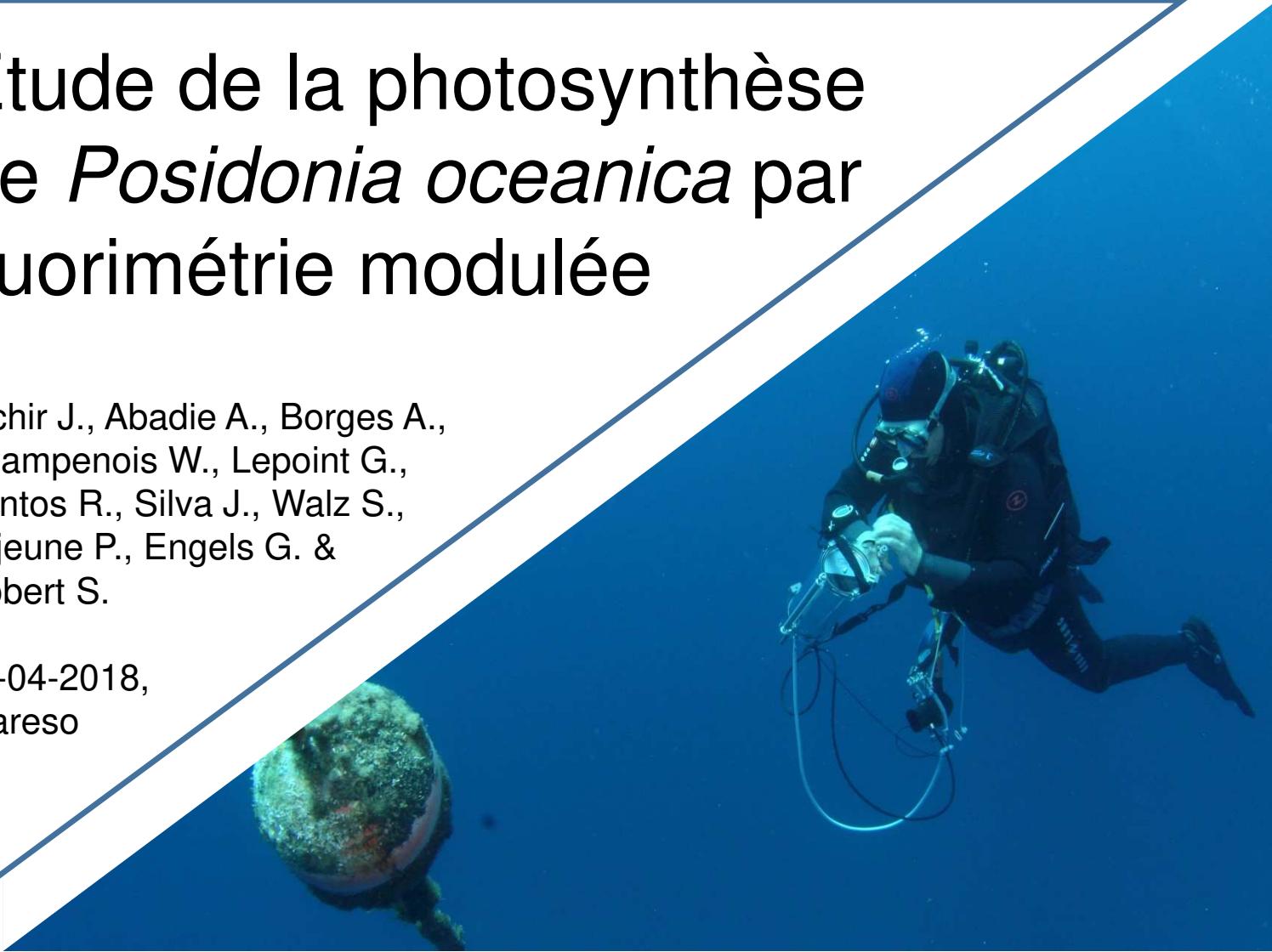




Etude de la photosynthèse de *Posidonia oceanica* par fluorimétrie modulée

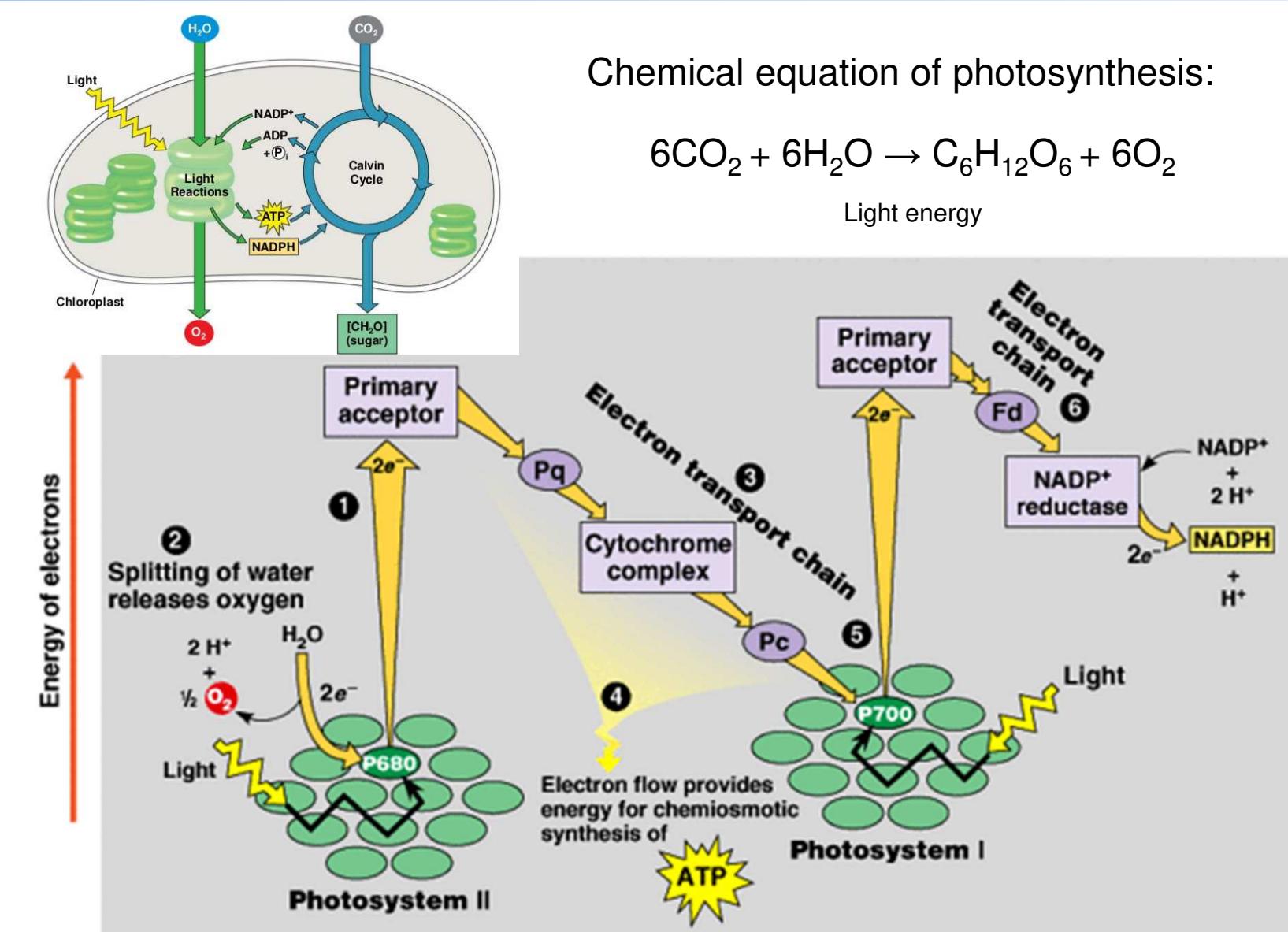
Richir J., Abadie A., Borges A.,
Champenois W., Lepoint G.,
Santos R., Silva J., Walz S.,
Lejeune P., Engels G. &
Gobert S.

