Alkalinity (HCO_3^-) Pumping by Seaweed Forests

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Korea Fisheries Resources Agency

POSTECH

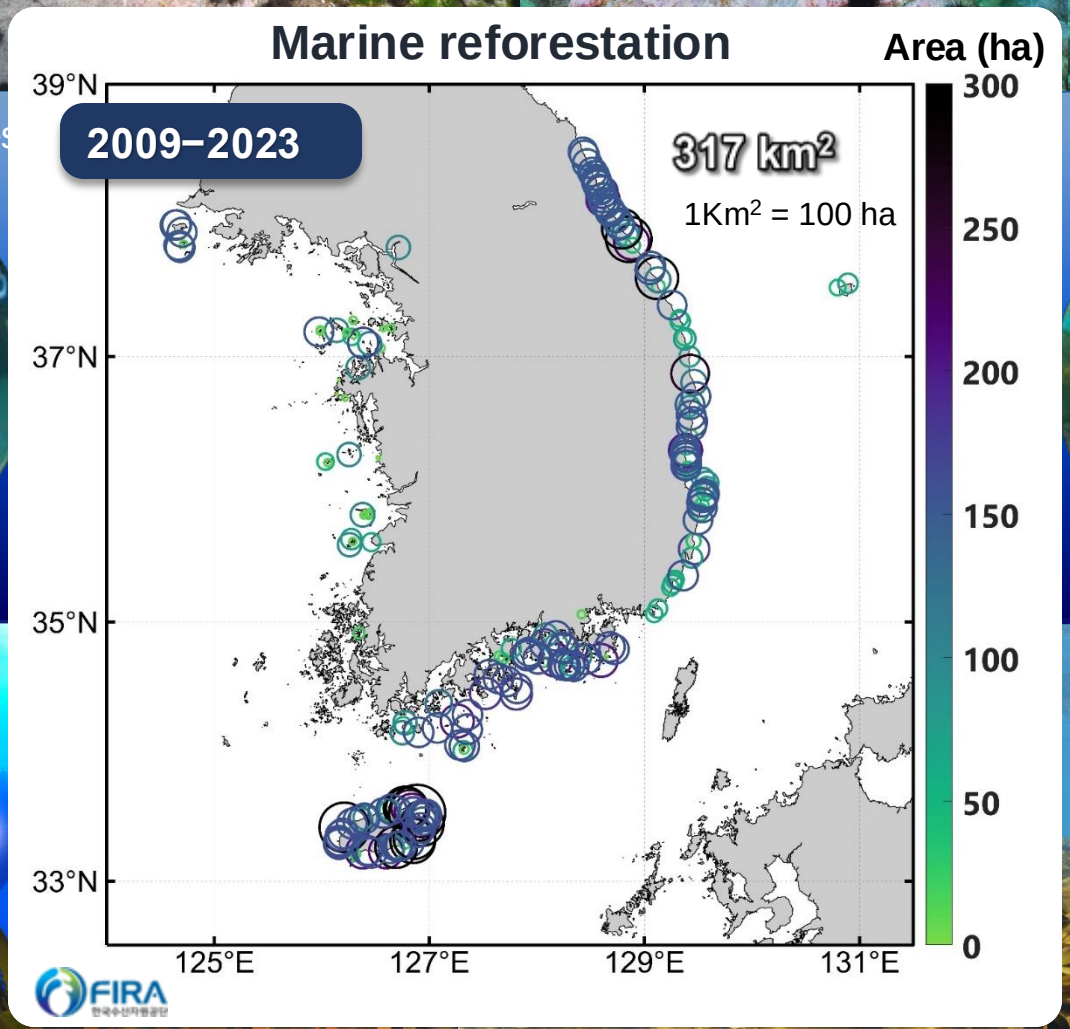
FIRA 한국수산자원공단

