Photosynthetic activity of early successional phytobenthos at a shallow CO_2 seep off Shikine Island, Japan

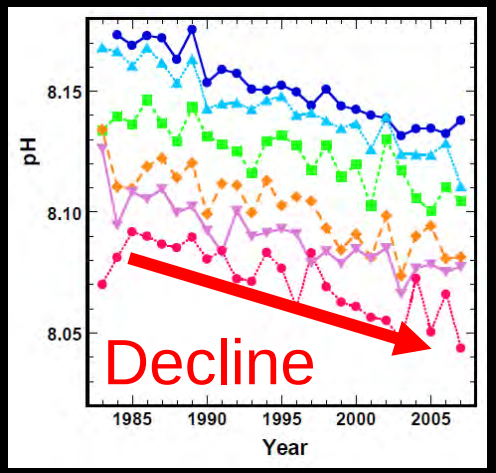
○Shigeki Wada[1], Agostini Sylvain[1], Ben Harvey[1], Yuko Omori[2], Jason Hall-Spencer[1,3]

[1]Shimoda Marine Research Center, University of Tsukuba

[2]Life and Environmental Sciences, University of Tsukuba

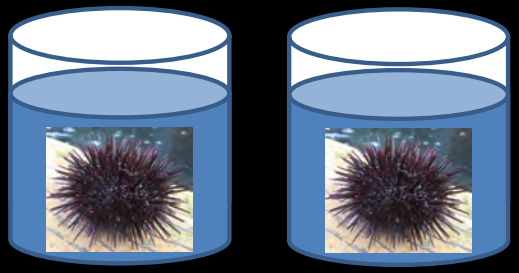
[3]Marine Biology and Ecology Research Center, University of Plymouth

Ocean Acidification (OA) and CO_2 seep



(Midorikawa et al. 2010)

Biological Assay



pH=8.1 pH=7.6

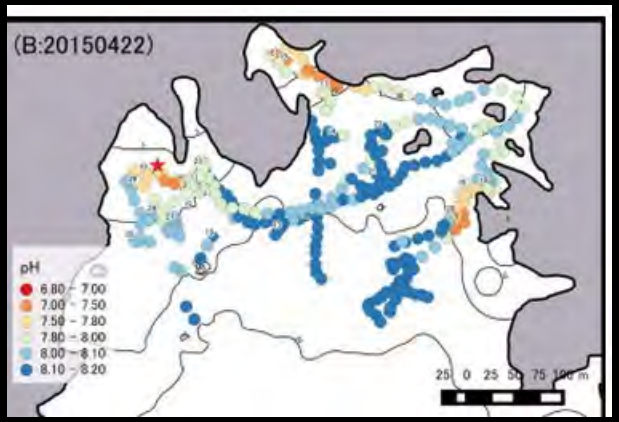
Problem

- Adaptation, Acclimation
- Interaction between Organisms

CO_2 seep

Shikine Island

pH Mapping



(Agostini et al. 2015)

Effects on Primary Producers and Photosynthesis

Control

CO_2 seep

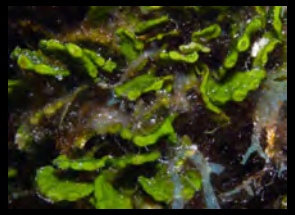
Change in Flora

- Decrease in Calcifying algae
- Increase in Turf algae

(Agostini et al. 2018)

How about the response of photosynthesis?

Past studies on photosynthesis in other CO_2 seep



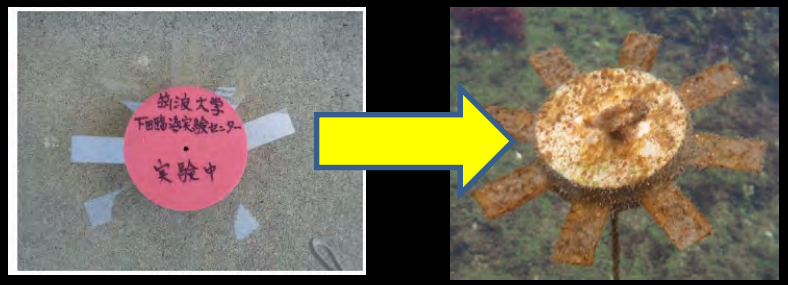
- Knowledge is limited to the species living in both area (Control and Acidified area)
- Response of community consisting of various algae is unknown

