The ecology of coral larvae: settlement patterns, habitat selection and the length of the larval phase.

Thesis submitted by

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Abstract

In order to increase the taxonomic resolution achievable in coral juveniles I compared skeletal morphology of juveniles from known parents from 19 species in 14 genera and 8 families to determine which of these taxa could be reliably distinguished. Three families had features which were both unique and consistent, enabling unequivocal classification throughout their life: the Acroporidae have a porous coenosteum, prominent basal ridges or septa and no columella; the Pocilloporidae have a solid coenosteum, prominent septa and a prominent columella; the Poritidae have septa with prominent teeth. Juveniles in the remaining 5 families examined could not be consistently distinguished. Some genera could be distinguished while the juveniles were young, including the genera of the Pocilloporidae and the Acroporidae The juveniles of broadcast spawned *Porites* could be distinguished from those of brooded *Porites* by the presence of an epitheca. After this time, variation in the growth rates of individuals and thickening of the skeleton obscure differences between the taxa.

I next examined the depth patterns of coral settlement around Lizard Island. Many taxa showed a pronounced and consistent decline in abundance with depth. In particular, *Isopora* and *Pocillopora* recruits were largely restricted to the reef crest. A similar pattern was evident in the adults of these taxa, suggesting that larvae can recognize and respond to cues from the parental habitat. To test this hypothesis the larvae of six common coral species, with contrasting depth distributions, were introduced into aquaria containing tiles conditioned at depths of 2 m and 12 m. Settlement densities on tiles matched those predicted from the depth distribution of adults. I next examined the induction of metamorphosis in larvae of the brooding corals *Stylophora pistillata* (F.

Pocilloporidae) and *Acropora palifera* (F. Acroporidae). *A. palifera* metamorphosed only in assays which included CCA. In contrast, some *S. pistillata* larvae metamorphosed in all assays, including sterilized seawater, which suggests that *S. pistillata* larvae do not require a biologically conditioned surface to settle.

To test the likelihood of localised recruitment and the potential of coral larvae for long distance dispersal, I compared the frequency distribution of settlement and the competence of larvae of five *Acropora* and two faviid corals. Some settlement was recorded within 4 days of gamete release in all species, indicating a shorter pre-competent period than has been generally accepted. Pronounced differences were also apparent among species in the capacity to delay metamorphosis. Settlement competence peaked between 7-10 days, after which the proportion competent to settle dropped rapidly in all species except *A. valida* and *A. millepora.* The maximum competency periods were 110 days for *A. valida*, 60 days for *A. millepora,* 36 days for *G. retiformis*, 34 days for *A. gemmifera* and *P. daedalea* and 14 days for *A. pulchra.* However, larval survivorship in cultures was low in all species. Low survivorship of larvae combined with a rapid drop in the proportion remaining competent to settle suggests that while connections between populations may be sufficient to prevent population divergence the numbers of migrants are unlikely to be high.

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