

# A descriptive study of physico-chemical characteristics of *Posidonia* litter accumulation

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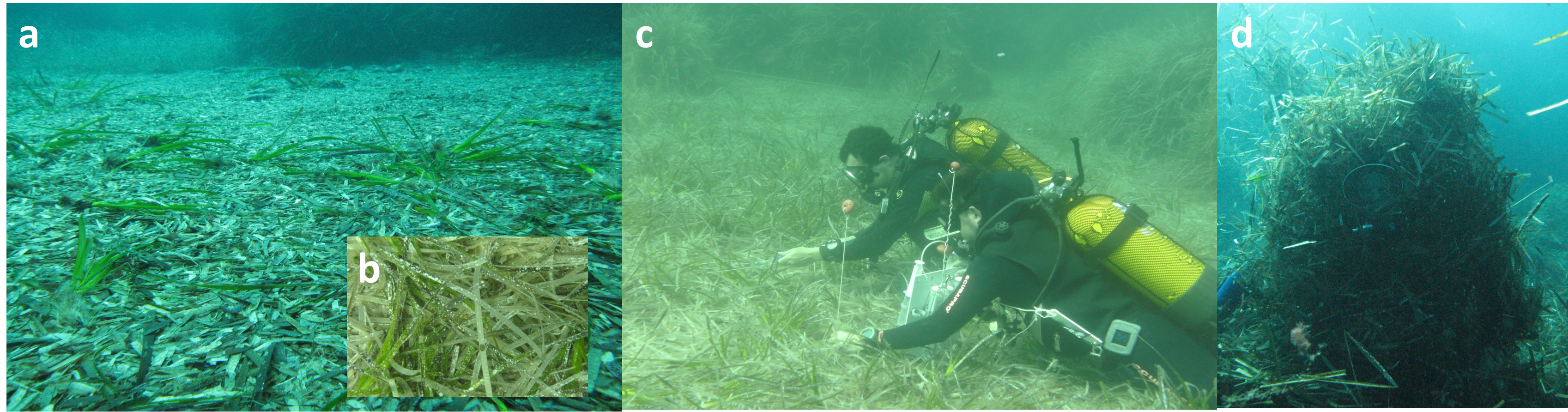
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## Introduction:

- \*The natural life cycle of the seagrass *Posidonia oceanica* involves senescing of leaf biomass and seasonal massive leaf fall,
- \*Such phytodetritus exported outside the seagrass meadow may constitute big submarine accumulations (**fig. 1**),
- \*This particular habitat is colonized by various organisms which participate to the degradation and to the seagrass carbon transfer through detritus foodweb,
- \*These accumulations are subject of intense remineralisation and degradation processes.

