

Effects on local and vagrant tropical fish assemblages of the range expanding coral *Pocillopora aliciae* into temperate SE Australia



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under the supervision of Prof. David Booth and Dr.
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CERTIFICATE OF ORIGINAL AUTHORSHIP

I, Max James O'Connell declare that this thesis, is submitted in fulfilment of the requirements for the award of MSc (Research), in the School of Life Sciences (SoLS) at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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Ethics approval and collection permit

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General Abstract

The increase in global sea surface temperatures and strengthening of poleward-moving western boundary currents has resulted in the expansion of tropical reef fish assemblages and habitat-forming corals into temperate ecosystems. These range-shifting species have already altered temperate ecosystems through competition of resources or alteration of habitat. Likely linked to these mechanisms, the Sydney Coral Gardens (SYCOGA) in Sydney, Australia, has seen a rapid proliferation of branching hard coral *Pocillopora aliciae* habitat and associated small tropical vagrant fish species since initially seen in 2013.

To address what mechanisms tropical vagrant recruits utilise when locating and settling on novel habitat I subjected humbug damselfish *Dascyllus trimaculatus* individuals to a four – way aquarium choice experiment, providing olfactory cues of *P. aliciae* and visual cues of conspecifics and congeners (neon damselfish, *Pomacentrus coelestis*). *D. trimaculatus* individuals both selected and spent the most amount of time within quadrants that possessed the olfactory habitat cues and showed similar responses towards conspecific olfactory cues, outlining the importance of olfactory abilities of new recruits when locating and settling on novel habitat. To understand how range-shifting tropical and local temperate species spatially use coral habitat I observed behaviours of 14 fish species (tropical and temperate) associating with *P. aliciae* habitat, by mapping movement area and habitat partitioning. It was found that tropical individuals utilised different parts of coral heads to temperate species potentially allowing for reduced spatial competition within SYCOGA. Finally, I observed the seasonal changes in fish assemblages associated with the novel coral habitat, at locations in South-eastern Australia to study differences in fish assemblage composition between coral habitat and native temperate habitat located both adjacent to the coral in SYCOGA and at other sites in the Sydney region. Both tropical and temperate fish species were observed in far greater

densities on the coral than surrounding habitat, showing this coral habitat facilitates dense assemblages of both tropical and temperate fish species, potentially aiding and accelerating the process of tropicalisation of temperate reef ecosystems within south-eastern Australia.

The results of this thesis show the ability, through olfactory and visual cues, of juvenile vagrant reef fish species to locate suitable but rare novel habitat and conspecifics. Furthermore, tropical and temperate fish species prefer different sections of individual coral heads, suggesting potential coexistence and a lack of space-use competition. Finally, this newly formed coral habitat, is providing preferred habitat for both tropical and temperate species seasonally compared to surrounding temperate habitat.

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