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Effects of increased pCO₂ on phytoplankton community compositions in the NW subarctic Pacific and Bering Sea in summer

Hisashi Endo¹, Takeshi Yoshimura², Koji Sugie³, Koji Suzuki⁴

¹Graduate School of Environmental Science, Hokkaido University, Japan
²Environmental Science Research Laboratory, Central Research Institute of Electric Power Industry, Japan

1. Introduction
- Rising atmospheric CO₂ concentration have led to decrease in pH (i.e. ocean acidification, Caldeira and Wickett, 2003).
- Since marine phytoplankton play an important role on CO₂ fixation through photosynthesis, they have feedback effects on climate change (Cerneno et al., 2008).
- However, effects of ocean acidification on phytoplankton community compositions are still largely unknown.
- Hence, quantitative estimations of ocean acidification would allow us to predict future climate change precisely.
- We examined the effects of projected changes in CO₂ on phytoplankton community compositions in the NW subarctic Pacific and Bering Sea.

2. Methods
1. Water samples were collected from ~10 m depth and filtered through 197 μm Teflon net to remove large plankton.
2. Subsamples were poured into acid-cleaned 12 L polycarbonate bottles for incubation.
3. Prior to incubation, a FeCl₃ solution was added into the several bottles (5 nM in final conc.) in order to reduce the growth limitation of phytoplankton.
4. In the laboratory, phytoplankton pigment concentrations and algal community structure were estimated using HPLC pigment analysis with the program CHEMTAX (Mackey et al., 1996), respectively.

3. Results and discussion
- All figures show the data sampled at the end of incubation (i.e. day 11 in 2008 and day 6 in 2009) and error bars denote ±1SD.
- Changes in relative phytoplankton abundance with the increment of CO₂ concentrations (180 ppm →1000 ppm).
- Ability of CO₂ uptake by the ocean depends on the dominant group of phytoplankton.
- Ocean acidification may alter the phytoplankton community compositions in both areas.
- However, the magnitude and directions of CO₂ effects differed between the study sites.

4. Future challenge
- To clarify the physiological responses of phytoplankton to CO₂, the expression of rbcL gene, which encodes the large subunit of RuBisCO playing a major role in CO₂ fixation, will be examined in both laboratory and field experiments.

5. Conclusions
- Concentrations of 19'-Hex decreased along with increasing CO₂ in both study sites, suggesting the decrease in haptophytes including coccolithophores.
- In the Bering Sea, significant decreases in fucoxanthin concentration along with increasing in CO₂, and that was possibly due to a decrease in diatom biomass.
- Our results shows that ocean acidification might have a significant impact on phytoplankton community compositions, resulting in changes of CO₂ absorption ability in the study area.
- The responses of phytoplankton to the ocean acidification would differ among sea areas. Therefore, more detailed field studies including physiological researches on phytoplankton would be required.

References