10-04-2018,
Stareso



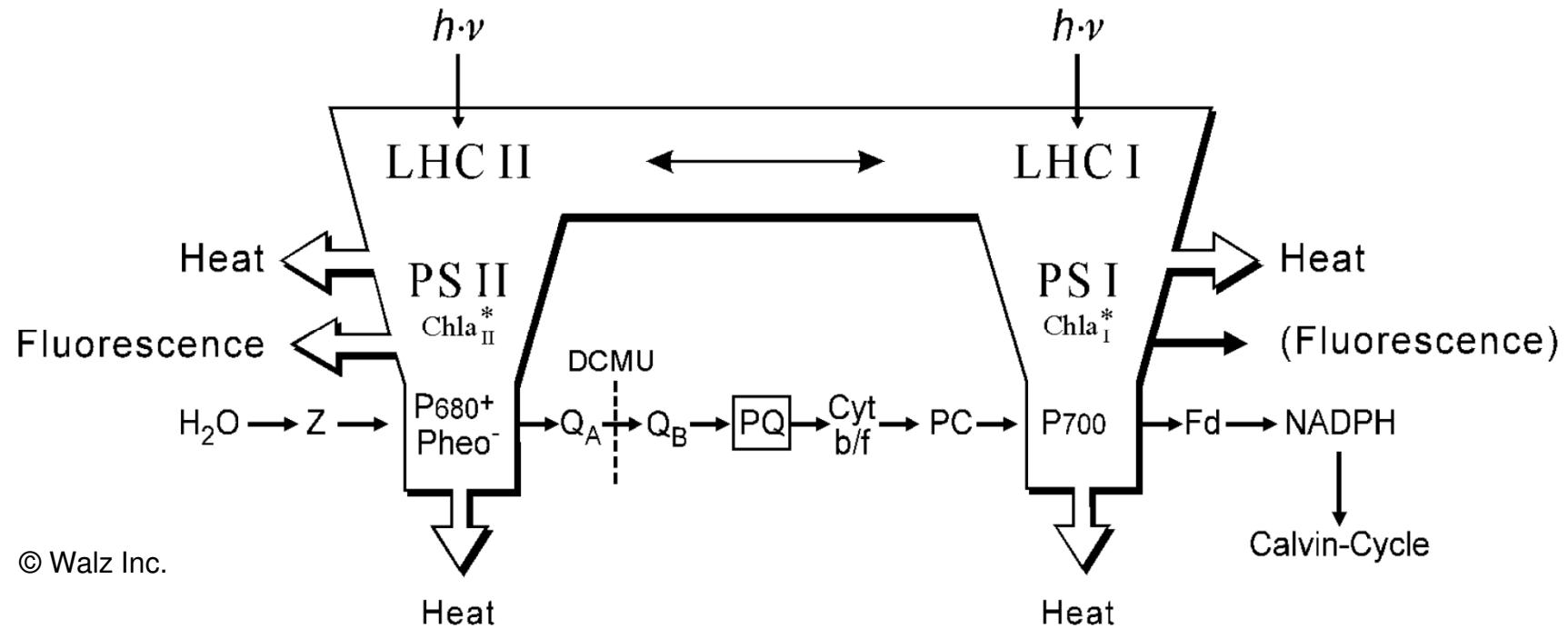


The light reactions





Fluorescence emission



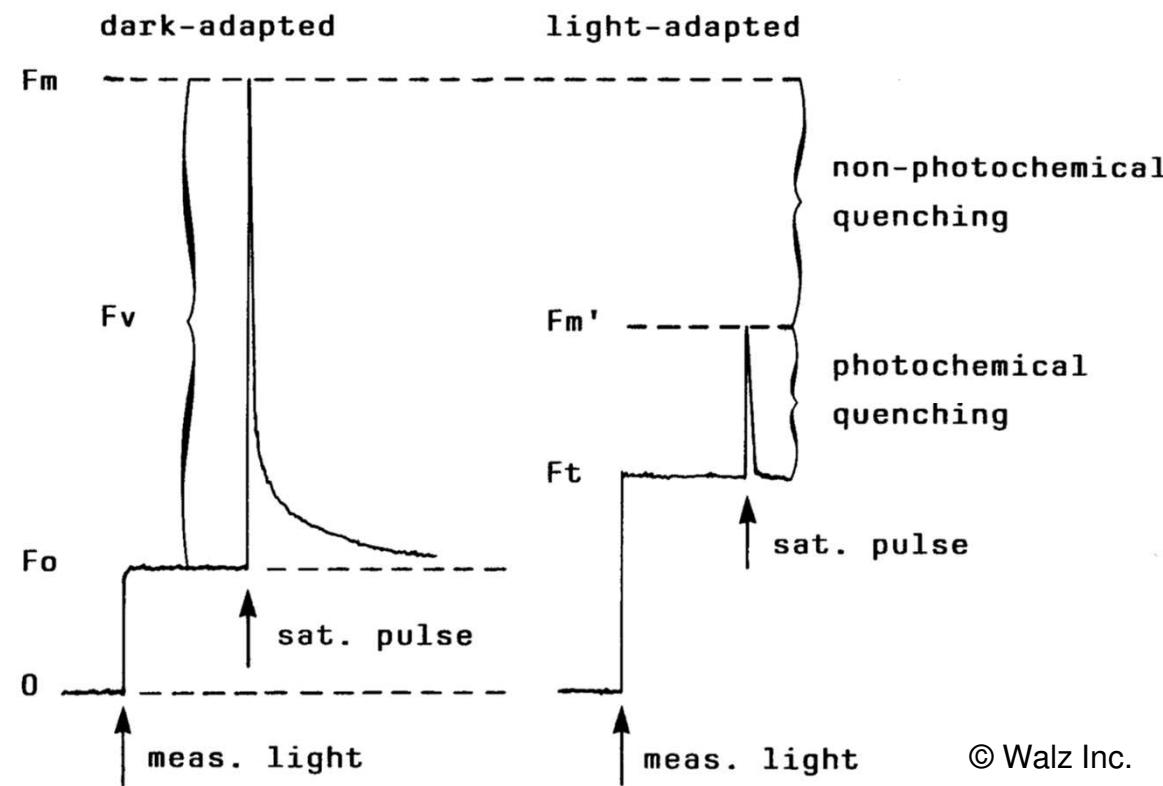
Fluorescence emission is complementary to the alternative pathways of de-excitation, which are photochemistry and heat dissipation.