Marine reforestation project in Korea

Past

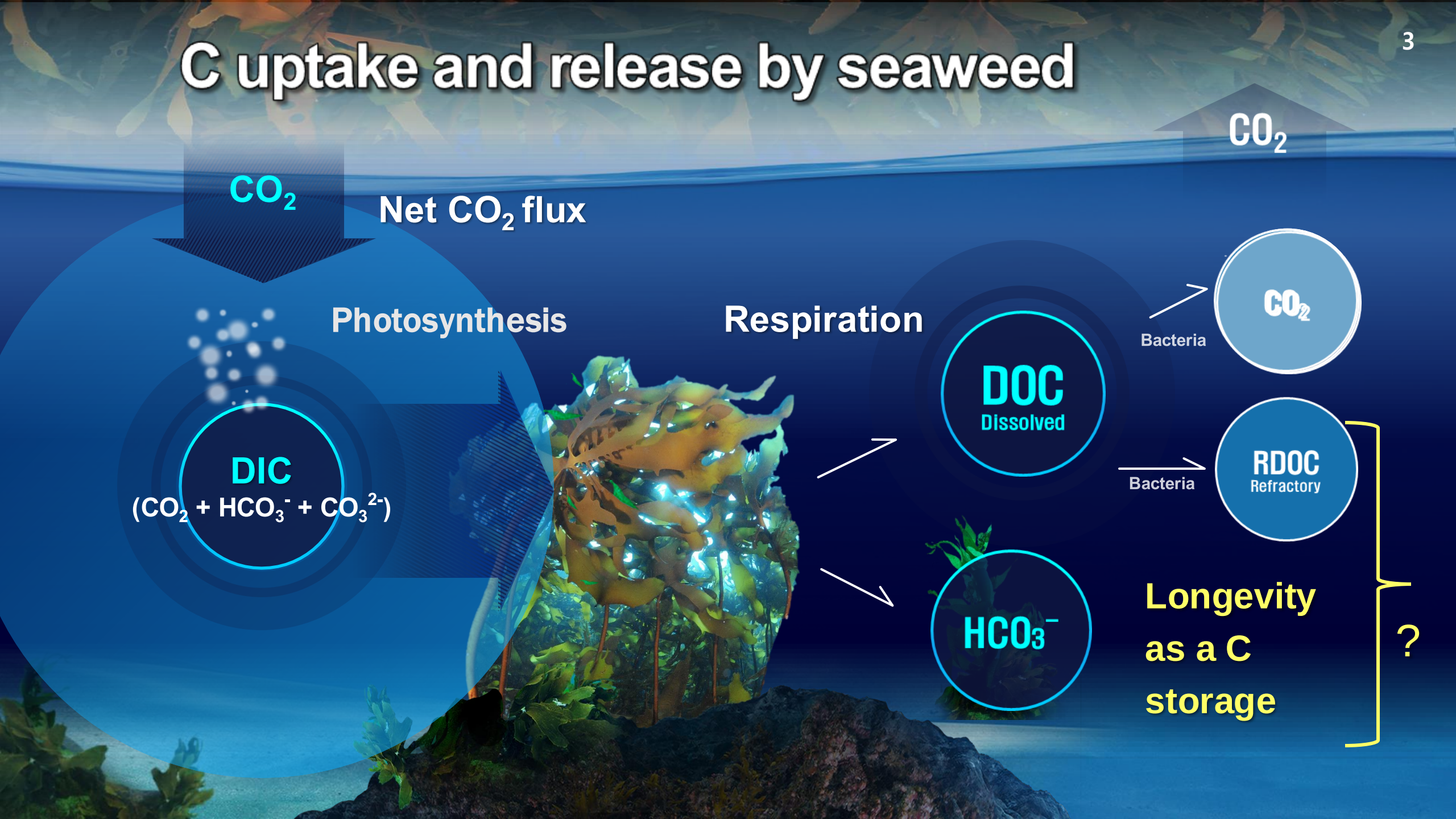
Spraying of zoospores

Present

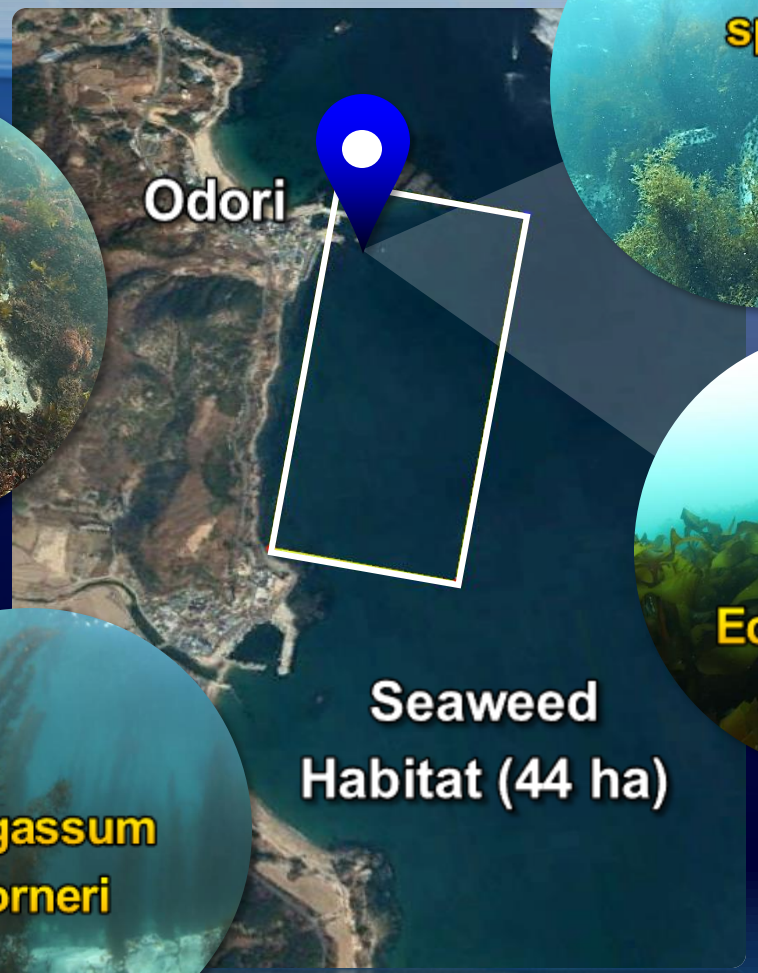


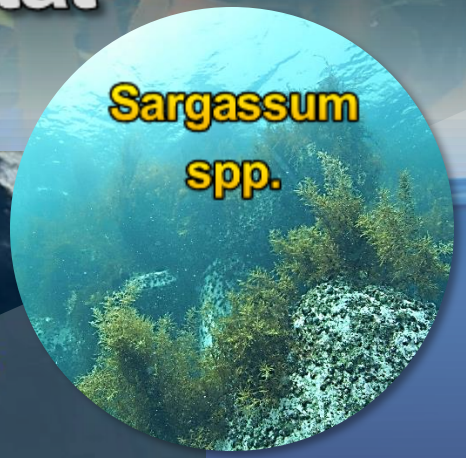
Data credit FIRA

