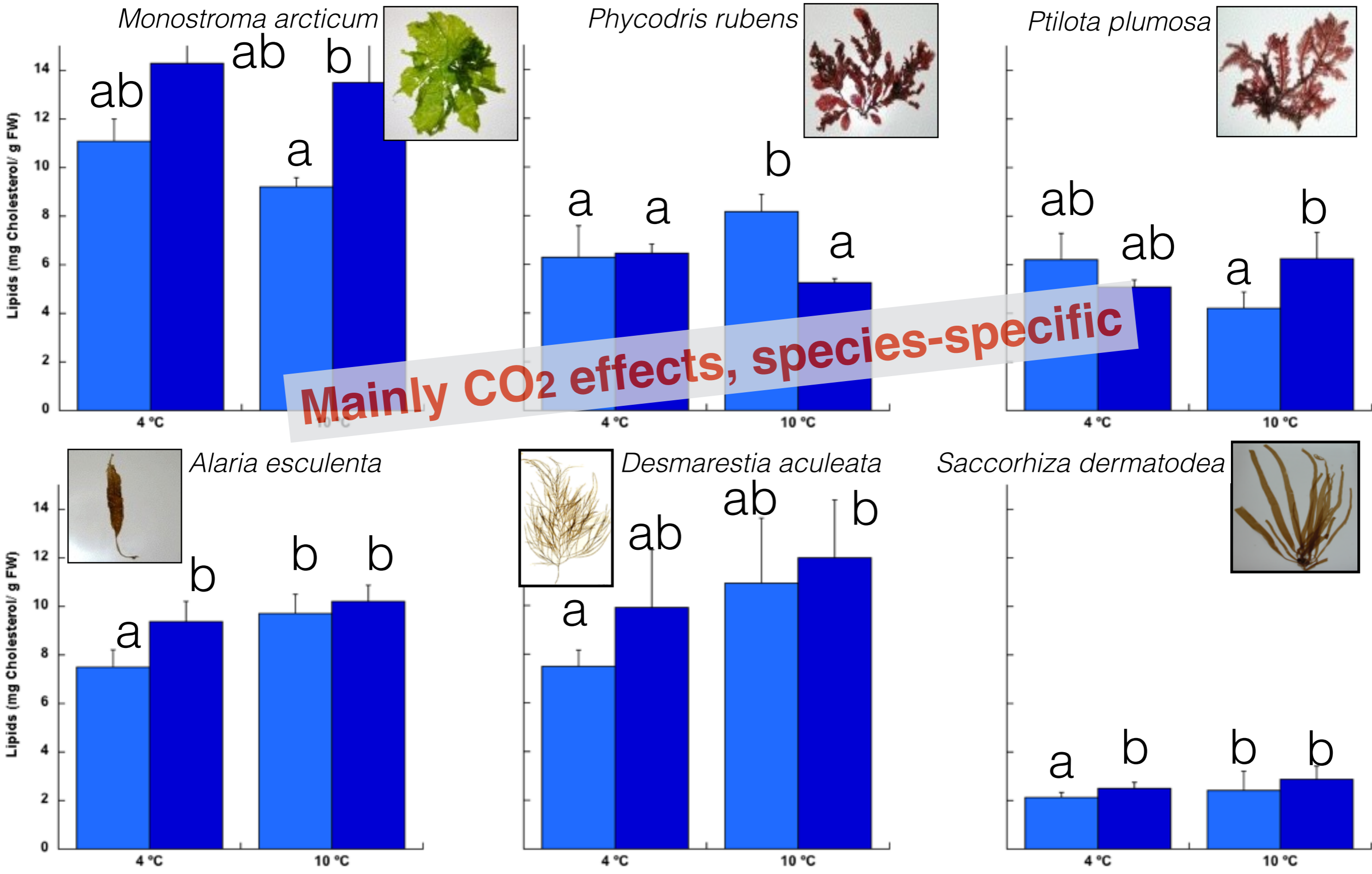




# Soluble Carbohydrates

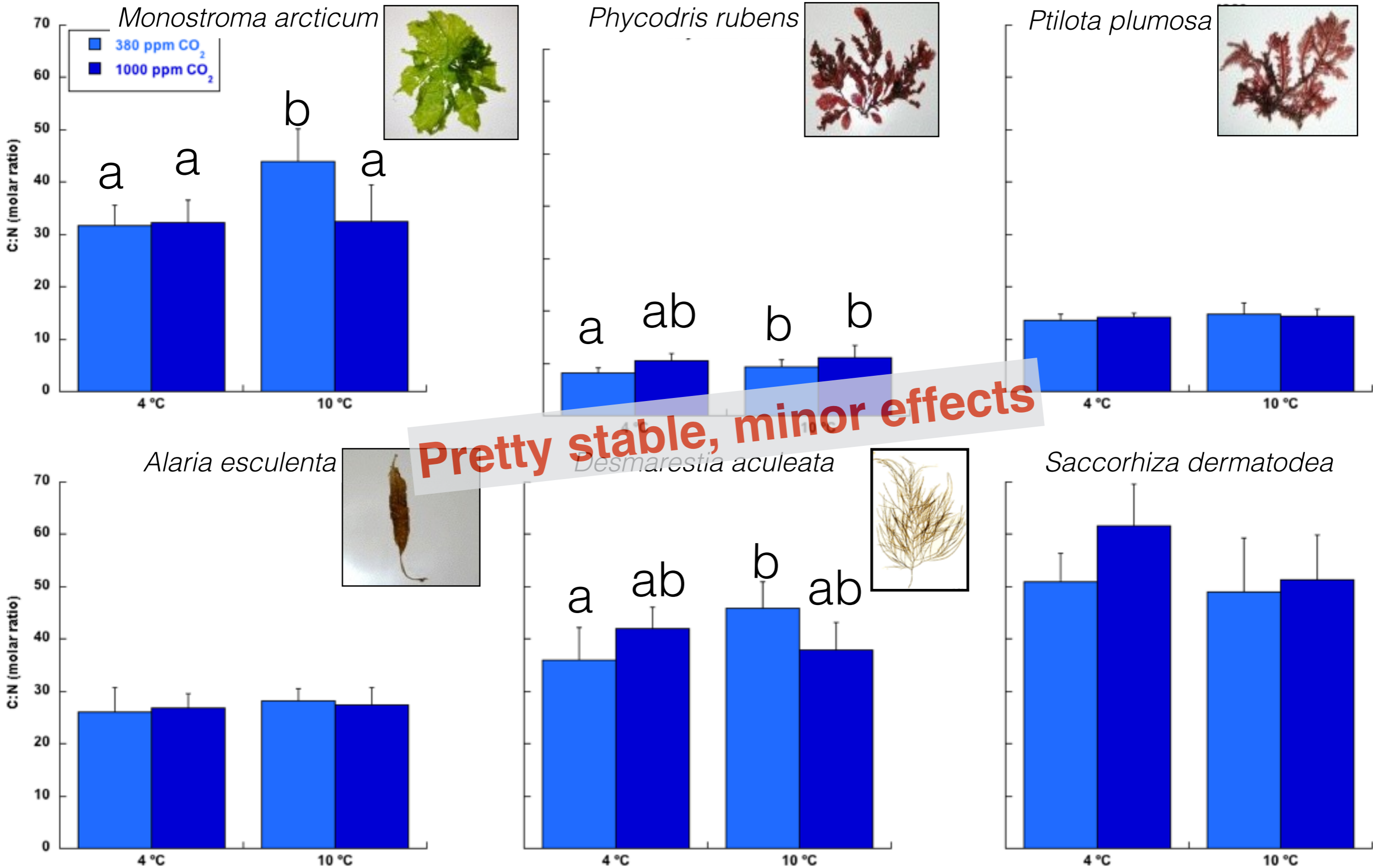


# Lipids





# Total C:N



# Summary - 1

The expected increase in **atmospheric CO<sub>2</sub> and temperature** has the potential to affect species composition/domination, since **different species responded in different ways:**

## Growth:

- Enhanced by CO<sub>2</sub> alone: *Phycodris rubens*, *Alaria esculenta*
- Enhanced by combined CO<sub>2</sub> and Temp: *Saccorhiza dermatodea*
- Enhanced by Temp: *Ptilota plumosa*
- Inhibited by CO<sub>2</sub>: *Desmarestia aculeata*



# Summary - 2

## Biochemical Composition

- CO<sub>2</sub> affects mostly carbohydrates and lipids, but species specific.
- C:N ratio quite stable, there must be a 'C regulatory mechanism'

