Combined effects of burrowing crabs and tides on carbon fluxes in sediments

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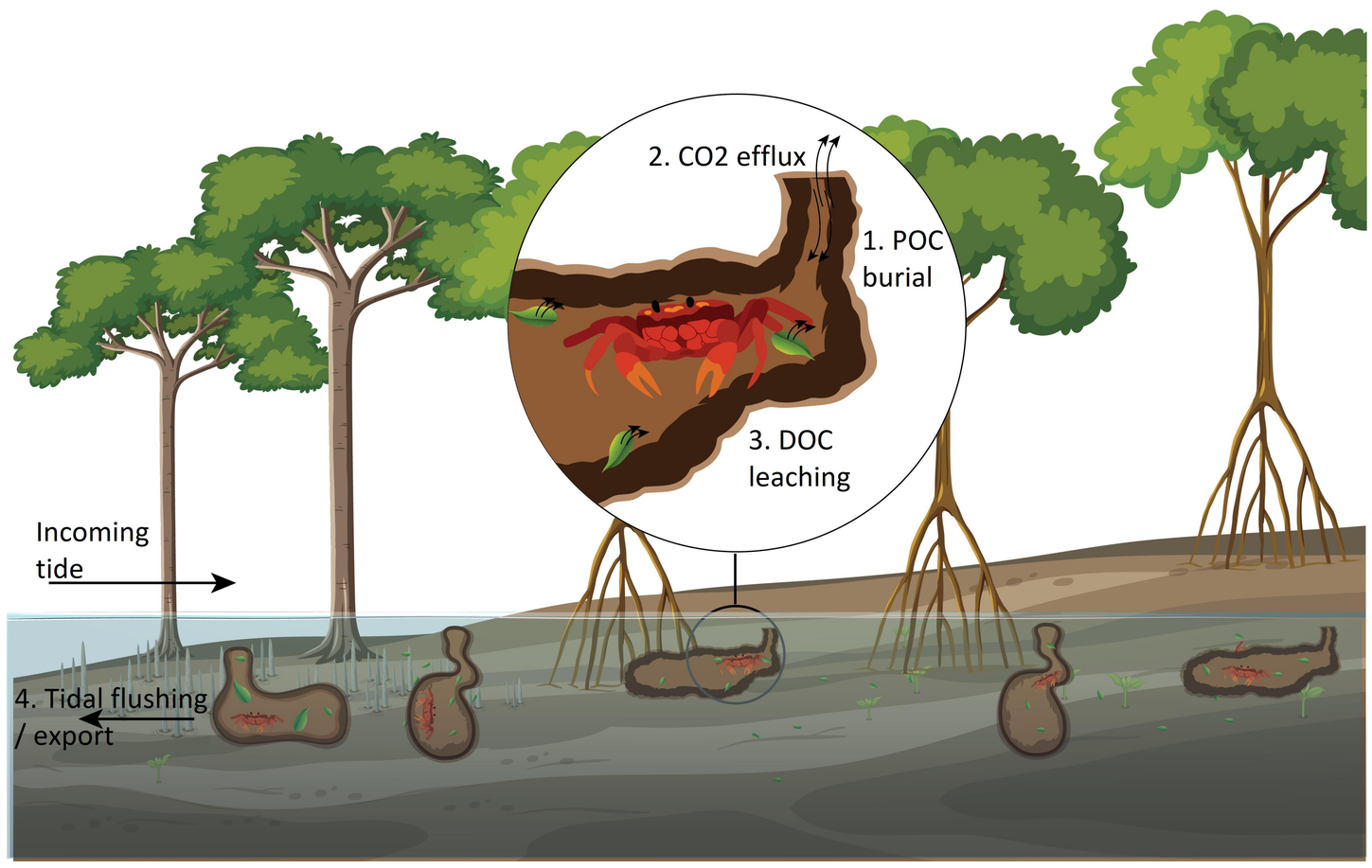
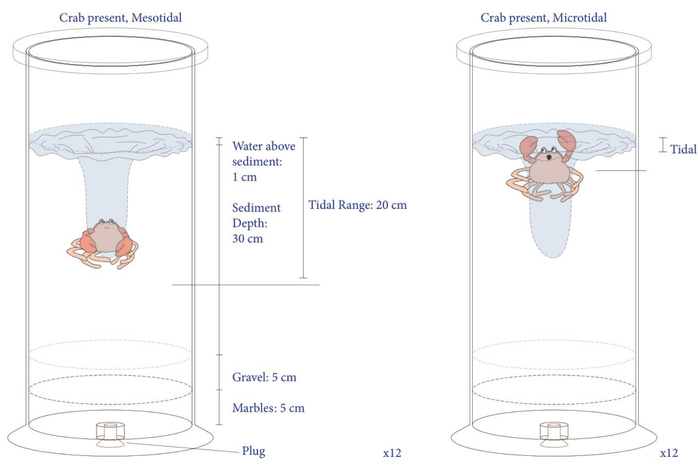
The impact of burrowing crabs on carbon storage and stocks in mangrove systems is complex.

