POST-SETTLEMENT SURVIVAL AND GROWTH OF A TROPICAL SPONGE

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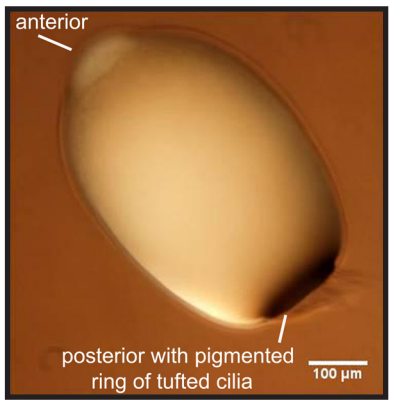
Coscinoderma matthewsi

Background

Understanding post-settlement mortality and growth is fundamental to explaining adult population distributions of sessile benthic organisms. *Coscinoderma matthewsi* is a brooding Indo-Pacific sponge and releases developed larvae that settle within 72 h, with metamorphic success approaching 98% (Abdul Wahab et al. 2011). To date, surface area has been used to determine size and growth of sponges with massive growth forms. The aims of this study were to understand post-settlement processes, and assess accuracy of using surface area to assess growth in *C. matthewsi* through:

- Quantifying juvenile post-settlement mortality at different densities and growth over seven months
- Comparing growth as measured by surface area (2-dimensional, 2D) against volume (3-dimensional, 3D)



C. matthewsi larva

Methodology

- **Post-settlement mortality**

  Larvae were settled onto sterile 6-well plates at densities of 0.1, 0.2, 0.5 and 1 larvae cm^{-2} and maintained in an outdoor raceway with flow-through seawater. Juvenile survival was monitored monthly for seven months (n_{larvae} = 50 per treatment).

- **Post-settlement growth and accuracy of 2D measurements**

  Juvenile size (surface area, 2D) at settlement and seven months was measured under light microscopy (n = 6). Juvenile size (volumes, 3D) was also determined using computed tomography of Z slice photos from confocal microscopy (**Box 1**) (n = 6).

Results

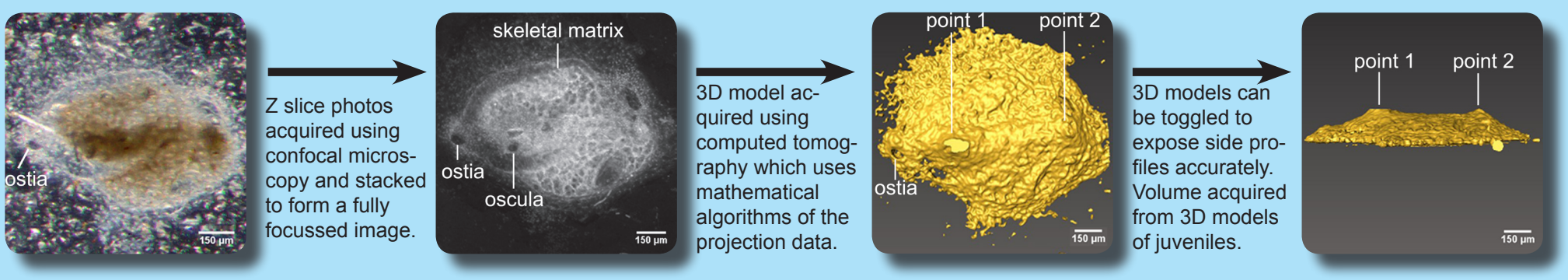
- **Post-settlement mortality**

  Post-settlement mortality was independent of settlement density and ranged between 70 - 88% at seven months (Kaplan-Meier survival analysis: $p > 0.05$) (**Figure 1**).

- **Post-settlement growth and accuracy of 2D measurements**

  Growth as measured by changes in surface area (2D) and volume (3D) were both significant at seven months (t-test and Mann-Whitney U test: $p < 0.05$). Percentage growth obtained using the 2D methods was 85% while the 3D method yielded 190% growth.

Box 1: Schematic flow-chart for 3D model acquisition showing light and confocal microscopy images, and 3D model of the same seven month old *C. matthewsi* juvenile



Light image, top view | Confocal image, top view | 3D model, top view | 3D model, side view

Conclusion

- Density independent post-settlement mortality demonstrates that juveniles are not influenced by negative conspecific interactions and are more likely to be affected by inter-specific interactions and environmental factors such as sedimentation.
- High mortality during post-settlement (up to 88%) compared to “at settlement” (2%) supports a proposal that post-settlement processes play a vital role in adult population dynamics.
- Surface area is unsuitable as a proxy of size and growth estimates in sponges with massive morphologies contributing to underestimation of values

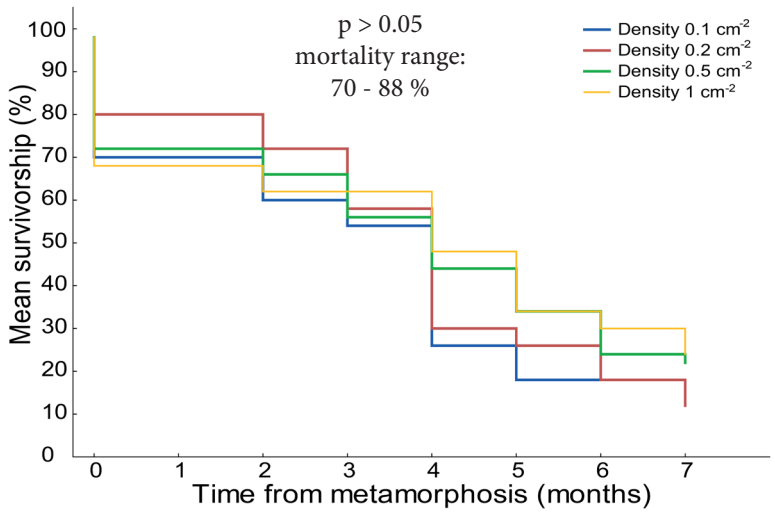


Figure 1: Survival curve of juvenile *C. matthewsi* grown at different densities over seven months

Acknowledgements

We would like to thank Shane Askew from the Advanced Analytical Centre, JCU for training on the confocal microscope. This research was funded through an Australian Research Council linkage grant with Reef HQ (LP0990664).

References

Abdul Wahab, MA, de Nys, R & Whalan, S (2011) Larval behaviour and settlement cues of a brooding coral reef sponge. *Coral Reefs* 30:451-460.