Breeding for the Future: A Software Simulation Approach to Crossbreeding Corals for Reef Resilience

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Coral reefs are some of the most biodiverse ecosystems on Earth, but are increasingly prone to bleaching due to warming ocean temperatures and acidification. Selective breeding of corals, especially with those that share a genus, to heighten tolerance to these stressors has been proposed as a possible solution to combat the loss of reef systems and enhance coral resilience. In this project, a software modeling system and web-based interface were developed to simulate coral crossbreeding outcomes and evaluate offspring risk rates and performance under environmental conditions specific to a selected geographic region. The software system (webpage) has a user interface that presents three coral species that are prevelent in oceans near the equator, (Acropora cervicornis, Acropora palmata-symbiodinium, Acropora palmata-durusindium) with heat and pH parameters and hertiability numbers found in secondary data and published research papers (listed in bibliography). Users may select two coral parents and the amount of offspring produced and upload a database (in this experiment one from NOAA), to apply to the offspring. The algorithm simulates offspring with inherited tolerance traits based on a heritability coefficient of 0.53. Simulations were conducted on three different coral pairings: A. cervicornis x A. cervicornis, A. cervicornis x A. palmata-symbiodinium, A. cervicornis x A. palmata-durusindium. Because all three of the coral species share the same genus (Acropora), hybridization and sucessful cross-breeding of these is biologically feasible. Results from the experiment indicated that the A. cervicornis species when crossed with the two A. palmata species maintained a lower risk rate for longer durations under the fluctuating pH and thermal conditions.

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