Growth patterns along environmental gradients of tropical pomacentrid fishes

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Certificate of authorship

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that this thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in this thesis.

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General abstract

The goal of this thesis is to evaluate latitudinal patterns in the life history traits, standard metabolic rates, and growth potential of two geographically widespread damselfishes, the dispersing *Pomacentrus moluccensis* (Bleeker 1853) and the brood-caring *Acanthochromis polyacanthus* (Bleeker 1855) between Lizard Island, Orpheus Island, and One Tree Island along the Great Barrier Reef, Australia (14° 41' S, 18° 37' S, and 23° 30' S).

P. moluccensis displayed no clear latitudinal maximum age (7-10 years) or asymptotic size (57.3 mmSL +/-3.0) difference, between Lizard, Orpheus, and One Tree Islands. Based on experimental manipulations of water temperature at the three islands the metabolic rate at a given temperature (e.g. 27°C) was significantly lower at the lowest latitude Lizard Island (0.048 mgO_2/g fish/hour) compared to mid- and high-latitude Orpheus and One Tree Islands (0.088 mgO_2/g fish/hour +/-0.004). Regardless of location, the growth of *ad libitum* fed juveniles was consistently higher at higher temperatures (0.0641-0.1190 $\log(g_{(final)}/g_{(initial)})$/day), indicating higher potential growth rates at lower latitudes.

A. polyacanthus displayed a lower asymptotic size at the highest latitude One Tree Island (72.5 mm SL) compared to Orpheus and Lizard Islands (86.9 mmSL +/-2.3) though the maximum age was the same across latitudes (8-10 years). The metabolic rate at a given temperature (e.g. 27°C) was consistently significantly higher at higher latitudes (0.053-0.106 mgO_2/g fish/hour). The growth of *ad libitum* fed juveniles was significantly lower at Lizard Island (0.0575 $\log(g_{(final)}/g_{(initial)})$/day +/-0.0057) than Orpheus and One Tree Islands (0.1303 $\log(g_{(final)}/g_{(initial)})$/day +/-0.0153). These two results in conjunction may indicate that *A. polyacanthus* maintenance costs are low at low latitudes through low metabolism, but has simultaneously reduced its ability to speed up growth rates in periods of abundant food, such as coral spawning (Oct-Nov).

Over the coming century rapid climate change is predicted to increase the average sea-surface temperatures on the GBR, with possible migration of widely distributed species from warmer areas of their distribution to colder. The ensuing

changes in reaction norms due to a lateral shift will largely depend on their current geographical and temperature ranges. Based on the results of this study, it appears that *P. moluccensis* might be able to tolerate a transition to warmer habitats, while *A. polyacanthus*, more adapted to its local habitat, would be less able to adjust to a change in temperature regime.