QCL WATER SCIENCE

University of Trieste

Fucus Virsoides

Metabolic Rates of a Glacial Relict in a Changing Scenario

Background

Fucus virsoides J. Agardh is a glacial relict endemic to the northern Adriatic and the only representative of the genus in the Mediterranean. Once widespread in the region, this species has experienced a significant decline in recent decades due to multiple stressors. Particularly, because of phosphorus load decrease in its main freshwater source together with an implementation in the Italian legislation, the area has experienced a subsequent increase in the N:P ratio, which has led towards oligotrophic conditions. This project aims to quantify the metabolic rates of F. virsoides under different nutrient conditions.

Set Up/Sample/Method

Apical fronds of Fucus virsoides were collected in the Gulf of Trieste, transferred to the laboratory, cleaned from epiphytes, rinsed, weighed and acclimatized to laboratory conditions for 72 hours. The experimental set-up consisted in fixed conditions of 15°C, 120 µmol photons m-2 s-1, 35 psu artificial seawater and a photoperiod of 15:9 hours light-dark cycle which lasted for two weeks. Due to the limited size of the fronds, we selected the 20 mL PyroScience vials (OXVIAL20) provided with sensor spots (OXSP5) as our incubation volume. Prior the experiment, the contactless optical fibers (SPFIB-BARE) were calibrated, and a preliminary test was conducted in order to define the suitable incubation time. These probes were connected to a 4-channel optical O2 sensor system (FireSting-O2; FSO2-C4, PyroScience GmbH, Aachen, Germany) and to a PC running PyroScience Workbench software (PyroScience GmbH, Germany) where data were logged and stored. After the acclimation, the fronds were randomly distributed to the different N:P nutrients conditions and every four days we performed photo-respirometry measurements, both in light and dark conditions to record net production and respiration rates, respectively.

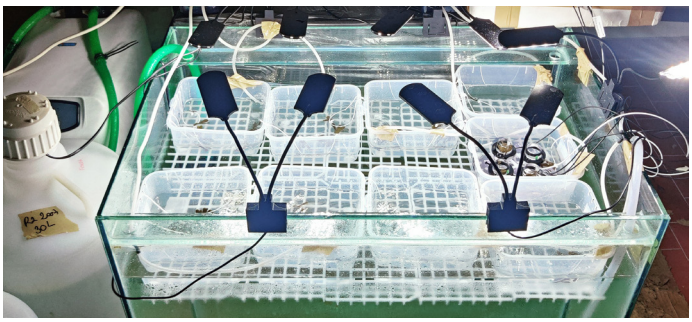

Fig. 1 Light set-up for net production measurements.

Data Recording and Processing

Each incubation time along the experiment, 3 fronds per aquarium were randomly incubated within the vials; the fourth channel was assigned to the control vial filled up with only with seawater. Such control incubation allowed potential correction of measurements on samples due to minor microbial contamination in the measuring chambers leading to undesired microbial-mediated O2 production and/or consumption. All vials were submersed in their tanks (1L) to maintain the temperature and light conditions of the treatment during the incubation time. Chambers were manually agitated to ensure the continuous mixing during the incubation and reduce the formation of the boundary layer around the fronds.

Dissolved oxygen measurements were adjusted by the changes in temperature thanks to the TSUB21 temperature sensor, recorded in mg/L and then converted to µmol O2 g FW-1 h-1. Data were recorded to the PC and downloaded through the Pyro DataInspector software (PyroScience GmbH, Germany). Results were obtained from the difference between the final and initial O2 concentration from which we subtracted the control, then dividing it by the water volume and by the sample fresh weight (g FW). Gross photosynthetic rates were calculated by adding the absolute values of the respective respiration rates to the respective net photosynthetic rates.

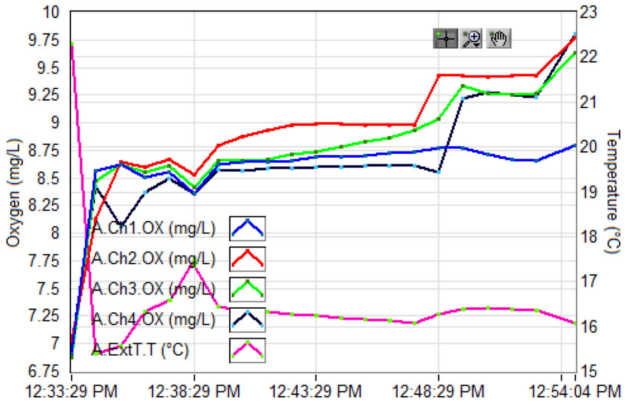

Fig. 2 Raw data of dissolved oxygen expressed in mg/L during a light incubation. Ch1 is the SW-Control. Data were recorded every minute for a total time between 15-20 mins.

Conclusion

Photo-respirometry is a common method applied to quantify seaweeds' metabolic rates and therefore their role in terms of Blue Carbon sequestration. Fucus virsoides is at the edge of its extinction, therefore understanding its role in terms of primary productivity is pivotal to stress the importance of its conservation and reinforce its restoration actions. The support of PyroScience as sponsor of the ICYMARE2023 Conference, made quantifying the metabolic rates of this relict species after more than 30 years possible.

The instrument is highly sensitive and easy to use. Moreover, the contactless readings quantify minimum variation of dissolved oxygen along the incubation time and provide precise measurements.

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