Fluorescence measurement

- ❖ Dark adapted YIELD = $(Fm-F0)/Fm = Fv/Fm$
→ maximum photochemical efficiency
- ❖ Light adapted YIELD = $(Fm'-Fm)/Fm' = \Delta F/Fm'$
→ effective photochemical efficiency



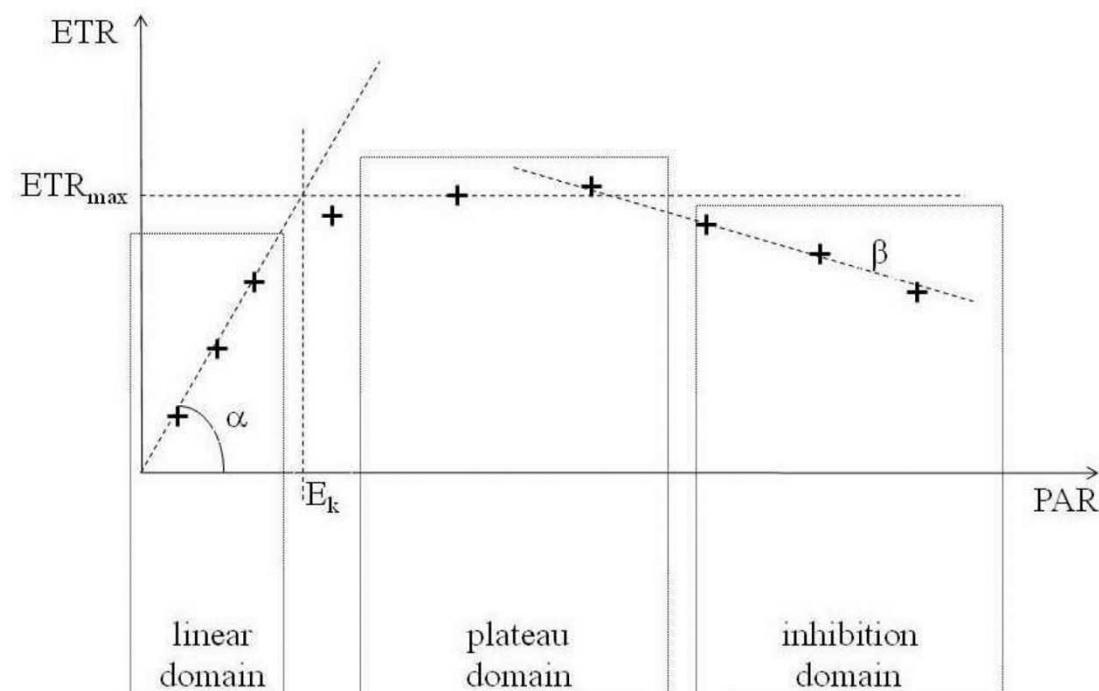
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ETR - RLC

- ❖ Relative Electron Transfert Rate :
 $ETR = YIELD \times PAR \times 0.5 \times ETR\text{-factor}$
- ❖ Rapid Light Curve : photosynthetic flexibility with which a sample can adapt its photosynthetic apparatus to rapid changes of light intensity



(Lassauque, 2008)

ETR_{max} = maximum electron transport rate

E_k = compensation irradiance



Diving-PAM

- ❖ Underwater study of *in situ* photosynthesis
- ❖ Optimized to determine the effective quantum yield of photosynthetic energy conversion, $\Delta F/F_m'$



Julien Lassauque



Objectives

"With our present understanding of seagrass photosynthetic responses to anthropogenic stress, it would be ill advised to employ PAM as anything but a complementary tool to validate environmental stress derived with other, more robust methodologies." (Gera et al., 2012)



A more in-depth knowledge of the natural and stressful causes of variability of *P. oceanica* photosynthetic responses is a prerequisite to any surveys relying on that time and cost-effective method.

This work aimed to determine the influence of :

- ❖ **plant-ecophysiological characteristics**: pigments, carbohydrates, C/N/P, micronutrients, DMSP/DMSO,
- ❖ **environmental parameters**: light, temperature, nutrients,
- ❖ **stress-conditions** : metal toxicity, shading

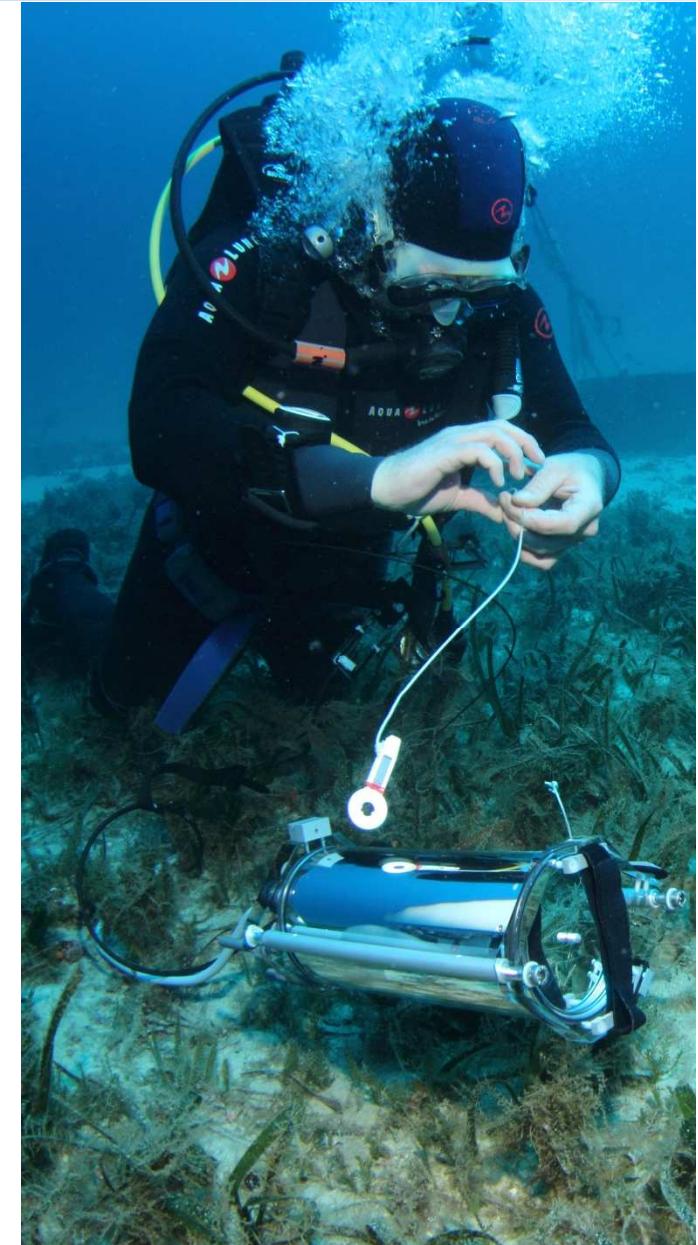
.... on **photosynthetic responses** : Yield, ETR, RLC of *P. oceanica*.



Preliminary work (2011-2012)

Essential to develop a consensual protocol to publish reliable and comparable results :

- ❖ to perform measurements at the zenith;
- ❖ at 10-15 m depth (and depth profile for physiological adaptation to reduced light conditions);
- ❖ on the middle part of the 3rd leaf, highly photosynthetic, little epiphyted.

