Project Oceanography
Coral Reefs V:

REPAIRING - RESTORING CORAL REEFS

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As you have learned, coral reefs are a unique feature of the natural world. They serve as living breakwaters, provide a living space (ECOLOGICAL NICHE) for a multitude of plant and animal species, and are an economic asset for their fisheries and as tourism destinations; they also provide building materials, and sand for beaches. Coral reefs are many things to many people. As a society and members of a global community we can appreciate this wonder of the ocean and be responsible stewards.

The most destructive natural agent that destroys coral reefs is related to hurricanes and typhoons that are common in tropical oceanic areas. Wave energies and rainfall can cause fundamental changes on a coral reef. While a coral reef may look solid and formidable, in reality, a coral reefs' foundation is composed of coral limestone that is not solid, but is filled with voids or open space, thus its structural strength is weak. When huge waves generated by tropical storms beat on the reef, it is easily broken and corals and other organisms are dislodged. If a 200 mph hurricane comes across a reef, it may leave the reef as a flat featureless sea floor. It will require thousands of years to regenerate a large coral reef.

Since humans first took to the sea in boats, they have invariably come in contact with, or wrecked on, coral reefs. In the area of the Florida Keys, hundreds of vessels have wrecked on the reefs. When ships were constructed from wood, wrecks on coral reefs did not cause catastrophic damage to the reef; however, steel ships do cause tremendous damage to coral reefs. The steel hull of a 1000 ft ship moving at 15 mph can destroy or severely damage acres of reef.

Dredging operations to mine sand or deepen channels is the other significant physical damage agent that brings havoc to the coral reefs. The dredge can physically destroy coral reefs and the chronic silt generated during dredging can stress the corals and other light sensitive organisms by reducing the light and choking the reef with a rain of silt.

Restoration of coral reefs has about a 20 year history. It began with research on transplanting corals into damaged areas or areas where corals were previously abundant. The technology progressed as we gained knowledge about cements and epoxy that worked underwater and did not poison the water or corals.

In a typical project where there has been severe damage, the work progresses in an order of: surveying and evaluating the scene, salvaging live coral and placing it in temporary storage areas, removing loose debris, and finding places that are suitable for transplanting corals. If the area has been pounded flat by a large ship grounding or dredging, it may be necessary to construct reef-replacement structures to add three dimensional topography to the area. Doing this will provide refuge for mobile organisms and places where corals can be transplanted. The structures are generally two to five feet high, and five to ten feet across. They must be secured to the sea floor with cement and steel rods. If large boulders are found in the accident area, they can be piled together and secured with cement and epoxy to add structural complexity.

We currently do not have coral nurseries where we can go out and purchase corals to transplant on the reefs. One technique used in Guam was to harvest corals that were just about ready to spawn. These were brought into a laboratory and after spawning, the babies (termed larvae) were nurtured until they were ready to settle and grow into corals. Then they were released into the area they wanted to rehabilitate. The larvae settled, and repopulated the barren areas.

A labor intense method of transplanting corals is typical in ship grounding-restoration projects. The salvaged corals are taken to the areas where reef replacement structures were installed or areas that have been judged suitable for transplanting. The work teams clean the attachment surface of the coral and the area where the coral will be attached with wire brushes to remove sand and algae. If the area is not flat, a small hole is drilled into substrate and a steel of brass rod is cemented into the hole. A similar hole is drilled into the bottom of the coral. The area receives a covering of cement or epoxy. The coral is placed on the cemented area. The epoxy will become hard in about 30 minutes, hydraulic cement requires several hours.

Monitoring the project success provides insight as to what is working and where problems occur.

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STUDENT EXERCISE

A scenario of a vessel grounding

ROLES:

1. Ship's Captain
2. Coast Guard Officer in Charge
3. Environmental Department Expert
4. Salvage master
5. Legal Representative for shipping Co.
6. Legal Representative for Government
7. Salvage team (six, two tug boat captains, 4 drivers)
8. Reef Rescue Team
9. Restoration Master
10. Environmental Consultant for Shipping Co.

THE SCENARIO

1. The Ship, Monkey Business runs aground on No Name Reef, off the coast of Paradise, a small island that has a strong dependence on their coral reefs for tourism and fishing.

2. The Coast Guard Responds to the accident. The ship is sound and aground on No Name Reef. It has a cargo of soft drinks and it is leaking some fuel oil.

3. What action should be taken:
   Dealing with oil leak?
   Removing the ship from the reef?
   Minimizing damage to the reef during salvage?
   Restoring the reef following the vessel removal?

4. Conduct a preliminary survey to evaluate damage.

5. Develop a plan for restoring the reef.
   a. Negotiate (Legal folks) a mechanism to pay for restoration with the responsible party (Ship Owner and Insurance Companies).

b. The government and consultant people must work out the details of what should be done.

c. The Reef Rescue Team does the work under the supervision of the Restoration Master
d. A hurricane is on the way. Find some way to secure the salvaged corals.
e. Complete the restoration.
f. Monitor the results.
g. Report back the findings.