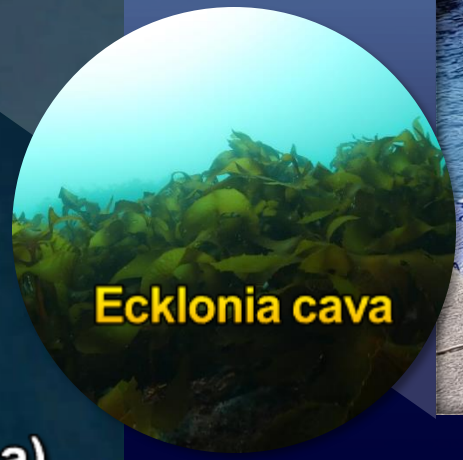
C uptake and release by seaweed



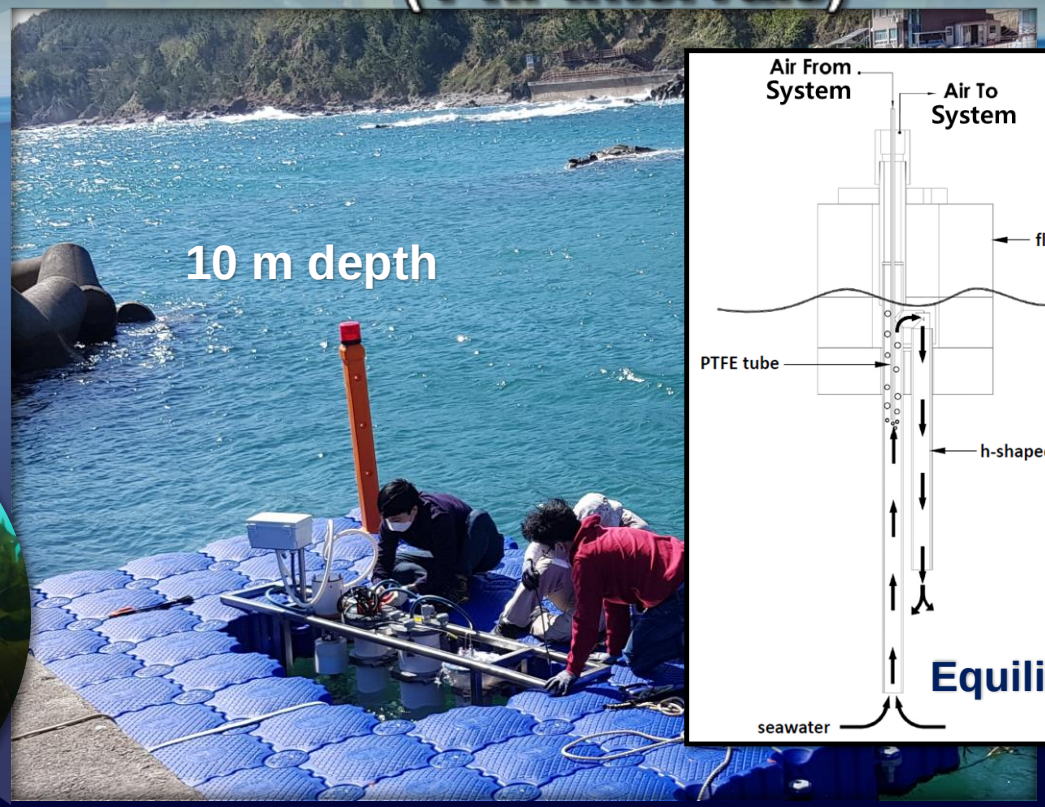
Seaweed Habitat







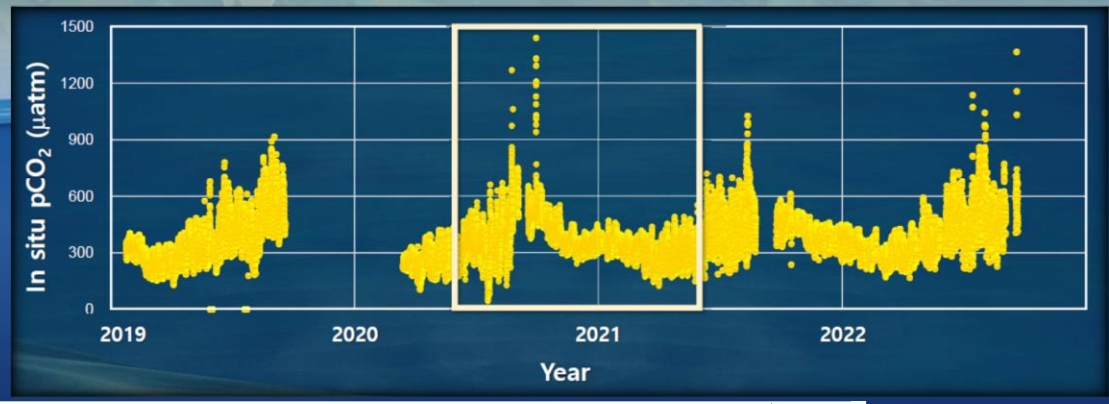
pCO_2 (1-hr intervals)



