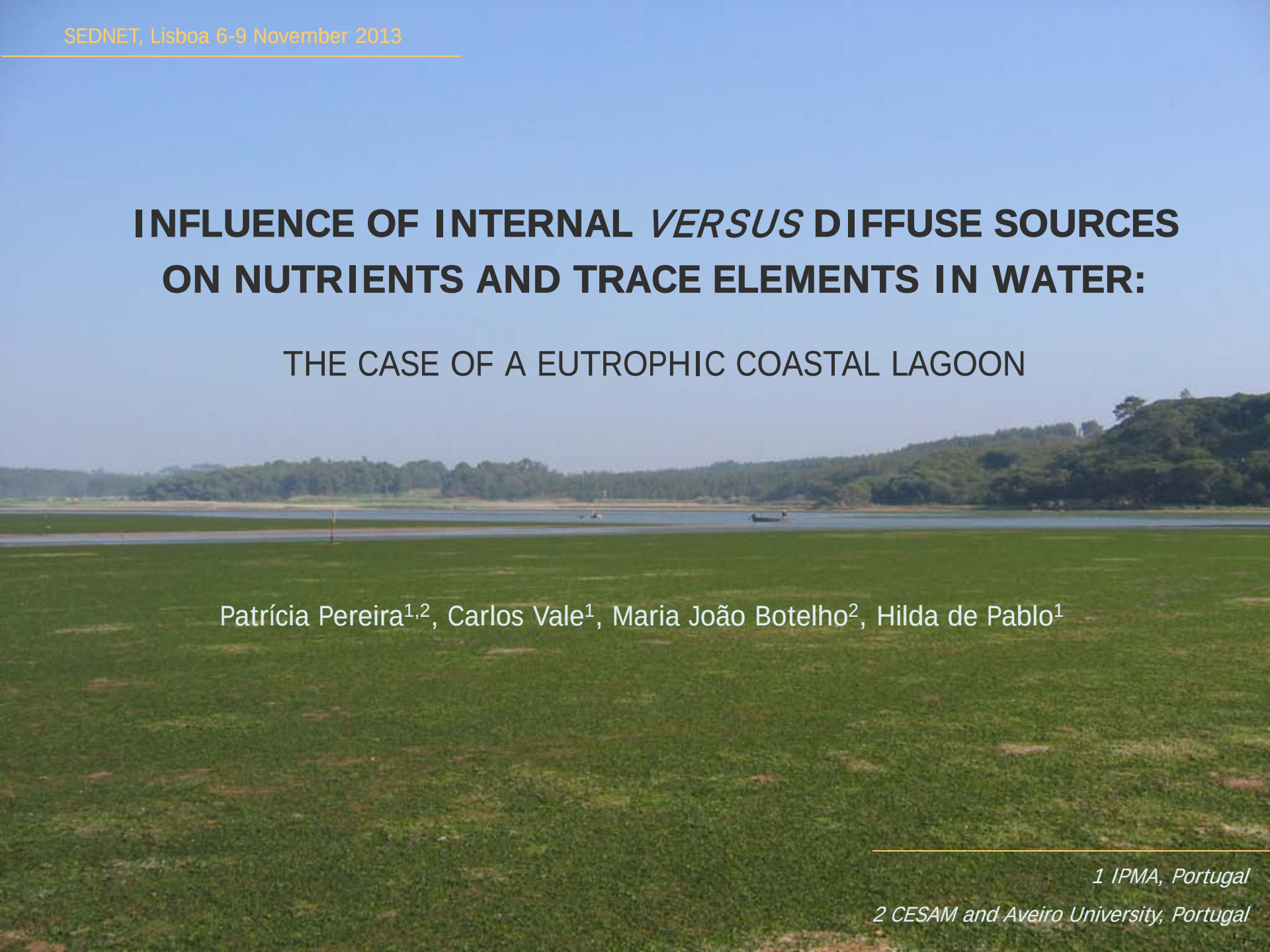
INFLUENCE OF INTERNAL *VERSUS* DIFFUSE SOURCES ON NUTRIENTS AND TRACE ELEMENTS IN WATER:

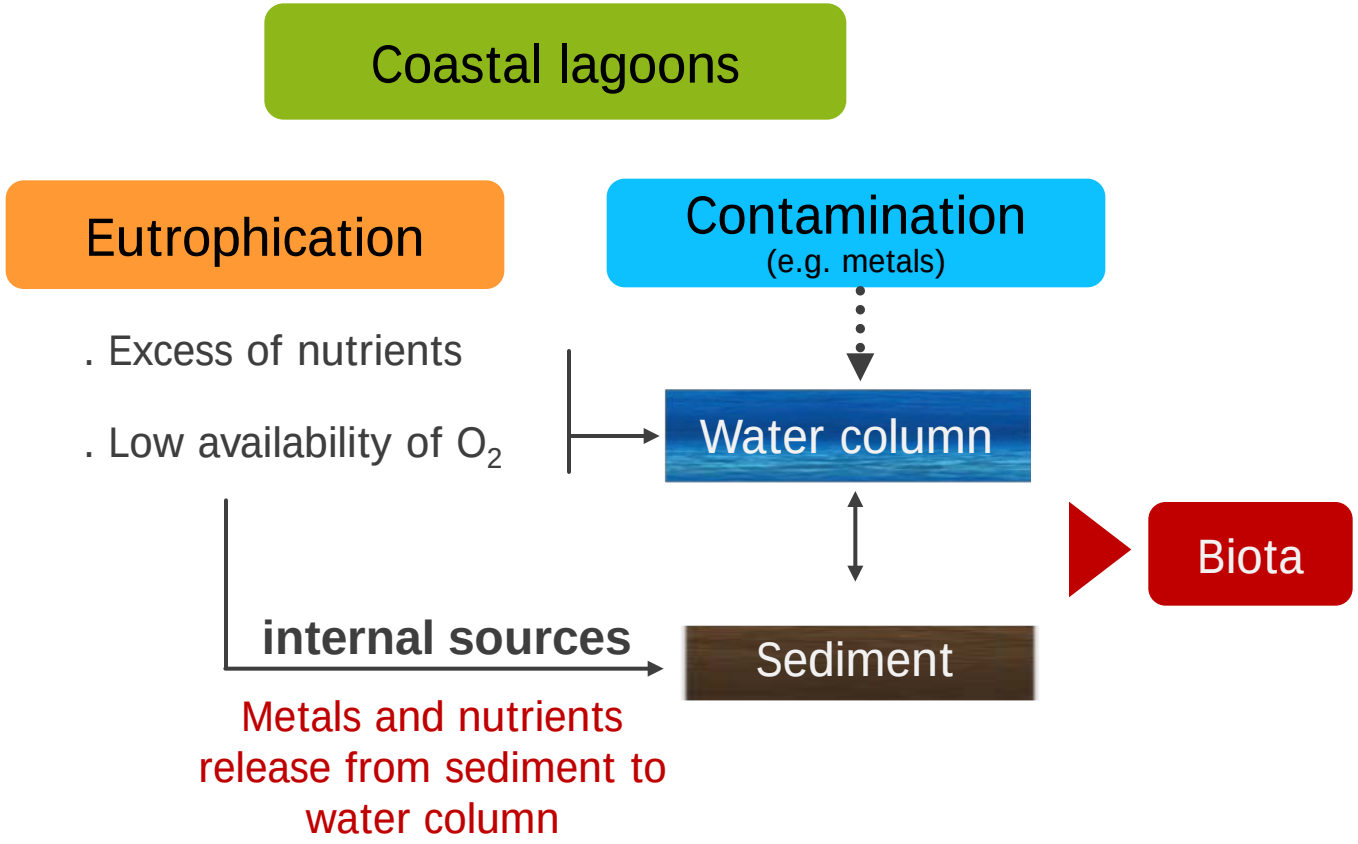
THE CASE OF A EUTROPHIC COASTAL LAGOON



Patrícia Pereira[1,2], Carlos Vale[1], Maria João Botelho[2], Hilda de Pablo[1]

1 IPMA, Portugal

2 CESAM and Aveiro University, Portugal



- Additionally, rivers, tributaries and localized **diffuse sources** also supply nutrients and trace elements to coastal lagoons.

WHY THE ÓBIDOS LAGOON?

. Area: 7 km^2
. Depth: 1-2 m

Problematic area: Barrosa branch

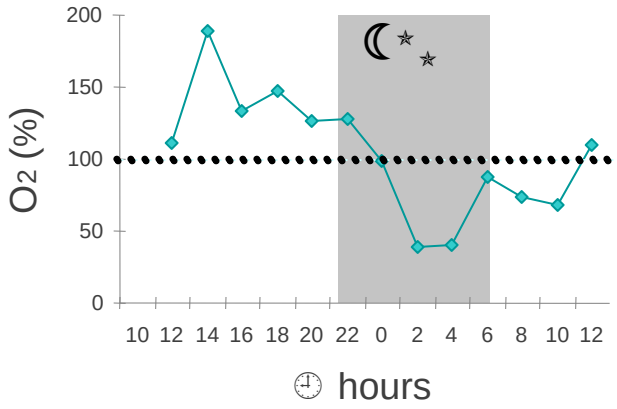
- Input of municipal wastewater discharges (until 2005) and drainage of agriculture fields
- Discharge of a small tributary (Cal river) (winter discharge of 0.1 $m^3 s^{-1}$)
- Low water renewal → High residence time (> 20 days)
- "Blooms" of *Ulva* sp. and *Enteromorpha* sp.

WHY THE ÓBIDOS LAGOON?

- ⇧ Ammonium and phosphate in Barrosa branch

- Barrosa branch was classified as polytrophic based on DIN according with Wasmund at al. (2001)