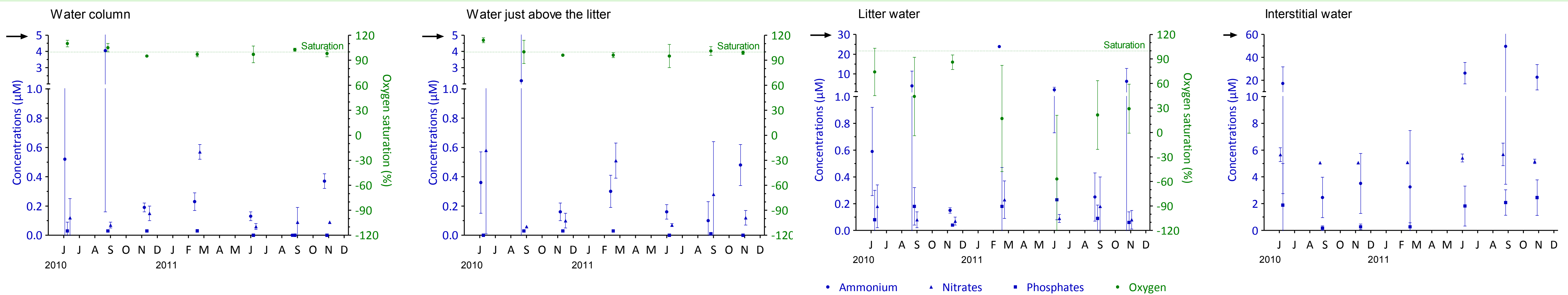


**Figure 1:** *Posidonia oceanica* litter accumulation outside the seagrass meadow at 10 m depth in the Revellata Bay (Corsica, Mediterranean Sea). **a.** Large patch (about 200 m<sup>2</sup>) of fragmented dead leaf and uprooted green *Posidonia* shoots; **b.** Larger dead leaves; **c.** water sampling using tri-dented syringe inside the litter for O<sub>2</sub> and nutrient concentrations measurements; **d.** Litter monster.

**Aim:** By repetitive sampling in different litter accumulations occurring in the Revellata Bay (Calvi, Corsica) (2009-now), this preliminary study aimed to describe the cycle of litter accumulation occurrence, to determine their composition, to describe oxygen and nutrient concentrations inside the litter.

## Results I: Litter accumulation occurrence and composition

- .Big accumulation of dead leaves were only found in fall (average thickness: 30-50 cm), but persisted till winter (average thickness: 5 - 10 cm),
- .Litter accumulation may be found in all seasons, but in spring and early summer, macroalgae wracks and uprooted *P. oceanica* shoots contributed significantly to accumulation biomass,
- . Photosynthetic active material was found in litter accumulations (macroalgae as wrack or epiphytes and diatoms as epiphytes).