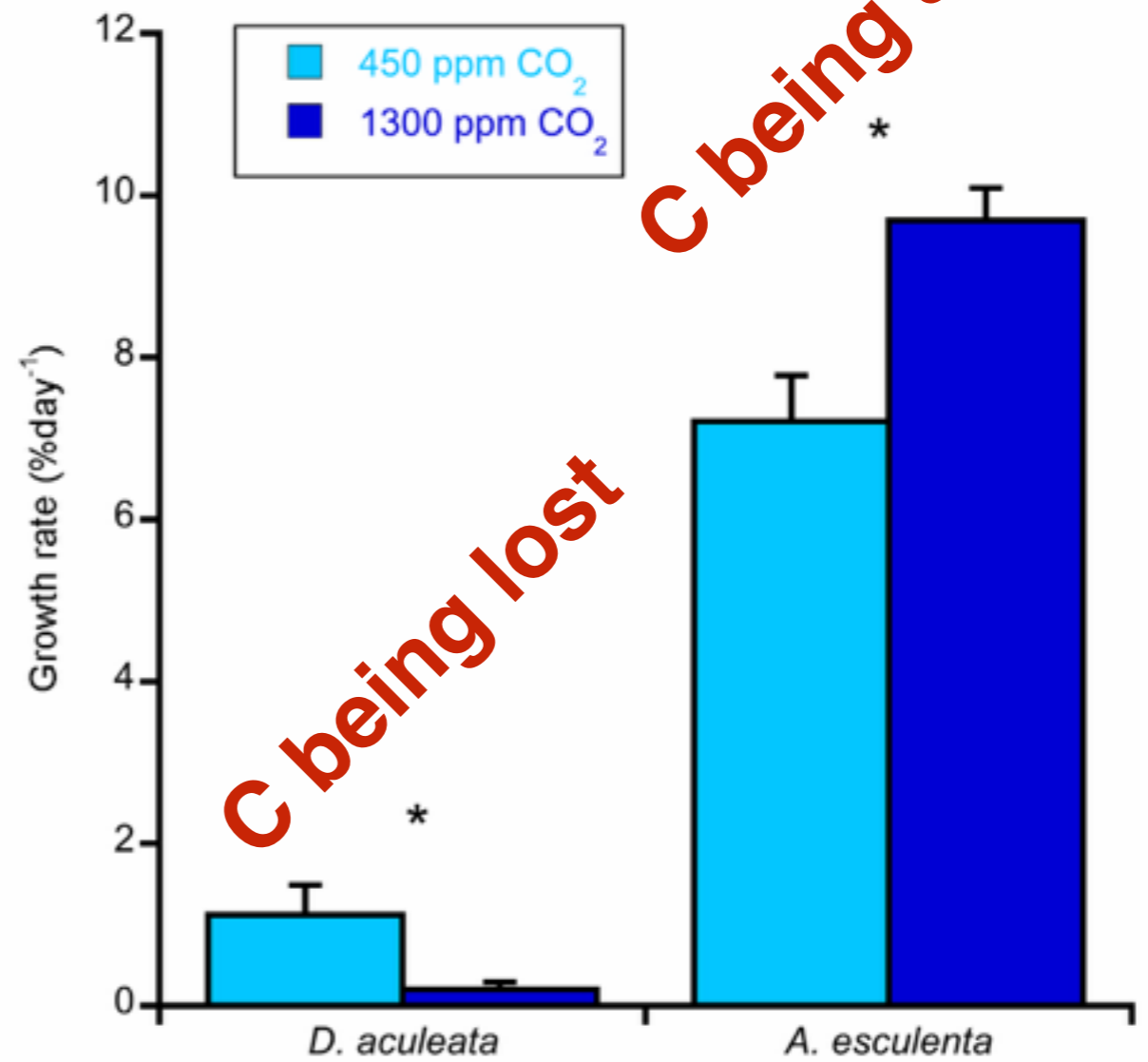
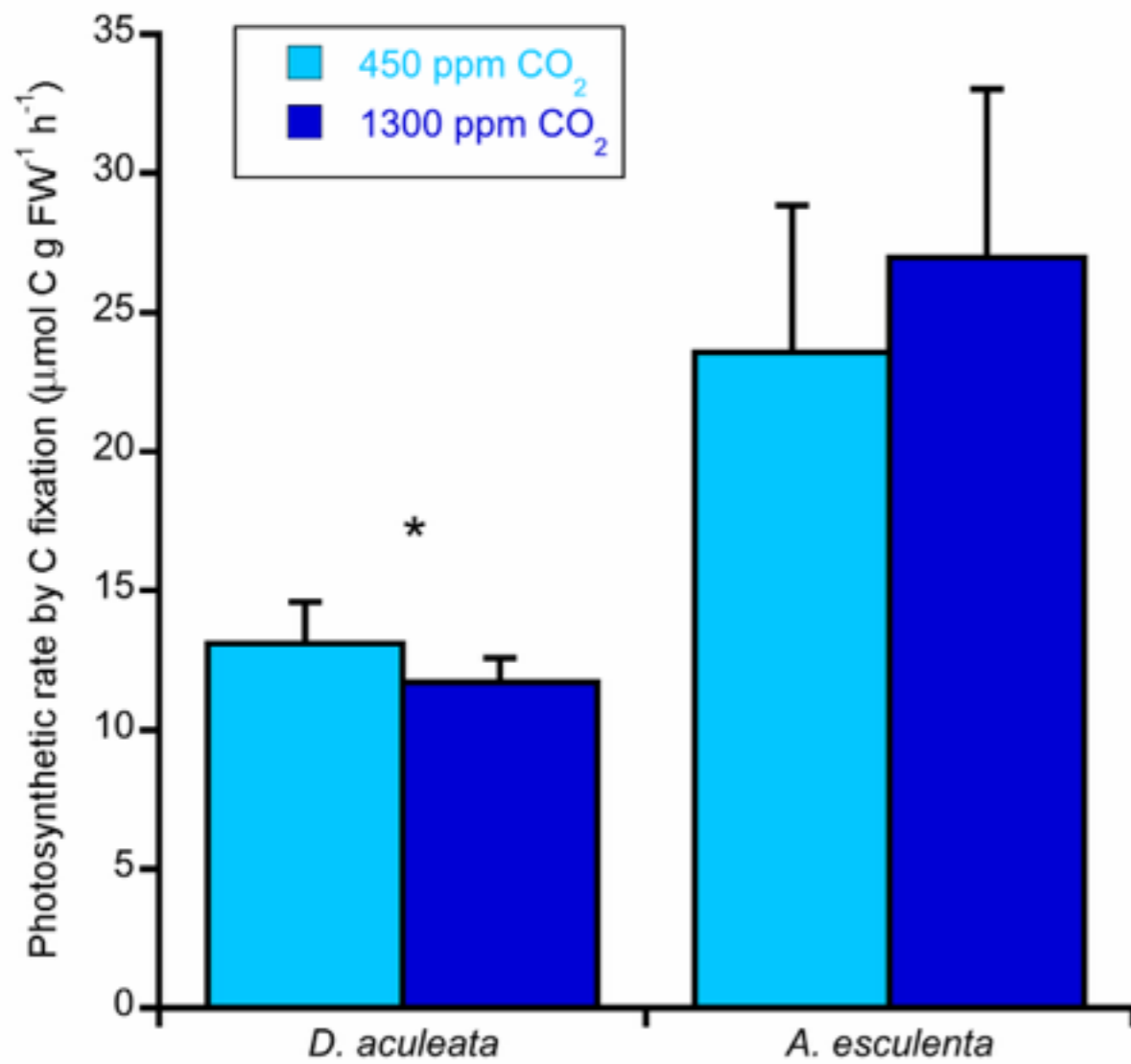
## Common to all polar seaweeds so far