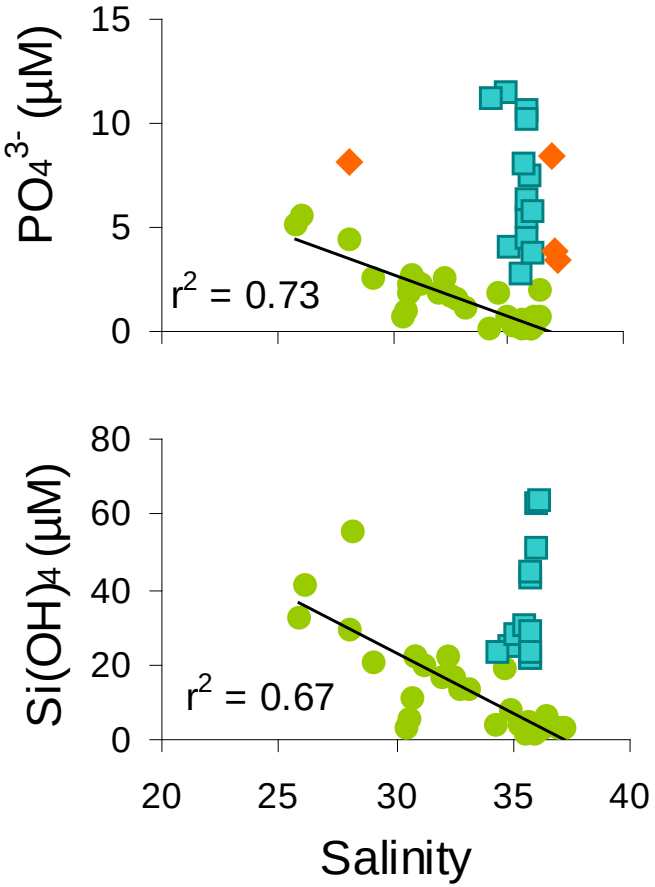
  - O_2 decreases in water column during the night



Under these oxic-anoxic conditions, trace elements and nutrients are release from sediments (Pereira et al., 2009)

WHY THE ÓBIDOS LAGOON?

- A previous work pointed out the relevance of sediment as an **internal source** of nutrients and trace elements for the water column (particularly in summer) (Pereira et al., 2009).



Out of the relationships:

. Day-night cycle data

. Summer data

Similar to Cu

26-h survey data

Summer data

Seasonal data





AIMS OF THE WORK

- To assess daylight-night changes on water quality in two seasons: **summer** eutrophic conditions that promotes **internal sources** *versus* **winter** conditions with high freshwater discharges (**diffuse sources**).

- To describe the magnitude and extension of **internal sources** (sediments) on nutrients and trace elements availability during the night under eutrophic conditions.

SAMPLING AND PARAMETERS

- Summer 2007 and Winter 2008

Óbidos lagoon

Day-night scale

Water column

24-hour cycle

In situ measurements each 2 - 4 hours

- FQ parameters (temperature, salinity, pH, O_2)

Surface water collection each 2 - 4 hours

- Trace elements in suspended particulate matter (Al, Fe, Mn, Pb)

- Nutrients and trace elements in dissolved fraction (NH_4^+, $Si(OH)_4$, NO_3^-, PO_4^{3-}, Mn, Fe, Pb, Cu)

SAMPLING AND ATMOSPHERIC CONDITIONS

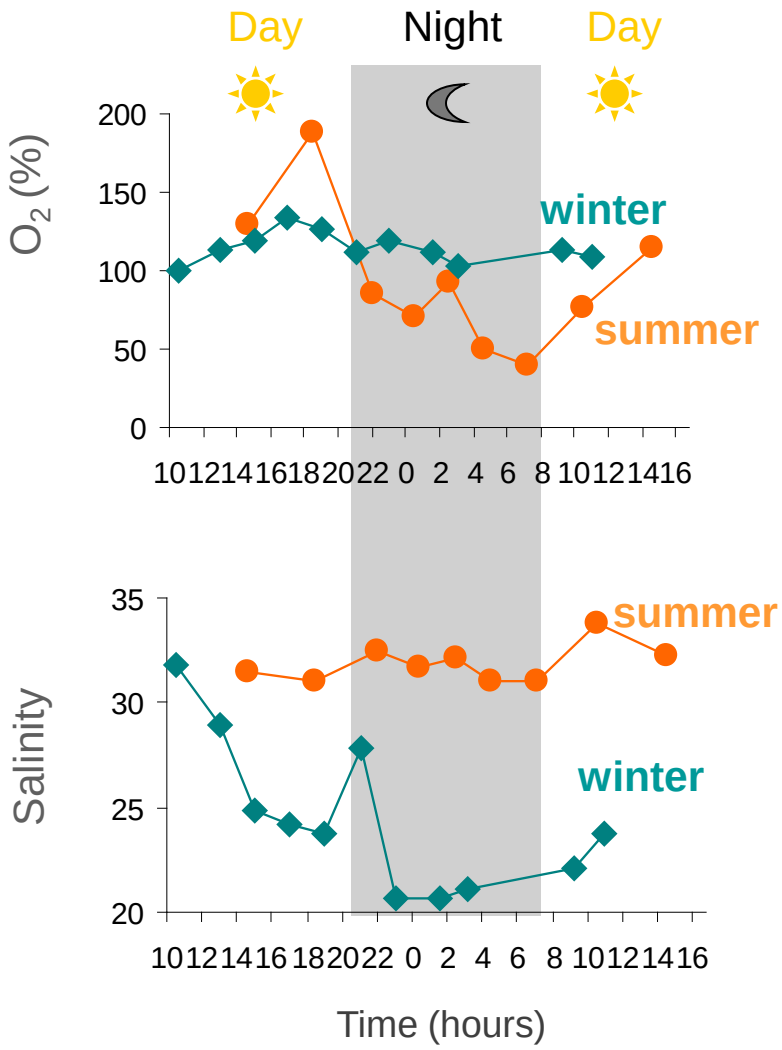
- Summer 2007 and Winter 2008

Óbidos lagoon

	Summer	Winter
	20/07/07	3/12/08
Temperature (ºC)	21	13
Precipitation (mm/3h)	0	3
Clouds (%)	0	100
Wind direction	NW	W
Wind intensity (m/s)	6	9

