EGU
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First year of results from a mooring over a Posidonia Oceanica seagrass meadow (Corsica, France)

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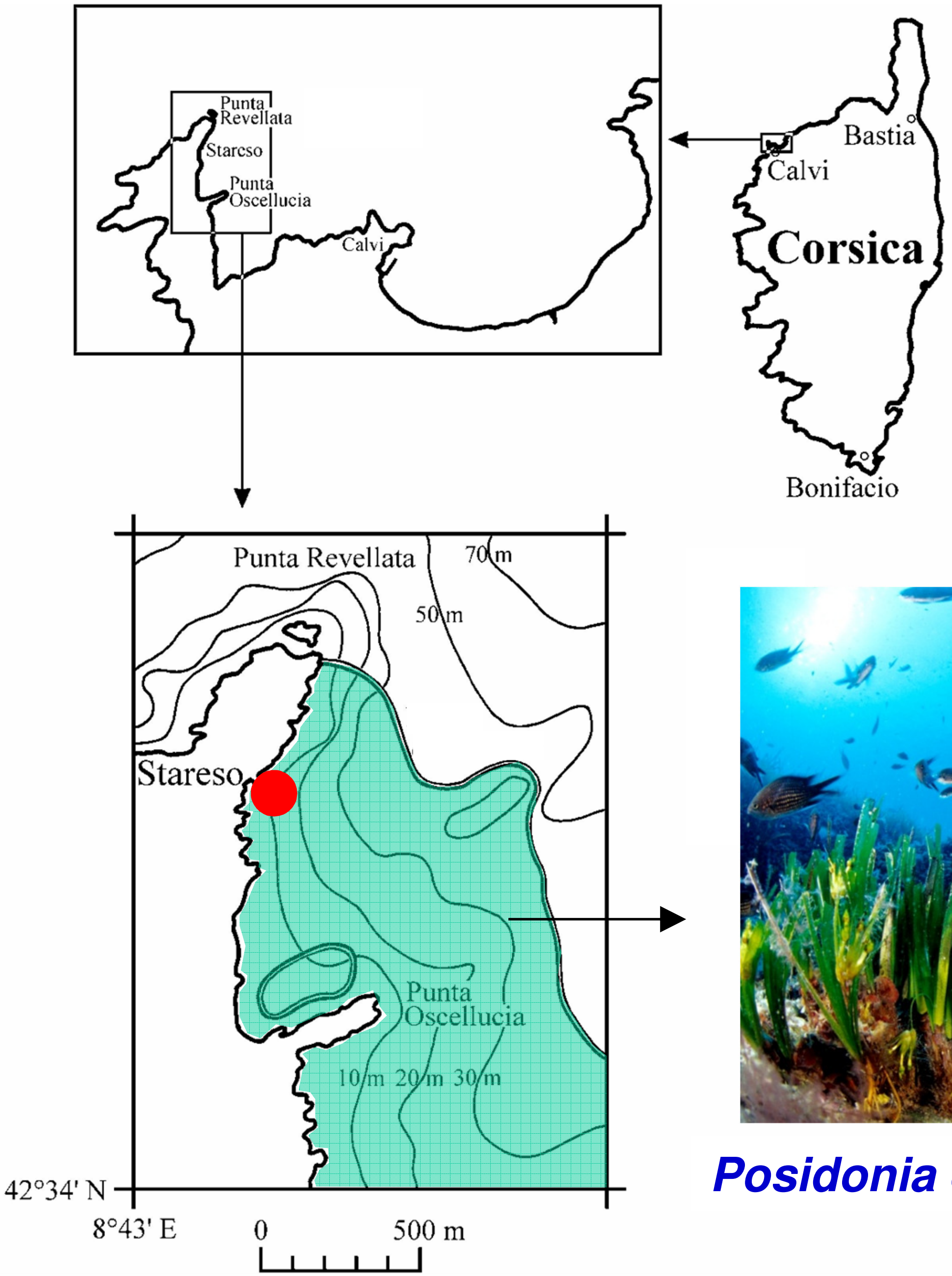
[2] STARESO, France

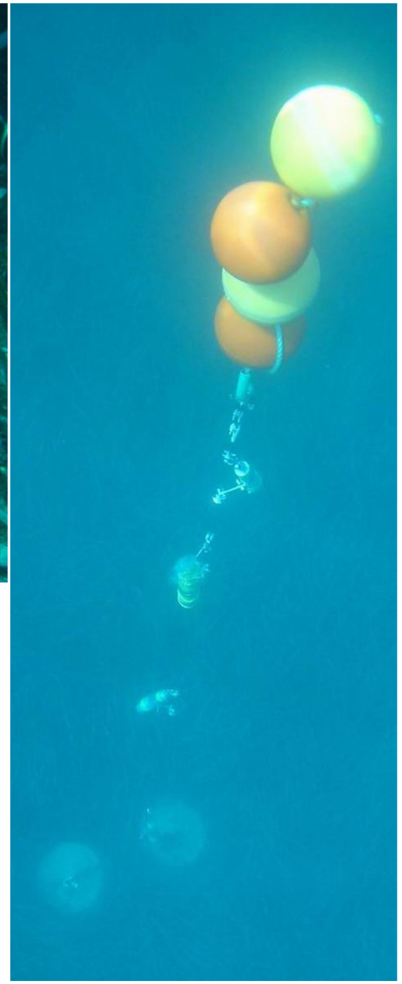
Methods



***Posidonia oceanica* seagrass meadow**

Methods



Aanderaa optodes 3835
Wetlabs Eco fluorometer
Pro-oceanus CO_2-Pro

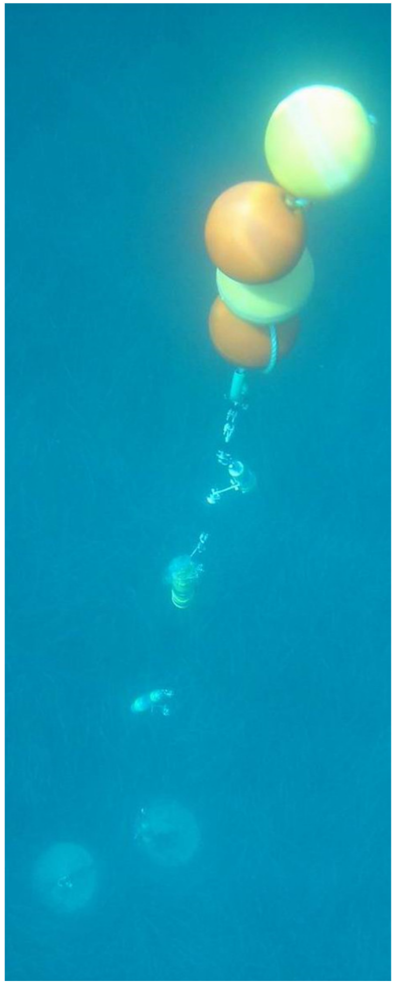
Methods

Moored instruments (10m depth) :