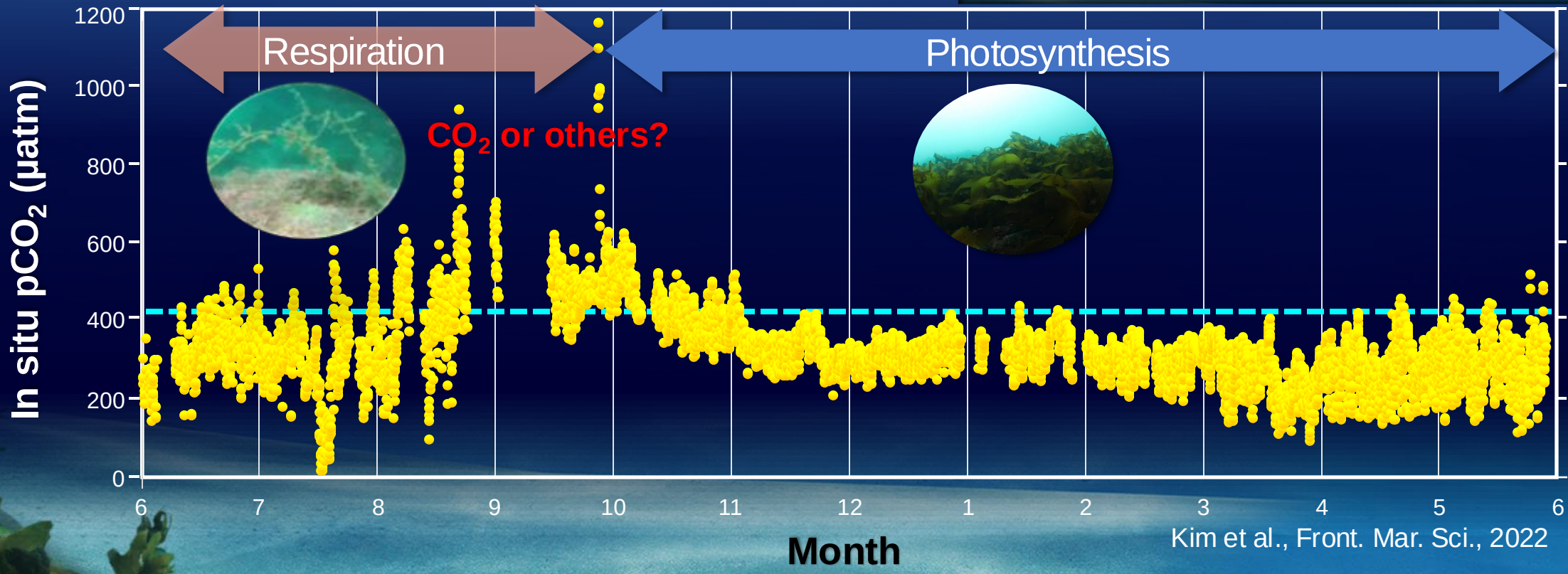
Credit: J.-H. Kim

Surface pCO_2 in the seaweed habitat

The seaweed habitat is a strong CO_2 sink!