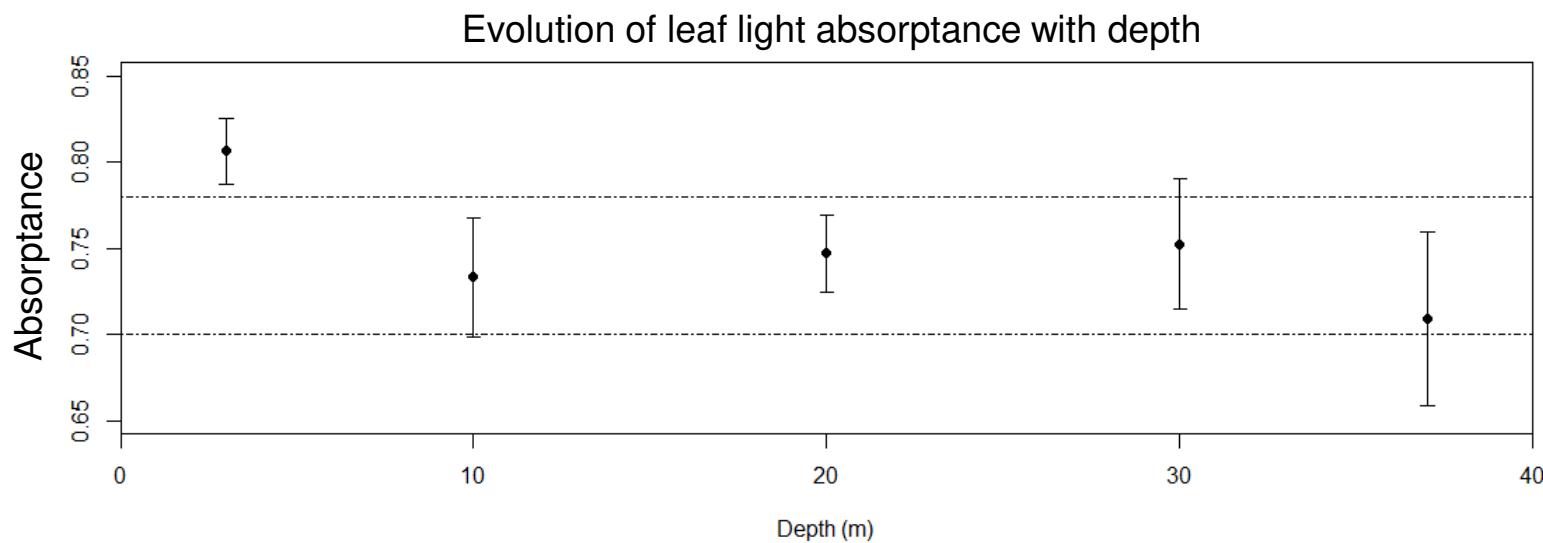
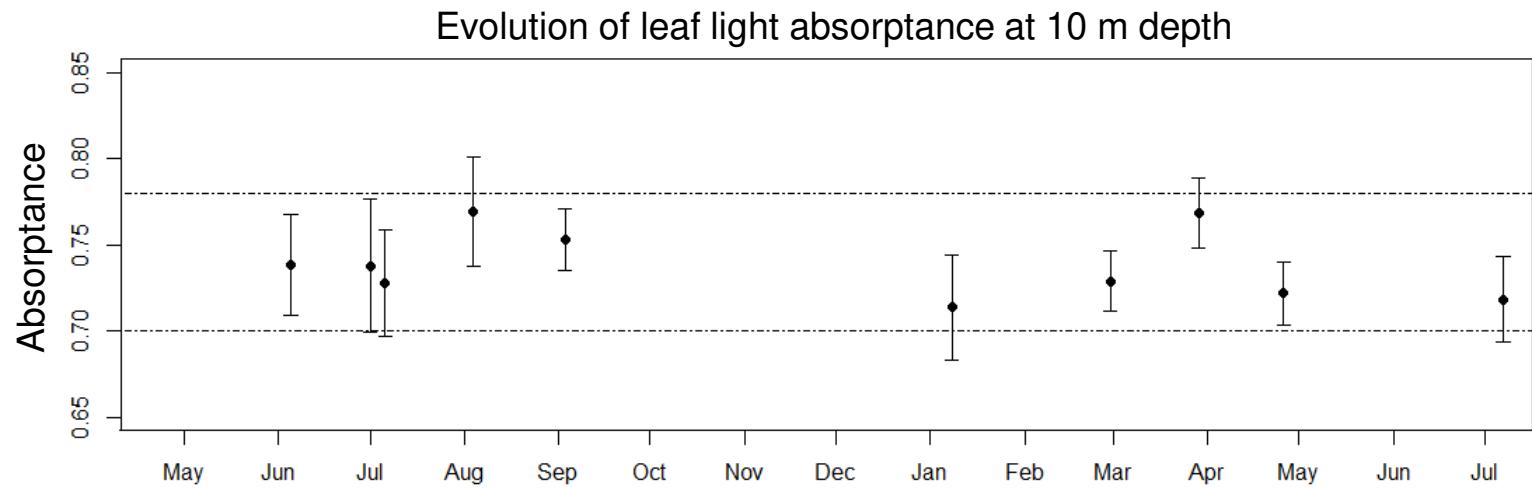


One-year survey (2015-2016)