Objectives in Our Research

To assess the effect of OA on the productivity of algal community

Types of the Community

1. Early succession phase ⇛ This Study
2. Natural Community ⇛ S. Kurosawa (from 17:30)



Photosynthesis in the early succession phase

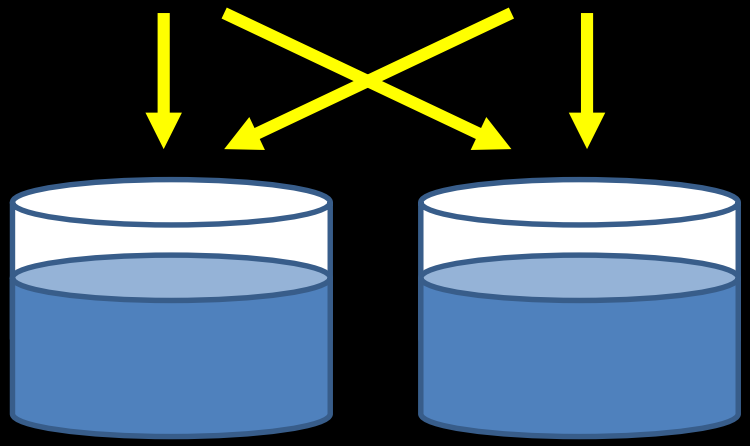
Measurement of Photosynthesis of Attached Algae

