GLOMAR

Ph.D. Defence

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Title of the Thesis Colloquium:

The application and potential toxicity of innovative antifouling coatings for coral reef restoration

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ZMT, Fahrenheitstr. 6, large seminar room
and online via Zoom

The application and potential toxicity of innovative antifouling coatings for coral reef restoration

As more tropical reefs worldwide undergo climate- and eutrophication-driven phase-shifts from coral- to fleshy algal-dominated cover, interactions between fouling organisms and corals become more pronounced and frequent. Competition with benthic algae is recognized as a key threat to coral settlement and the survival and growth of coral recruits and the success of adult corals, reducing overall survival for coral reef replenishment and supply for restoration programs. The application of antifouling (AF) coatings on settlement surfaces for coral larvae may enhance the viability and profitability of sexually propagated corals by improving the survival and growth of coral spat that make it through critical early life stages.

In this context, three innovative AF coatings with potential low toxicity were developed and tested for their (1) efficacy to inhibit fouling, (2) potential toxicity towards coral spat, and (3) design to be further tested and applied for reef restoration efforts. A series of interconnected experiments was conducted at the Australian Institute of Marine Science (AIMS) in natural filtered seawater in large outdoor flow-through aquaria, as well as indoors in different temperature-controlled rooms of the National Sea Simulator (SeaSim).

Two of the three tested coatings (antiadhesive, encapsulated dichloroo-ctylisothiazolinone: DCOIT) were found to effectively inhibit algal growth (crustose coralline algae (CCA), green and brown algae) on coral settlement plugs (“coral plugs”), with no detrimental effects of the 37-day old pre-conditioned coatings on Acropora tenuis coral larvae during settlement. Furthermore, an adapted protocol for fouling analysis from photo monitorings was developed with the machine-learning Trainable Weka Segmentation (TWS) plugin in the Fiji distribution of the image processing program ImageJ. Survival of Acropora millepora coral spat after 69 days on nonconditioned coral plugs was higher on the uncoated areas of the partially-coated plugs in the DCOIT treatment as compared to the Control plugs without any coating, suggesting that inhibited algal growth by the coating could have created beneficial effects on the corals' survival. Acropora millepora coral larval swimming behavior (velocity and activity) was investigated for the first time with an automatic and quantitative measurement software EthoVision XT (Noldus Information Technology), and differences between swimming behavior on top of the coatings became evident.

Tracking of swimming behavior with this setup and software was identified as a reliable and feasible method for assessing potential non-lethal responses to AF coatings. The manual for the utilization of this software with coral larvae is included in this work. The studies here provide a valuable contribution to the development of innovative and sensitive techniques to assess the ability of AF coatings to reduce competition from biofouling and increase coral survival to size-escape levels.