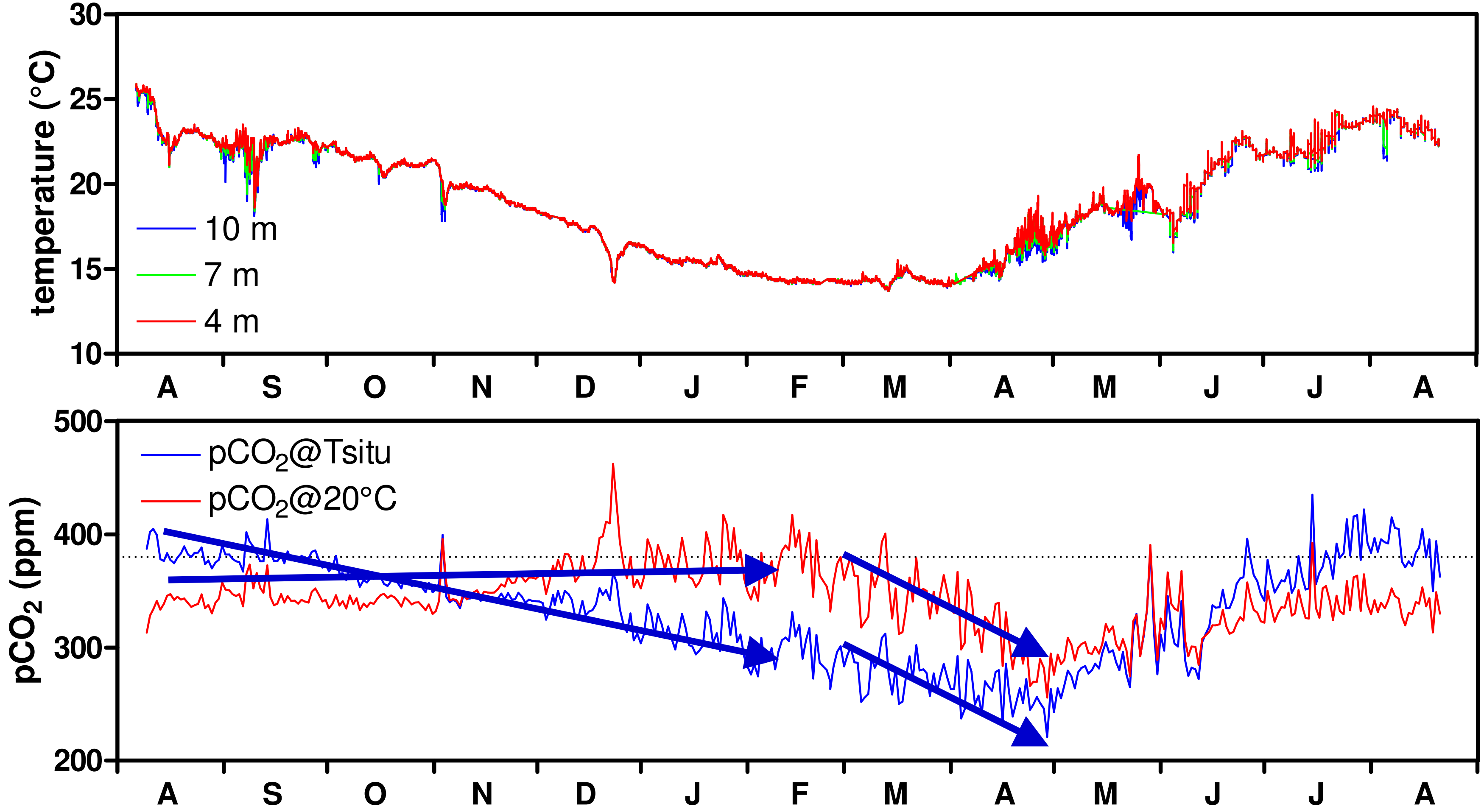
Fluorescence	4m	12 h
pCO_2	4m	24 h
$\%O_2$	4, 7, 10m	30 min
Temperature	4, 7, 10m	30 min
Wind speed	-	1 h

Benthic incubations :

CO_2, O_2, nutrient fluxes	10m	2 months



pCO_2 mooring

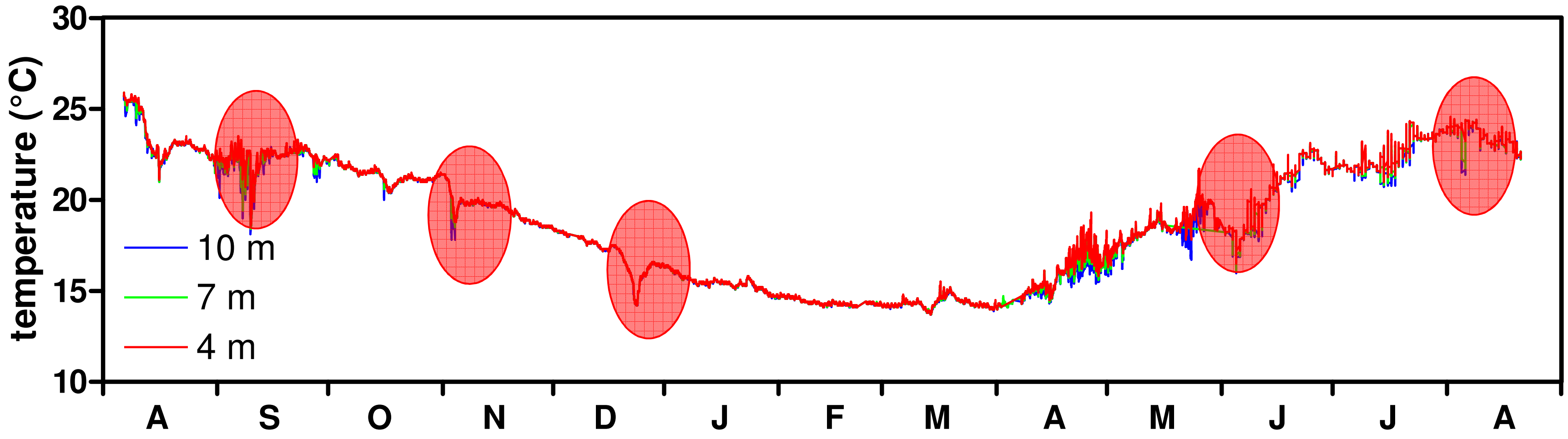


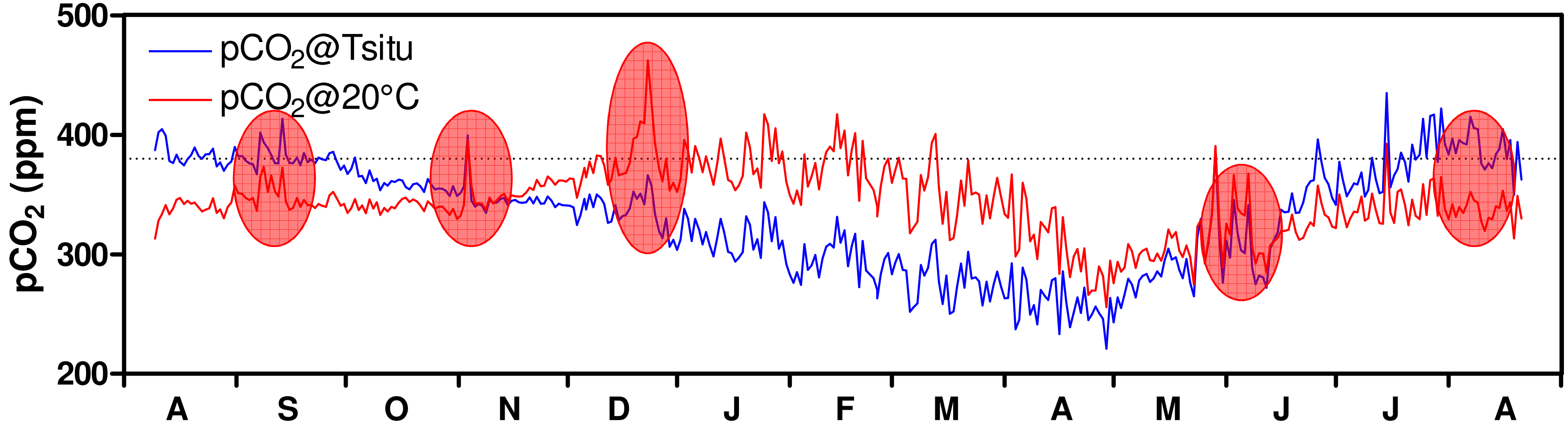
Except in summer (June-September) pCO_2 in water < pCO_2 in air = sink for atmospheric CO_2

Decrease from September to February related to temperature decrease

Decrease from September to May related to biology

pCO_2 mooring





Except in summer (June-September) pCO_2 in water < pCO_2 in air = sink for atmospheric CO_2

