

## Dominance of tabular Acroporid species and the abundance of echinoid grazers in high-latitude coral communities of Amakusa, southwestern Japan

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Communicated by Hiroya Yamano (Editor-in-Chief)

**Keywords** *Acropora*, encrusting and massive corals, sea urchins, grazing

Located at 32°8–13'N, coral formation in the south of Amakusa, southwestern Japan, constitutes one of the high-latitude coral assemblages (Nozawa et al. 2008). Spatial dominance by tabular *Acropora* species, particularly *A. hyacinthus*, *A. solitaryensis*, *A. glauca* and *A. japonica*, is marked on rocky outcrops (Fig. 1a), while species of encrusting and massive forms, though numerous, have mostly small colony sizes of <30 cm in the longest dimension. While this may generally be attributed to low growth rates of non-tabular species (Nishihira and Veron 1995), slow growth alone cannot fully explain the small colony sizes of these potentially long-lived species. Our surveys reveal that many of these reefs support high abundances of echinoid grazers, particularly on rocky substrates on which corals occur. Eight species of echinoids, *Echinostrephus molaris*, *Diadema setosum*, *D. savignyi*, *Echinometra* sp., *Parasalenia gratiosa*, *Toxopneustes pileolus*, *Tripneustes gratilla* and *Clypeaster japonicus* (identification and nomenclature based on Nishimura (1995)) commonly occur on rock surfaces with combined densities of up to 50 individuals m<sup>-2</sup>. As these echinoids graze freely on rock surfaces and/or bore holes, they tend to demarcate the edges of encrusting and massive forms of corals (Fig. 1b,c), thereby restricting colony sizes. In contrast, tabular forms can escape from the direct effects of grazing by growing 'away' from the substrates and keeping their growth points free from grazing echinoids. As massive and encrusting corals are small in size, tabular corals can more easily overshadow and outcompete them to achieve spatial monopoly. The abundance of echinoids in turn seems to be related to low seawater temperatures in winter (minimum: 11–13°C) that increase the availability of algae as major food resources. Established tabular corals are unlikely to be eroded by echinoids as algae are scarce under the shadow of a table coral.

### Acknowledgments

This work was supported by the Kyushu University P & P program, the 21<sup>st</sup> century COE and GCOE programs (at Kyushu University) and the grants-in-aid for scientific research from the JSPS.

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Received: 13 October 2010/Accepted: 25 November 2010  
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**Fig. 1** a Tabular *Acropora*-dominated reef of Amakusa. b *Echinostrephus molaris* surrounding a colony of *Turbinaria peltata*. c Grazing ground of *Diadema savignyi* demarcates the border of *Montastrea valenciennesi* colony (top right)

