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Effects of large amplitude internal waves and monsoon on coral growth and skeletal density

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Introduction

Coral growth is influenced by environmental factors such as temperature, light, sedimentation rate and nutrient concentration. Large amplitude internal waves (LAIW) can bring up cold, nutrient-enriched water from below the pycnocline into shallow waters and may influence coral growth. Monsoon-induced heavy rain and wave action influence among others turbidity, light penetration and physical forces and may as well affect coral growth. The aim of the present study was to examine the alternating effects of LAIW and monsoon on the skeletal density and growth rates of the massive coral *Porites lutea*. Coral nubbins were collected at the LAIW- and monsoon-exposed west (W) and sheltered east (E) side of the central Similan island Ko Miang off the Thai coast in the Andaman Sea in two depths (7 and 20 m, Fig. 1).

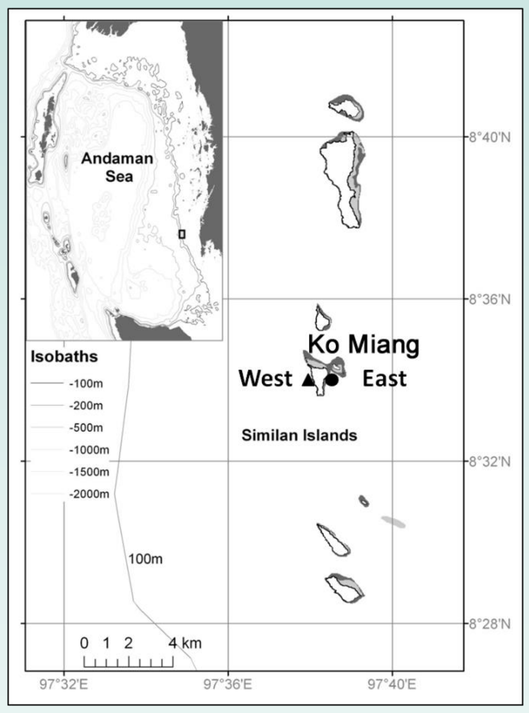

Fig. 1: Map of the Similan Island in the Andaman Sea (Thailand).

Methods

The collected coral nubbins were bleached and dried before analyses:
Annual linear extension rates were measured by use of the density and fluorescent bandings in the coral skeletons (examples provided in Fig. 2).
The buoyant weighing method was used to determine the skeletal bulk density (Bucher *et al.* 1998, Davies 1989) .
The calcification rate was calculated by multiplying the linear extension rate by the skeletal bulk density.

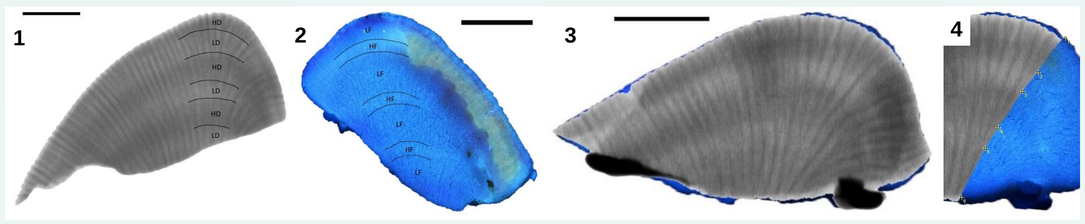

Fig. 2: Coral slabs of *Porites lutea* from the island Ko Miang. (1) X-radiograph, (2) fluorescence image, (3) combined X-ray and fluorescence image, (4) growth measurement along individual polyp (3 different polyps), scale = 10 mm

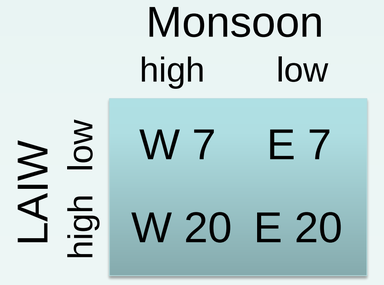

Fig. 3: Impact of large amplitude internal waves (LAIW) and monsoon on W and E side and depth.

