

IH322 The survival rate of newly settled fish larvae on reefs of varying predator density and habitat quality, Indonesia

Julius J.B. Piercy, University of Essex

Most coral-reef fish have a bipartite life history consisting of a juvenile and adult benthic stage, and a pre-settlement larval stage spent in the open ocean. The pre-settlement stage has been the focus of many reef-fish population dynamics studies because of its critical importance in supply and dispersal to reefs which has a profound effect on the how fisheries can be managed better. The live reef fish trade which relies on residents of the reef such as groupers instead of pelagic fish is likely to be the most directly affected because the capacity for dispersal of most adult reef dwelling fish is nearly exclusively limited to the larval stage. The demand for live reef fish is on the increase and more and more frequently fishermen in South-East Sulawesi are switching to this fishery practice as their main source of income. However, there is likely to be a significant effect also on pelagic fish because of their indirect reliance on reefs and nursery habitats.

Because of the importance of dispersal and recruitment to fisheries, modelling these patterns accurately is of large economic and conservation management value. However, early attempts at modelling dispersal and supply of fish larvae which focussed on the effect of currents and tides around coral-reefs proved to be too inaccurate. The realisation that some late stage fish larvae had strong swimming and sensory abilities profoundly changed these models. Fish larvae went from being considered plankton, passively transported by the currents until they reach a reef by chance, to nekton, strong swimming animals capable of overcoming the prevailing currents to actively navigate towards a settlement site of their choice. The sensory abilities of larvae coupled with the strength and typology of potential cues emanated from the reef were found to have the greatest influence on the outcome of new models into which navigation abilities were included, stressing how essential the need is to explore the behaviour and sensory environment of fish larvae.

Despite their small size compared to the surrounding oceans coral reefs effectively “advertise” their presence like a beacon, providing a suite of cues that the larvae can utilise to navigate towards them. From the colourful visual presence of reef dwellers, to the odours and sounds they produce which reach out into the seas for kilometres, fish larvae have a multitude of cues to choose from. Recent findings suggest that sound and odour play the most important roles in larval navigation and more importantly that cues emanated from the reef go hand in hand with habitat type and quality. For example, sound quality is such a reliable indicator of reef quality that it has recently been suggested as a fast and inexpensive reef monitoring tool. If humans are able to gain this kind of information reliably, it is likely that the fish larvae are able to do so on an even more accurate scale.

Our research on Hoga Island aims to explore how soundscapes around reefs of differing quality varies on a temporal and spatial scale and to determine whether variation correlates with patterns of recruitment of different fish species. With this information we will attempt to create predictive models on fish abundance and diversity with decline in habitat quality. Light traps are set up on a daily basis in the

ocean close to the reefs to intercept the fish larvae as they recruit towards a reef prior to settling on it. By analyzing and identifying the catches we can then answer questions about the recruitment patterns prior to settlement on the reef and how this varies with a lunar, seasonal or annual cycles.

However, confounding factors immediately following settlement have the potential to greatly affect predictive models based on pre-settlement information, offering a wide scope of possible studies for dissertation students. The most important of these factors is predation given that the abundance of adult fish on a reef will depend largely on the survival rates of the new recruits. Fish larvae mortality rates in the pelagic exceed 99% and it has been estimated that 43-65.5% of new recruits are predated upon within the first two days of settlement. In order to make reliable predictions on how levels of recruitment affect overall fish abundance and fish community structure in habitats of different qualities, it is essential to understand how abundance and diversity of predators affects mortality rates of new recruits at these sites first.

Possible dissertation projects include using visual transects to survey the abundance of predators and new recruits at sites of different habitat quality and structure. The survival rates of the new recruits at sites of different predator abundance during the first few days post settlement could also be examined by monitoring abundance of recruits on specific coral heads and combined with experimental setups in situ using artificial patch reefs. Behavioural observations of predators such as lizardfish and dottybacks could be used to evaluate their reliance on new recruits as a food source and it changes in response to recruitment patterns. In-situ manipulations of predator presence at patch reefs coupled with laboratory based choice chamber could provide scope for dissertation projects interested in exploring anti-predatory behaviour and predator avoidance strategies of new fish recruits.

Essential reading

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Recommended further reading

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