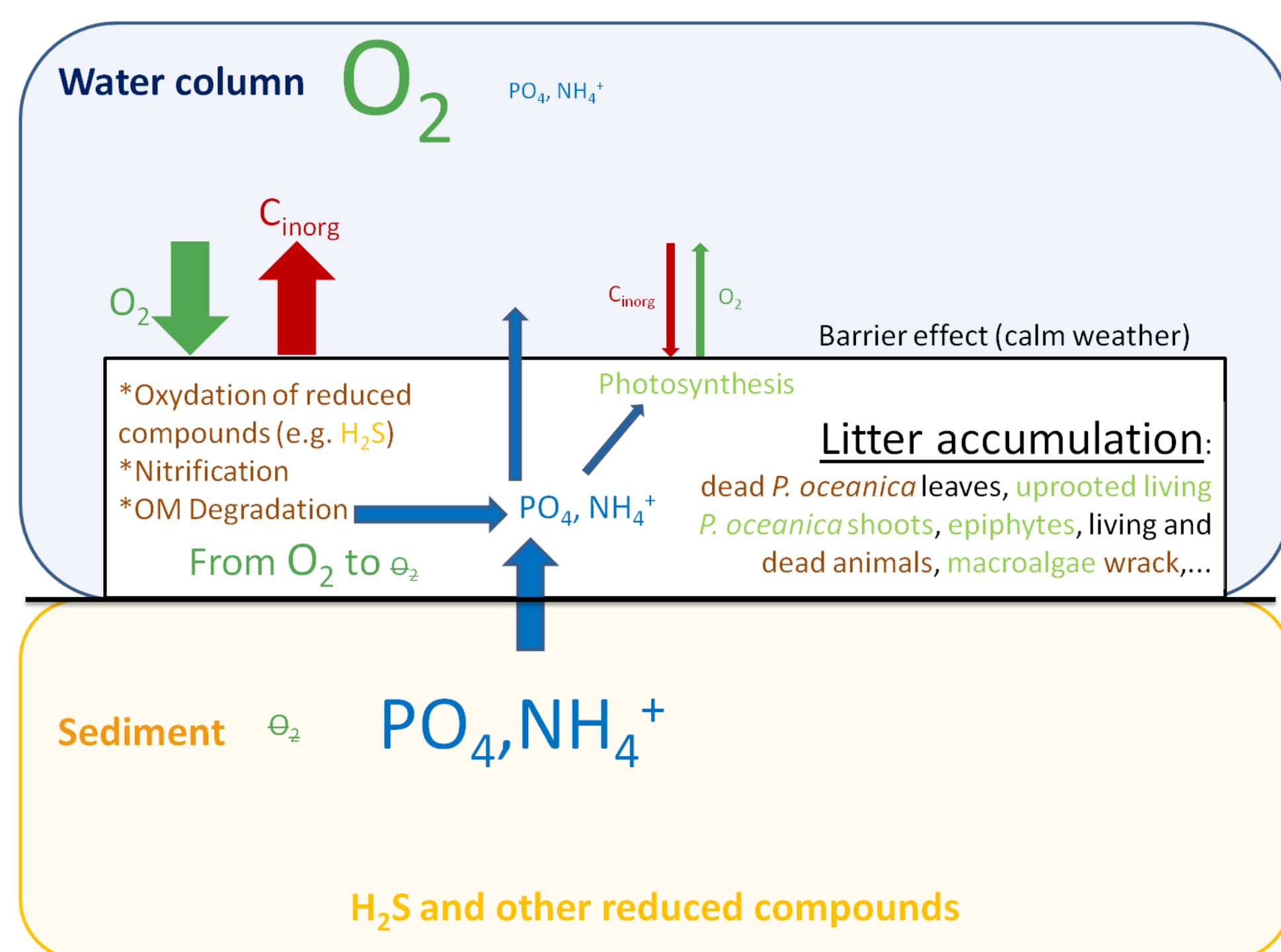
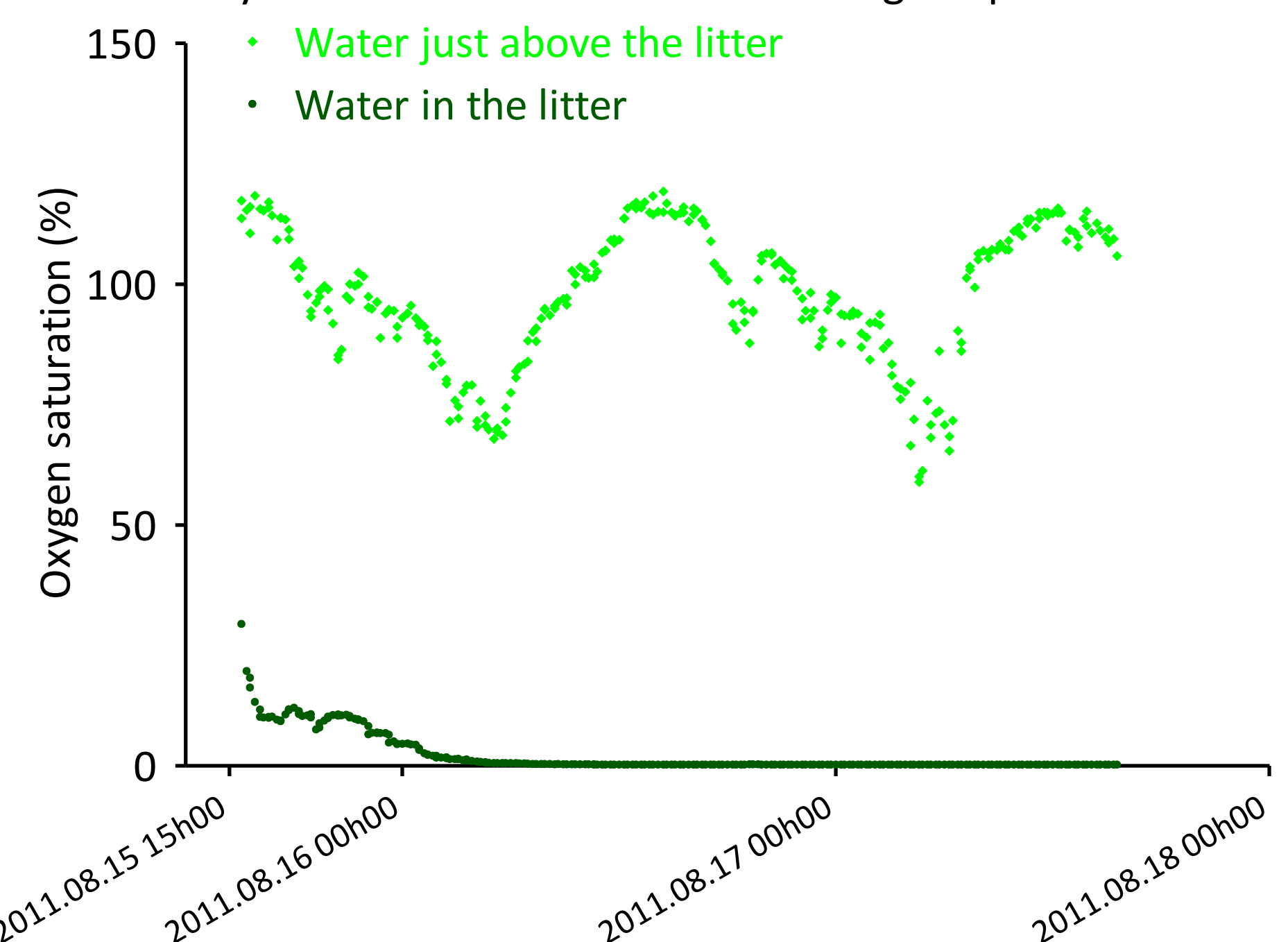


