IH271: Fish and invertebrate assemblages on non-reefal coral communities in marginal environments, Indonesia

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Scleractinian corals are generally associated with clear tropical waters, and indeed these tend to provide the ideal environment for their growth. Thus it is in these environments that the complex structures of coral reefs are mostly found, along with the faunal communities which they support. As ecosystem architects, scleractinian corals are responsible for maintaining the thriving communities found there, which are amongst the most diverse and productive on the planet. Key to this is the high degree of topographic diversity (or spatial complexity) which is formed by the various coral growth morphologies and the calcium carbonate structure of the underlying reef itself. This provides an array of microhabitats for organisms to exploit, thus driving the high biodiversity present on coral reefs.

However, scleractinian corals are not entirely restricted to these 'ideal' locations, and can exist in a wide range of atypical environments. Here, a number of conditions can vary significantly from the levels ideal for coral growth, including light availability, temperature, salinity and sediment loading. This pushes corals towards their thresholds for tolerance. As net reef growth is dependent on calcification rates exceeding loss through various processes such as erosion, there can be significant impacts on coral growth as calcification rates are reduced. Hence these marginal coral communities are often termed non-reefal, as new growth is not sufficient to form the complex reef systems seen under more optimal conditions.

Those reefs found at high latitudes are considered marginal, as their conditions do not necessarily conform to the ideal range for coral growth. In low latitude systems, for example in Indonesia where this project takes place, a classic example of a marginal reef environment is intertidal fringing mangroves. Corals have been found existing along the seaward edge of mangrove forests, experiencing particularly high fluctuations in temperature and sediment loading.

But there are also less obvious habitats which could be termed sub-optimal for coral growth. Reef flats are one example, as they exist at shallow depths with subsequently high light availability. Although light is vital for coral growth due to the photosynthetic activity of symbiotic algae (zooxanthellae), too much can be toxic. Despite this, large outcrops of scleractinian coral, termed 'coral bombies' exist on the reef flats, sometimes to an extent where occasional emersion takes place at extreme low tides.

Fish and some invertebrates, on the other hand, have an advantage over sessile organisms such as corals in that they are transient. This affords them the opportunity to move between areas of the reef, thus potentially avoiding sub-optimal conditions where necessary. They exist in significant abundance and diversity in a range of environments considered marginal for coral growth, including mangroves and reef flats, and previous research on coral bombies in particular has highlighted the existence of both resident communities, as well as transient ones. However, the impact of a reduced coral community, as found in marginal environments, on associated fish and invertebrate communities is not fully understood.

With predicted climate change, marginal reefs are predicted to become more common as environmental conditions become increasingly sub-optimal for coral growth. With current

marginal coral communities dominated by more massive morphologies, the structural complexity of reefs in the future could be severely diminished. The full implications of this shift for associated biodiversity and productivity can be better predicted by developing our understanding of the communities associated with marginal corals in the present.

As non-reefal coral communities tend to exist in shallow waters, data collection for this project will be via snorkelling. Surveys of the fish and macro-invertebrate communities associated with corals living in sub-optimal environmental conditions will be carried out using visual census techniques. Therefore good identification skills will be beneficial. In addition, a differentiation between transient and resident populations will shed further light on the level of reliance of these faunal communities on the corals themselves.

Reading List

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