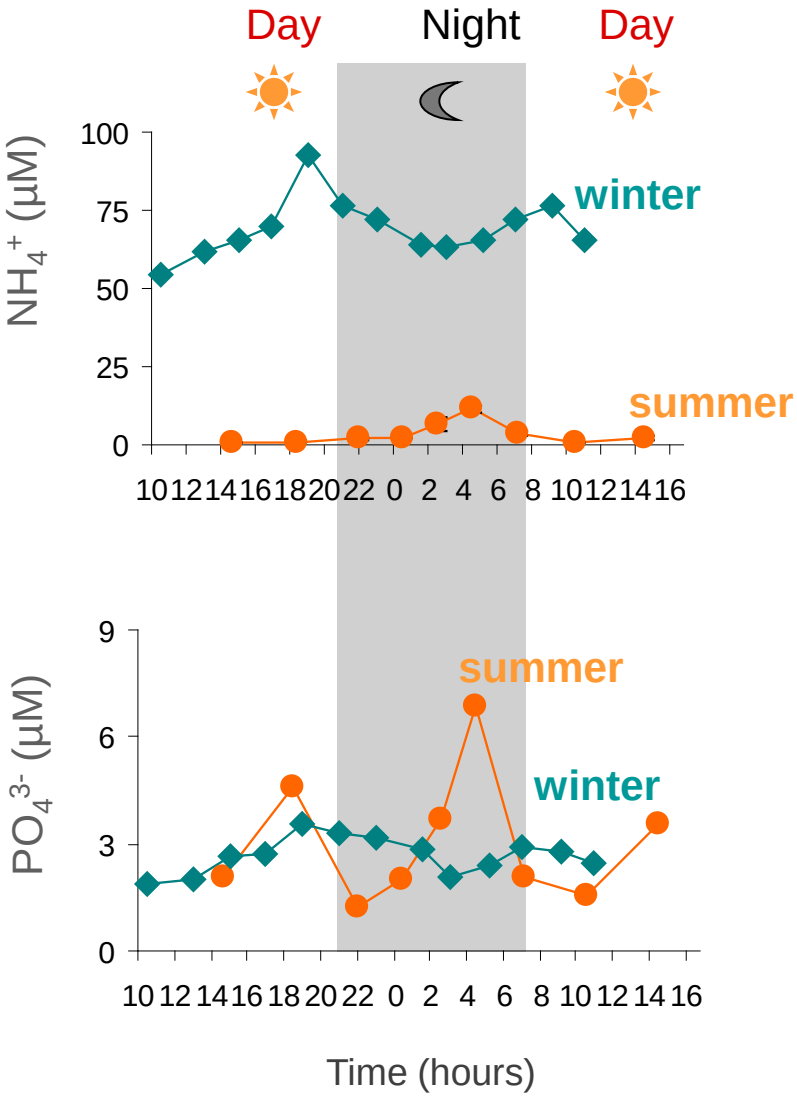

RESULTS AND DISCUSSION

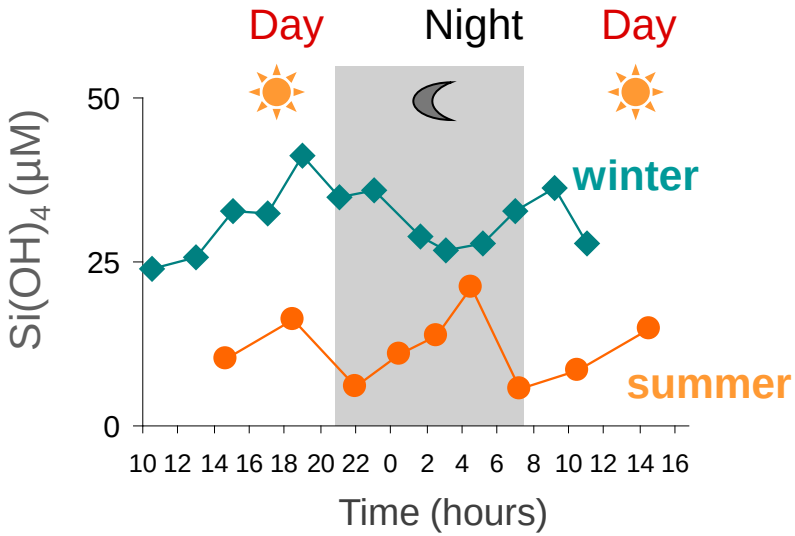
DAY-NIGHT CYCLES - Physico-chemical parameters



- Large day-night fluctuation in summer
  - Night: ⇩ O_2 reaching 40%
- More constant values in winter
- Lower salinity in winter
  - Higher influence of freshwater discharges

