

Effects of seasonal environmental fluctuations on physiology of reef-building coral

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We conducted an outdoor aquarium experiment to clarify the effect of seasonal environmental fluctuation on corals.

We monitored algal photosynthesis in hospite of *A. digitifera* weekly with a Diving-PAM chlorophyll fluorometer. Colony growth was measured monthly by the underwater buoyant weight method. Light and water temperature conditions were recorded using data-loggers.

In subtropical southern Japan under the influence of monsoon climate, seasonal change in weather condition had strong impacts on the photophysiology of *A. digitifera*. *A. digitifera* was evenly stressed in spring as well as in summer. Notably, rainy periods facilitated rapid recovery from photodamage in spring season. Highest photosynthetic efficiency was often recorded just after the period of rainy season.

Although there are numbers of investigations that report the effects of water flow in short-term (hours to weeks) experiments, long-term effects especially on the interaction with seasonal change in weather condition are not fully understood. In combination with seasonal change in environment, water motion has significant impacts on the physiology of corals; limitation in water-motion causes severe bleaching in the coral *Acropora digitifera* during a period with strong light and high water temperature.

Throughout the entire experimental period, photosynthesis of *A. digitifera* in limited-flow conditions showed lower activity level than that of in flow conditions. Less colony growth with the disappearance of axial polyps was also observed under limited-flow conditions in contrasted with flow conditions. These adverse effects of limited-flow could be diminished by the subsequent exposure to flow treatment.

The results confirm that water-flow can keep photosynthesis as well as growth of *A. digitifera* in good conditions throughout the years. These results imply that the absence of water motion in coral reef is crucial especially during the stressful period. We suggest that water-flow is an important factor that should be taken into the consideration of coral reef conservation.