Control

CO_2 seep

Deployment: Apr 2016
⇒Retrieved on day 44, 72

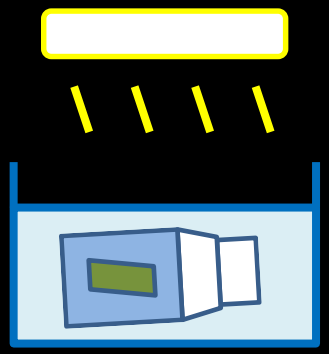
Pigment Analysis⇒HPLC

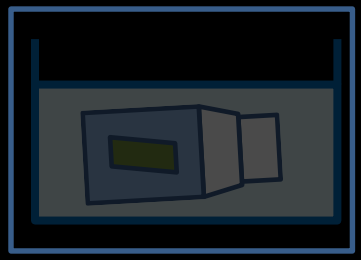


Control

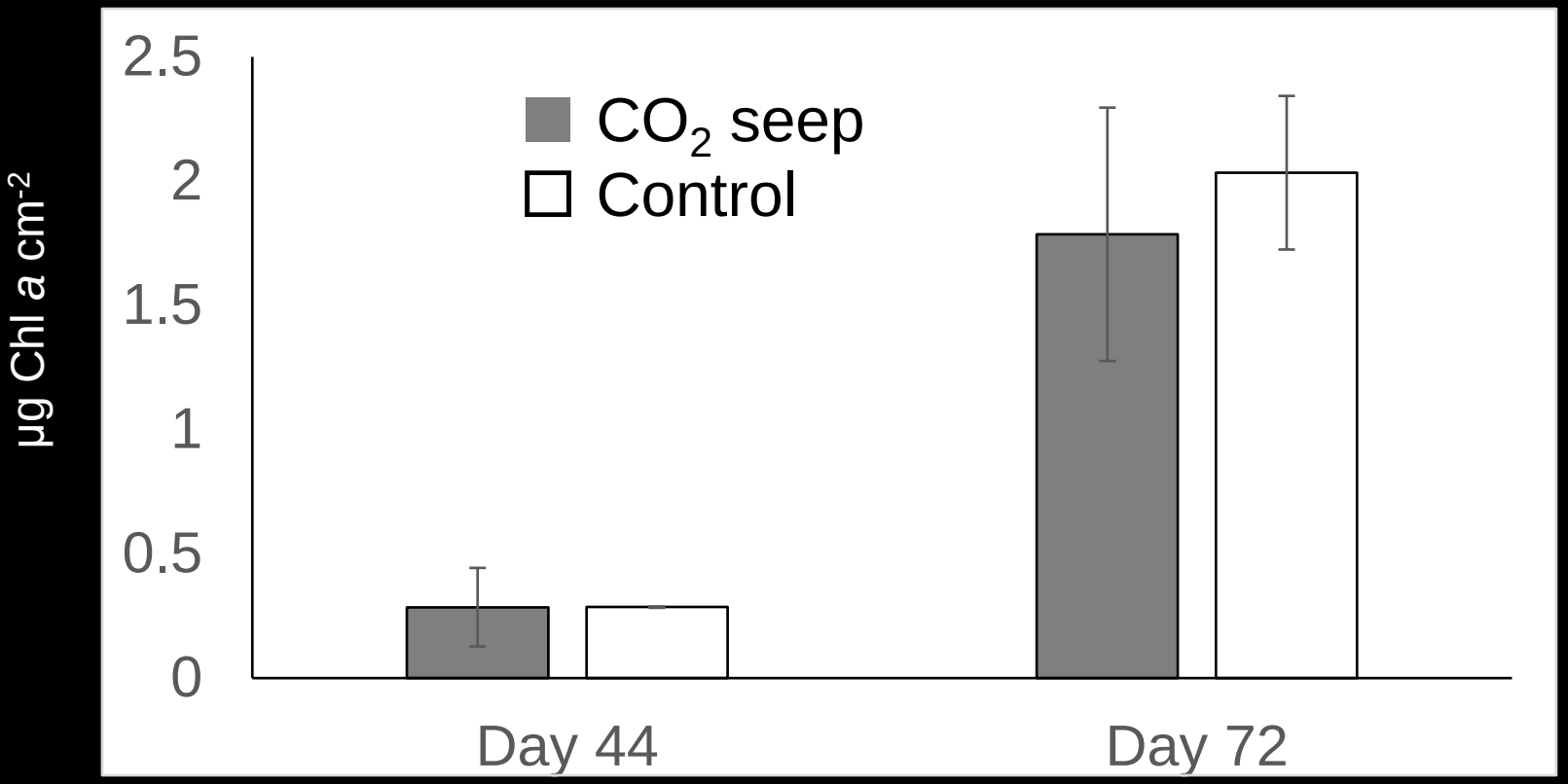
CO_2 seep

Cross Exp. (Plate & Seawater)
Light & Dark⇒DO change