**Figure 2:** Oxygen saturation percentage and nutrient concentrations measurement in the water column, just above and inside the litter accumulation and in the interstitial water under *Posidonia oceanica* litter. Oxygen have been measured using a Winkler methods adapted for small volumes (10 ml) and nutrient have been measured by spectrophotometry using SKALAR analytic chain with method and tubing adapted for oligotrophic seawater (R. Biondo) (n = 12 per point, except Interstitial water, n = 6).

## Results II: Oxygen and nutrient concentrations

- \***oxygen:** Water inside the litter showed high variability in oxygen concentrations (from saturation to anoxia) (**fig. 2**) ; oxygen depletion was not measured in the water just above the litter (**fig. 2**) ; anoxia appeared rapidly during the night and period of low water movement (**fig. 3**),
- \***nutrients:** Litter was generally enriched in NH<sub>4</sub><sup>+</sup> and PO<sub>4</sub> and depleted in nitrates when compared to oligotrophic water column (**fig. 2**) ; nutrient enrichment was not measured in the water just above the litter (**fig. 2**).

**Figure 3:** Oxygen saturation percentage measured inside and just above a litter accumulation (40 cm thick) using 2 Optodes during 3 consecutive very calm days in August 2011. For Optode methodology applied in this seagrass meadow, see Champenois & Borges, Limnology & Oceanography (2012), 57(1), 347-361.



**Figure 4:** Conceptual model

## Results III: Conceptual model

- . When and where water movements are low, litter accumulations act as a permeable barrier between sediment and water column (**fig. 4**) and:
- . Nutrient (and DOC) coming from sediment or produces by remineralisation inside the litter are temporarily trapped inside (and consumed by associated heterotrophic and autotrophic organism),
- . Nitrification, oxidation of reduced compound (e.g. H<sub>2</sub>S) and respiration by decomposing organisms and litter fauna consume oxygen, driving sometimes to anoxia,
- . Photosynthesis occurs due to the presence of macro and micro epiphytes and of active *P. oceanica* and macroalgae wrack, but it is not enough to compensate respiration due to decomposition,
- . Passage to oxic and low nutrient condition inside the litter are due to physical disturbance of litter accumulation linked to water movement

## Take home message:

- . *P. oceanica* phytodetritus form large ephemeral accumulations outside the seagrass meadow,
- . These accumulations, heterogeneous in their composition, are present in all season, but are important in autumn,
- . Water inside the litter encompassed a large range of O<sub>2</sub> and nutrient concentrations, but may be depleted in O<sub>2</sub> and enriched in nutrient compared to water column,
- . This particular environment could be an interesting natural model to study hypoxic effect on biodiversity.



