The University of Texas at Austin
Environmental Science Institute

Coral Reefs as an Endangered and Diverse Ecosystem

Lesson Plan for Grades: 3rd - 5th
Length of Lesson: 50 minutes

Authored by: UT Environmental Science Institute
Date created: 04/10/2018

Subject area/course:

- Science (focus on Life Science, Biology, and Environmental Science)

Materials:

- Timer for Teacher (to keep track of time)
- Diorama Worksheet (1 per student),
- 5 shoe boxes (1 per group of 3-4 students for approx. 20 students, 5th as an example)
- Thin and Thick Markers (1 set of each marker type per group)
- Paint (class set)[1]
- Pipe cleaners (multi-colored, enough for class set)[1]
- Hot glue guns (for teacher use only for grades 3, students/groups can carefully handle at grade 5)
- colored construction paper (enough of blue and brown/tan per each group)
- scissors (1 per student/pair)
- fake sand (for class set, enough for each group)[1]
- fake seashells (for class set, enough for each group)[1]
- Glue sticks and liquid glue (for class set, 1-2 of each per student/pair)
- fake plants (for class set, enough for each group)[1]
- Printer paper for labels/ written descriptions
- Pencils (1 per student)
- additional arts and crafts supplies as desired by class instructor[1]
- **Access to computers/compatible iPads/or other appropriate technology (To create a technology-incorporated lesson plan so as to have students become more comfortable using technology for science)[2]**

[1]These supplies listed are more ideas on how the dioramas can be decorated; teachers can decide which supplies they wish to use for the Explore.
[2]If classrooms are unable to use technology, alternate lesson plan is included in the Elaborate section.

*****NOTE:** As making shoebox dioramas require a lot of time and work, **please prepare some of the material that will be used by students in advance to the lesson (to make the lesson 50 minutes long)**. Otherwise, no prior preparation will require multiple days/more time to work on the activity, so please adjust for additional time for exploration portion of lesson plan.

Example for Advanced Preparation (Prior to Lesson Plan): (should be done for each box, total amount of preparation to be determined by teacher)

1. Place Blue construction paper or paint all over the shoebox (the deeper box) to mimic underwater ocean environment
2. Place brown/tan construction paper or that colored paint or fake sand all over the shoebox lid (the shallow box).
3. Hot glue the two boxes together.
4. Print out pictures of marine life animals (examples on Teacher Template of Exploration Activity

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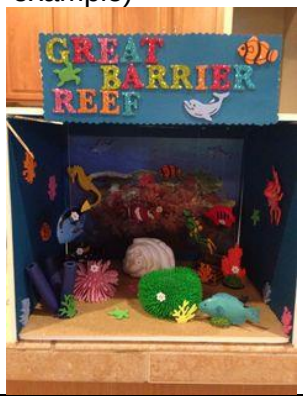
page) or have students bring in marine life pictures from magazines.
5. Cut out printed/magazine animals and plants.
6. Divide up needed supplies for each group.

Pictures of how the diorama should look like as a finished product: (general idea, specifics depend on supplies and advanced preparation provided as a teacher and whether the teacher decides to take more time to conduct lesson plan (90 minutes rather than 50, for example)

TEKS/SEs:

§112.14. Science, Grade 3, Beginning with School Year 2010-2011.

(10) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that help them survive within their environments. The student is expected to:

(A) explore how structures and functions of plants and animals allow them to survive in a particular environment;

(B) explore that some characteristics of organisms are inherited such as the number of limbs on an animal or flower color and recognize that some behaviors are learned in response to living in a certain environment such as animals using tools to get food;

§112.15. Science, Grade 4, Beginning with School Year 2010-2011.

(10) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that help them survive within their environment. The student is expected to:

(A) explore how adaptations enable organisms to survive in their environment such as comparing birds' beaks and leaves on plants;

§112.16. Science, Grade 5, Beginning with School Year 2010-2011.