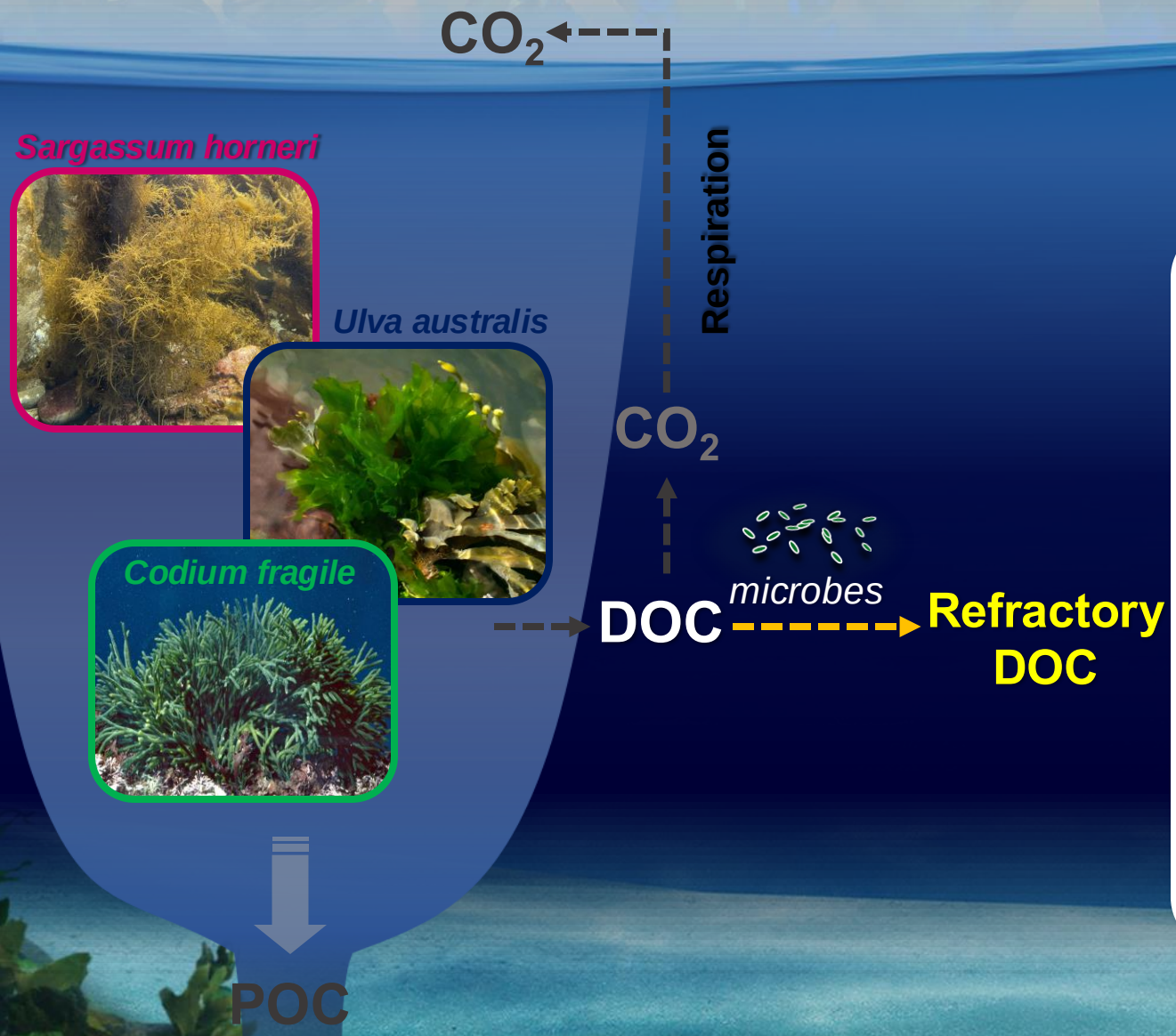


2020. 06 – 2021. 05

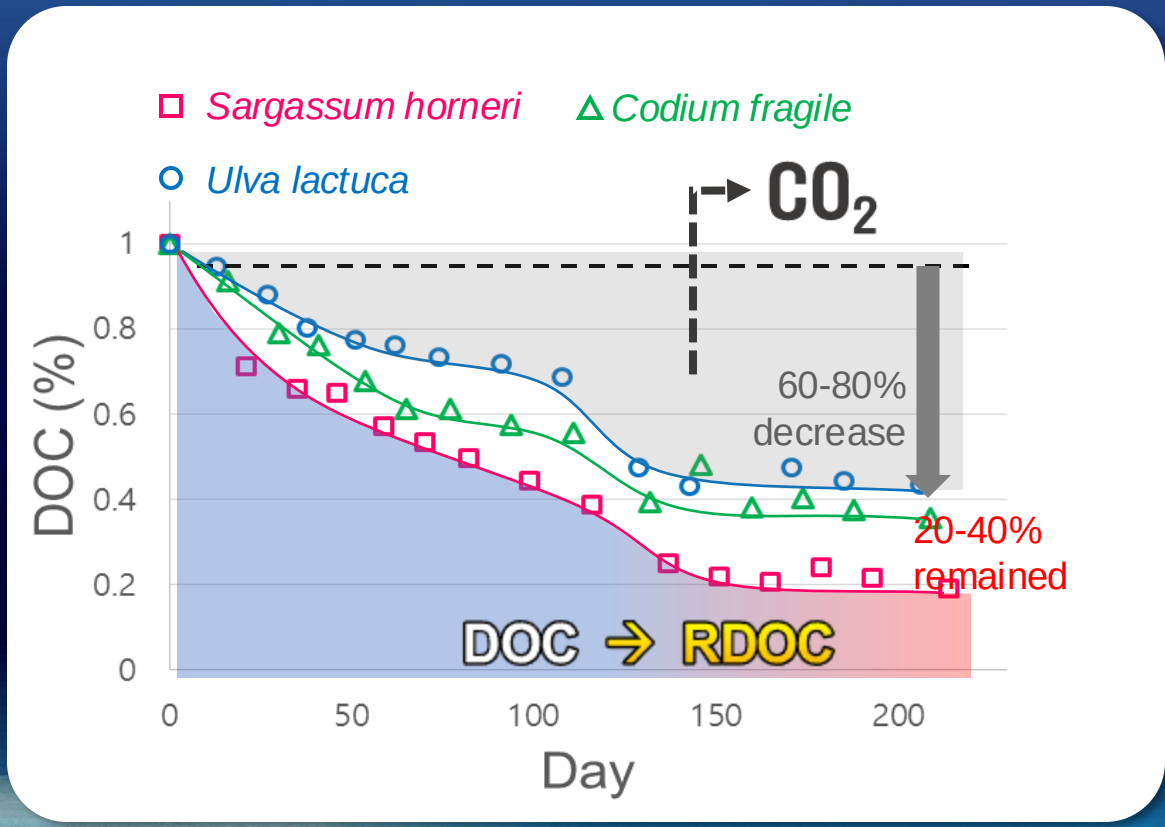


Kim et al., Front. Mar. Sci., 2022

C stored in the form of DOC (cultured exp.)



