

# Recurrent disease outbreak in a high latitude marginal coral community

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## Introduction

Climate change and ocean acidification are driving the degradation of coral reefs at a rapid rate, through increasing the prevalence of coral bleaching and disease outbreaks. With increasing temperature causing greater risk for tropical coral, cooler high latitudes could serve as a refuge for hermatypic coral. Here, we describe a recurrent disease outbreak in a high latitude marginal community only affecting the coral species *Porites heronensis*. A yet uncharacterized disease has been observed over the last four years at Shimoda, Japan. This, to our knowledge, represents the first report of disease outbreak in non reefal high latitude coral community.

## Research Objective

To compile the progression and etiological data from start to end of the disease outbreak in a marginal coral community.

## Methodology

Spread, growth rate, and disease prevalence were collected by weekly photographic monitoring using a 25 x 25 cm quadrat and digital camera to photograph individually diseased occurrences observed while snorkeling in Shidagaura, Shimoda. Monthly monitoring data over the last four years was collected at 10 permanent quadrats (50 x 50 cm) in Shidagaura, Shimoda. Data was analyzed using ImageJ (ObjectJ plugin) by categorizing 64 points placed on a grid.

## Results

The disease has a white to yellow mold-like appearance, a size ranging from small spot-like infections (< 2 cm<sup>2</sup>) to large, misshapen infections (> 25 cm<sup>2</sup>), no discernable band, as well as a uniform non-diffuse border. Weekly monitoring showed all affected colonies suffered partial to total mortality following disease with no recovery. Growth rates showed punctuated growth ranging from rapid daily to weekly increases, to minimal or no growth (Figure 1). Growth rates, active disease occurrence count and progression of the disease all showed maximum values during the warmest period (summer season) (Figure 2). Monthly monitoring data showed that the disease outbreak appeared and peaked during the summer months of the four years observed (26 – 30°C) with no disease record during the winter months. Winter months that had high numbers of cold-bleached colonies did not visibly influence the number of diseased colonies during the summer months (Figure 3).

## Discussion and Conclusion

The results suggest that temperature is the main environmental factor leading to disease outbreaks. However, the exact causative agents and parameters are yet unknown. This is especially important in high-latitude coral

communities due to rising sea temperatures, and the slow creep of reefal corals moving towards cooler waters (Yamano et al., 2011). Growth rates of the disease varied across different colonies and survey periods, with most colonies exhibiting little to no growth. The disease's punctuated growth contrasts with the linear growth pattern exhibited by other coral diseases like black band disease (BBD) and atramentous necrosis (Anthony et al., 2008; Cooney et al., 2002). Overall, the traits exhibited by the disease observed here distinguished it from other already described diseases in tropical areas (BBD, Atramentous Necrosis, White Plague, White Band, etc.). We suggest calling this yet uncharacterized disease "White mold disease".

## Future Aims

To append to this field research, laboratory and additional field assessment will be conducted throughout the next two years, as well as a complete microbiological analysis of the diseased tissue in order to properly describe its consortium. With further research, we hope to detail the different causative agents and parameters in order to develop suitable management practices and approaches.

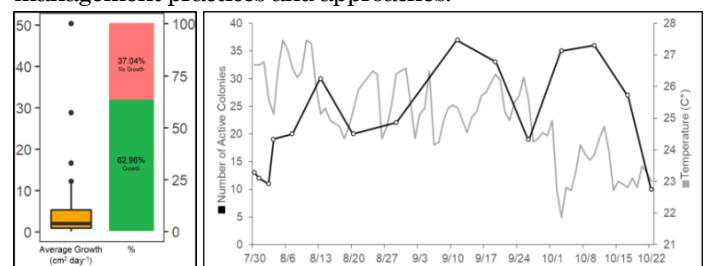


Figure 1—Total Growth

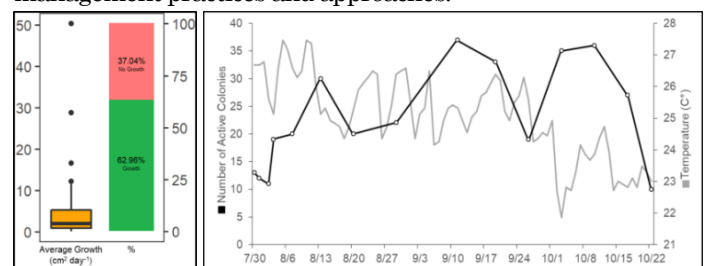


Figure 2—Active disease colonies and temperature (°C)

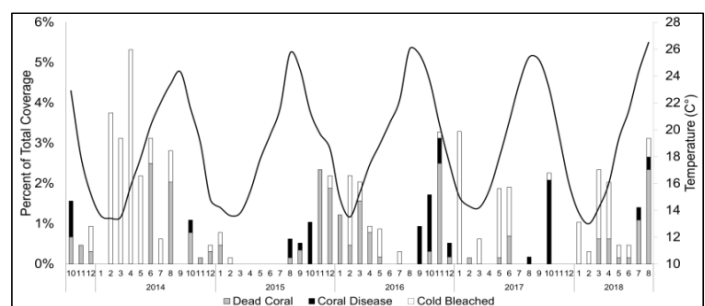


Figure 3—Monthly monitoring survey data and temperature (°C)

## References

- Anthony, S.L., Page, C.A., Bourne, D.G., Willis, B.L., 2008. Newly characterized distinct phases of the coral disease "atramentous necrosis" on the Great Barrier Reef. *Dis. Aquat. Organ.* 81, 255–259.
- Cooney, R.P., Pantos, O., Le Tissier, M.D.A., Barer, M.R., O'Donnell, A.G., Bythell, J.C., 2002. Characterization of the bacterial consortium associated with black band disease in coral using molecular microbiological techniques. *Environ. Microbiol.* 4, 401–413.
- Yamano, H., Sugihara, K., Nomura, K., 2011. Rapid poleward range expansion of tropical reef corals in response to rising sea surface temperatures