- Lack of inhibition of eCA. Most likely a cold-adaptation.

## Far Reaching Consequences

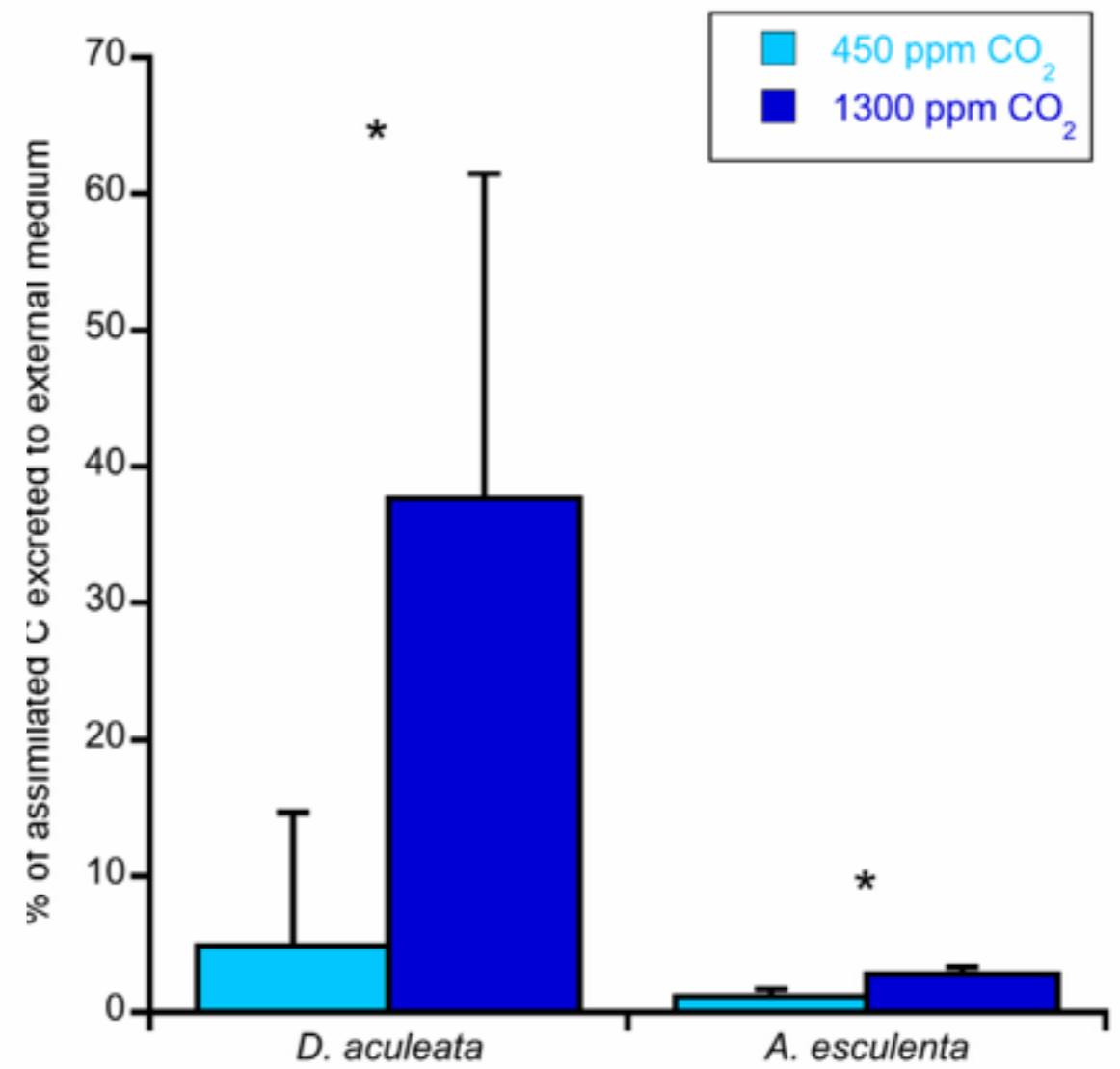
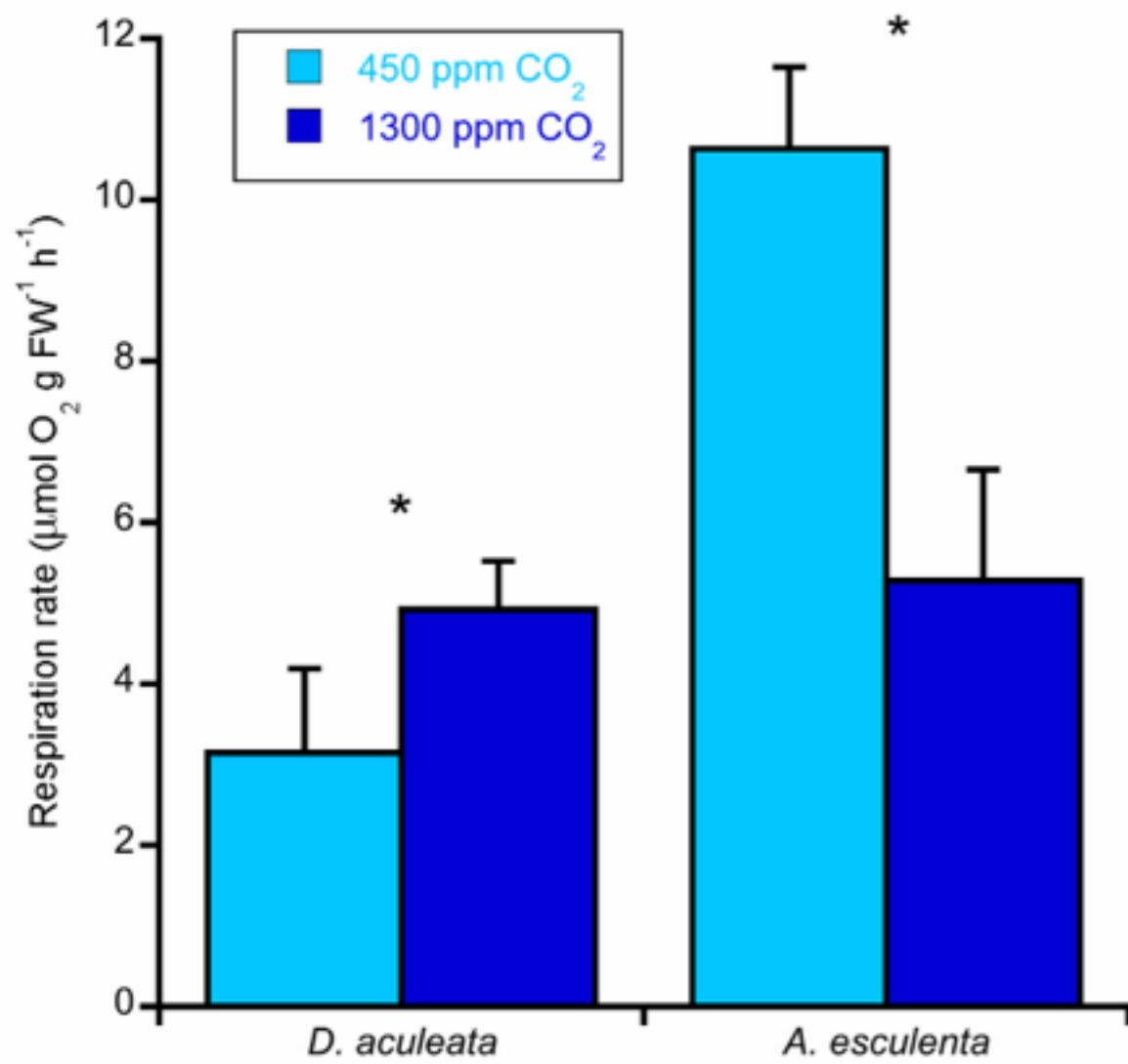
- Differences in biochemical composition might affect **grazers**
- Overall **C biogeochemical cycle** (bacteria?) might be affected