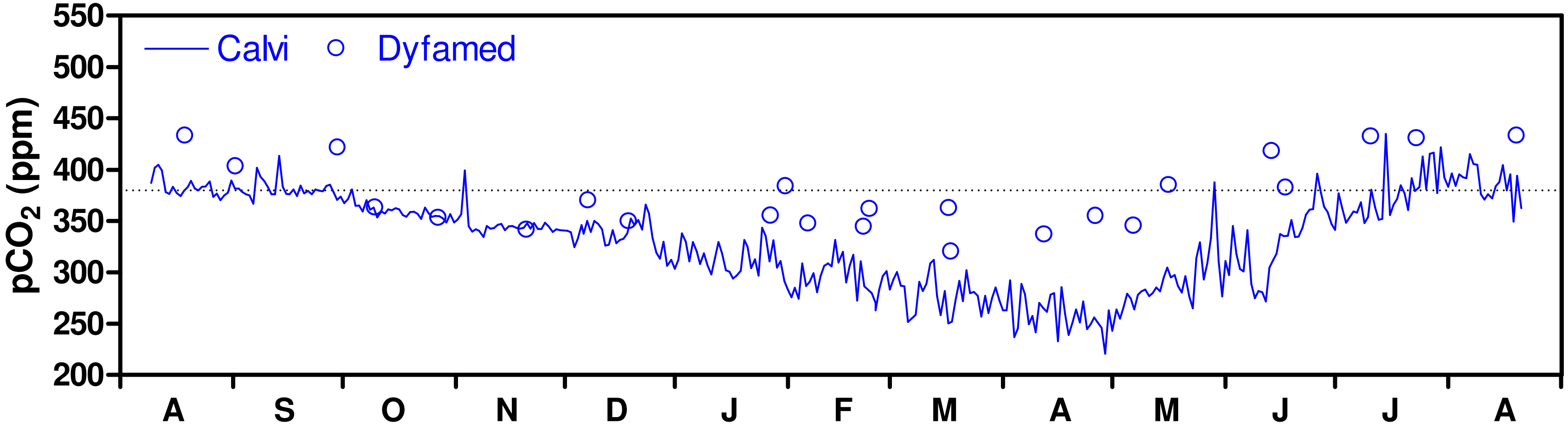
Decrease from September to February related to temperature decrease

Decrease from September to May related to biology

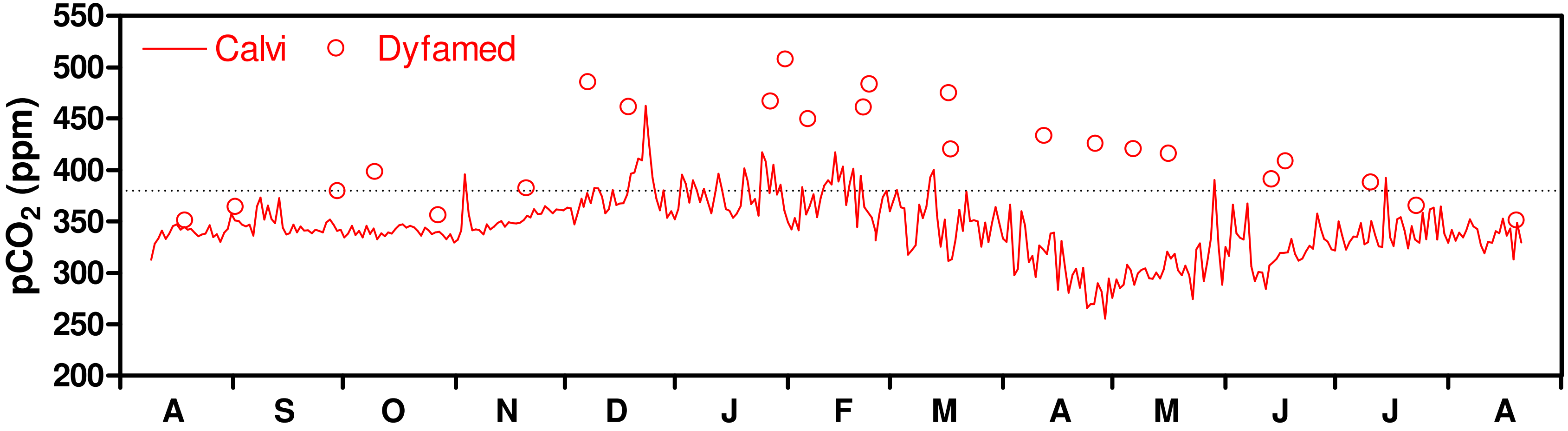
Extreme events bring offshore water (colder & higher pCO_2)