Cultured Experiment



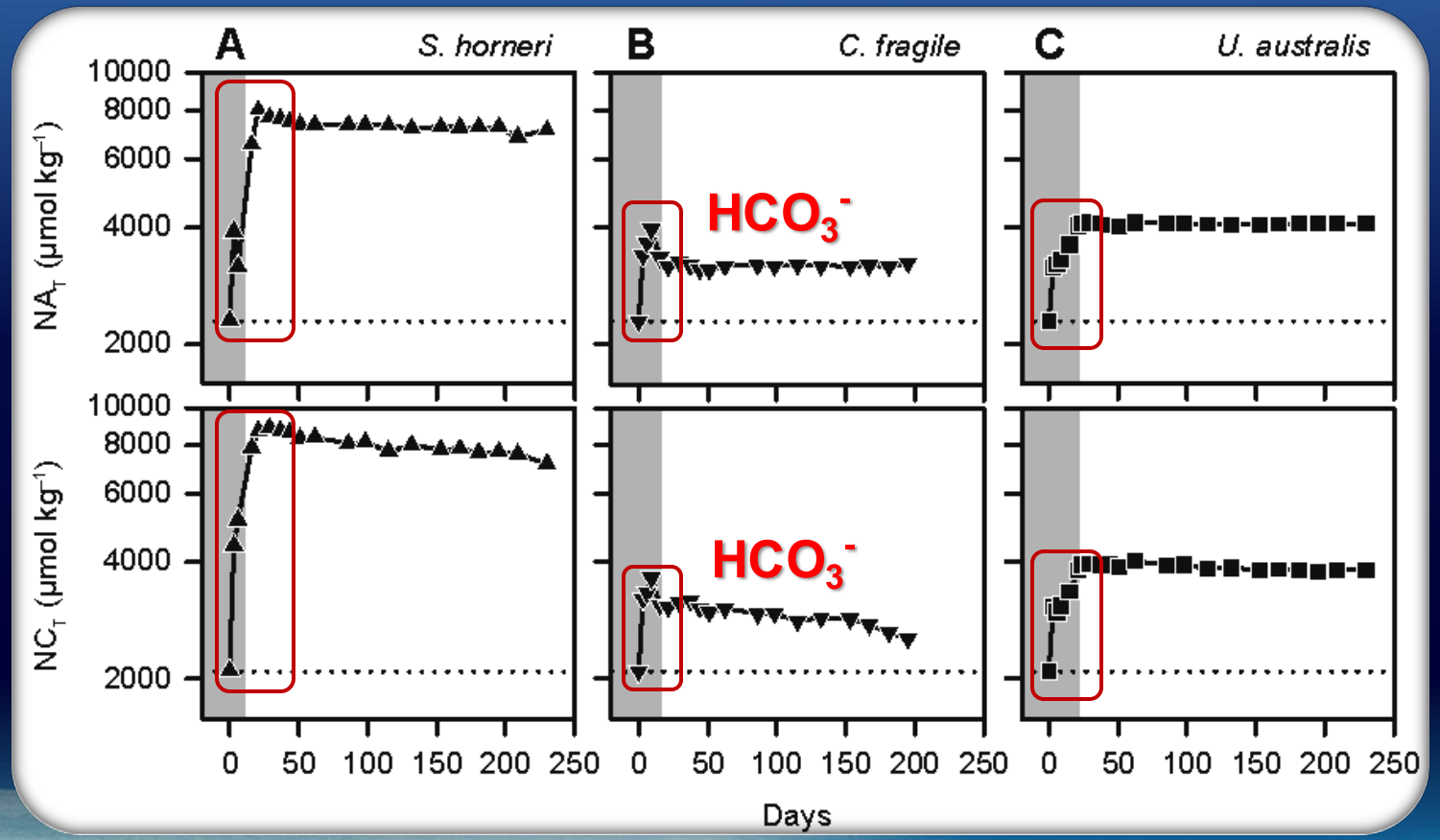
C stored in the form of HCO_3^- (cultured exp.)