DAY-NIGHT CYCLES – Nutrient availability



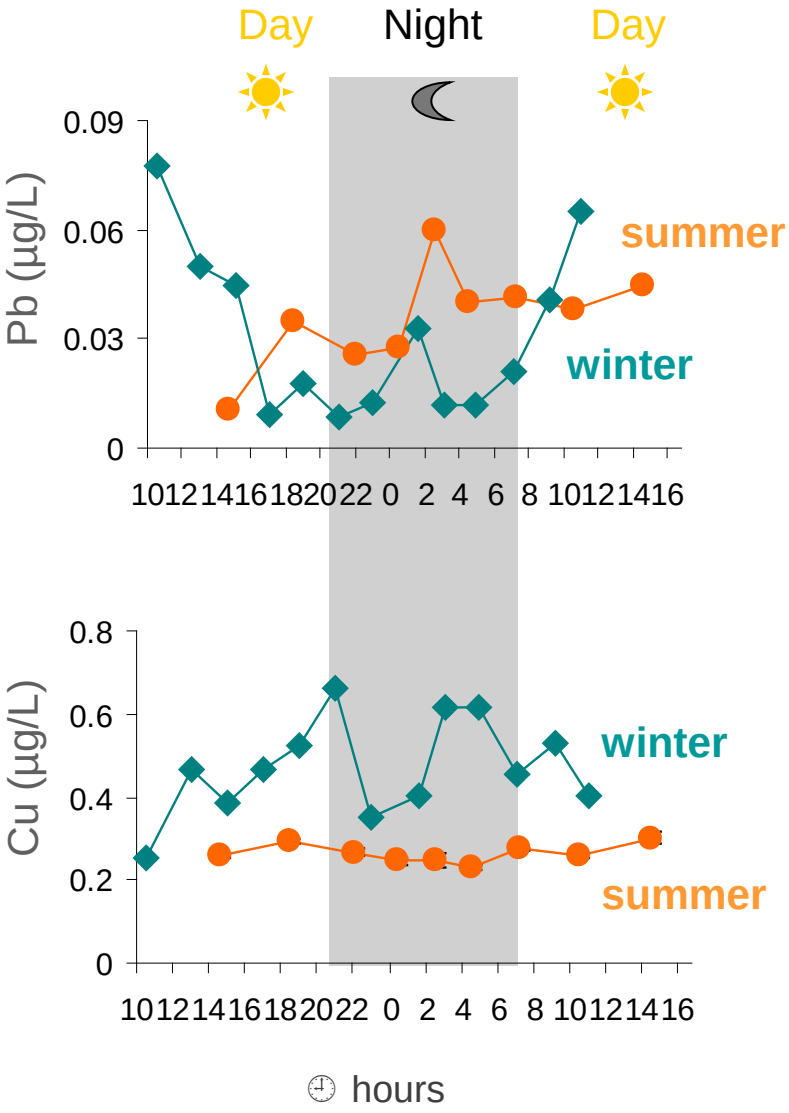


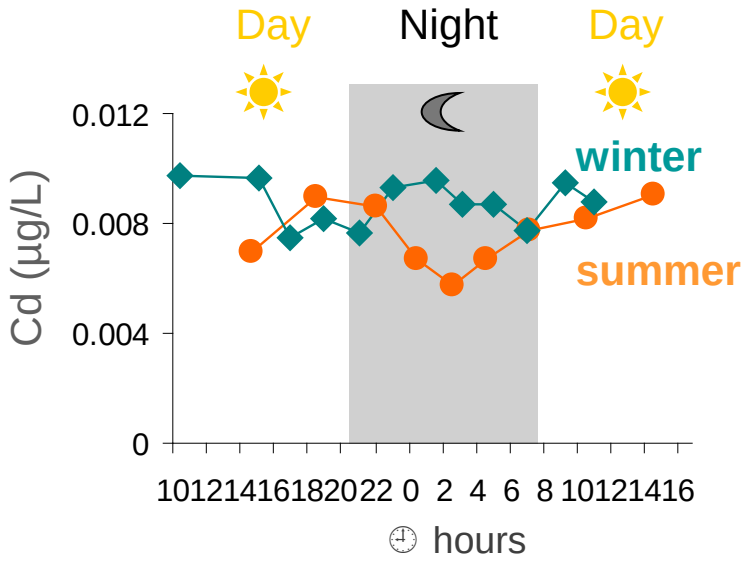
- Peaks during the night in summer when O_2 was lower

Nutrient regeneration in the anoxic sediment and exportation to the water column (relevance of **internal source**)