pCO_2 mooring

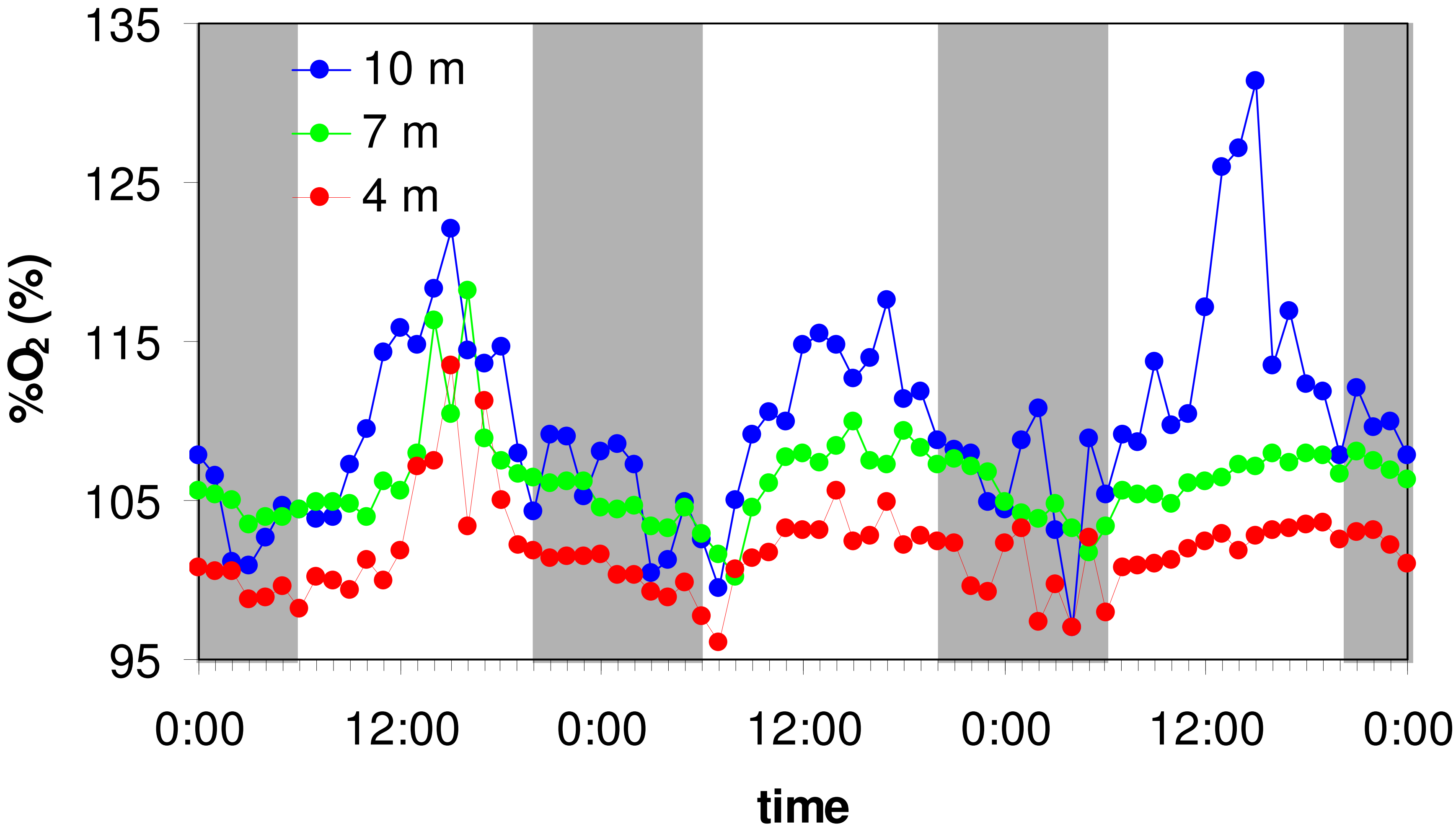
pCO_2@in-situSST



pCO_2@20°C



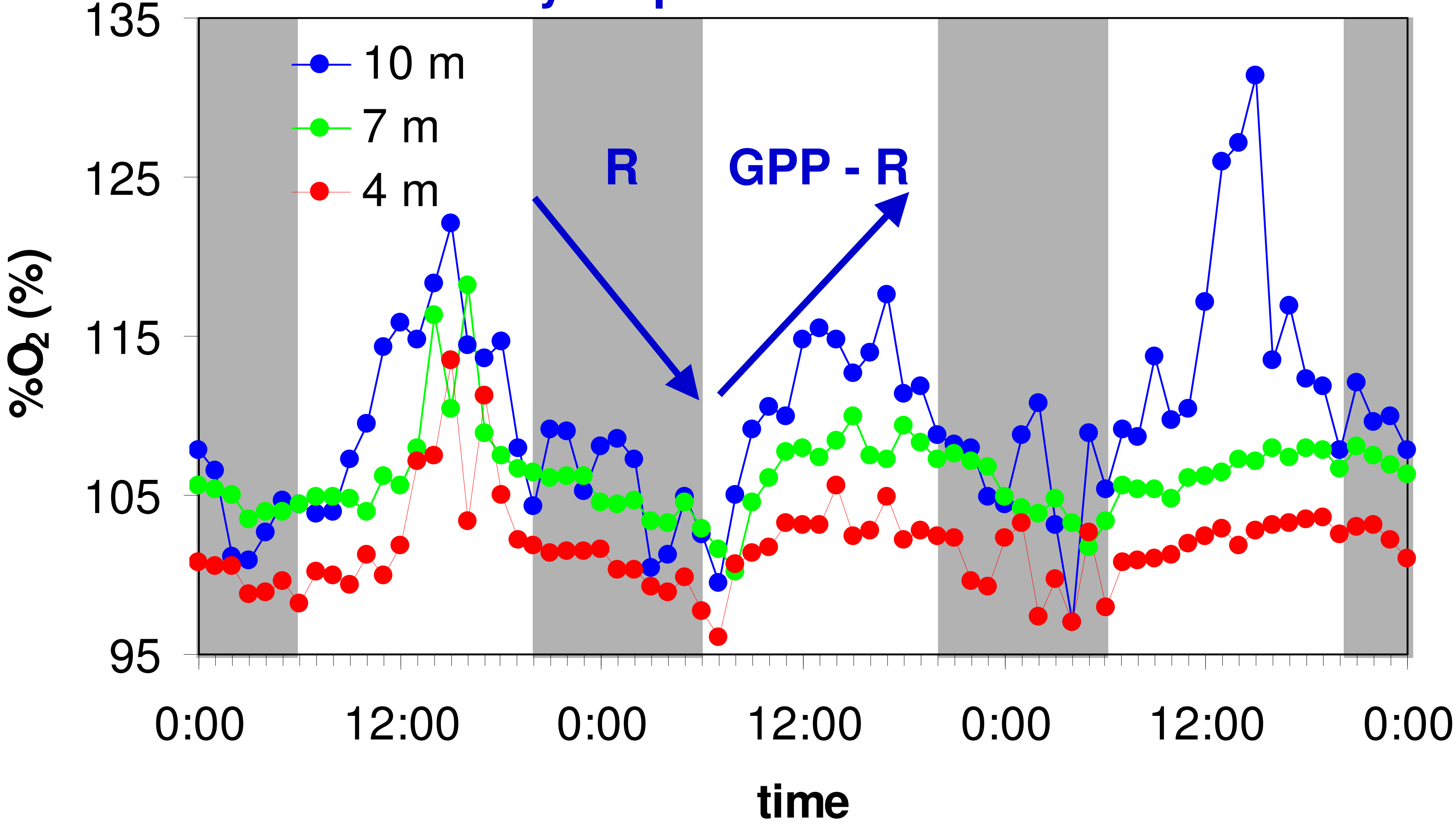
O_2 mooring



Higher O_2 at 10m
Higher daily amplitude of O_2 10m
} **Effluence of Posidonia biology**

O_2 mooring

GPP = Gross primary production
R = Community respiration



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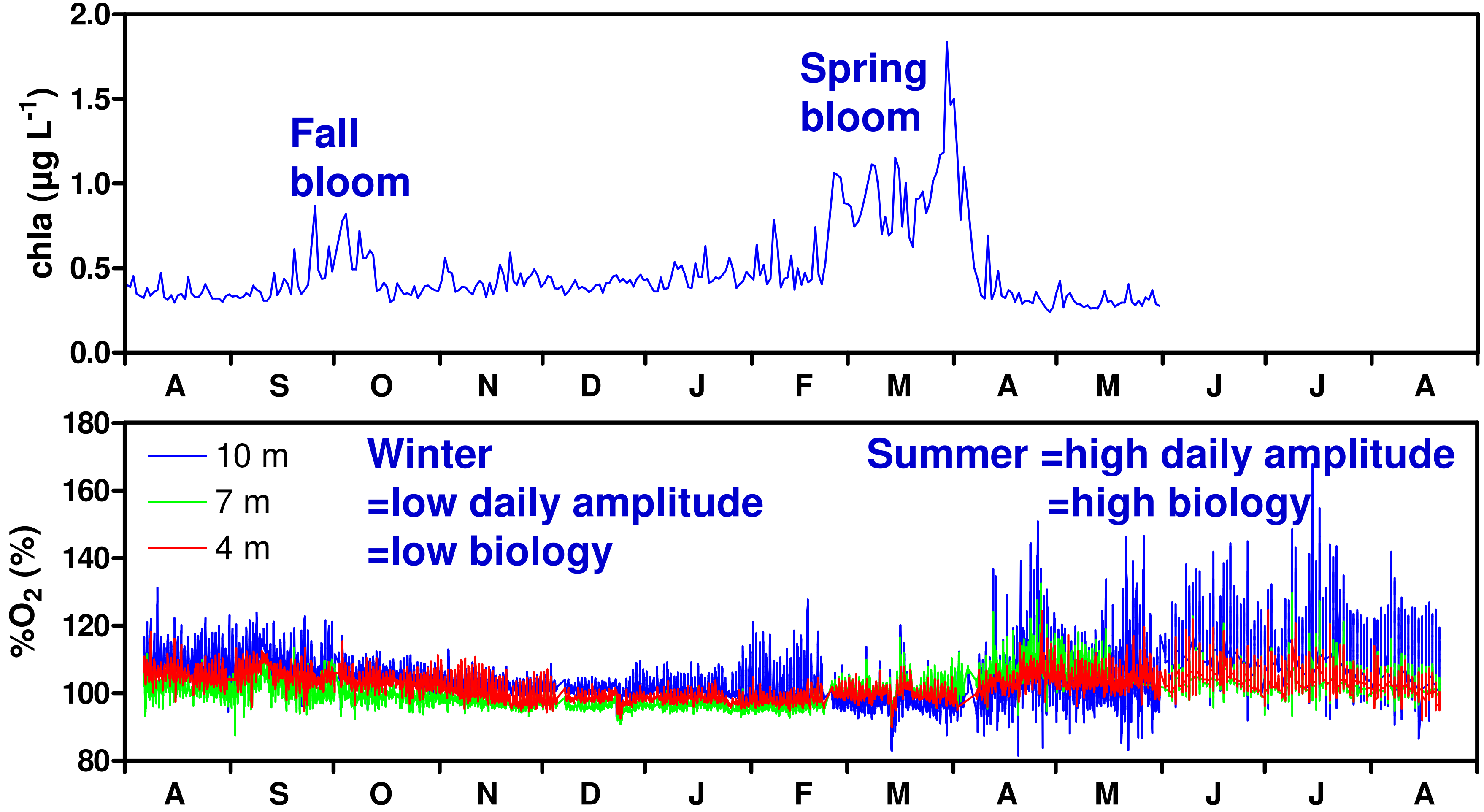
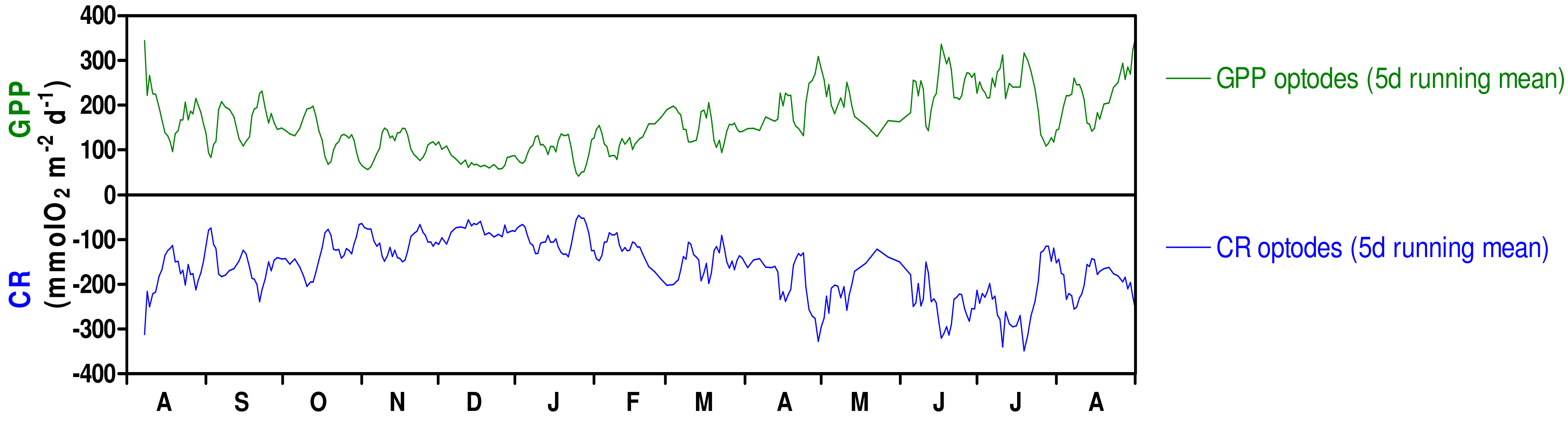
O_2 mooring



