IH301 Photoacclimation potential of reef building corals in response to sea level rise, Indonesia

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Coral reefs are an invaluable resource that millions of people worldwide are dependent upon. They provide a variety of 'ecosystem services' including the production of food, building materials, income, coastal protection and cultural heritage. Quantifying the worth of these benefits is very difficult due to the vast number and the many unknowns, Costanza *et al*., (1997) has put a value of approximately $30 billion per year in net benefits from these habitats. Coral reefs are especially important to isolated underdeveloped areas such as the islands of Indonesia. Here communities are very remote and do not have easy access to external resources or outside trade. People survive on the reefs making their homes out of the corals and gaining their main source of protein from the fish. Communities like this are very susceptible to reef destruction and may not be able to survive without them.

The rate of sea level rise is predicted to increase as climate changes with potential implications to reef systems. Current rates of sea level rise have been estimated at 1–3 mm per year since the 1960s and projected to increase by 18–59 cm per year by 2100 (IPCC, 2007). Changes in sea level ultimately alter the light climate available for corals to grow and consequently the diversity and productivity they can support. Corals require sunlight to grow but are predicted to 'drown' unless key species are able to grow fast enough to keep up with the rate of sea level rise, or successfully acclimate to altered light climates until they can catch up.

Increases in sea level have been predicted to be driven by increases in climatic warming. This will already place significant pressures on coral species in reef environments which will become intensified with the added stress of sea level rise. This will likely increase incidences of bleaching among coral species and make it further difficult for species to 'keep up' with changes in sea level.

As yet, little is known of these fundamental properties for the range of reef building coral architect species that exist throughout the Indo-Pacific. This project could examine the rates and mechanisms of photoacclimation of coral species across natural light gradients and in particular focus on how corals acclimate (or coral communities adapt) to extremes of high and low light intensity. This will provide insight into the ability of corals to cope in future climate situations and can be coupled with data surrounding corals responses to other warming stressors. Predictions can then be drawn about the outlook of future coral reefs and what changes in species diversity may be expected.

This project can look at changes in coral characteristics across a light gradient and may include controlled experiments identifying rates of acclimation to new light environments. Projects can include both in-situ observational and ex-situ experimental laboratory methodologies. Observational methodologies may include 3D colony topography and vertical complexity assessment as well as ecosystem functioning and associated species utilisation. Laboratory methodologies include fluorometry to assess photosynthetic efficiency, spectrophotometry to assess chlorophyll concentration and microscopy to analyse symbiont cell densities. There is also potential to utilise new non invasive methodologies to assess colouration and chlorophyll densities using new protocols

involving digital image analysis. The experimental component of the research includes a mixture of laboratory and field methodologies and opportunities exist to tailor this to the needs of the student.

Suggested Reading

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