Assessing the health and distribution of Scleractinian coral colonies in Akumal

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Scleractinian coral is vital for coral reefs providing 3D structure as well as a diverse food supply for a variety of species. These reef-building corals are facing extinction, and, without maintaining genetic diversity on the reefs, we risk losing entire populations if multiple colonies are descended from an individual lacking resistance to disease, warming oceans and eutrophication. Coral restoration is increasingly considered to be a viable recovery plan for coral reefs in the changing marine environment.

In Akumal preliminary research has been conducted to trial the success rates of coral nurseries where *Acropora cervicornis* fragments are collected, tied to lines, grown, propagated and then transplanted onto the reef. The methods used are minimally invasive, require cheap materials, and involve the local dive community. The trials have proved to be successful, with doubling of live tissue from dying rescued fragments within a year, and fusion and growth of transplanted colonies onto the reef. However, when fragments of coral are used in coral nurseries the results corals are genetically homogenous. Coral disease is an increasingly big problem for coral conservation and without maintaining genetic diversity on the reefs, we risk losing entire colonies if they are all from the same individual that has no resistance to disease.

To maintain genetic diversity during reef restoration the ideal method is assisted fertilization of coral gametes, which are then grown and transplanted to nurseries as coral recruits. Assisted fertilization of coral gametes has been pioneered over the last decade by local researchers, the Coralium Laboratory of the National Autonomous Univeristy of Mexico (UNAM) to improve fertilisation and genetic diversity juvenile coral recruits which are grown and transplanted onto the reef in the National Park of Puerto Morelos. Corals spawn only once or twice per year at full moons during the summer and in Akumal these gametes are collected for assisted fertilization and rearing in our on-site laboratory. However, with only a few nights each year in which gametes can be collected, the Coralium group urgently need data showing where the largest and healthiest coral colonies are located so they can target gamete collection appropriately and maximise success.

Operation Wallacea is assisting this long-term research project in Akumal by mapping the distribution of colonies of coral species from the genera *Acropora, Orbicella, Montastraea***,** *Diploria, Pseudodiploria* and *Dendrogyra*. Coral colonies will be assessed using belt transects in which all colonies of target coral genera are georeferenced, each colony is assigned to a size category and the health of the colony (% bleaching and evidence of coral disease) is recorded. Scleractinian coral distribution maps are then created for the Coralium coral reproduction research team to determine the best locations of gamete collection during spawning. In addition, to optimize the potential of transplanting colonies onto the reef, it is first necessary to evaluate the remaining Acropora population; locate historical sites of high Acropora density, count living colonies and their health, identify any patterns, and eventually, to provide a map for genetic sequencing of the population.

Projects can focus on describing reef structure of Akumal and provide a baseline for comparison and to assess long-term restoration impacts. Projects will help to understand current population distribution of Acropora palmata and Acoropora cervicornis and determine best locations for gamete collection during spawning. In the future, coral fertilization could be extended to other species of hard coral and monitoring of these species will provide insight into the conservation status of Akumal reefs in addition to informing further decisions for the coral restoration project. With the addition of fish and invertebrate transects, projects can also investigate the relationship between reef structure and diversity.

Methods

Data will be collected via diving and snorkelling, and students will be trained to identify Scleractinian coral species, key fish species and invertebrates. Students will also receive training in estimating sizes of coral colonies. At each dive site (see Figure 1) the coral mapping team will take position to form a line of divers spaced at 3m intervals, essentially forming 4 x 3m belt transects, running parallel to the shore. Simultaneously, divers will swim along transect, each diver looking 1.5m to the left and 1.5m to the right. When a target species of Scleractinian coral is spotted the diver must signal to the others to stop. Divers will remain where they are, apart from the closest diver who can assist to take measurements and / or photos if necessary. For each coral colony encountered, the species will be recorded along with size category L (large colony >3m), M (2-3m size colony), S (1-2m colony) and FRAG / CLU (single or <5 fragments or cluster of >5 frags). In addition, health of the colony will be recorded based on colour (% categories of bleaching) and notes will be made of any noticeable predation or disease. GPS readings will be taken on boat at point of entry and at the end of the transect.

At a subsite of site (e.g. healthy vs degraded colonies), additional transects may be conducted for key invertebrates such as urchins and herbivorous fish to investigate the relationship between reef structure and diversity.

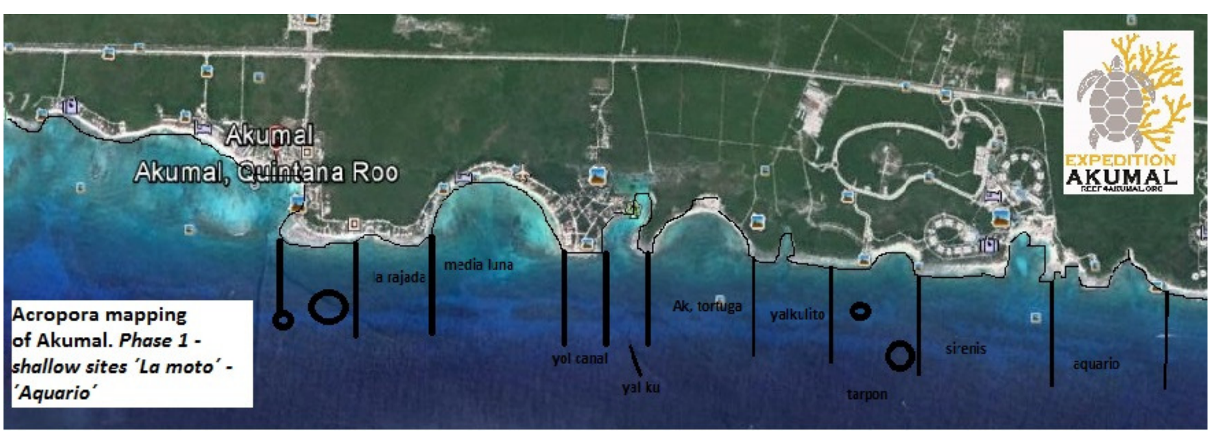

Figure 1: Dive sites for Akumal Scleractinian coral mapping

Relevant Literature

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