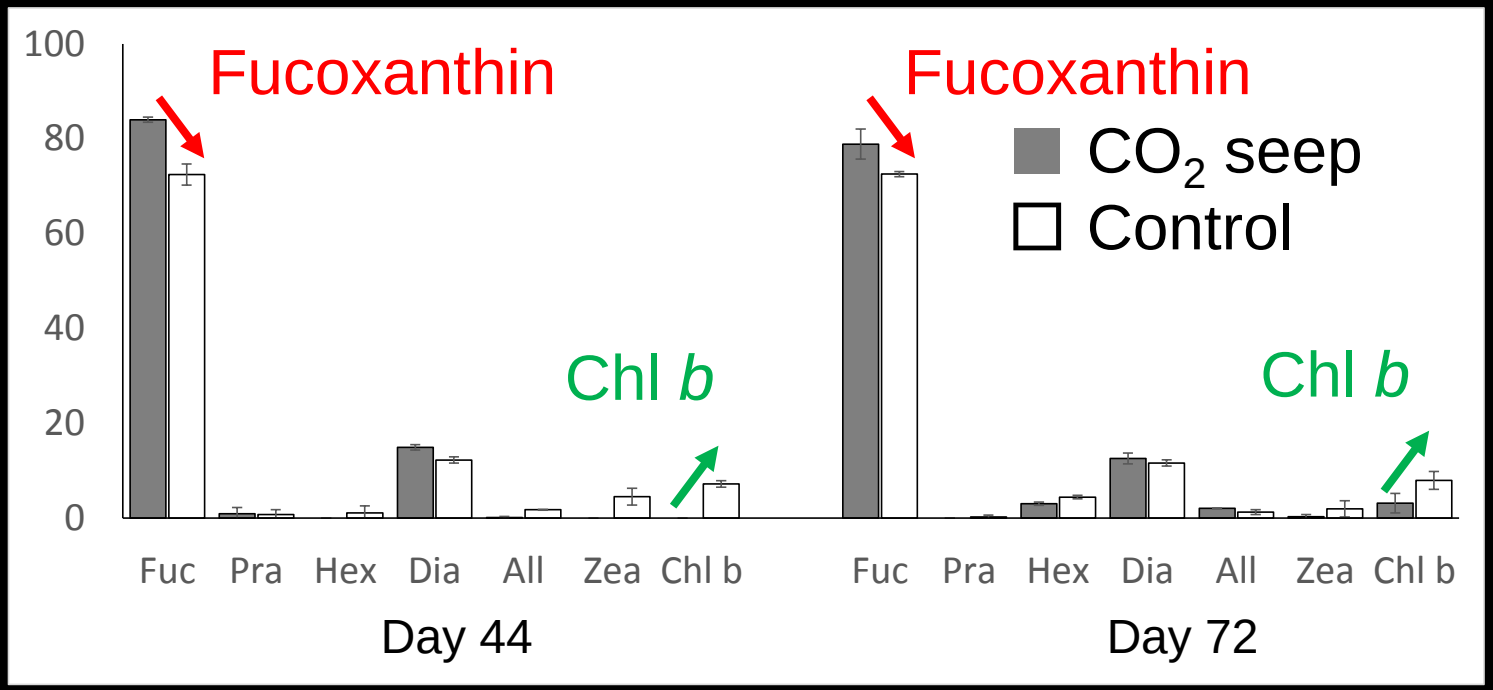


Chl *a* per Unit Area of the Plate



No significant difference between the sites

Pigment except Chl a

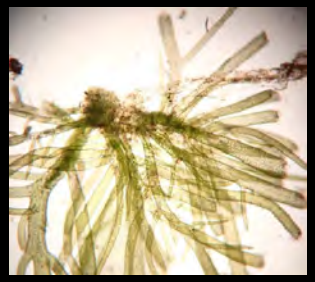


CO_2 seep ➡ Higher content of fucoxanthin

⬍

Diatom

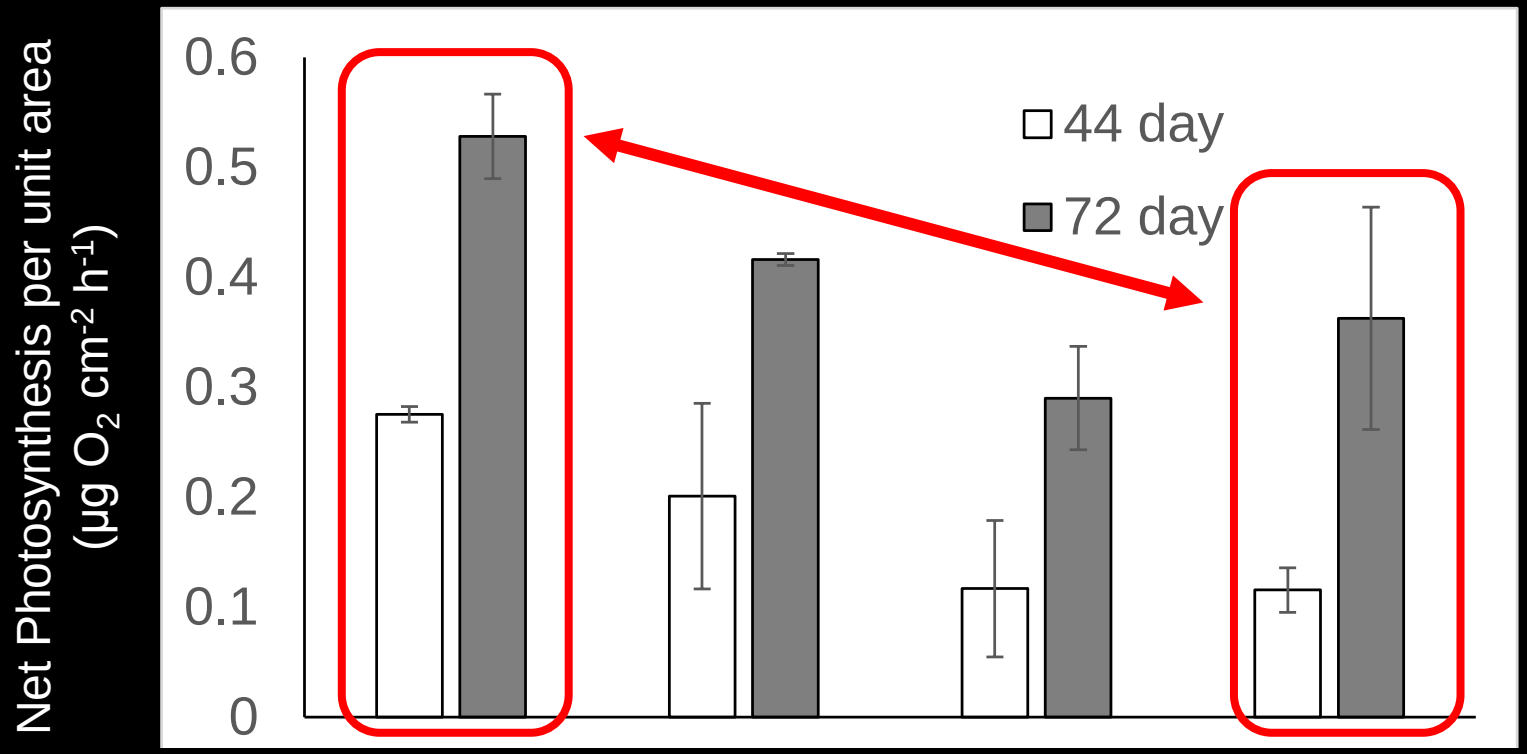
Control ➡ Higher content of Chl *b*



