Control of the migratory behavior of Intertidal MPB by light, tide and endogenous rhythms

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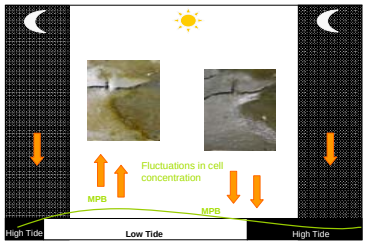
1. Microphytobenthos

- Microphytobenthos (MPB, Intertidal benthic microalgae) undergo vertical migratory movements to and from the surface of the sediment in close synchrony with the beginning and end of the daylight periods of low tide.

- These fluctuations in MPB concentration in the upper layers of the sediment largely affect primary productivity of estuarine tidal flats and are known to be partially under endogenous control. External factors such as water cover, irradiance and desiccation are also involved.



2. Objectives

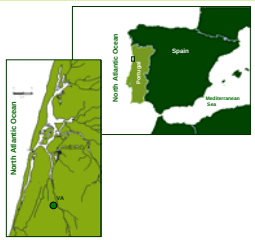
The purpose of this work was to study vertical migratory behavior of MPB relative to daily variations of the timing of tidal exposure along the spring-neap tidal cycle, by measuring the photosynthetic active biomass, during low tide periods, using non-invasive tracing, under :

i) field conditions,

ii) constant low light (LL),

iii) constant darkness (dark).

3. Sampling Site



Undisturbed MPB samples were collected close to Vista Alegre (VA), Ria de Aveiro, central West Coast of Portugal.

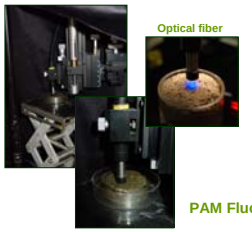
4. PAM Fluorometry and High-Resolution Spectral Analysis

Measurements were carried out on undisturbed samples using two **optical** and **non-invasive techniques:**

i) Pulse Amplitude Modulated (PAM) Fluorometry – F_o (Minimum Fluorescence Level)

ii) Reflectance High-Resolution Spectral Analysis – NDVI (Normalized Difference Vegetation Index, NDVI = R_{750}-R_{675}/R_{750}+R_{675})

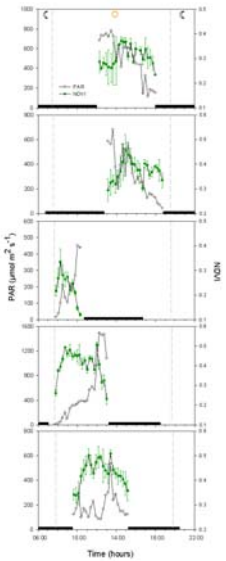
F_o was measured on undisturbed sediment samples simultaneously exposed to low light (150-200 µmol m^{-2} s^{-1}) and darkness, and **NDVI** in samples exposed to field conditions.



PAM Fluorometry

Spectral Analysis

5.1. Field Conditions



Field conditions i.e. *in situ* - exposed to variable light and weather conditions

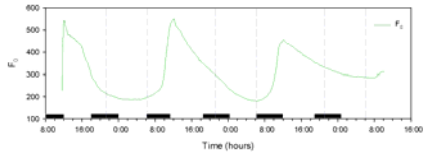
- Benthic microalgae under field conditions displayed a tidal rhythm with:

Upwards migration synchronized with the beginning of low tide (NDVI increase)

Downwards migration related to flood time or night (NDVI decrease)

- This rhythm repeated itself along the spring-neap tidal cycle.

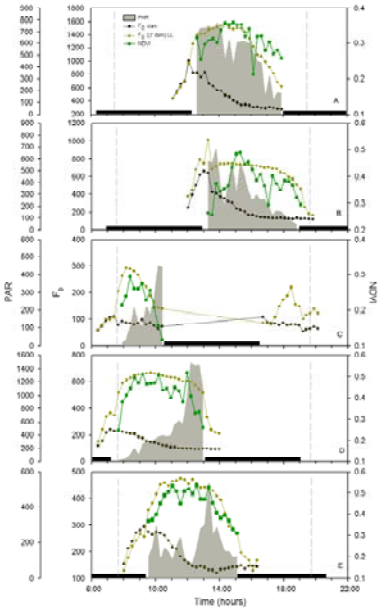
5.2 Dark Conditions



Endogenous variation of the productive biomass (F_0) in constant darkness during 3 days.

Biomass peaks in close synchrony with the diurnal low tide.

5.3. Light, Tide and Endogenous Rhythms



- Dark: MPB appeared at the sediment surface for a short period revealing that irradiance is essential in the regulation of biomass surface.

- Low light: showed that light alone isn't sufficient to keep MBP at the surface.

- During low tide periods, low light-incubated samples presented more surface biomass than under field conditions, showing the high light induced migration occurring *in situ.*

Upwards migration

– endogenous controlled (cells emerge during daytime low tide)

Downwards migration

– endogenous controlled (cells disappeared with incoming tide and/or night)

Acknowledgements: This work was supported by Fundação para a Ciência e a Tecnologia, SFRH/BD/23720/2005 .