University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

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BSc (University of Hawaii at Hilo, 2013)

"Implications of heat stress and local human disturbance on early life stage corals"

Department of Biology

Tuesday, January 14, 2020
11:00 A.M.
Clearihue Building
Room B021

Supervisory Committee:
Dr. Julia Baum, Department of Biology, University of Victoria (Supervisor)
Dr. Francis Juanes, Department of Biology, UVic (Member)
Dr. Peter Edmunds, Department of Biology, UVic (Outside Member)

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Dr. Alexandre Brolo, Department of Chemistry, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Coral reef recovery following a disturbance relies heavily on the restoration of coral cover, via growth of existing colonies and the successful recruitment of new corals. In well connected reef networks, recruits may be sourced from neighboring reefs. In contrast, coral recruitment on geographically isolated reefs is reliant on adult corals at that location, which may limit recovery rates following mass coral mortality events. Such mortality events are increasingly caused by climate change induced temperature anomalies, which are overlaid on the local chronic human disturbances that already affect most of the world's coral reefs. In this thesis, I exploit a natural ecosystem-scale experiment to examine how multiple anthropogenic stressors impact densities of coral recruits and small corals (e.g., juveniles; £5 cm) on Kiritimati (Christmas Island, Republic of Kiribati), an isolated atoll in the central equatorial Pacific Ocean. Specifically, I used benthic survey videos from before, during, and one year following the 2015 2016 El Niño and coral settlement tiles deployed during the three years after the event at 22 sites across the island, to quantify small corals and coral recruits, respectively. Local chronic stress negatively impacted small corals, with densities 47% lower at sites exposed to very high levels of chronic stress prior to the heat stress. The El Niño further resulted in a 56% loss of small corals, particularly for competitive coral species. Following the event, stress tolerant small corals rebounded to pre-El Niño densities within a year, whereas competitive and small corals overall had non-significant increases. I also quantified a low recruitment rate of 8.31 recruits m-2 per year (± 1.9 SE) during the three years following the El Niño compared to previous studies around the Pacific; recruits were genetically identified as primarily belonging to the stress tolerant family Agariciidae and the genus *Pocillopora*. Local human disturbance also impacted coral recruitment with densities significantly lower at those with the greatest local chronic disturbance, together suggesting that local disturbance impedes post-settlement survival of recruits and the resilience of young corals during acute stress events. With increased net primary productivity, densities of both small corals and recruits (non-significant) also increased, which could reflect the positive influence of coral heterotrophic nutrition supplements during and after stress events, increasing survivability. Despite very low overall coral recruitment, all island regions did have some recruits, but Vaskess Bay (a bay region on the southern part of the island) had the highest densities. Overall these results indicate the negative consequences combined chronic

and acute stressors can have on coral recruits, small corals, and accompanying coral resilience. When viewed together, this work suggests how the resilience is compromised by chronic stressors on Kiritimati and that the recovery trajectory may be variable across the disturbance gradient. Thus, local reef management may provide an avenue for enhancing recovery rates as acute temperature anomalies increase in frequency under our current climate trajectory.