

【Grant-in-Aid for Scientific Research (S)】

Integrated Disciplines (Environmental Science)



Title of Project : **Experimental Studies of Ocean Acidification Impact on Coastal Marine Organisms and Ecosystem**

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Research Project Number : 26220102 Researcher Number : 10150161

Research Area : Environmental science, Environmental analyses and evaluation, Environmental dynamic analysis

Keyword : Carbon dioxide, Ocean acidification, Marine calcifier, Manipulation experiment

【Purpose and Background of the Research】

The increasing atmospheric CO₂ causes ocean acidification (OA), in other words, increasing partial pressure of CO₂ (pCO₂) or decreasing of pH in surface seawater. The increasing pCO₂ in surface seawater makes decreasing of saturation state of CaCO₃, which in turn, decreasing easiness of calcification for marine calcifiers. In this project, impact of increasing pCO₂ in seawater on coastal marine organisms is experimentally studied in species level. Impact on ecosystem is also studied by recruitment experiment and by observation of interspecies interaction. The target is coastal marine biome around Japan.



Figure 1 Seawater pCO₂ of 600 ppm (right) gives impact on arm length of sea urchin larvae, compared with pre-industrial seawater pCO₂ of 300 ppm (left).

Researches have been done mainly for marine calcifiers, such as corals, shellfishes, sea urchins and so on. Calcifiers are generally sensitive for pCO₂ change and their calcification rate decreases at high pCO₂. However, details for impacts on grows, reproduction, and abundance are not well understood even for these sensitive groups.

【Research Methods】

1. Impact of OA on various species will be done with indoor CO₂ manipulation system for small organism and larvae. The system can mimic the diurnal variation of pCO₂, which is useful for the understanding of effect of CO₂ variability.
2. Using outdoor CO₂ manipulation system, impact study of multiple species will be done simultaneously. The system will be applied for recruitment study, observing settlement of calcifiers and non-calcifiers in the overflowing

seawater tanks with various pCO₂.

3. Reproduction experiment (spawning, fertilization, and hatching) of valuable fish species under various pCO₂ will be done using large volume seawater tanks.

【Expected Research Achievements and Scientific Significance】

Impact of OA on various marine organisms around Japan will be evaluated using state-of-art CO₂ manipulation systems. OA impact on coastal marine ecosystem will be evaluated under unified protocol within Japanese maritime laboratories. The experimental data will be submitted to international database. The project will contribute to collaboration with Asia-Pacific developing countries for OA research.

【Publications Relevant to the Project】

T.Onitsuka, R.Kimura, T.Ono, H.Takami, and Y.Nojiri, Effects of elevated pCO₂ on the early developmental stages of the horned turban, *Turbo cornutus*, *Marine Biology*, **161**, 1127-1138 (2014).

A.Kato, M.Hikami, N.H.Kumagai, A.Suzuki, Y.Nojiri, and K.Sakai, Negative effects of ocean acidification on two crustose coralline species using genetically homogenous samples, *Marine Environmental Research*, **94**, 1-6 (2013).

R.Suwa, Y.Nojiri, T.Ono, and Y.Shirayama, Effects of low pCO₂ conditions on sea urchin larval size, *Marine Ecology*, **34**, 443-450 (2013).

【Term of Project】 FY2014-2018

【Budget Allocation】 149,900 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.cger.nies.go.jp/ja/news/2014/140516>

http://www.cger.nies.go.jp/ja/library/qa/6/6-1/qa_6-1-j