⬍

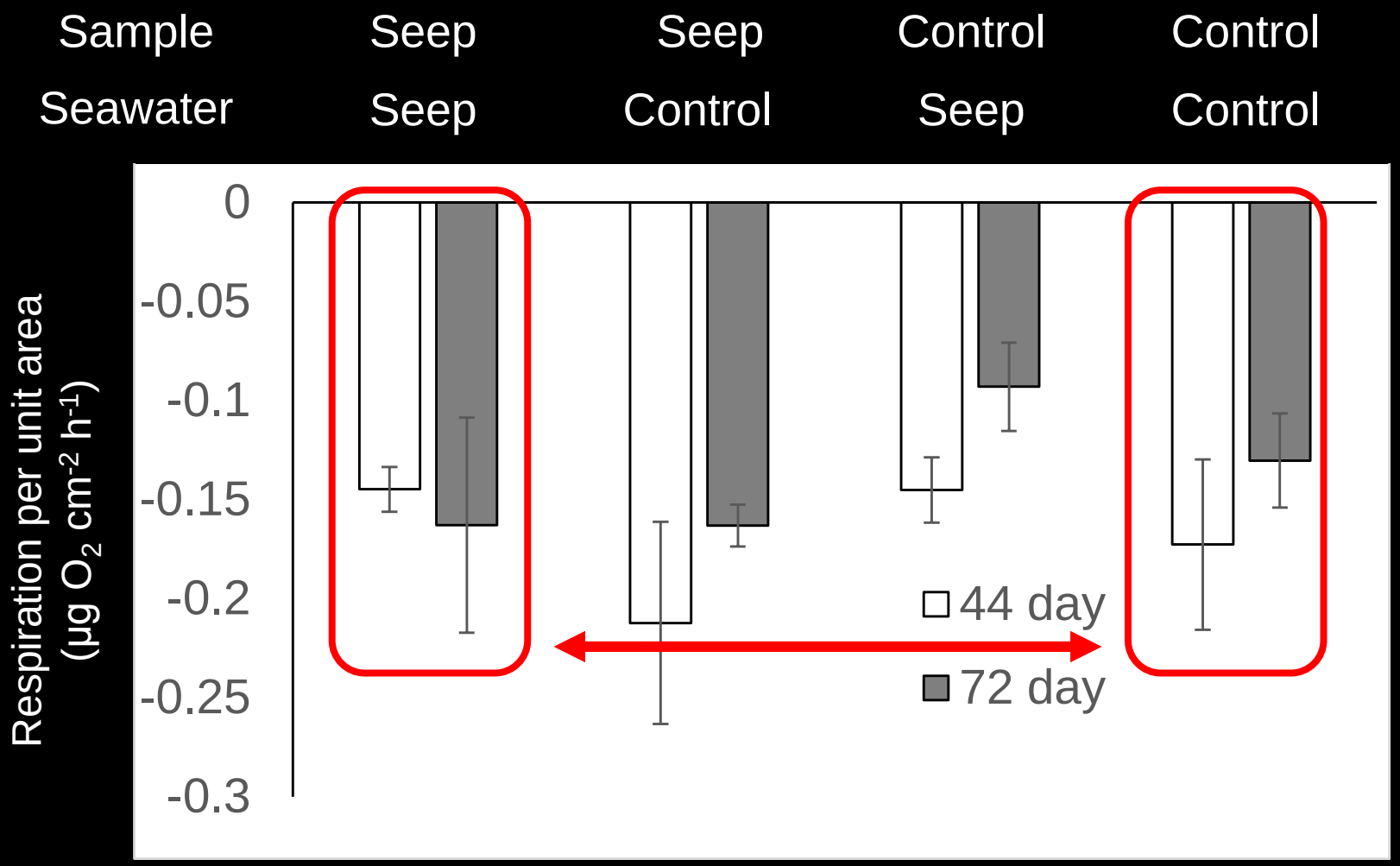
Green algae

Net Photosynthesis per Unit Area



Increase in net photosynthesis under OA
(two-way ANOVA and Tukey: $p<0.01$)

Respiration per unit area



No significant difference of respiration

Biomass did not reflect the change in productivity

