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ESM 260: Homework 3

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Tests of Hypotheses and Management Actions

1. Fine Branching Corals and Coarse Branching Corals in Rarotonga
2. Fine Branching Corals

**Hypothesis 1**: Fine-Branching Coral might decrease due to an increase in algae in Rarotonga

**Observations**: Observations on fine branching corals could be conducted through transects and counting experiments in the water.

**Experiment**: A manipulative experiment would include removal of algae where fine branching corals are present or might be present to see if growth would increase with the absence of algae. Samples of fine branching coral should be planted in areas with no algae and algae to see confirm if algae effect the growth of fine branching coral. Some of the planted coral should have a cage around it to ensure protection and some of the planted coral should brave the elements of the ocean.

**Hypothesis 2**: A steady population of Surgeon recruitment might increase the amount of Fine-Branching Corals in Rarotonga

**Observations:** The per capita and total production of babies by adult Surgeonfish vary positively with the amount of the fine branching coral. Get in the water and observe where the Surgeonfish are recruiting. If they are not recruiting on fine-branching corals, they will have a negative effect because their urine is a valuable nutrient to the coral.

**Experiment:** Collect Surgeonfish from other healthy populations of fine branching coral populations (from Aitutaki) and bring them to Rarotonga. This way they will recruit on the fine branching coral that is there and develop a healthier fine branching coral population.

1. Coarse Branching Corals   
   **Hypothesis 1**: Coarse-Branching Corals might decrease due to the presence of algae. Algae tends to be a big competitor when space previously used by Coarse-Branching corals is open. Once algae is stable, it is hard for corals to make a comeback.   
   **Observations**: Observations of coarse branching coral would be conducted with getting in the water and using quadrats. Randomly assign plots to place the quadrats over along a transect. Count how many coarse branching corals fall within each quadrat as well as algae or other species.  
   **Experiment**: Actively pull out algae from area that have resemblance of coarse branching corals and plant new corals that would otherwise grow there.   
   **Hypothesis 2**: Coarse-Branching Corals might decrease due to a decrease in young Coral Trout recruitment. Recruitment of young fish is vital to the growth of corals. They excrete ammonia that the corals use as a fertilizer.

**Observations**: Observe the number of adult Coral Trout that are in the area with coarse branching corals.

**Experiment**: Collect Coral Trout from an outside lagoon and place them in areas where coarse branching corals are diminishing.

1. Spotted Damselfish: Manipulative Field Experiment.   
   **Limited supply of larvae**: Have two sections of reef where no Spotted Damselfish are brought in from a neighboring lagoon and where adult Spotted Damselfish are brought in from a neighboring reef. One section that does not have the newly introduced fish will serve as the control. The section that will have the newly introduced fish will be the experiment where if the adults recruit on the reef, there will no longer be a limited supply of larvae.   
   **Limited habitat available**: Manually create new habitat by bringing in preferred Spotted Damselfish habitat – sea anemones. In one section of the reef, take away all the algae that has grown, and plant sea anemones in the newly created free space. If recruitment takes place by the adults, we know that the problem was the limited habitat available.
2. Surgeonfish in Rarotonga  
   **Hypothesis 1**: Adult Surgeonfish may have increased in Aitutaki but decreased in Rarotonga due to the recruitment of young on their preferred microhabitat, Fine-Branching Corals. Fine-Branching corals displayed a similar pattern where they increased in Aitutaki and decreased in Rarotonga.   
   **Manipulative Experiment**: Remove algae that has taken up space that Fine-Branching corals need to live in order to provide microhabitat to Surgeonfish. Plant some Fine-Branching coral with a cage around some of them to allow for no fish alteration, and plant some with no cage to allow for fish recruitment. If Surgeonfish show up, the microhabitat was the limiting factor.  
   **Hypothesis 2**: Adult Surgeonfish might have decreased in Rarotonga due to the increase in fishing. Fishing might have an effect on Adult Surgeonfish because they are a large enough fish for human sustenance.

**Observation:** Do transect counts of Surgeonfish in Rarotonga where they are fished, and in Aitutaki, where they are protected.

1. Management Action for Branching Corals  
   **Tested Explanation**: Remove the algae and corals will grow!   
   **Management Action**: The best form of action is the remove as much algae as possible in a few areas of the lagoon. Not up to 100% removal, due to the difficulty of the task, but maybe at least 50%. As algae is being removed, actively pant branching corals back into the newly empty spaces. Do not wait till after the algae removal period to plant the new coral though. This might give the algae enough time to regrow and outcompete the coral again. Coral will be collected from neighboring lagoons with higher coral abundance and introduced back into Rarotonga. Algae removal teams should be sent out frequently in order to prevent regrowth. Coral plantation should be monitored to ensure proper growth.