# Carbon Gain





# Carbon Losses



## Summary - 3

Mechanisms involved in response to CO<sub>2</sub>:

- **Not only photosynthesis**, but also respiration and organic C release, among others
- The release of **DOC** acts as a **regulating valve** with presumably far reaching consequences (bacteria)



Thanks to:

Carlos Jiménez

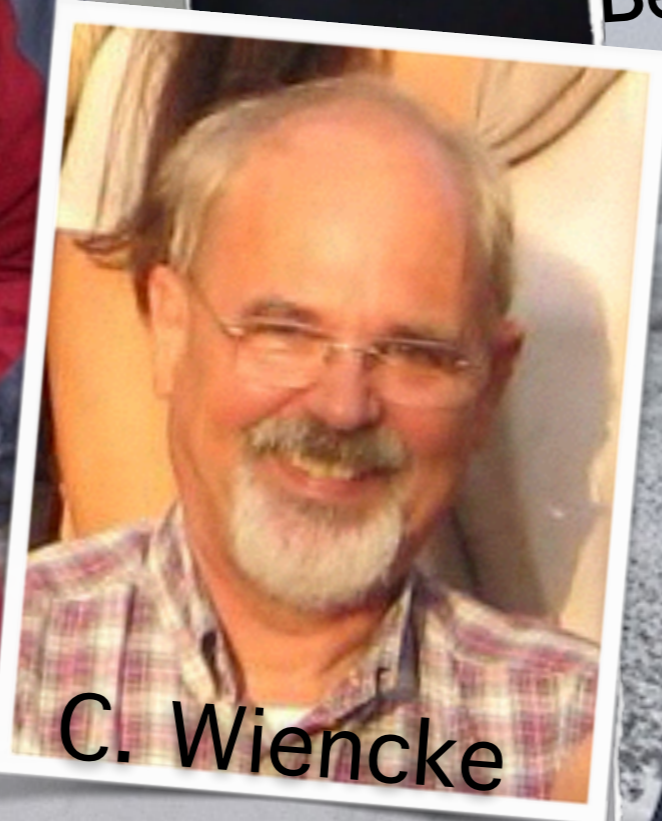


Charo Lorenzo.

Raquel Carmona



Benjamin Viñegla



C. Wiencke



...and special thanks to AWI Diving Team





Thank you



See you there!