- The **burial of leaves** by crabs may lead to enhanced carbon storage in mangroves (1).
- Burrows increase the sediment-air interface, **enhancing CO_2 fluxes** from the sediment, potentially counteracting the effect of burial (2).
- Further, burrows can act as preferential flow paths, **facilitating tidal export** of carbon (3,4)

Objective:
Assess the combined impact of burrowing crabs and tides on carbon storage in mangroves.



APPROACH



Experimental Design:

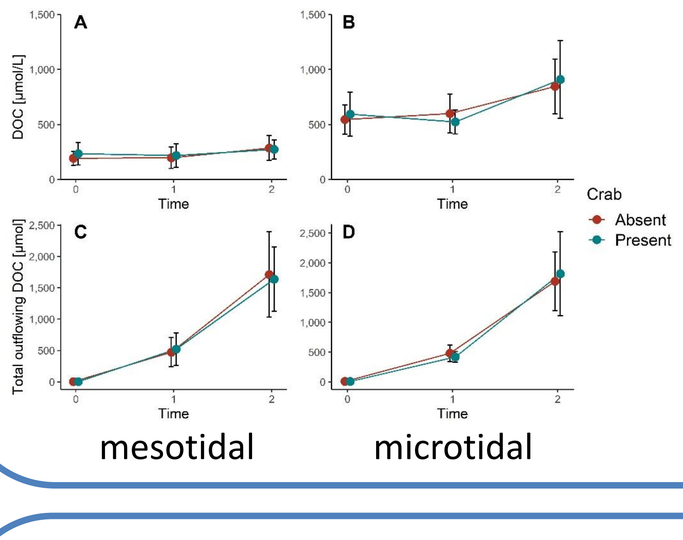
- fully crossed design to examine effects of crabs and tides on dissolved organic carbon (DOC) and CO_2 flux:
- *Neosarmatium africanum* present *vs*. absent under
- "mesotidal" *vs.* "microtidal" regime

Sampling & Analysis:

- Pore-water samples collected and analyzed for DOC content
- CO_2 flux measured using NDIR sensors

KEY FINDINGS

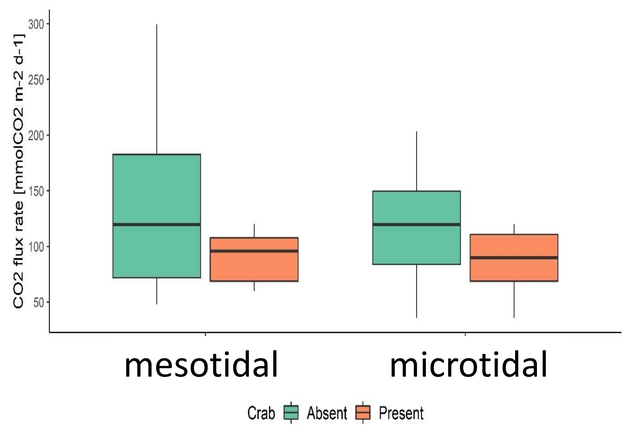
DOC



- DOC concentrations (A,B) higher and increasing over time in mesotidal treatments
- Total outflowing DOC (C,D) increasing over time in both tidal treatments
- No effects of crab presence on DOC dynamics and fluxes

CO_2

- CO_2 flux rates similar across tidal treatments
- CO_2 flux rates significantly higher without crabs than with crabs in both tidal treatments



TAKE HOME

Previous studies commonly reported higher CO_2 fluxes in crab burrows; our findings contradict these observations:

Lower CO_2 fluxes when crabs present:
leaf fragments trapped inside sediment upon burial and burrow collapse, reducing CO_2 emission from the sediment-air interface

Consider temporal variability of **burrow stability**:
collapse can impact the positive coupling between burrowing crabs and CO_2 fluxes

Significant impact of tidal regime on **porewater DOC**:
higher concentrations under microtidal conditions

Duration of submergence of POM:
Higher tidal flushing under mesotidal conditions compensates for lower DOC concentrations, resulting in similar DOC export under different tidal regimes

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