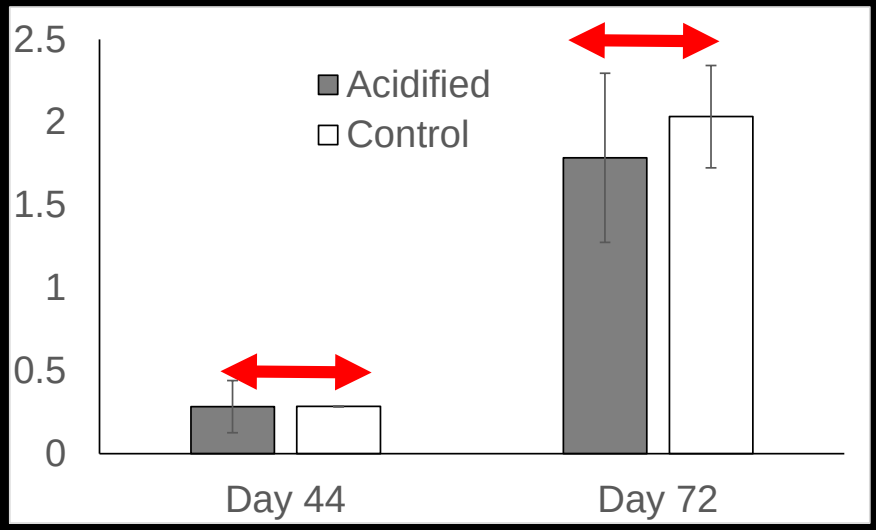
OA・・・photosynthesis ↗

⇩

How about biomass?

No increase in Biomass

Chl a per unit area



Biomass does not reflect the photosynthesis・・・loss of energy?

~~・Increase in respiration?⇒No change~~

・Other fate?・・・Dislodgement of algae from the base?