Results & Conclusion

The skeletal bulk density was higher at the exposed W side of Ko Miang compared to the sheltered E (Fig. 5b, Holm-Sidak Test: p = 0.017, One Way ANOVA: p = 0.026). This was particularly visible at shallow depth with greater skeletal bulk densities at W 7 m compared to E 7 m (Holm-Sidak Test: p = 0.004) and may therefore be attributed to the impact of the SW monsoon. The linear extension and the calcification rate did not show differences between sampling sides (W and E) and depths (7 and 20 m, Fig. 5a,c). The results indicate that higher hydrodynamic energies due to monsoonal wave action lead to greater skeletal bulk densities of *P. lutea*, whereas LAIW induced environmental fluctuations (e.g. like temperature, Fig. 4) have no discernable influence on growth and skeletal density of this coral.

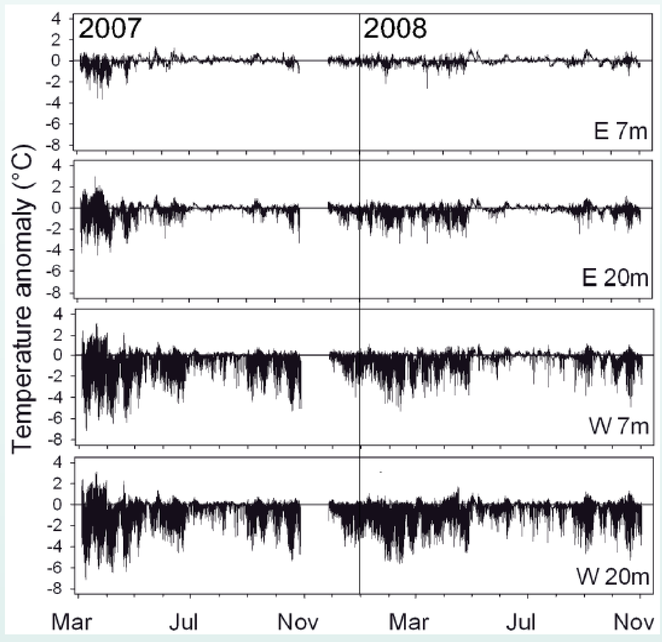

Fig. 4: Temperature anomalies at Ko Miang, Similan Islands (from Schmidt & Richter 2013).

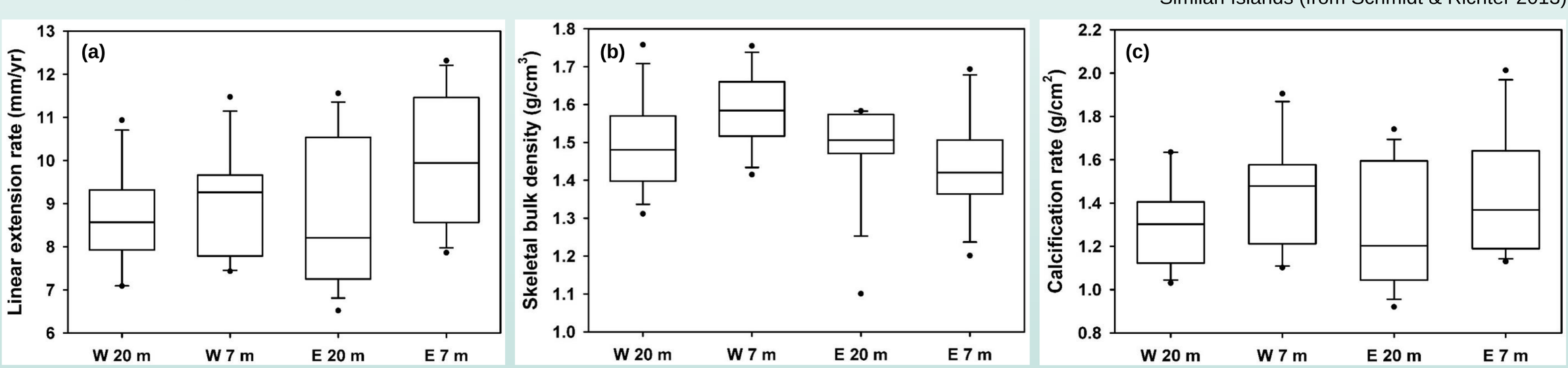

Fig. 5: Central tendency box plots of (a) linear extension rate, (b) skeletal bulk density and (c) calcification rate of *Porites lutea* plotted against all sample sites at the central Similan island Ko Miang.

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Literature

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Federal Ministry of Education and Research