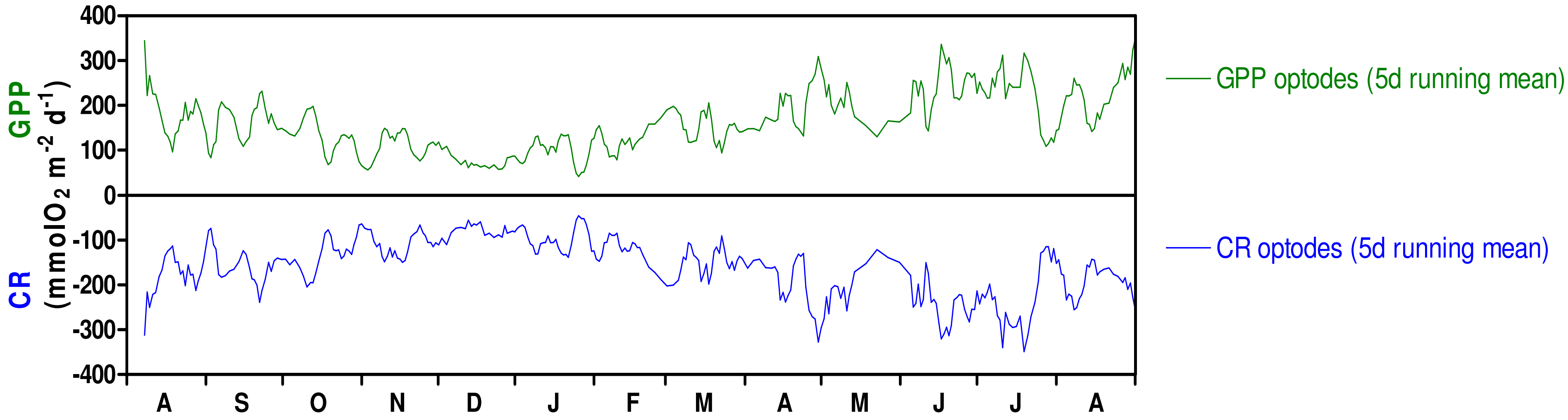
Largest daily amplitude observed from mid-April to September
= after the spring phytoplankton bloom
= production of Posidonia much larger than pelagic production
= production of Posidonia related to light availability (internal nutrient recycling)

O_2 mooring



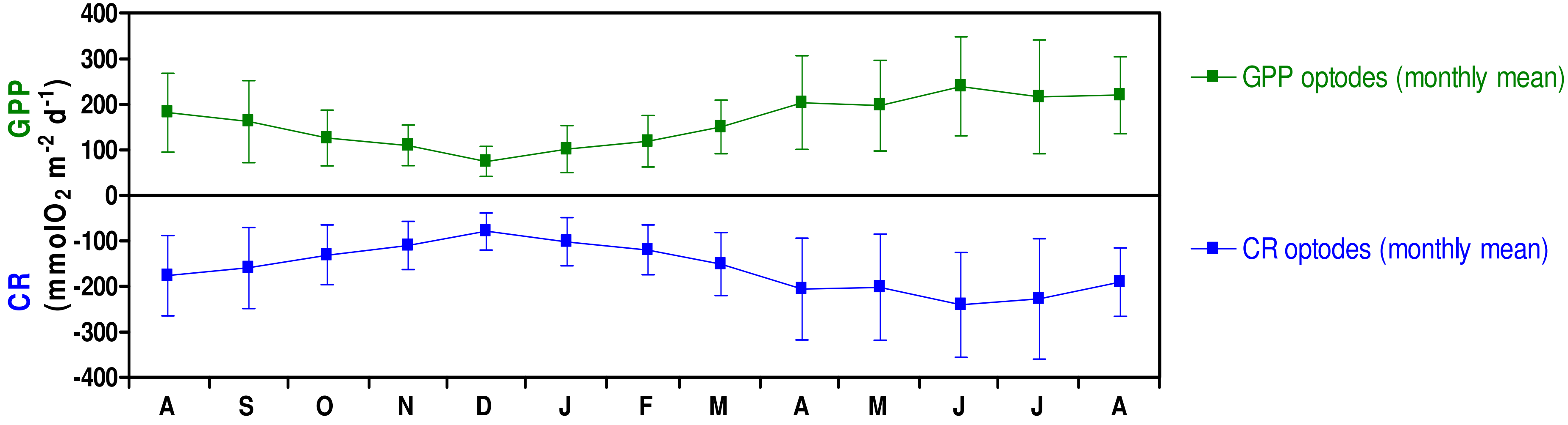
- Close coupling between Gross Primary production and Community Respiration

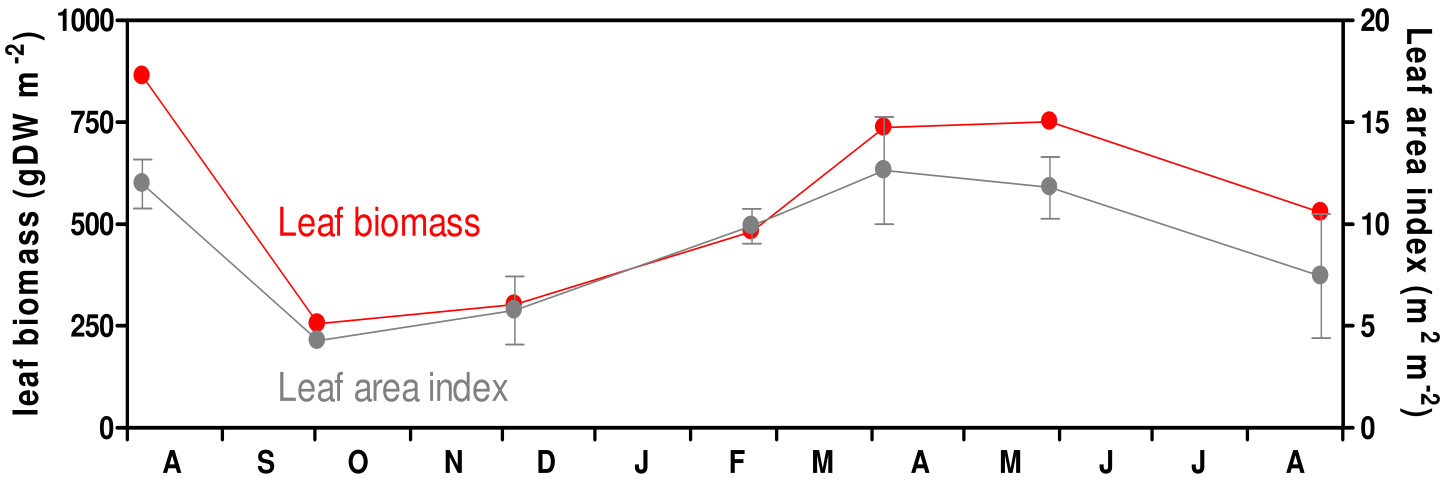
O_2 mooring



- Close coupling between Gross Primary production and Community Respiration
- Strong short-term variability (related to light conditions)