$$C_T = [CO_{2(aq)}] + [HCO_3^-] + [CO_3^{2-}]$$
$$A_T = [HCO_3^-] + 2[CO_3^{2-}] + [OH^-] - [H^+]$$

Respiration

HCO_3^-

POC
Particulate

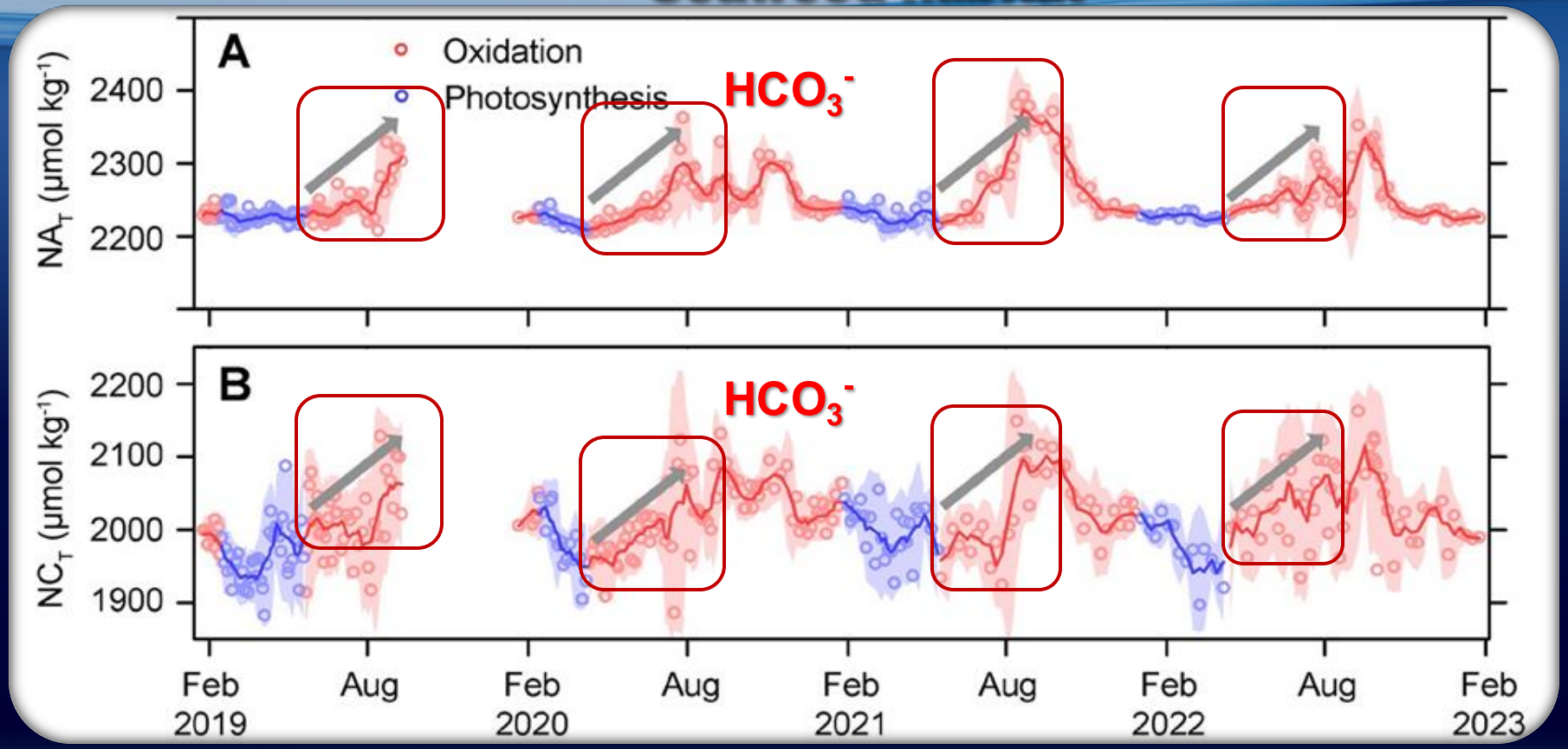


Lee et al., under review

$\Delta TA\uparrow : \Delta DIC\uparrow \approx 1$

C stored in the form of HCO_3^- ions (Field Exp.)

Seaweed habitat



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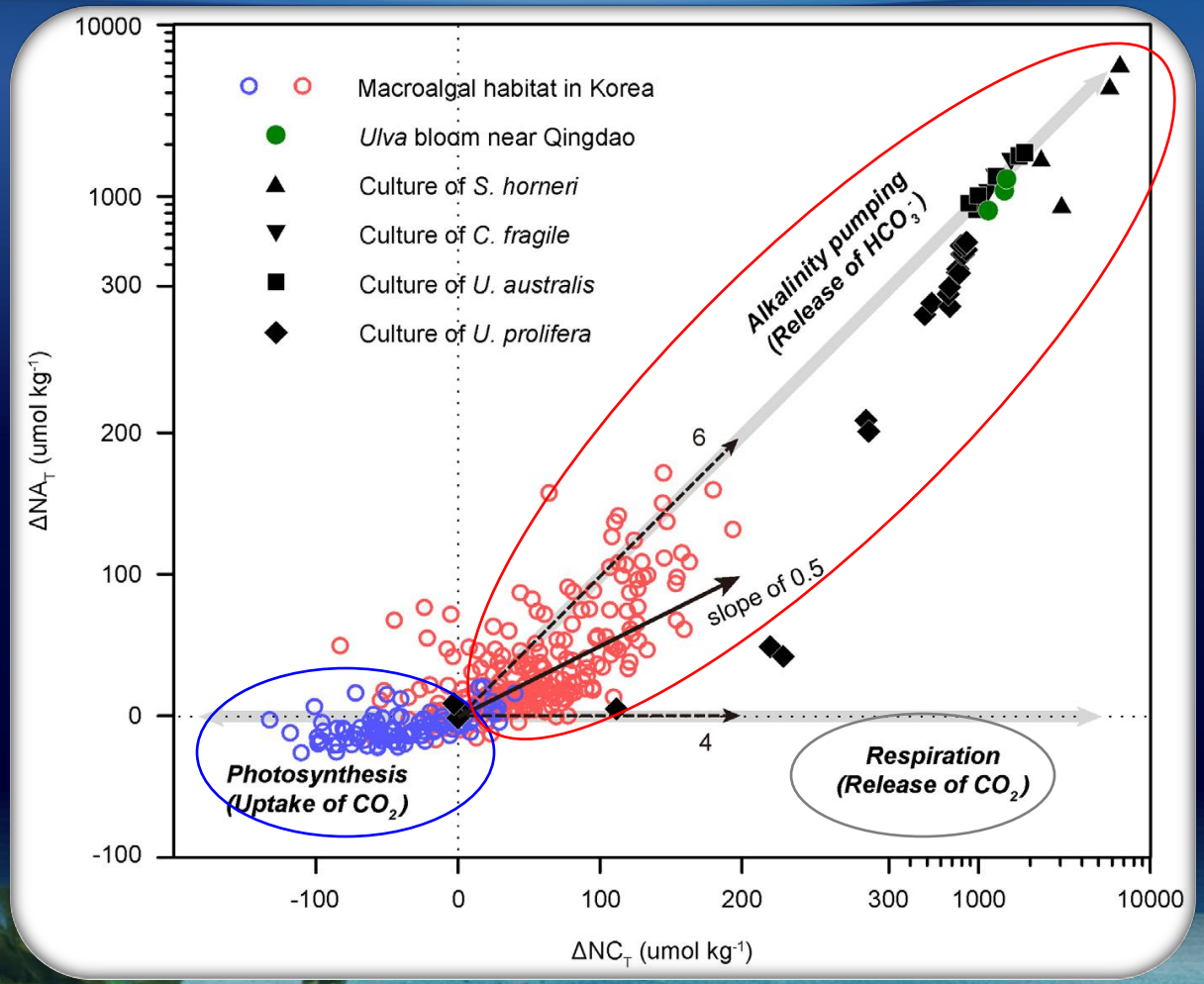
Δ TA↑ : Δ DIC↑ ≈ 1

