
**STRESSORS OF EASTERN AUSTRALIAN
SUBTROPICAL CORALS:
AUSTRALIAN SUBTROPICAL WHITE
SYNDROME AND CORAL BLEACHING**

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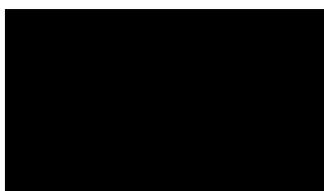
This thesis submitted for the degree of Doctor of Philosophy at the University of New
England, Armidale, NSW, Australia



DECLARATION OF ORIGINALITY

I declare that the substance of this thesis is my own work. I certify that this thesis has not been submitted as part of another degree and is not currently being submitted for any other degree or qualification.

I certify that any help in preparing this thesis has been acknowledged and all sources have been cited.



Steven Dalton

Date: 10th June 2010

ABSTRACT

Subtropical benthic communities associated with island fringing reefs along eastern Australian are comprised of a mix of tropical, subtropical and temperate coral species that compete with other sessile organisms such as macroalgae for available substrate. Increasingly, various types of perturbation, both natural and anthropogenic, are exerting stress on these subtropical coral communities. My research focused on the ecology of progressive coral tissue loss associated with a subtropical disease epizootic. Additionally, I completed *in situ* coral stress surveys and monitored the benthic community at representative eastern Australia subtropical locations (Flinders Reefs southern Queensland, Solitary Islands Marine Park (SIMP), Lord Howe Island Marine Park (LHIMP) and South West Rocks northern New South Wales) to determine if disease and/or bleaching were affecting coral cover. Observations made in the field, with respect to the mode of disease spread and the impacts of ambient temperature were further explored in aquarium experiments using *Turbinaria mesenterina* and *Pocillopora damicornis*.

During initial surveys completed at South West Solitary Island within the SIMP, prevalence of coral disease was highest during warmer periods and reached approximately 14% in March 2003. Between 2003 and 2004, a significant positive relationship was observed between sea water temperature and disease prevalence and the rate of tissue loss. Aquarium and *in situ* studies confirmed that progressive tissue loss observed in *Turbinaria mesenterina* corals was transmissible through direct contact and by a predatory vector, but transmission through the water column was not observed. These observations indicated that this condition is different from other described white diseases/syndromes and was therefore named Australian subtropical white syndrome (ASWS). Australian subtropical white syndrome was observed at all locations investigated and prevalence tended to decline between 2004 and 2006, with a significant increase during the warmer months. A total of 33 coral species (26% of all species present) from six families were observed with ASWS-like symptoms and dominant coral species were more susceptible. Acroporids were most affected on reefs in LHIMP, whereas, along the coast of mainland New South Wales, dendrophyllids were more susceptible. Transmission of ASWS was observed *in situ* between colonies of the same species, between species within a genus and between genera.

There were no severe bleaching events within the SIMP and LHIMP between 2004 and 2007. However, there was a significant difference in bleaching susceptibility between seasons (summer and winter), between coral families and between sites within different locations. These differences were attributed to the composition of the coral assemblage and differential bleaching susceptibility of different taxa at each site. Bleaching experiments, using a pulse amplitude modulating (PAM) fluorometer to monitor the photosynthetic efficiency of the PSII of symbiotic algae associated with *Turbinaria mesenterina* and *Pocillopora damicornis*, confirmed differences in bleaching response between families. Additionally, photosynthetic efficiency was significantly reduced when experimental corals were exposed to conditions under which bleaching is known to occur in subtropical locations (i.e. above the proposed subtropical bleaching thermal threshold).

A strong difference in coral assemblages was evident across the range of latitudes examined in the study (between Flinders Reef [26.5°S] and LHIMP [31.5°S]) but there were also some similarities between sites hundreds of kilometres apart. Coral cover within the SIMP remained stable over the duration of the study, and decadal comparisons showed that subtropical coral communities were generally stable at the regional scale. These combined results indicate that subtropical corals communities along the east coast of Australia, which are subjected to a range of perturbations, appear to be more resistant and resilient than their tropical equivalents. Further monitoring at these locations, in combination with wider collection of environmental data, would further enhance our understanding of subtropical communities.



Photo by Sallyann Gudge

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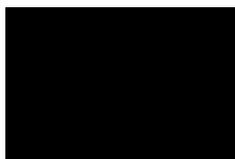
STATEMENT OF ORIGINALITY

We, the PhD candidate and the candidate's Principal Supervisor, certify that the following text, figures and diagrams are the candidate's original work.

Type of work	Page number/s
Chapter 1	All
Chapter 2	All
Chapter 3	All
Chapter 4	All
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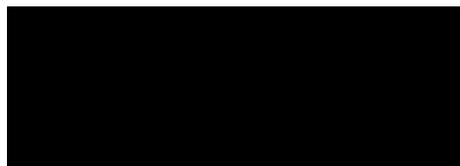
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