- Higher nutrient availability in winter, except phosphate

DAY-NIGHT CYCLES – Metal availability



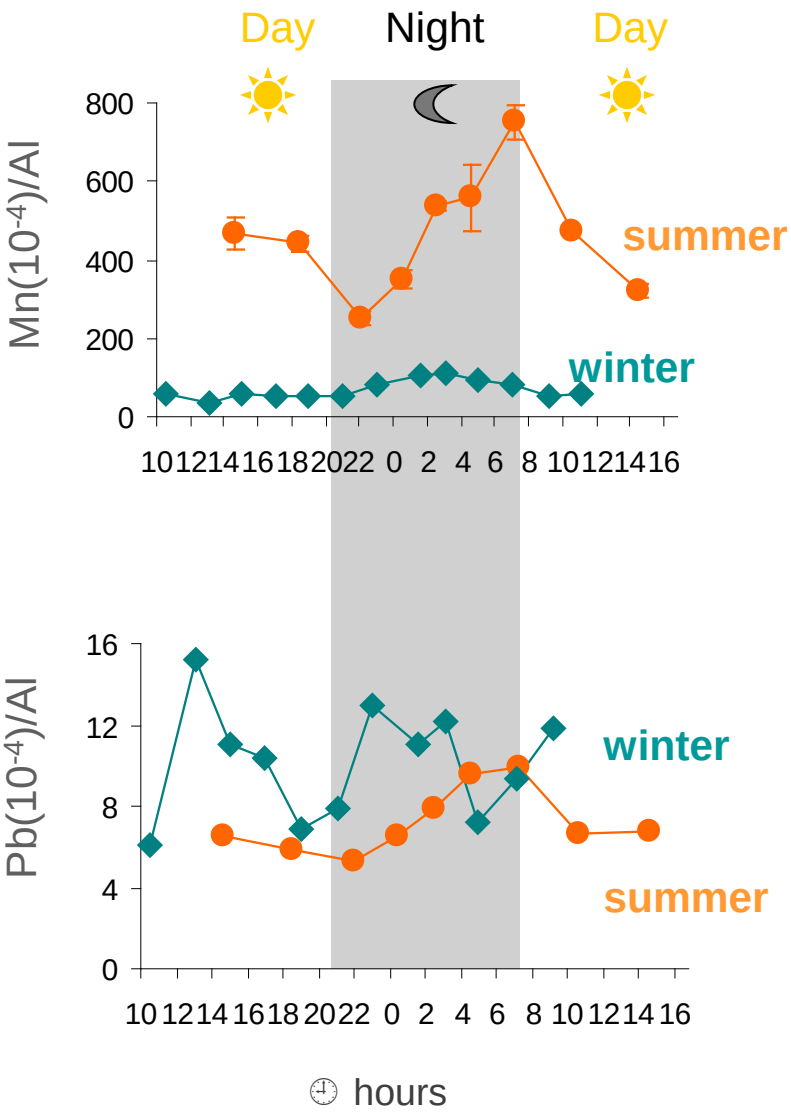


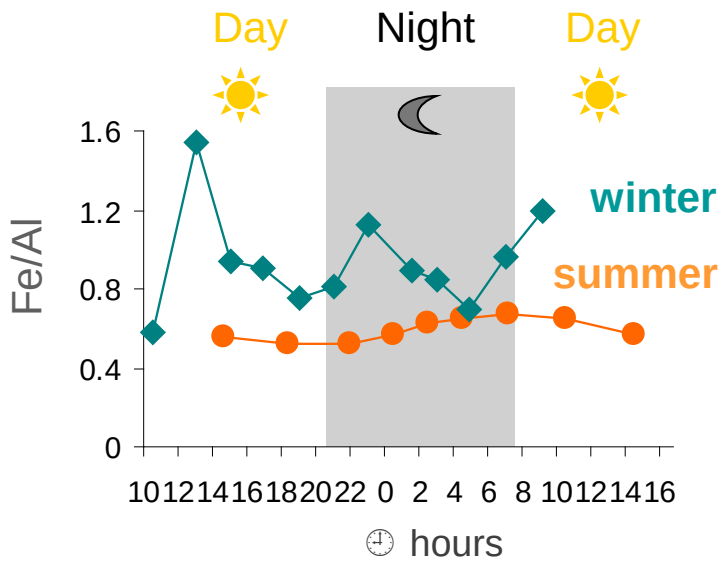
- Pb peak during the night in summer when O_2 was lower

Metal remobilization in the anoxic sediment and exportation to the water column (relevance of **internal source**)

- Higher Pb levels in summer than in winter; the opposite pattern was recorded for Cu and no differences were found for Cd.