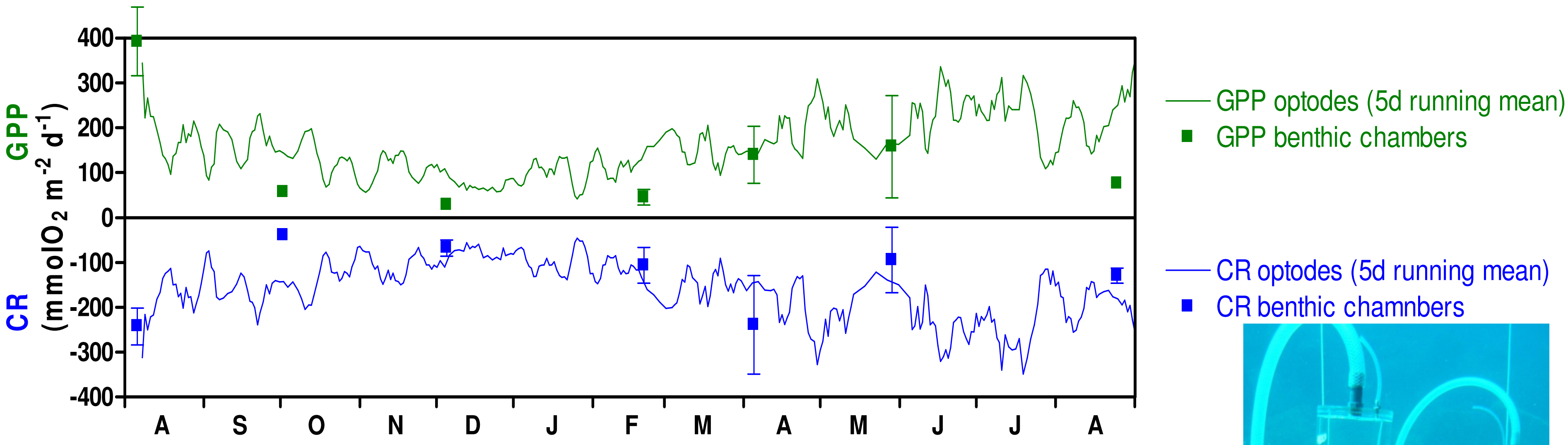
O_2 mooring

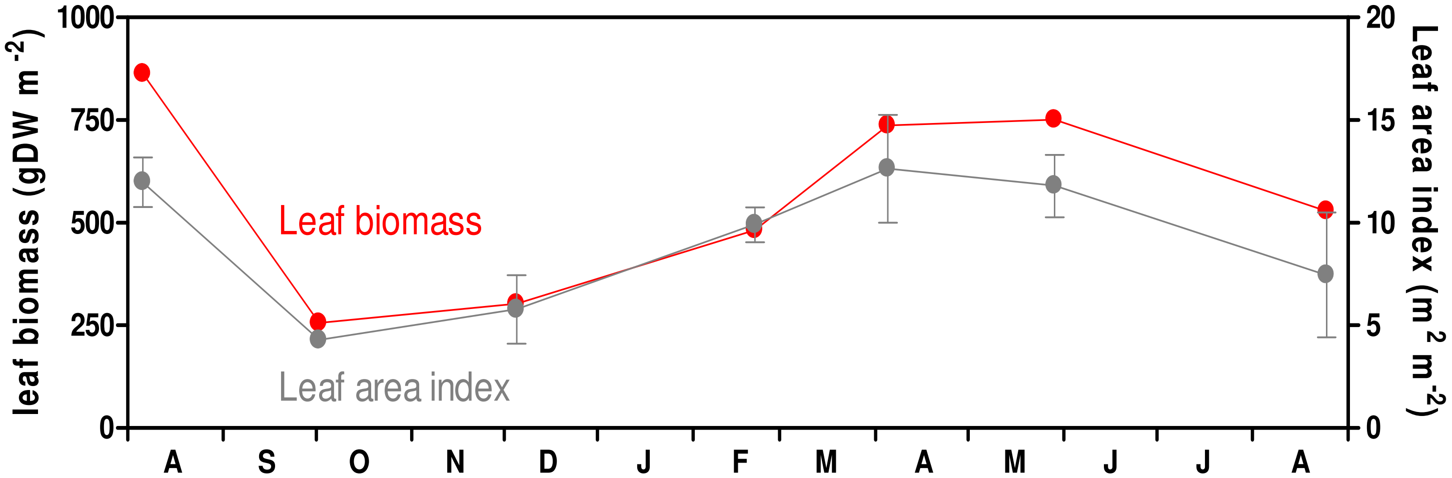


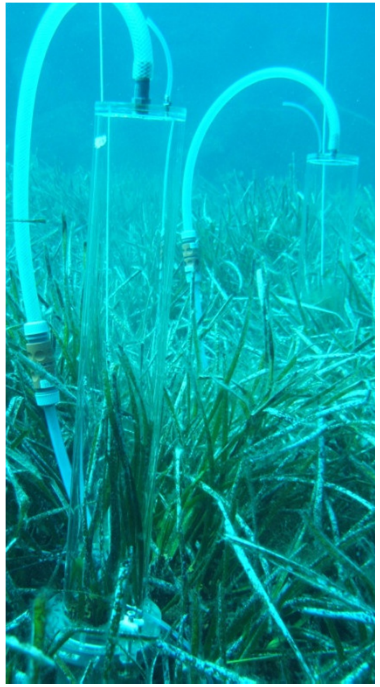


- Close coupling between Gross Primary production and Community Respiration
- Strong short-term variability (related to light conditions)
- GPP (and CR) track annual cycles of biometric variables

O_2 mooring

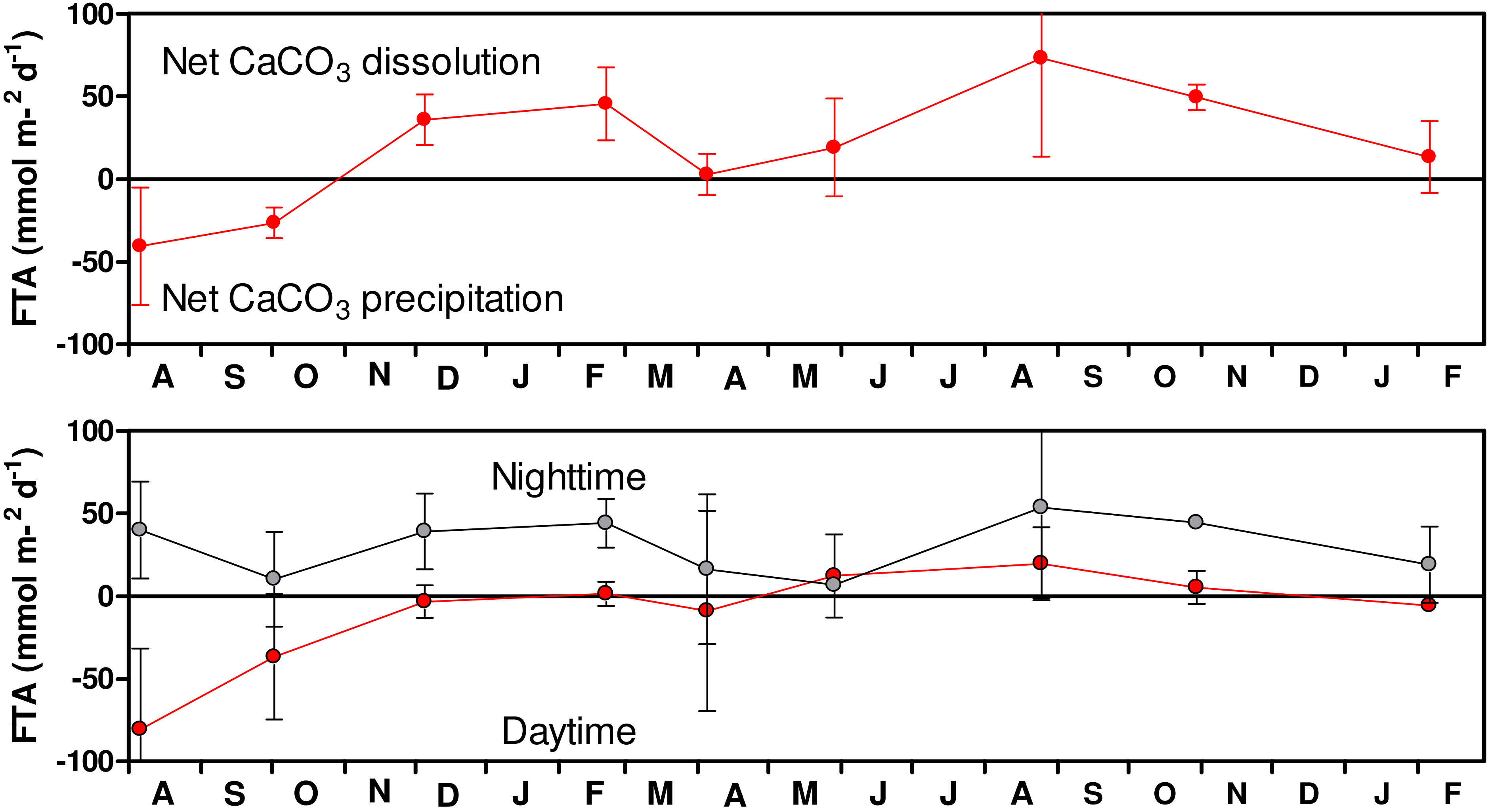






- Close coupling between Gross Primary production and Community Respiration
- Strong short-term variability (related to light conditions)
- GPP (and CR) track annual cycles of biometric variables
- Good agreement with discrete measurements, possible under-estimate of GPP

