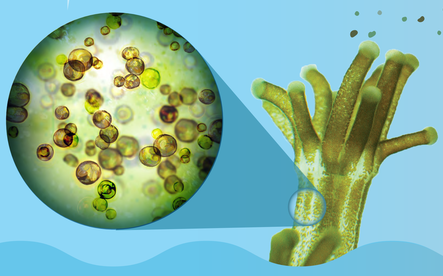
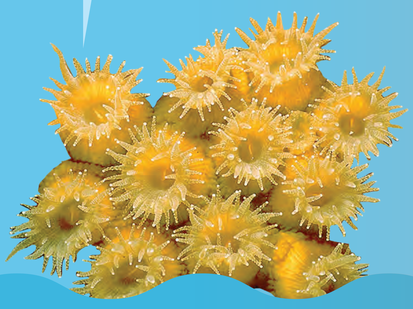
MUTUAL SYMBIOSIS
CORAL & ZOOXANTHELLAE

ZOOXANTHELLAE is a micro-algae that lives inside of coral tissue. Zooxanthellae provides the coral with products of photosynthesis in exchange for nutrients.



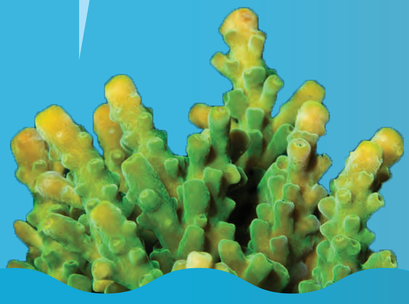
However, when coral becomes stressed due to biological or enviromental factors it will expel its zooxanthellae.

Corals brilliant colors come from the pigmentation in zooxanthellae algae.

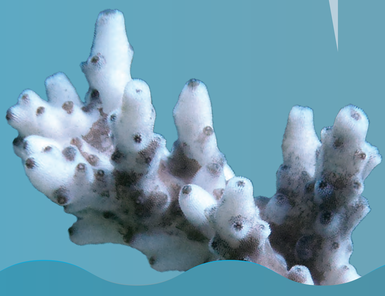


Coral appears "bleached" without the algae. Without zooxanthellae algae the coral can no longer benefit from photosynthesis.

Reefs are made up of coral animals. Corals are colonies of indiviual poylp animals sharing a skeleton.



The bleached coral will die without the zooxanthellae alage. The dead tissue sloughs off to reveal the coral's calicum skeleton.



Coral reefs are complex ecosystems. Reefs support 25% of all marine life.

This coral reef once full of life is now a graveyard.

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Project Summary

For my final project I chose the ecological concept of mutual symbiosis, specifically the relationship between zooxanthellae algae and coral. Coral reefs form complex ecosystems that provide shelter for 25% of the ocean's marine life. Without the mutual symbiosis between zooxanthellae and coral these reef ecosystems would not be able exist. To demonstrate this concept I created an infographic that illustrates the great importance of this relationship. The infographic illustrates the consequences of what happens when coral loses zooxanthellae algae. The first level is a microscopic view of a single coral polyp with visible zooxanthellae algae. From there down the infographic is divided vertically, the left side depicts coral with healthy zooxanthellae while the right side depicts bleached coral that no longer has zooxanthellae in its tissue. Each lower level zooms out until the final level reveals the entire reef.

This infographic is meant to raise awareness of the crucial importance of the fragile symbiosis between coral and zooxanthellae. By demonstrating the enormous impact of what happens when coral becomes bleached, the viewer has a better understanding of how dependent reefs are upon their relationship with zooxanthellae.

To fully understand this concept, the viewer must understand some basic coral anatomy, that is why I created to infographic with multiple layers of zoom. Something that few people know is that corals are actually animals, not plants. Zooxanthellae is a micro algae that lives inside the tissue of a coral polyp (5). Although coral polyps can obtain energy by consuming food with their mouth, 90% of their energy is produced by photosynthesis (3). This is where the zooxanthellae becomes important. The coral will provide the zooxanthellae with a protected environment and also the carbon dioxide and water necessary for the algae to perform photosynthesis. The products of its photosynthesis are sugar, lipids, and oxygen which it returns to the coral. The coral uses these elements to grow and continue producing for the algae (2). Without each other these two organisms would perish.

Coral can regulate the amount of zooxanthellae living inside of its tissue by expelling some of the algae when needed, but if a coral becomes overly stressed due to biological or environmental factors then it will expel too much or even all of its zooxanthellae (4). When a coral loses its zooxanthellae it will appear white because coral tissue is transparent and the calcium skeleton below the tissue is now visible. The phenomena of massive expulsion of zooxanthellae is called “coral bleaching” (1). Without zooxanthellae coral can not produce enough energy to grow or even live. The coral tissue will starve to death and leave nothing behind but its white skeleton.

Stony corals that grow symbiotically with zooxanthellae are the building blocks of the magnificent coral reefs. Coral reefs provide resources for 25% of all marine life in the ocean (3). Without zooxanthellae the individual coral animals that make up these reefs would die. In turn,the entire coral reef ecosystem would collapse with stony corals to provide food, shelter, and structure to the environment. These facts are what make the relationship between coral and zooxanthellae one of the most import symbiotic relationships in our world.

Works cited

1) Brown, B. E. "Coral bleaching: causes and consequences." *Coral Reefs* 16 (1997): S129-S138.

This in depth scientific article covers the phenomena of coral bleaching. It is full of information and charts about the intensity and factors of coral bleaching.

2) "Diagram of Coral and Zooxanthellae Relationship." *NOAA's National Ocean Service*. N.p., 25 Mar. 2008. Web. 17 Apr. 2014. <http://oceanservice.noaa.gov/education/kits/corals/media/supp_coral02bc.html>.

This site provides a very basic description of what coral and zooxanthellae are. It also provides a simple description of the chemical exchange that occurs between the two. The page feature an animated diagram that illustrates the chemical exchange.

3) "Symbiotic Algae." *NOAA's Coral Reef Conservation Program:*. N.p., 13 May 2011. Web. 17 Apr. 2014. <http://coralreef.noaa.gov/aboutcorals/coral101/symbioticalgae/>.

This site provides a slightly more in depth description of the symbiosis between coral and zooxanthellae. It also touches on the subject of coral bleaching.

4) Muller-Parker, Gisèle, and Christopher F. D'Elia. "Interactions between corals and their symbiotic algae." Life and death of coral reefs (1997): 96-113.

This in depth paper outlines several topics including "the description of the symbiosis, nutrition and adaptations to environmental factors, stability of the symbiosis, cost-benefit analysis of the symbiosis, and environmental effects on the symbiosis."

5) Knowlton, Nancy, and Forest Rohwer. "Multispecies Microbial Mutualisms on Coral Reefs: The Host as a Habitat." the american naturalist (2003).

This scientific paper includes the most information about the zooxanthellae algae. It also includes a chart with numerical data regarding the abundance of zooxanthellae.