IH316: Eco-physiology of mangrove corals in Indonesia

Sarah-Jane Walsh

Coral reefs are limited to narrow environmental niches, requiring particular environmental conditions in order to reach their maximal growth potential. Where all of these needs are fulfilled, environments are regarded as optimal reef building habitats. These habitats are immensely important supporting millions of people worldwide through the fisheries they support and the "ecosystem services" they provide.

Generally an optimal environment consists of high light, stable temperatures, high flow and a complex assemblage of associated organisms such as herbivores. In these conditions coral photosynthesis is saturated but not inhibiting thus allowing corals to invest energy in to other areas which may be limited in environments of lower optimal growth conditions. In sub-optimal environments which encounter extreme high or low light intensities, photosynthesis can become under or oversaturated. Oversaturation of photosystems can lead to damage within the coral, drawing investment of energy in to repair and protection.

However, it has been increasing noted that corals can exist outside of these comfort zones and thrive one the sheer limits of their environmental capacity. Mangrove systems are considered to be "marginal" reef environments and are characterized by environmental conditions that are sub-optimal for coral growth. Typically, light and calcium carbonate availability required for growth are low, while daily temperature fluctuations, which can inhibit growth, are high. Corals which exist in these environments demonstrate that some coral species may be adapted to tolerate extreme environmental conditions, and thus could become the major reef formers as reef environments continue to rapidly change.

Climate predictions have warned that coral reefs are rapidly becoming subjected to increasing pressures driven by anthropogenic resource consumption and global greenhouse emissions. These stressors are foreseen to cause an increase in global temperatures which in turn will drive increases in the usually stable sea surface temperatures. Instances of extreme climatic events have been predicted to increase in regularity in the forms of increased storm and hurricane

action and extreme El Niño events. All of these factors have been shown to cause a stress response in corals leading to coral bleaching and coral death.

Corals existing in marginal habitats come under extreme daily pressures, yet seem to survive and proliferate in these environments. The key to their survival may help us to identify the mechanisms developed to cope with extreme conditions and may help us to protect coral reefs in the future or anticipate likely changes in reef community structure in the future. It may be that these marginal communities will serve as environmental refugia, potentially repopulating devastated reefs in the future.

Currently, little is known about community structure (diversity) or the form and function (species diversity, life history strategy, growth rates, mechanisms of tolerance to marginal growth conditions) of the coral species found within mangrove systems. This project could therefore conduct community analyses and physiological examinations of mangrove corals through laboratory experiments and detailed snorkeling based surveys.

Suggested Reading

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