DAY-NIGHT CYCLES – Metal availability



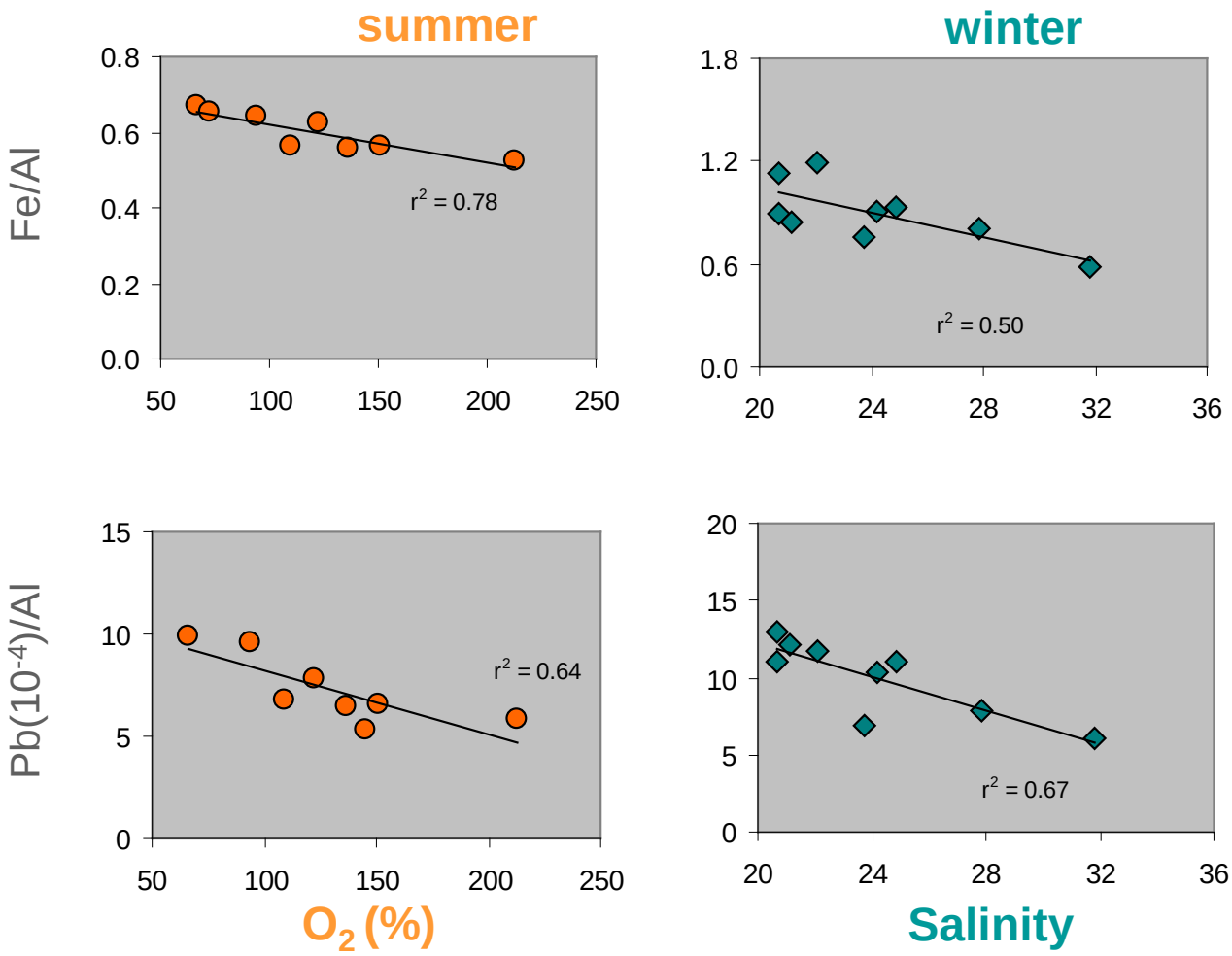


- Peaks during the night in summer when O_2 was lower, particularly for manganese

Metal remobilization in the anoxic sediment and exportation to the water column (relevance of **internal source**)

- Higher Mn/Al ratios in summer than in winter; the opposite pattern was recorded for Fe and Pb highlighting the importance of freshwater inputs.

METAL LEVELS *VERSUS* KEY PARAMETERS



. Significant correlations between metal levels and O_2 in summer

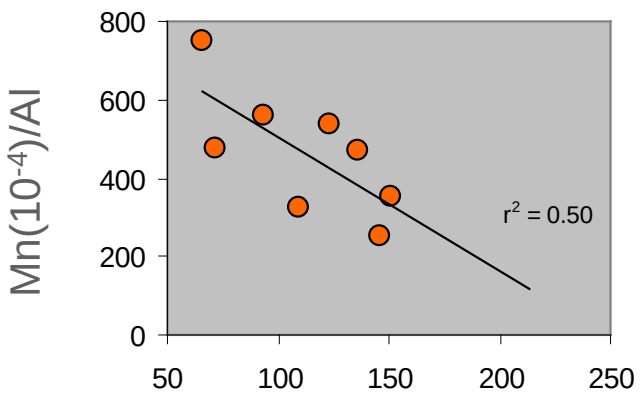
Internal source

. Significant correlations between metal levels and salinity in winter

Diffuse source

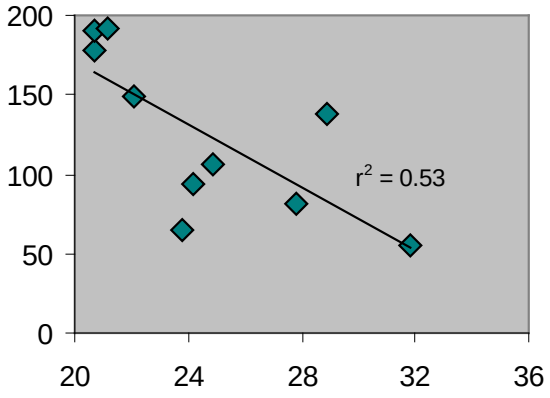
METAL LEVELS *VERSUS* KEY PARAMETERS

summer



O_2 (%)