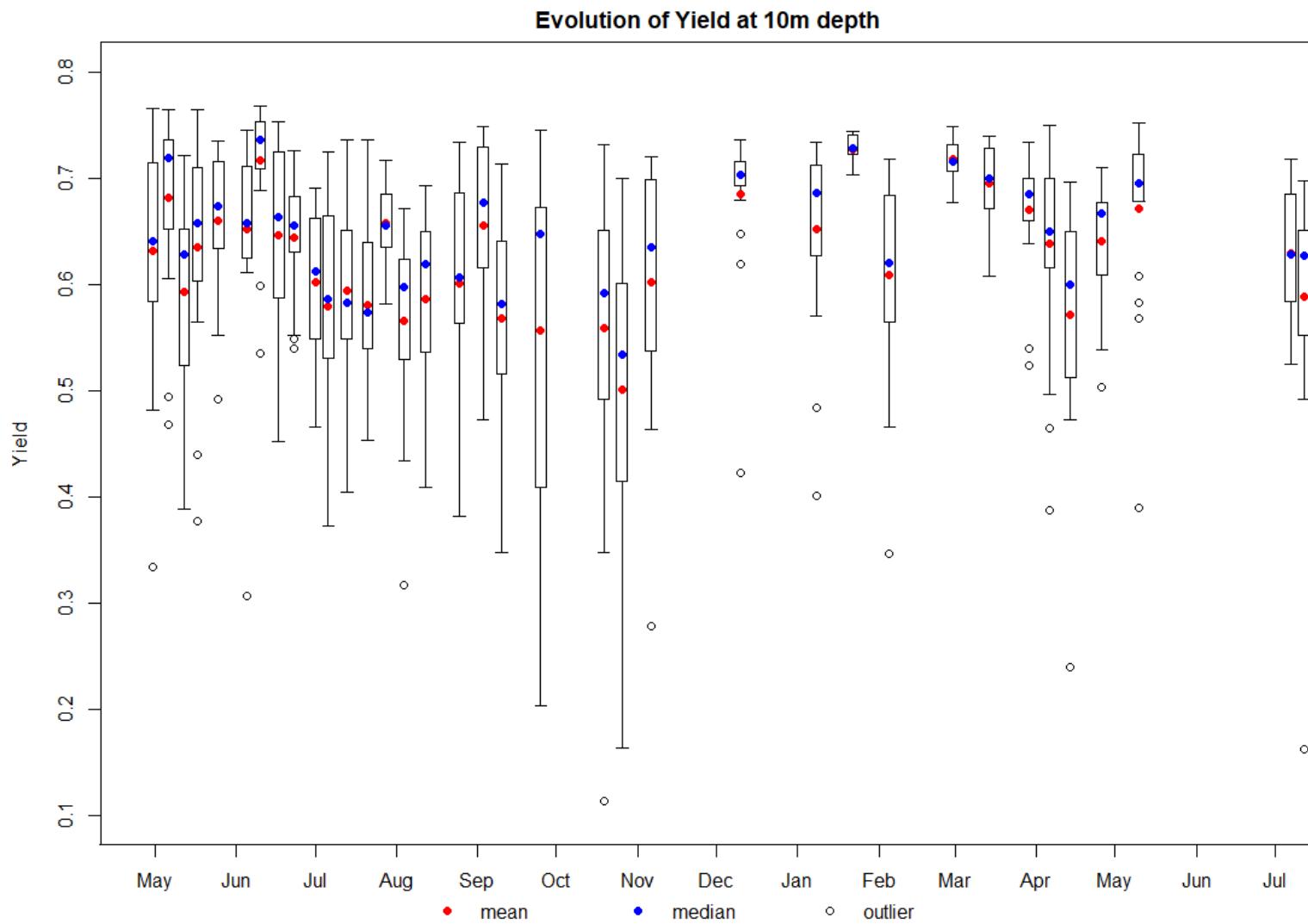


$$ETR = \text{YIELD} \times \text{PAR} \times 0.5 \times \text{ETR-factor}$$



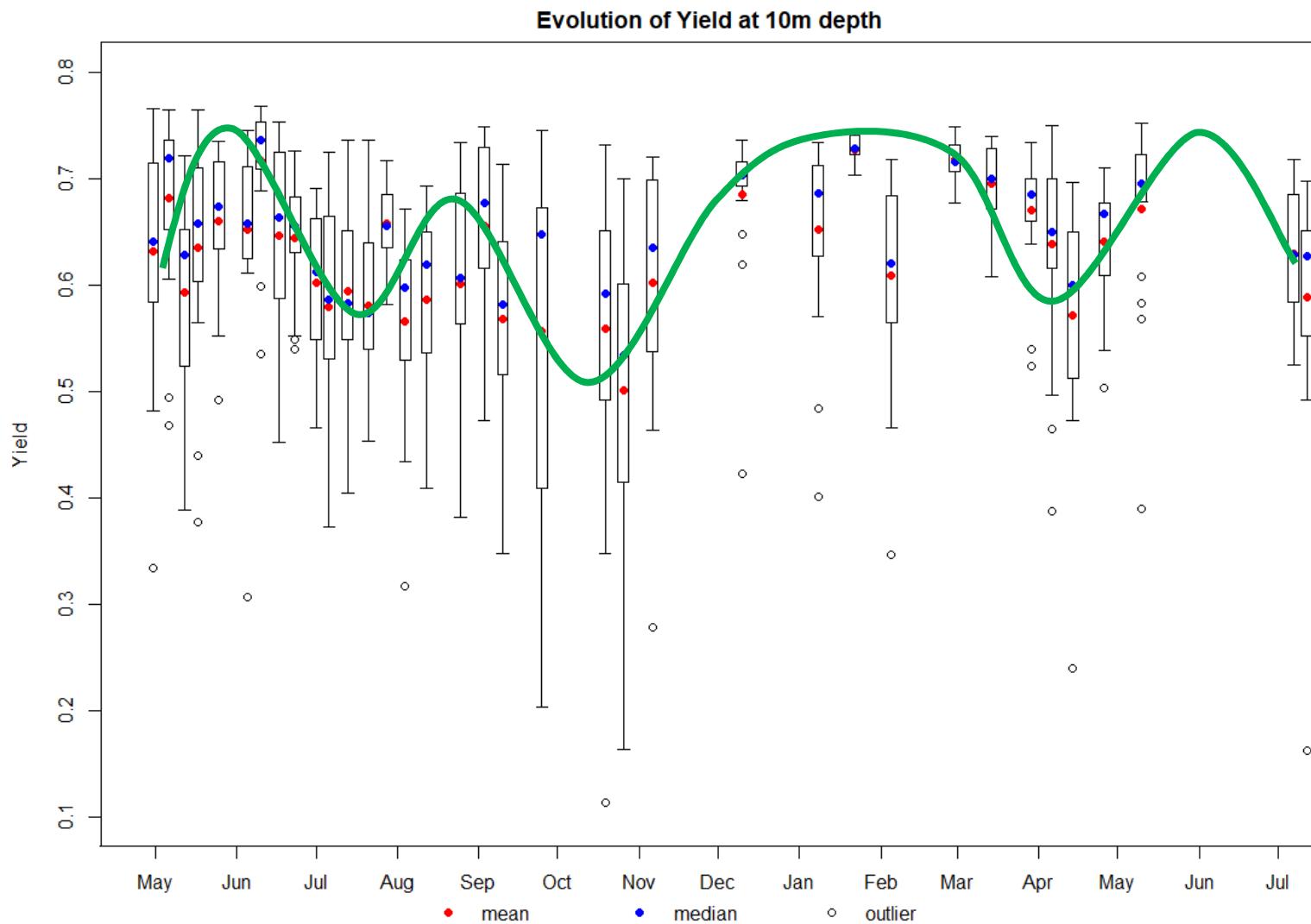


Effective photochemical efficiency



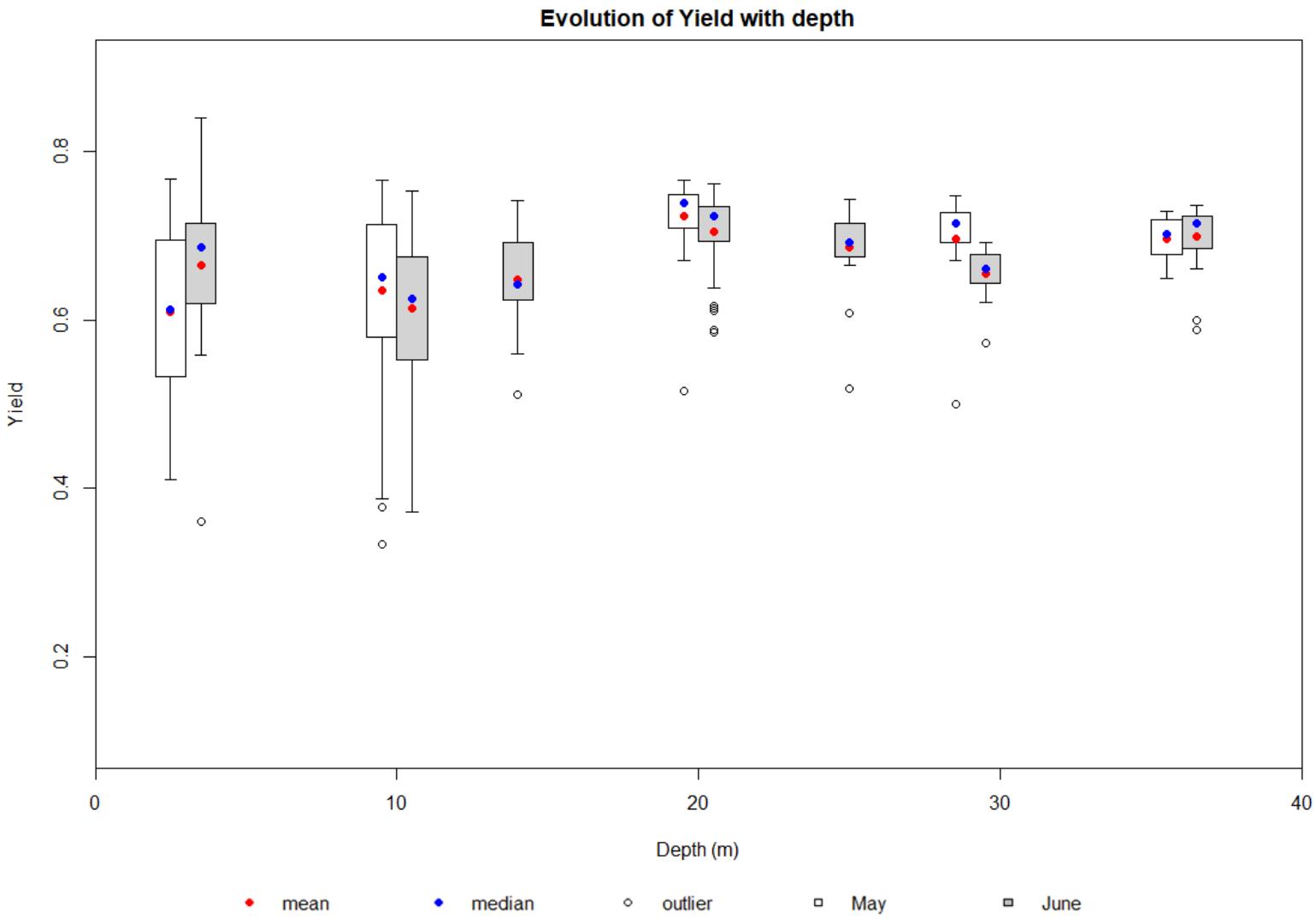


Effective photochemical efficiency



