Seasonal photosynthetic performance of *Macrocystis pyrifera* in Puerto del Hambre, Subantarctic Chile

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INTRODUCTION

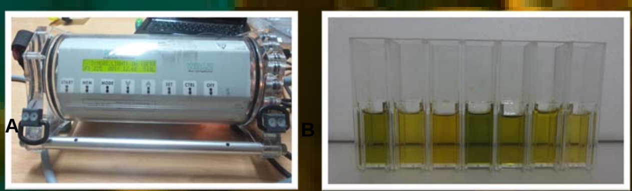
Macrocystis pyrifera **has a bipolar and antitropical geographical distribution. In the Pacific coast of South America *M. pyrifera* forms extensive subtidal forests from XX? (Peru) to Cape Horn (Chile) and it is a characteristic community of the fjords and channels in Sub-Antarctic Chile. A large geographical distribution suggests that this species is able to adapt to different environmental conditions in terms of depth, wave exposure, light availability and salinity, and to reproduce and complete its development under different regimes of seasonality of environmental conditions. The objective of this study was to assess the temporal variability of photosynthetic activity and pigment composition of *M. pyrifera* in the Sub-Antarctic environmental conditions of the Magellan Region (Chile).**

METHODOLOGY

We assessed differences in photosynthetic activity and pigment composition of *M. pyrifera* at four times during the year (spring, summer, autumn, winter), among different individuals from Puerto del Hambre (South 53°37' West 70°52') in Southern Chile.

Figure 1. a) , b) Locality of sampling Puerto del Hambre.

An apical frond of seven individual plants of *M. pyrifera* were collected, and acclimated for 24 hours in seawater at a temperature of 6.5°C, light intensity of 4.8 µmol photons $m^{-2}s^{-1}$ and a 12:12 h Light:Dark photoperiod. Using a Walz Diving-PAM fluorimeter we measured the relative electron transport (rETR) of apical fronds from X to Y irradiance levels and calculated photosynthetic efficiency α (ETR), photoinhibition β (ETR), and saturation irradiance (IK) using the ecuation of Platt *et al.*, 1981. Frond pigments were extracted with dimethylsulfoxide and their concentration calculated according to Seely *et al.*, 1972. Differences in photosynthetic parameters and pigment concentrations between times were evaluated using the non-parametric test of Kruskal-Wallis.



C

$$\text{Chl a} = A_{665}/\ 72{,}8$$

$$\text{Chl c} = (A_{631} + A_{582} - 0{,}297_{A665})/61{,}8$$

$$\text{Fucox.} = (A_{480} - 0{,}772(A_{631} + A_{582} - 0{,}297A_{665}) - 0{,}049A_{665})/130$$

Figure 2. A) Diving-PAM fluorometer, B) Pigment extraction of *Macrocystis pyrifera*, ready for the cuantification, and C) ecuations for calculation of pigment concentration.

RESULTS

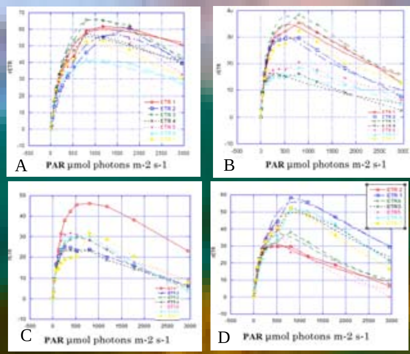


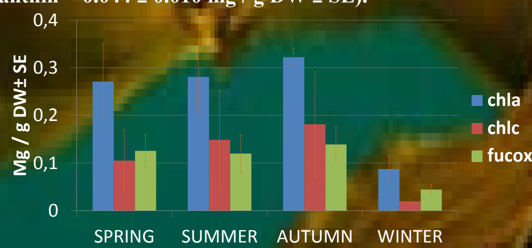
Figure 3. P-I Curves of apical fronds of *M. pyrifera*, colected in Puerto del Hambre, in different times A) Spring, B) Summer, C) Autumn, and D) Winter.

The highest rETRmax were measured in spring, with significant differences between times, showing similar trends in rETR (highest in spring). The αETR showed no significant differences between seasons, but the saturation point (Ik) was also highest in spring (460.84 µMol m-2s-1) and the lowest in summer

Table 1. Photosynthetic parameters of apical fronds *M. pyrifera*, in different times, collected in Puerto del Hambre

	SPRING	SUMMER	AUTUMN	WINTER
rETRs	135.4±72.75	30.9±12.57	43.8±12.77	80.40±25.47
Alfa (ETR)	0.24±0.06	0.23±0.03	0.25±0.04	0.20±0.04
Beta (ETR)	0.07±0.06	0.01±0.01	0.02±0.01	0.04±0.02
rETRmax	101.2±37.19	29.50±11.46	40.83±11.39	67.61±18.54
Ik (umol m2/s)	460.84±271.59	130.78±59.71	164.29±60.98	338.89±131.64

The pigment content of *M. pyrifera* is higher in autumn (Chl a = 0.322 ± 0.018 mg / g DW ± SE; Chl c = 0.181 ± 0.110mg / g DW ± SE; and Fucoxanthin = 0.139 ± 0.036 mg / g DW ± SE) with significant differences between autumn and winter (lowest concentrations in winter: Chl a = 0.087 ± 0.027 mg / g DW ± SE; Chl c = 0.019 ± 0.003 mg / g DW ± SE; Fucoxanthin = 0.044 ± 0.010 mg / g DW ± SE).



DISCUSION AND CONCLUSION

Measurements performed in apical fronds of M. pyrifera, showed that photosynthetic parameters such as rETR, rETRmax and Ik presented the highest values in fronds collected in spring and the lowest in fronds collected in summer. Other photosynthetic parameters, αETR and β ETR, were not different between collections times. , this can be given because the fronds in this time are in the presence of an increase of light intensity, and photoperiod, compared to winter conditions. So the photosystems are subject to a greater flow of electrons, being positive for photosynthesis and growth in young plants, which are coming out of seasons Autumn - winter, where they are in a optimum reproductive.

Concentration of all photosynthetic pigments was lower in winter-collected fronds than in other times. this is possibly because are in breeding season, so their energy is being used in the maturation of the reproductive soros, and optimal liberation of zoospores.

Temporal changes of photosynthetic activity and pigment concentration are described for first time in M. pyrifera growing in Sub-Antarctic environmental conditions. Additional studies should evaluate seasonality and spatial variability of the same characters in other locations within the region of Magallanes and elsewhere.

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