winter



Salinity

. Significant correlations between metal levels and O_2 in summer

Internal source

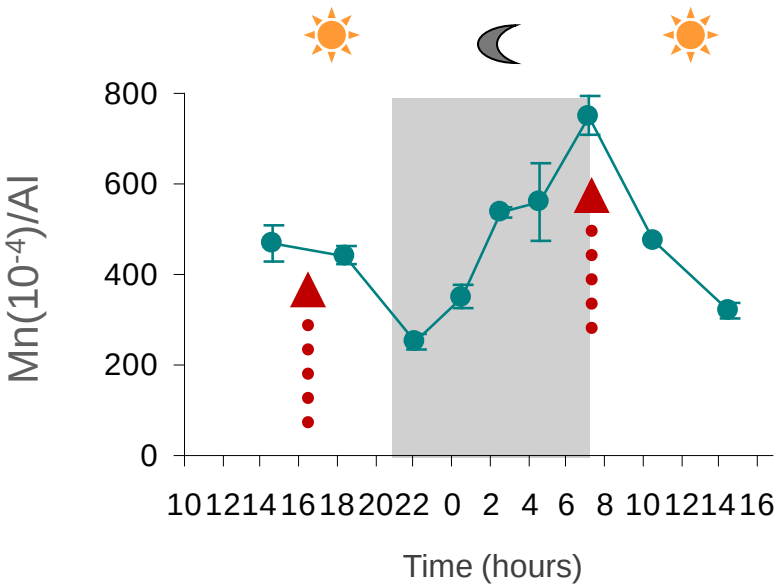
. Significant correlations between metal levels and salinity in winter

Diffuse source

DAY-NIGHT CYCLES

Eutrophic conditions
(Barrosa branch)

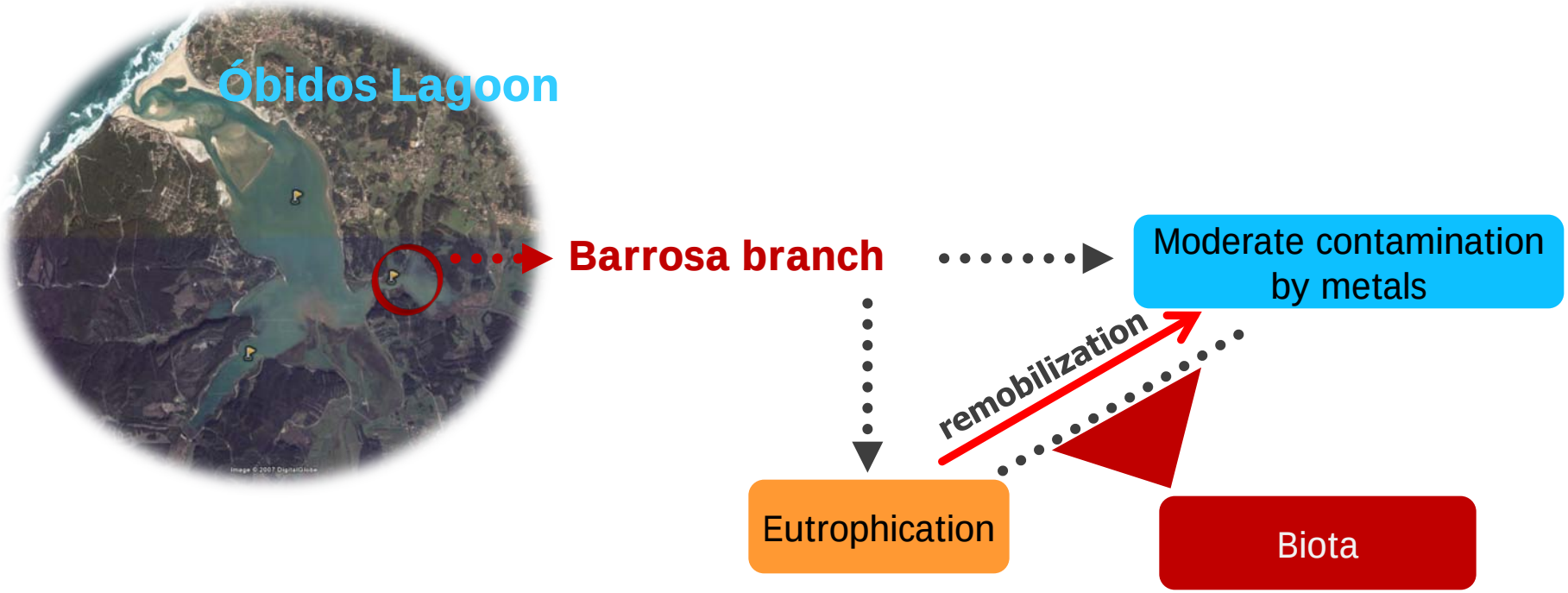
The example of Mn as an element with high mobility near the sediment-water interface



- Input of nutrients and metals at Barrosa branch by freshwater discharges (Cal river), mainly in winter (**diffuse source**).
- Supplementary input of nutrients and metals during the night at Barrosa branch, which for some elements is far above that provided by freshwater discharges (e.g. Mn).
- Reductive dissolution of Mn and Fe oxyhydroxides in sediments with the release of Mn^{2+} and Fe^{2+} and their upward diffusion in the water column.

FINAL REMARKS

- Under eutrophic conditions, metal remobilization in sediments and the subsequent exportation to the water column represent an additional input of metals that could be incorporated by the biota.
- Current results highlight to the importance of assessing environmental conditions over day-night cycles.
- This approach seems to be particularly relevant when addressing the relationships between “chemical conditions” and “biological quality elements” foreseen in the Water Framework Directive.



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