

TITLE PAGE

**Influences of benthic algae on coral settlement
and post-settlement survival: implications for the
recovery of disturbed and degraded reefs**

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ABSTRACT

Benthic algae generally dominate degraded and disturbed coral reefs, however our understanding of how algae influence coral recruitment, a critical process for the recovery of these reefs, is limited. Surveys to compare benthic biota close to versus distant from coral recruits on inshore reefs of the Great Barrier Reef identified several key groups of algae that are frequently associated with, and thus potentially favour coral recruitment. In particular, filamentous algal turfs dominated the substrata surrounding coral recruits and crustose coralline algae and the brown alga *Lobophora variegata* were also abundant and therefore may promote coral recruitment. In contrast, soft corals and even hard corals were less frequently found adjacent to coral recruits, suggesting that they are likely to have negative impacts on coral recruitment.

Subsequently, I experimentally investigated the effects of two filamentous algal turfs established on dead coral surfaces, and sediments, which are often trapped by algal turfs, on settlement of the coral *Acropora millepora*. Adding sediment reduced settlement but the effects of different algal turfs varied, a newly established (<6 week old) and relatively ungrazed turf reducing settlement, and a well established turf (up to 2.5 years) and grazed turf only reducing settlement when combined with sediments. This suggests that algal turfs can delay the recovery of coral populations on disturbed reefs, in particular in high sediment environments and with low grazing regimes.

Next, I investigated the potential for water-borne chemical influences from benthic algae to affect coral settlement, comparing settlement in seawater influenced by an alga identified as likely to promote and others identified as likely to hinder coral recruitment in surveys of coral recruit-algae associations. The fleshy alga *Lobophora variegata*

enhanced coral settlement, whereas the green filamentous alga *Chlorodesmis fastigiata* (Turtle weed) delayed coral settlement, and another brown alga *Padina sp.* (Funnel weed) apparently had no effect on coral settlement. Furthermore, these waterborne chemical influences were demonstrated to affect settlement of the coral *Acropora millepora* on the crustose coralline alga *Hydrolithon reinboldii*, which is known to induce the settlement of several *Acropora spp.* corals. The demonstration of waterborne effects suggests that some benthic algae can influence coral settlement before coral larvae reach the reef substrata and even where the immediate settlement location is free of algal cover.

Finally, I investigated early survival and growth up to four months after settlement of *Acropora millepora* recruits in reef environments dominated by fleshy algae (*Sargassum spp.* and *Padina spp.*), which had developed from algal turf assemblages solely as a result of reduced grazing. Surprisingly, I found recruits survived and grew more in reef environments dominated by the fleshy algae at a time when seawater temperatures were abnormally high, thus contradicting the paradigm that fleshy algae generally hinder coral recruitment.

My research suggests that, at least on inshore reefs of the Great Barrier Reef, corals may have no alternative but to recruit in habitats dominated by algae. Furthermore, the outcome of algal influence on coral recruitment, and consequently reef recovery from disturbance, may differ as a result of environmental stresses (sedimentation, elevated seawater temperatures), and the specific algae and coral life-stage (e.g. settlement, early survival) involved in coral-algal interactions.

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STATEMENT ON SOURCES

DECLARATION

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

Chico Liam Birrell