Benthic chamber data



Benthic chamber data

Dissolution of $CaCO_3$ in sediment pore waters :

Respiration $\longrightarrow CO_2$

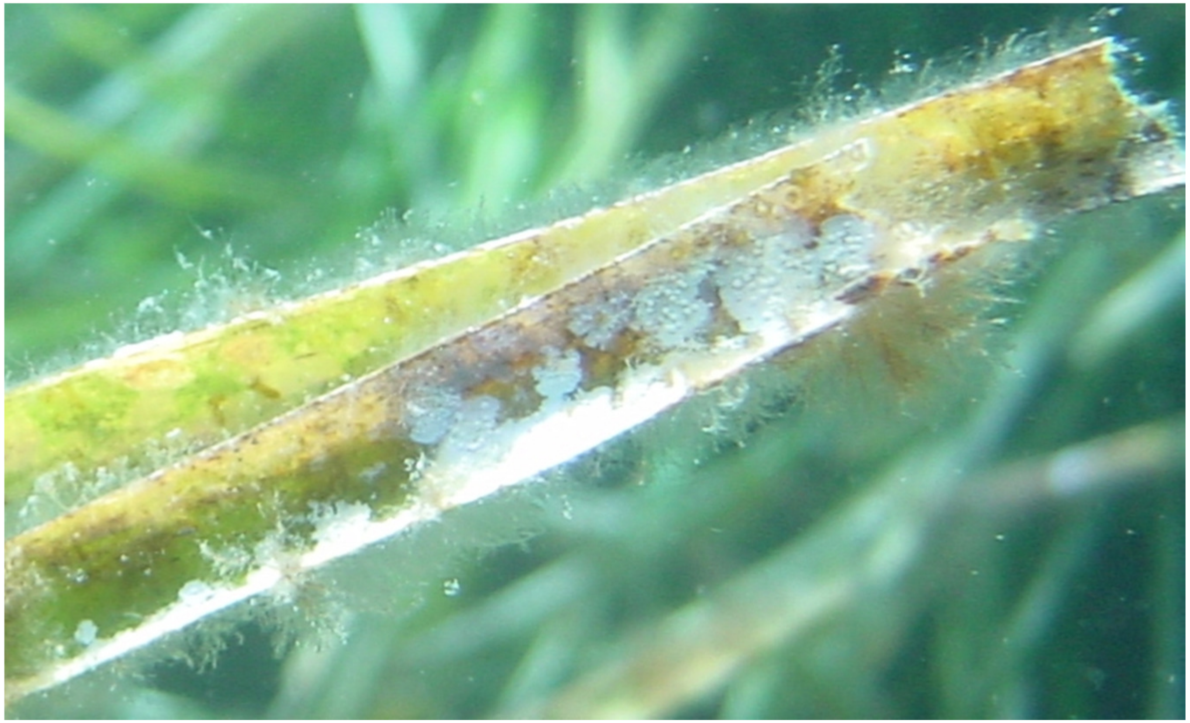
Sulfate reduction $\longrightarrow H_2S$

In oxic layer $H_2S \longrightarrow H^+ \longrightarrow CO_2$

Results in pore water acification :

$$CaCO_3 + CO_2 + H_2O \longrightarrow Ca^{2+} + 2HCO_3^-$$

Benthic chamber data



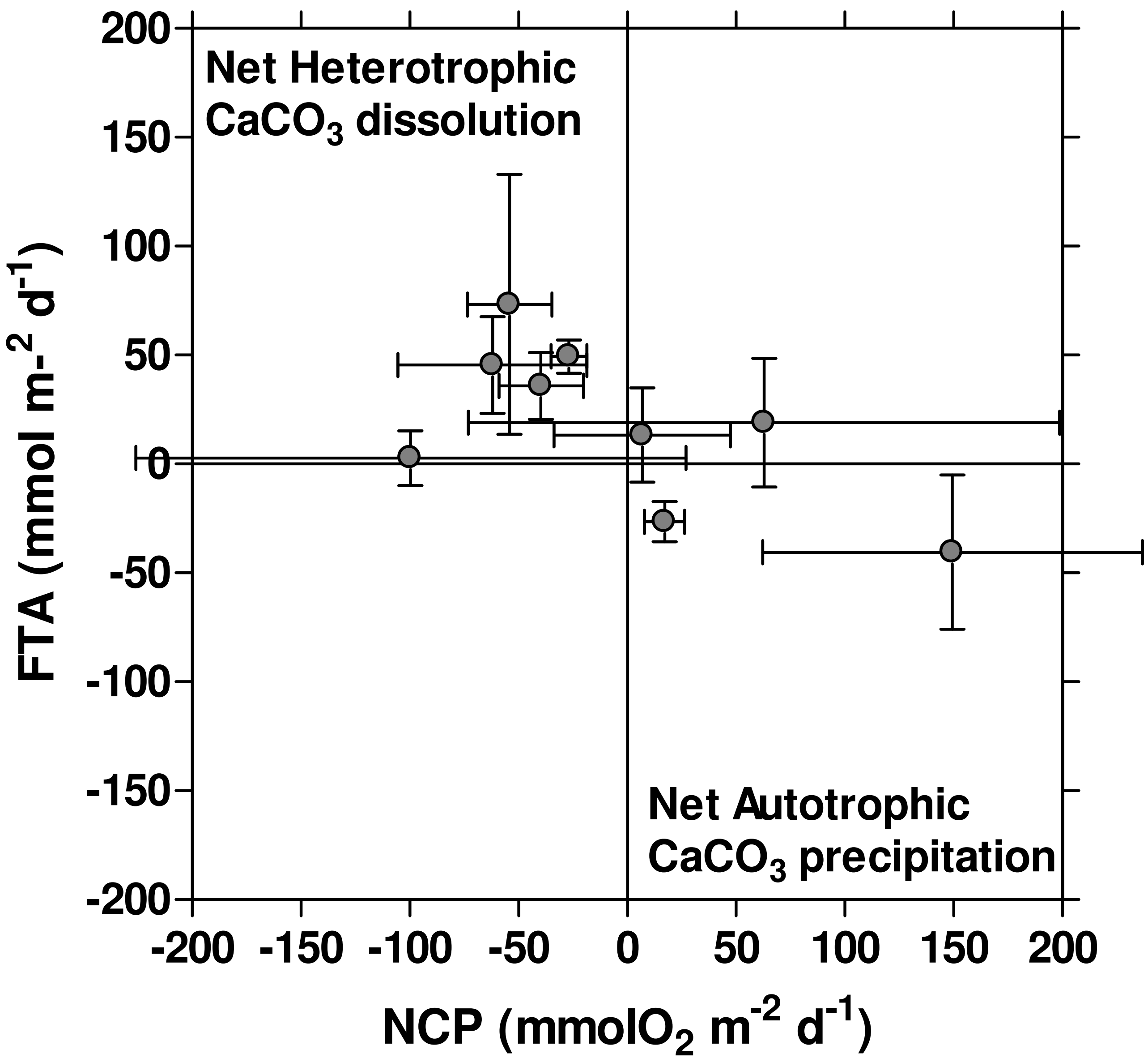
Epiphytes:

3-22% of leaf biomass
$CaCO_3$ = 40-53% of epipyte biomass

Bryozoans (*Electra posidonia*, *Fenestrulina johannae*, *Celleporina hassallii*, ...)
Foraminifera (*Conorboides mediterranensis*, *Elphidium macellum*, ...)
Polychaetes (*Pomencentros triqueter*, *Spirorbis sp*., ...)
Calcifying red algae (Melobesieae family) dominate in terms of leave cover

⇒ Explains net precipitation during daytime (link between calcification and primary production)

Benthic chamber data



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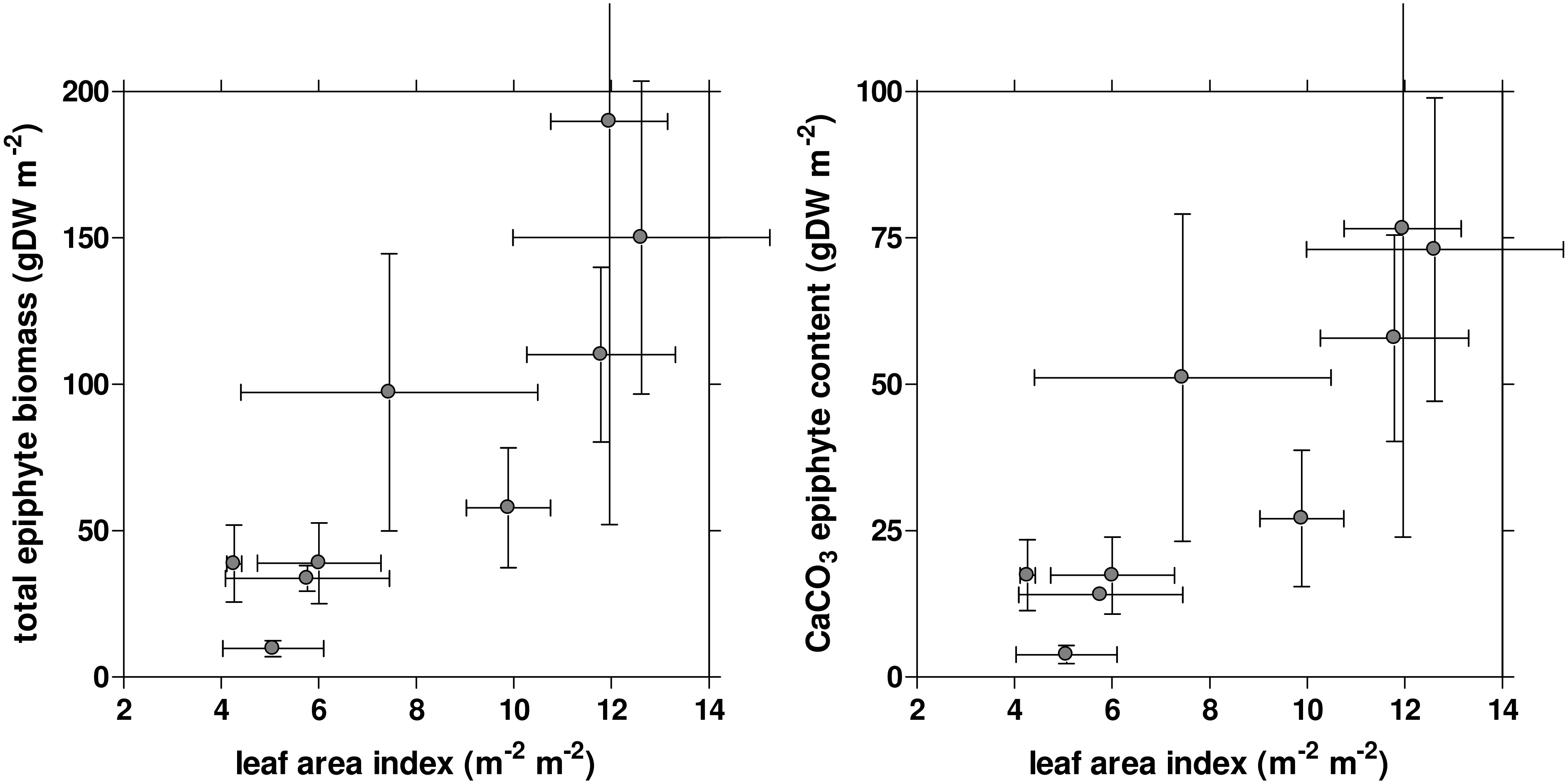

Autotrophic period (High LAI)
⇒ High epiphytes biomass
⇒ Calcification > sediment dissolution
⇒ Net calcification signal

Heterotrophic period (Low LAI)
⇒ Low epiphyte biomass
⇒ Calcification < sediment dissolution
⇒ Net dissolution signal

Back-of-envelope C budget

Based on optode data, this ecosystem seems to be net autotrophic on annual scale :

NCP = +6.7 molO_2 m^{-2} yr^{-1}

On annual scale there seems to be a net $CaCO_3$ dissolution :

Since $CaCO_3 + CO_2 + H_2O \longrightarrow 2HCO_3^- + Ca^{2+}$

→ absorption of 2.1 molCO_2 m^{-2} yr^{-1}

$CaCO_3$ dissolution provides an addition 32% sink for CO_2


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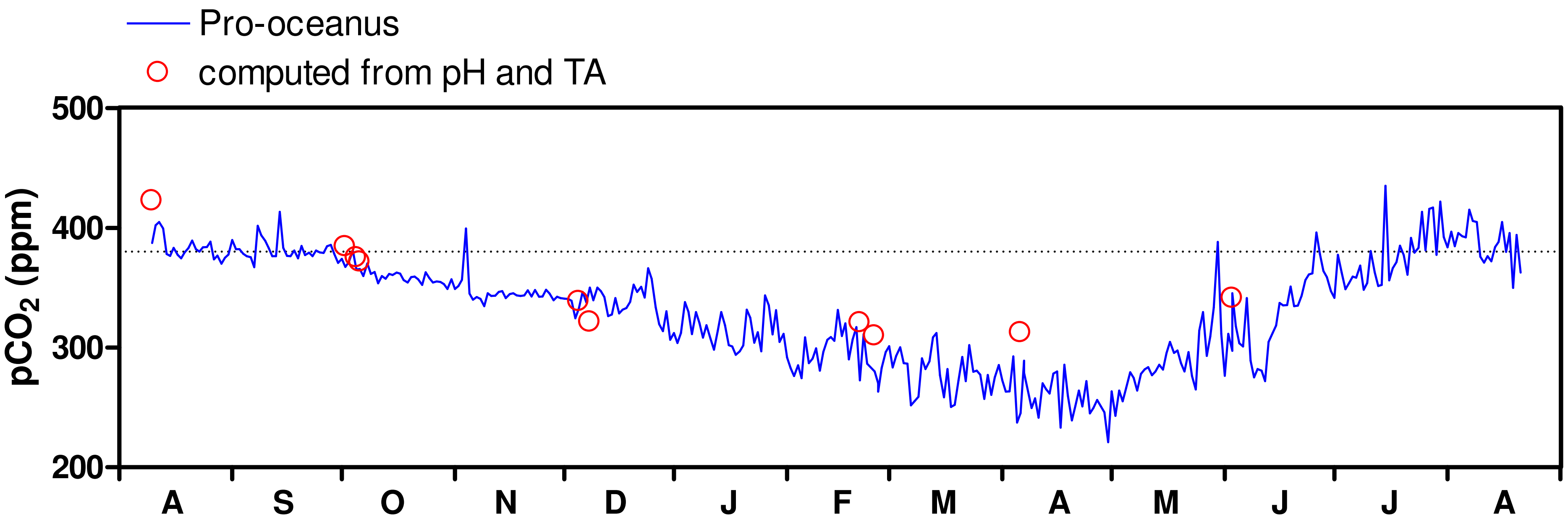
Pro-oceanus
computed from pH and TA
500
400
300
200
pCO2 (ppm)
A
S
O
N
D
J
F
M
A
M
J
J
A

Links between calcification and primary production :

1 - $CaCO_3$ precipitation requires energy that is provided by primary production.

2 – $CaCO_3$ precipitation provides intracellularly the CO_2 required for photosynthesis.

3 - $CaCO_3$ precipitation is a trash-can of energy that allows protection of photosynthetic system in light saturated conditions.