(9) Organisms and environments. The student knows that there are relationships, systems, and cycles within environments. The student is expected to:

(A) observe the way organisms live and survive in their ecosystem by interacting with the living and non-living elements;

(10) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that help them survive within their environments. The student is expected to:

(A) compare the structures and functions of different species that help them live and survive

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such as hooves on prairie animals or webbed feet in aquatic animals;

Lesson objective(s): Students Will Be Able To: (SWBAT)

- Model the ocean environment of a coral reef ecosystem
- Explore the effects humans have on the coral reef species
- Interpret graphical representations of how human interference can affect coral reef ecosystem populations

Differentiation strategies to meet diverse learner needs:

- The teacher should ask students whether they prefer to read or watch videos to learn about concepts; then have students learn in their preferred learning style. However, the teacher may assign students certain methods to improve their skills. For example, if a student prefers reading, teachers may have them watch a video and take notes to improve their listening skills.
- ELL students and students with learning disabilities should have multiple forms of instruction including visual and written instruction sheets as well as a verbal instruction and demonstration.

ENGAGEMENT (5 minutes)

- (Set timer for: 1 min) Have students talk about whether they have been to the ocean. “Have you been to the ocean?”
  - ➔ *If yes,* ask, “What kind of things do you see there? What kind of animals or plants live there?”
  - ➔ *If no,* ask, “From books, pictures, movies, or TV shows, can you describe what the ocean is? What kind of plants and animals live there?”
- (Timer: 1 min) Show a **picture of coral reef**. Ask: “What is this? Describe what you see or already know.” *(Student misconception: a plant/animal)* State that this is coral reef (type of rock). Then, ask: “How do you think these are important to the plants and animals that live in oceans?”
- Give 1 minute (timed) for *think-pair share* (within groups of 3-4 students) and then have students discuss as a class (for last minute of Engage) how they see coral reefs as being important to ocean life.

TRANSITION: “Today we will be creating a miniature model of coral reefs to see how animals and plants depend on and use coral reef systems.”

EXPLORATION (25 minutes)

- Students will be given a supplementary worksheet (Diorama Worksheet) to fill out about what they plan on using or adding in their dioramas as well as a Coral Reef Ecosystem Handout. The Coral Reef Ecosystem Handout will serve as a resource for students to use when filling out their Diorama Worksheet. Each student will fill out their own diorama worksheet and work on the dioramas in groups of 3-4.
- Group Roles should be assigned by teacher: for groups of 4: Marine Life Scientist, Diorama Designer, Technical Writer, and Presentation Organizer; for groups of 3: have the Technical Writer and Marine Life Scientist both also act as Presentation Organizers.
  - **Marine Life Scientist:** Helps draw, cut, and/or glue the animals, plants, and coral needed for the diorama based on the Coral Reef Ecosystem Handout and Diorama Worksheet; also helps organize the presentation.
  - **Diorama Designer:** Mainly draws, cuts, and/or glues the animals, plants, and coral needed for the diorama and arranges the different species in a manner that makes sense (i.e. most plants (not algae) on the ground, not floating on top of the diorama) based on the information provided on the Coral Reef Ecosystem Handout and Diorama

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Worksheet.
    - **Technical Writer:** labels the diorama with a title, labels the animals, plants, and coral appropriately through the use of the Diorama Worksheet and/or the Coral Reef Ecosystem Handout; writes a short caption of the diorama that explains the ecosystem.
    - **Presentation Organizer:** works with and helps everyone else; uses the Coral Reef Ecosystem Handout as well as the Diorama Worksheet to come up with an outline for the short presentation based on how the diorama is designed and labelled.
        - For the last 5 minutes of Explore, all other members of the group should work with the Presentation Organizer to discuss how to present their diorama. Each person should talk during the presentation.
- During the entire Explore, the teacher should walk around the classroom to make sure groups are staying on task and to help guide the activity.
- The Diorama Worksheet should serve as a supplement to the Diorama project. The teacher should instruct students to **first** complete their short worksheet in their Diorama groups (should take 2 minutes, up to a *maximum of 5 minutes timed*) and then turn it in, so that the teacher can provide feedback. The Diorama worksheets serve as a guide to what animals and plants live in coral reefs and relies on information provided in a separate Coral Reef Ecosystem Handout. Once worksheet is checked and approved, the groups will receive their dioramas along with supplies for one group. Groups will have 20 minutes (timed!) to work on their diorama and come up with a short presentation (1-2 minutes) explaining the animals and plants that live in the same environment as coral reefs.
    - Teachers should allow for student-directed learning during this time, but should also be highly engaged while students are performing activities, asking questions of the students one-on-one or while they are working in groups.