Evidence for HCO_3^- release

Release of intracellular HCO_3^- ions (cultured and field data)



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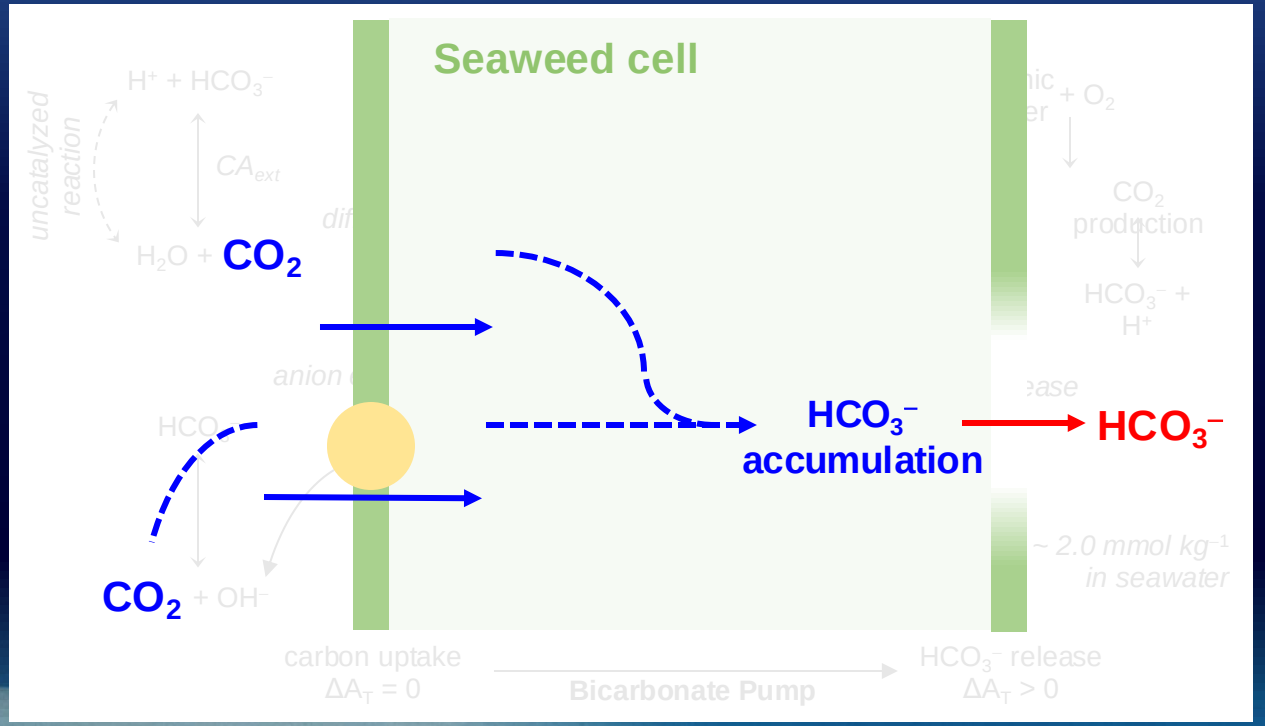

Recaps

Seaweed forests :

1. Rapid, considerable C removals
2. Store C in the recalcitrant DOM
3. Store C in the form of bicarbonate ions
4. Great potential as a new Blue Carbon