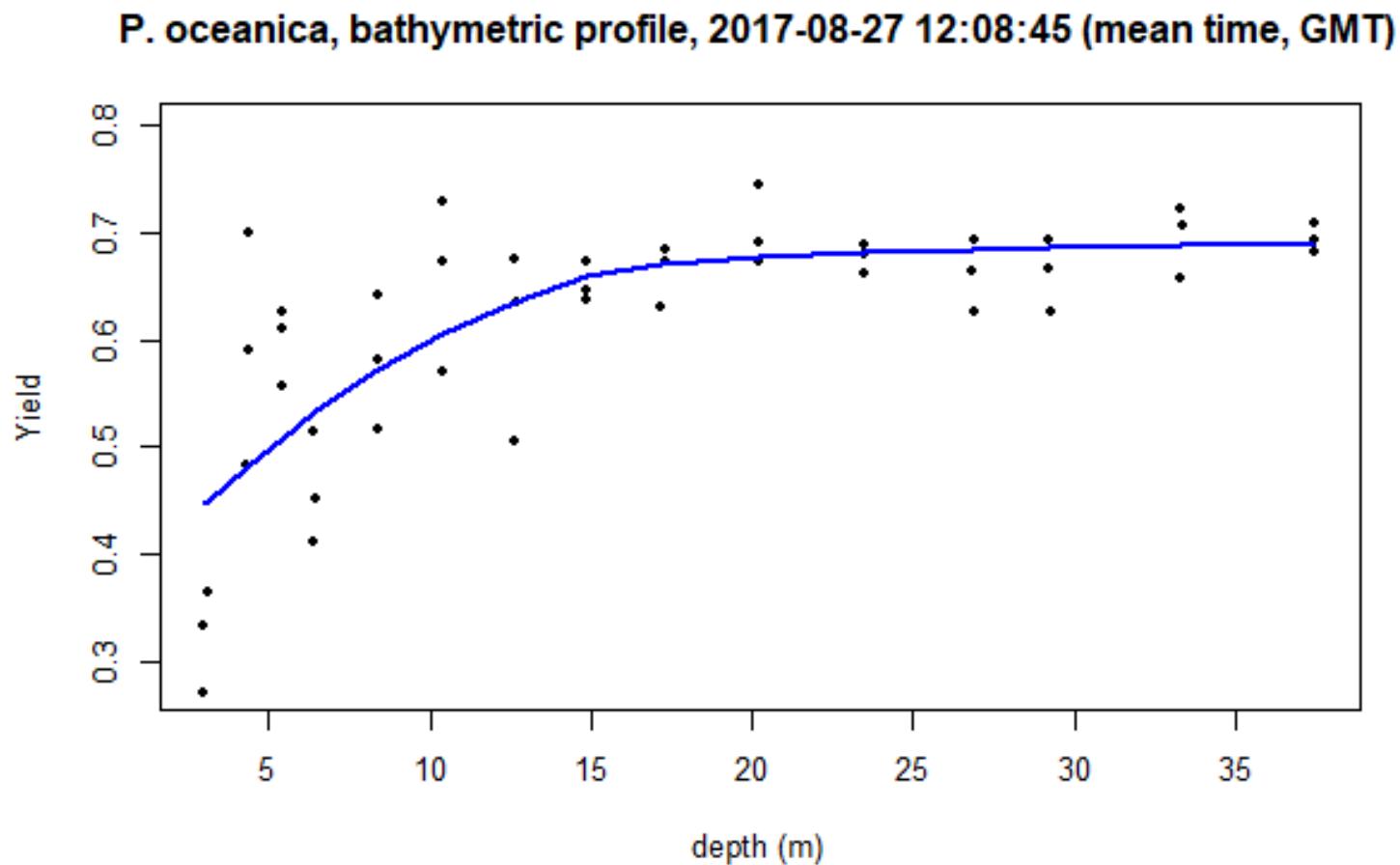


Effective photochemical efficiency



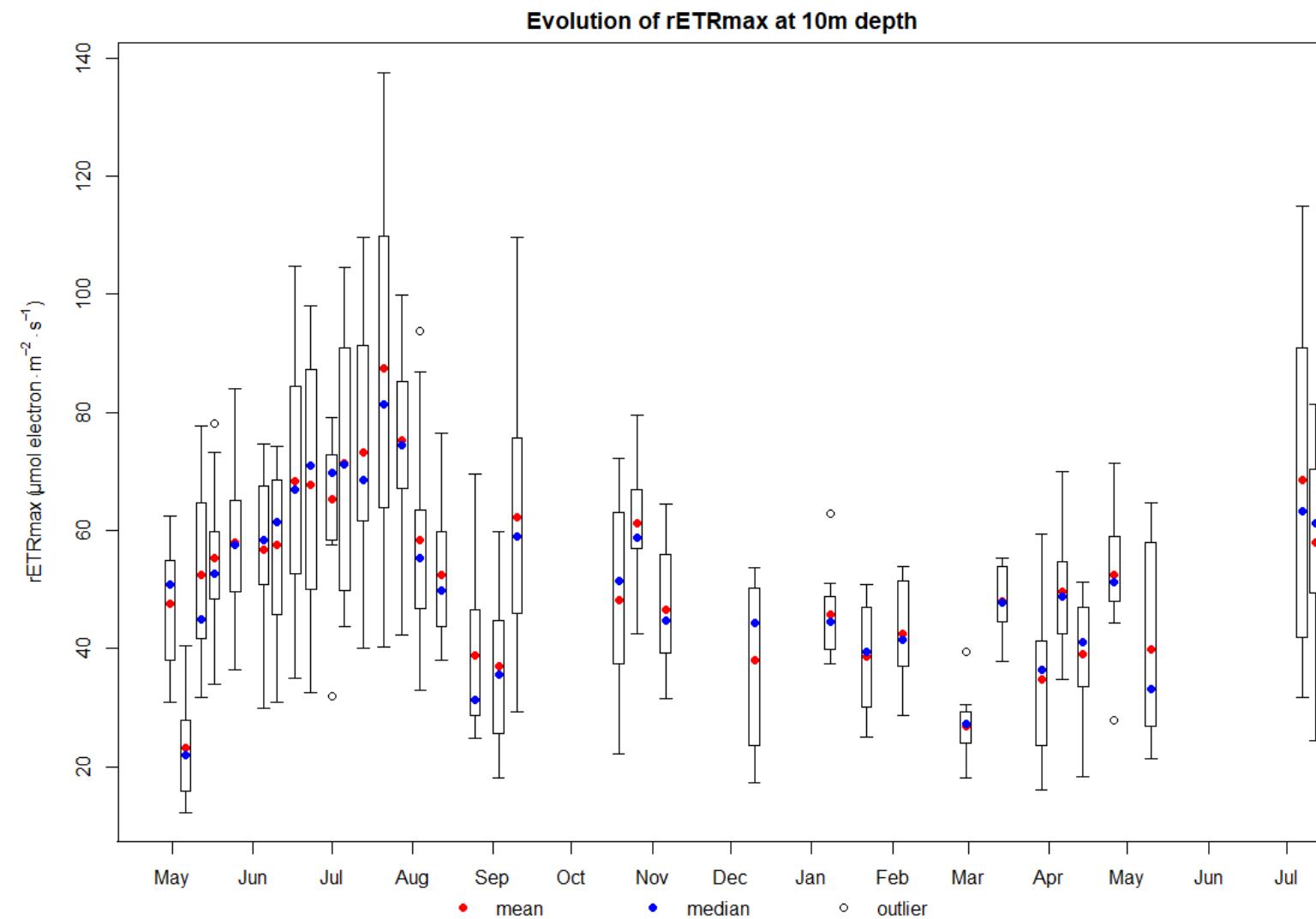


Effective photochemical efficiency

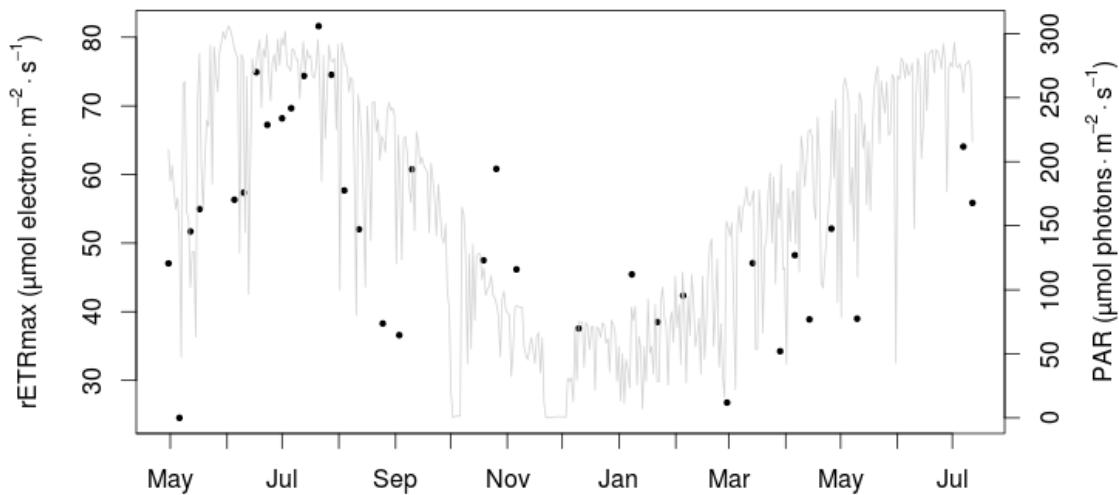




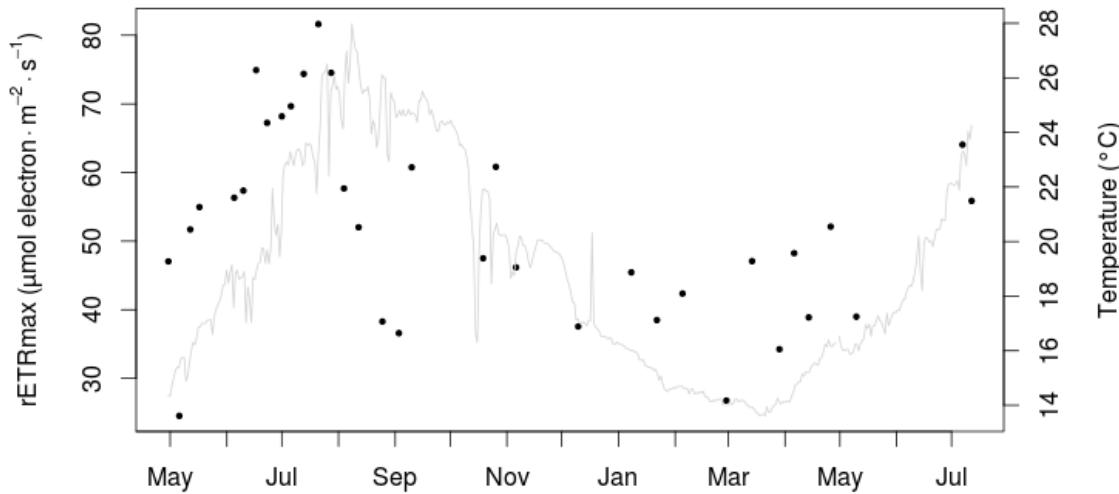
Rapid Light Curve



rETRmax vs PAR