Assessment of dislodgement under water flow

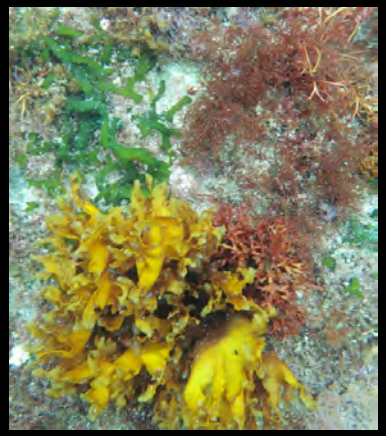
Sea Scooter (holding opposite direction)

Constant flow against the bottom

Control

Before

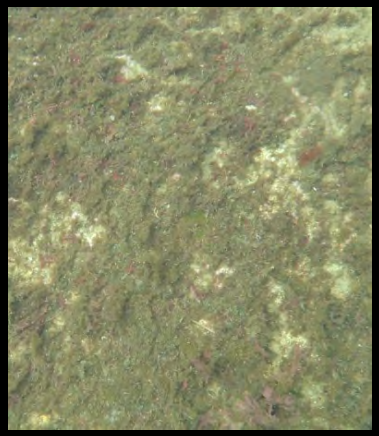
After



No Change

CO_2 seep

Before

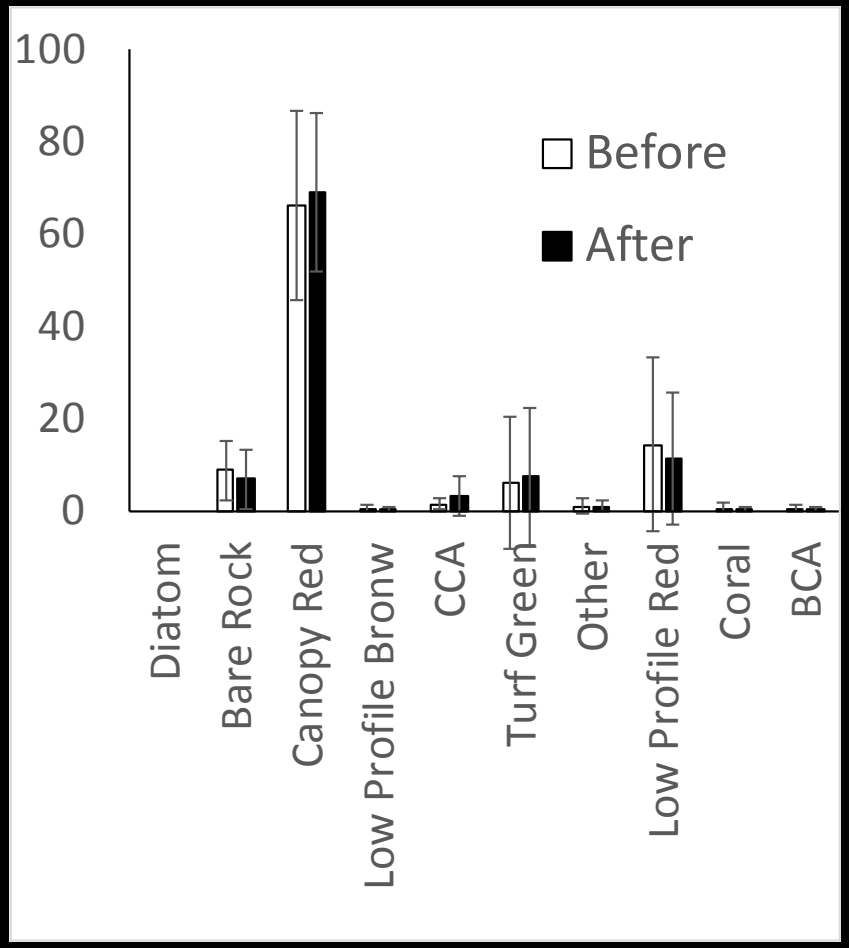


After

Disappearance of diatom mat

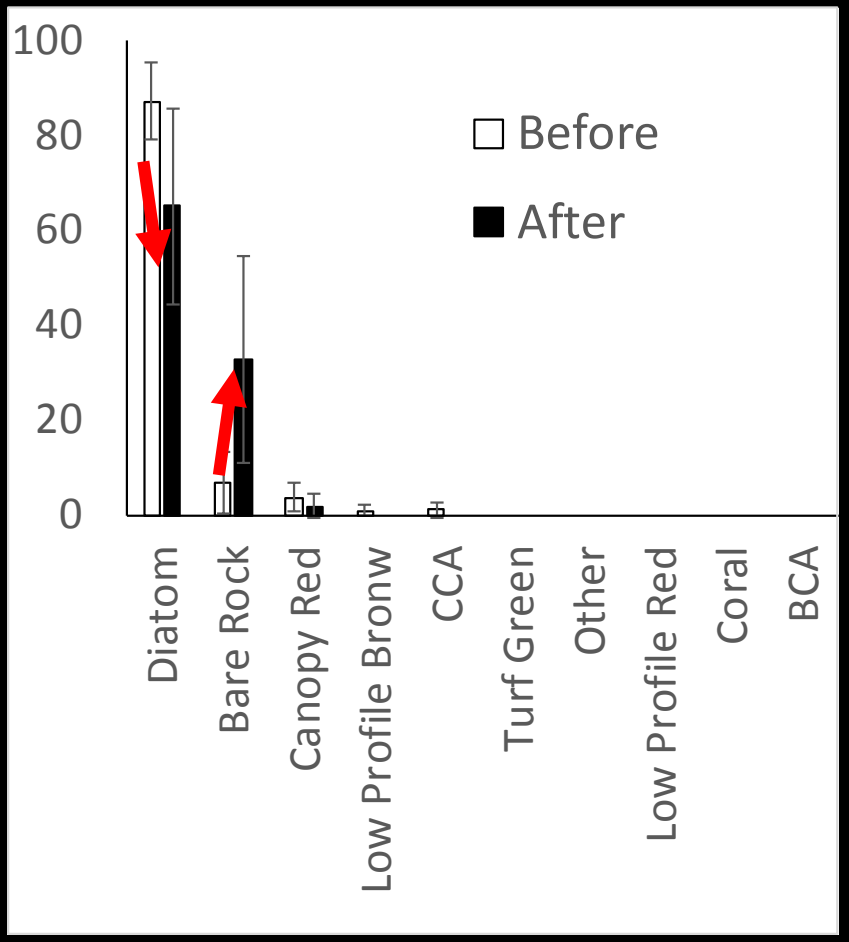
Comparison between before and after exposure

Control



No Change

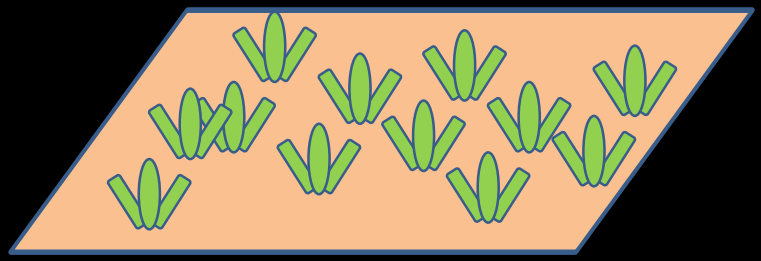
CO_2 seep



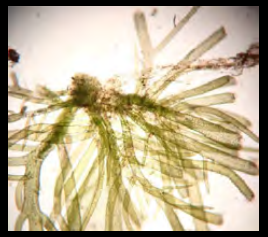
Decrease in Diatom
Increase in Bare Rock

What is the consequence of ecosystem?

Present



Future



Strong holdfast

No holdfast
Weak attachment

Conclusion

- Diatom would prefer the acidified condition
- Photosynthesis in early succession phase will be enhanced by ocean acidification
- Photosynthesis will increase, but biomass will be constant
- Fate of products would be dislodgement of algae
- Fixed energy will be exported to outside of coastal region, and energy will be dispersed under ocean acidification

Acknowledgements

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