

IH273: Resource utilisation of reef fish across environmental gradients, Indonesia

Jocelyn Curtis-Quick

The niche assemblage perspective is based around the assumption that communities are structured by resources and interaction, for example to avoid competition between species by specialising in a particular habitat or resource. The term niche refers to the space a species occupies and viably breeds under a certain set of conditions. Hutchinson (1957) defined the ecological niche further by describing the various conditions that limit a species as an axis or dimension which sets the range that a species can exist; this is known as the n-dimensional hypervolume (n is the number of axes). Some further developments of the niche concept have included that of the 'fundamental niche', which is the potential niche a species could occupy without the presence of negative interactions and the 'realised niche', which is the space occupied by species under pressure of negative interactions such as competition, predations and parasitism. This project will be examining the niche assemblage perspective, in regards to niche size and overlap to identify which factors are allowing fish species to co-exist, and if and how they change along environmental gradients.

This study uses reef fish species to assess the effect of habitat change and how these inhabitants respond under degradation of habitat. This is a starting point to answer such questions like: which species are adaptable? Which will persist under degraded conditions? How will this feed back into the system? Fish on coral reefs are numerous, there are over 3000 species (Bellwood et al 2003), most of which are very conspicuous due to their diverse variation of colours and markings. Hence they are easy to observe, and are perhaps the most well studied reef inhabitants (Wilson et al 2006). Reef fish are heavily dependent on the reef for their food, shelter and life cycles (Randall 1974), making them the ideal subjects to assess how changes in habitat quality affects their presence on the reef (Wilson et al 2006).

Not only are fish dependant on the reef but reefs are also dependent on fish. Fish are fundamental to the reef's processes (Dulvy et al 2004), and this has been well established through research, particularly the effect of coralivore activity on coral community assemblage and abundance (Neudecker 1979), and the grazing impacts of herbivores to control algae, which helps combat a phase shift to alternative stable states (Mumby 2006).

The role of functional guilds has a far reaching effect throughout community structure. Any decline or removal of functional guilds will have a knock-on effect on the other functional guilds present, a phenomenon known as a trophic cascade. There are two theories in trophic cascades: bottom-up (i.e. the removal of herbivores) and top-down (e.g. the removal or decline of predators, which has a knock-on effect through the food web (Pace et al 1999)). For example on Caribbean reefs, long term overfishing coupled with the decline of important sea urchin grazers left algal growth uncontrolled with devastating results for the reefs (Aronson, Precht, 2006). However, changes in resource availability and habitat quality may in turn affect reef fish niches. Examining the ability of species to adapt to changes in the available resources may explain the dominance (success) of some species over others. Any adaptability or plasticity in behaviour may determine a species 'and a guild's success, and therefore the overall community structure, with impacts for the ecosystem as a whole.

Ethological studies of time budgets and feeding behaviour will be conducted to assess fish niche plasticity. Examining the proportion of their time fish spend doing various activities is an important part of behavioural studies. Some research has claimed that from time budgets we can estimate "the distribution of food resources in the environment (Hanley 1984)". By collection time budget

data from a range of sites along a gradient of habitat quality, the effect of habitat type can also be assessed.

The partitioning of resources such as space and food can enable two similar species to exist within the same habitat/ ecosystem. For example, butterflyfish containing a number of very trophically similar species, and research has demonstrated that these species are able coexist, despite feeding on the same scleractinian corals, by feeding at different times (Zekeria et al 2002). This is a classic example of temporal resource partitioning. However, the ways in which reef fish respond to changes in resource availability, a predicted effect of future climate change and other anthropogenic pressures, is not fully understood. This study could therefore use ethological investigations to assess adaptation patterns in reef fish to a reduction in habitat quality.

Reading List

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