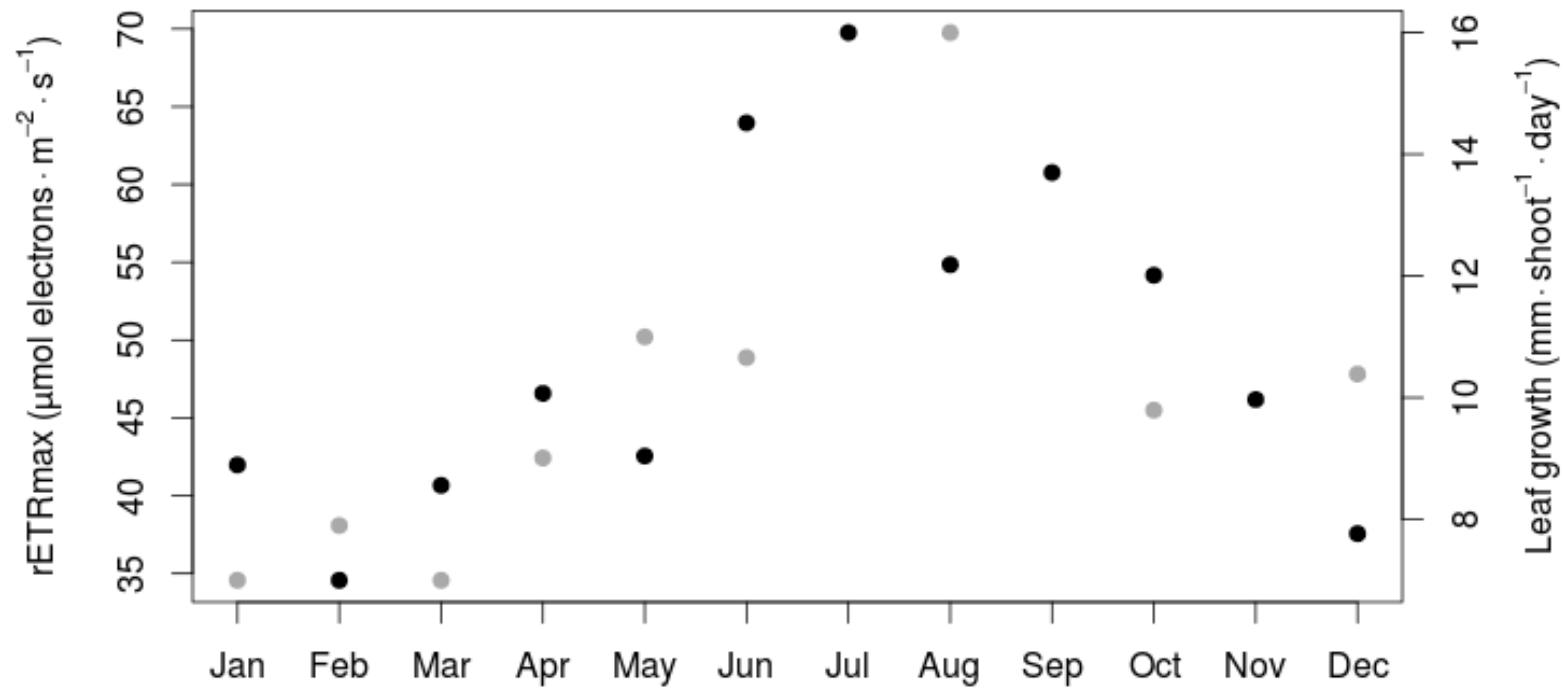


rETRmax vs temperature



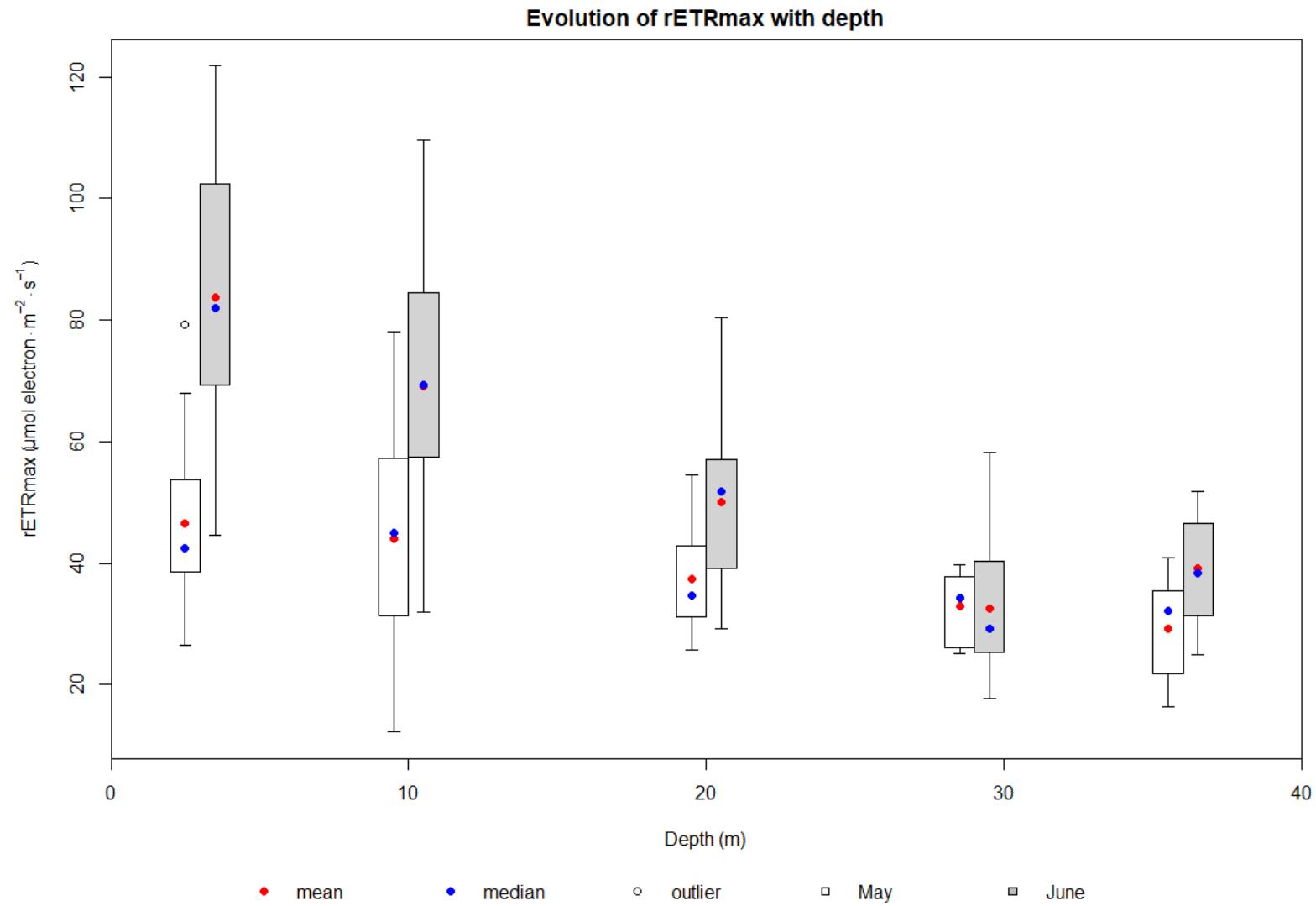


rETRmax = leaf growth proxy ?



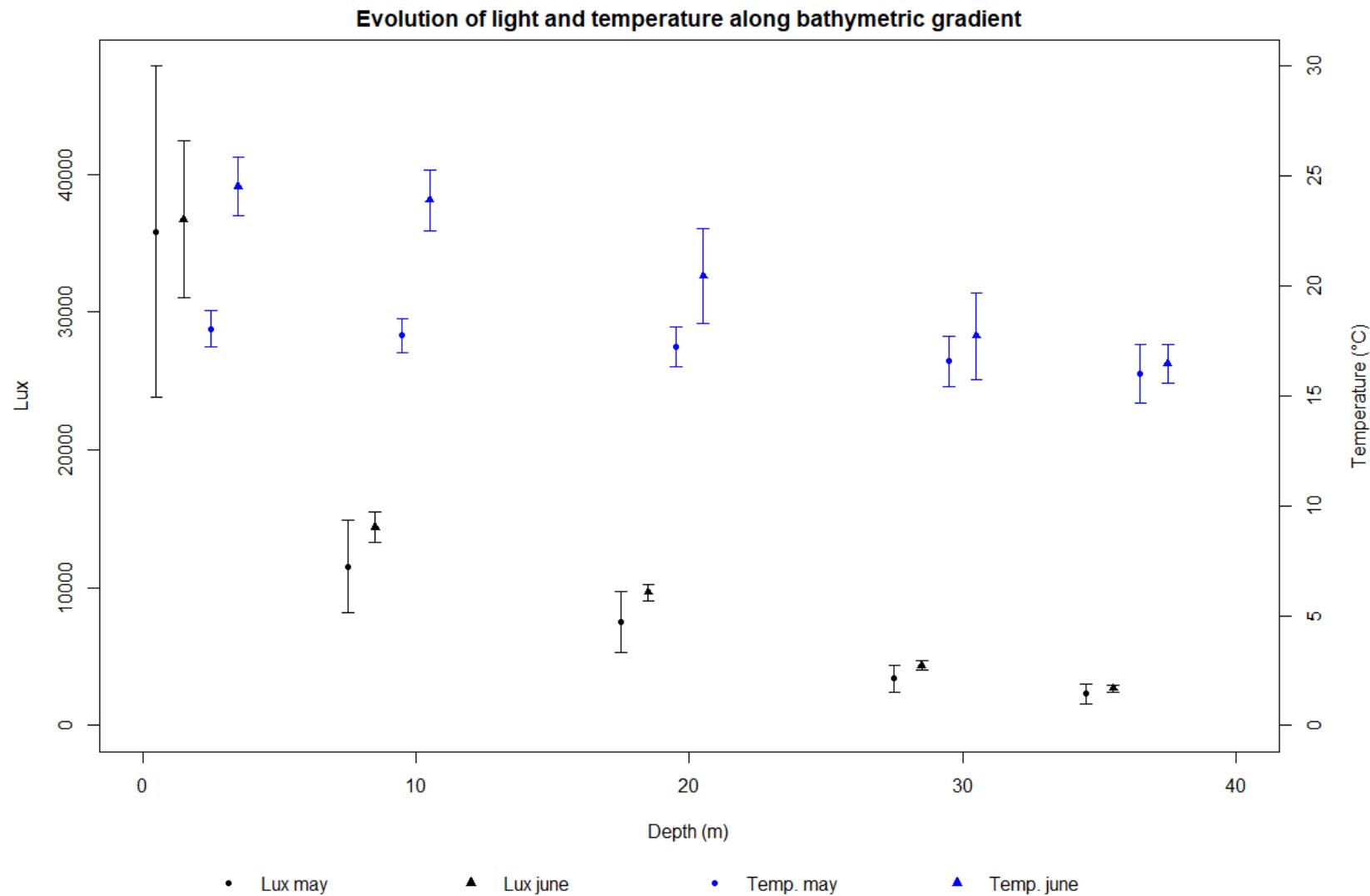


Rapid Light Curve





Light and Temperature





Conclusion et perspectives

Etude de la photosynthèse de *Posidonia oceanica* par fluorimétrie modulée ...



méthode rapide et peu couteuse pour :

- études écophysioliques.
- études écotoxicologiques?

La suite:

- relations photosynthèse vs croissance foliaire,
- relations photosynthèse et PP (O_2),
- biomarqueur de terrain.

