



UNIVERSITY OF THE PHILIPPINES

**THE LINEAR EXTENSION RATES OF THE MASSIVE CORAL *PORITES* SPP.  
FROM THE PHILIPPINES: ENVIRONMENTAL CONTROLS, SPATIO-  
TEMPORAL TRENDS AND IMPLICATIONS**

By

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# **The Linear Extension Rates of the Massive Coral *Porites* spp. from the Philippines: Environmental Controls, Spatio-Temporal Trends and Implications**

## **ABSTRACT**

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Linear extensions rates measured from annual density bands of massive corals provide a continuous record of responses to various environmental variables. In this study, coral growth band data was used to establish the responses of *Porites* spp. from four sites in the Philippines to changes in sea surface temperature (SST) and other physical factors from 1979 to 2004. The average extension rates are  $10.4 \pm 4.1$  mm yr<sup>-1</sup> for Calaguas Islands, Camarines Norte,  $11.2 \pm 2.1$  mm yr<sup>-1</sup> for Ayuki and General Islands, Surigao del Sur,  $11.0 \pm 2.5$  mm yr<sup>-1</sup> for Pamilacan, Bohol and  $9.6 \pm 0.5$  mm yr<sup>-1</sup> for Parola Island, Spratlys. The mean extension rate of the four sites is 11 mm yr<sup>-1</sup>. Extension rates are higher in sites with higher mean annual SSTs but lower for sites exposed to higher average wave energy during the monsoons. Other environmental factors latitude, salinity, outgoing longwave radiation, and annual total rainfall, were not significantly correlated with extension rates per site. The overall extension rates increased with a change in mean annual SST from ~28°C to 29.2°C but responses differed per site. Only the Calaguas site had a declining trend with rising SSTs while the rest were increasing overall. Threshold temperature is not distinct in this study possibly due to limited number of data at higher mean SSTs but the mean extension rates did not change even with higher average SSTs (>28.9°C). Also observed was the temporal variation of the extension rates per site, the Pamilacan colony had increasing extension rates from 1979 to 2004 while extension rates of the other sites declined. Extension and calcification rates in some Indo-Pacific reefs declined from 1990 onwards but in this study there was no apparent decrease. A decline was observed for all the sites after the 1997-98 ENSO event. Variable results per site indicate complex and localized responses of corals to warming ocean waters. Comparison with global trends show that extension rates of *Porites* spp. from the four sites are lower than expected possibly due to impact of high wave energy exposure enhancing or counteracting the effects of higher mean SSTs at the sites. Spatio-temporal trends show that higher mean annual SSTs initially appeared to have enhanced extension of *Porites* spp. but continued increases in temperature have started to adversely affect extension rates. Linear extension rates of *Porites* spp. are highly correlated to calcification rates and with extension rates not responding positively to higher mean annual SSTs, also reflect a non-positive response in the calcification rates of Philippine corals.