TRANSITION: "Alright, now that you have all worked on your Dioramas, lets come back as a class for group presentations."

EXPLANATION (10 minutes)

- Students will come to the front of the classroom and present their dioramas (1-2 minute short presentation - no longer than 2 minutes). Other students and the teacher will ask probing questions regarding the appearance of their diorama.
- *Probing questions* which teachers can ask include: "What part of the ocean does your diorama take place in?", "Does the sun reach the animals, plants, and coral reefs in your diorama? Why or why not?", "Are coral reefs living or not alive? Explain.", and even "From this activity what would you say is a coral reef?"
- Common *student misconceptions* include: "The diorama can be in any part of the ocean, and it can also be in lakes or rivers." , "The sun reaches parts of the diorama near the top, but not near the bottom, because it's too dark at the bottom.", "Coral reefs are rocks so they don't live" or "Coral reefs are plants so they are alive." , "Coral reefs are an animal because they have animals living in it."

TRANSITION: "So hand in your group dioramas and Diorama Worksheets, now we'll delve deeper into how humans affect this ecosystem."

ELABORATION (10 minutes)

- The following elaborate is used with technology, a non-technology alternate is listed in a separate "Elaboration Activity - Non-Technology Alternative" section near the end of this document.
- First, tell students to go to the website above by writing the website URL on the board or under the doc cam. Prior to conducting the activity, give students the Coral Reef As Endangered

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Ecosystem Handout so that each group can record their answers.

- Have each group pick the Overfishing for Food situation (should be the first one on the webpage).
- Have the groups answer the hypothesis question before checking to see the Immediate, and Short-Long Term Effects.
- Students should correct or keep their early hypotheses based on the new graph.
- Have students explore the other situations for the remainder of the time.
- Finally, collect all group handouts (summative assessment) and have students put away their technology.
- Vocabulary that will be introduced includes hypothesis and population.
- The activity focuses on environmental consequences from human overfishing, promoting awareness of human actions on coral reef ecosystems as well as how to interpret graphs when connecting data back to the preliminary hypothesis.
- The activity or activities will be described *in detail* in pages behind this along with the Coral Reef As An Endangered Ecosystem Handout.

TRANSITION: "Now, you should hand in all your Coral Reef As An Endangered Ecosystem Handout and group diorama to me, and make sure your area is clean."

EVALUATION (throughout entire lesson)

- Formative assessment will be conducted by teacher as students work collaboratively on dioramas and when students present their diorama work in the Explain.
- Summative Assessment will include students filling out Diorama Worksheet (to guide how the dioramas will be set-up) as well as the Coral Reef As An Endangered Ecosystem Handout.

SOURCES AND RESOURCES:

- **Dr. Adrienne Correa's *Hot Science – Cool Talks #111,* "Texas' Own Coral Reefs: Weathering the Storm",** http://www.esi.utexas.edu/talk/texas-coral-reefs/
- **Whyville - Coral Reef Simulation,** http://j.whyville.net/smmk/reef/simulation#history
- **Kids Do Ecology - Santa Barbara, NCEAS, © 2004** http://kids.nceas.ucsb.edu/biomes/coralreef.html

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ENGAGEMENT ACTIVITY

Purpose: To draw interest in coral reefs and engage students by having them remember the ocean/think about the ocean.

Materials: A picture of coral reef:

Safety Information: N/A

Procedure: Listed above in lesson plan (Engage)

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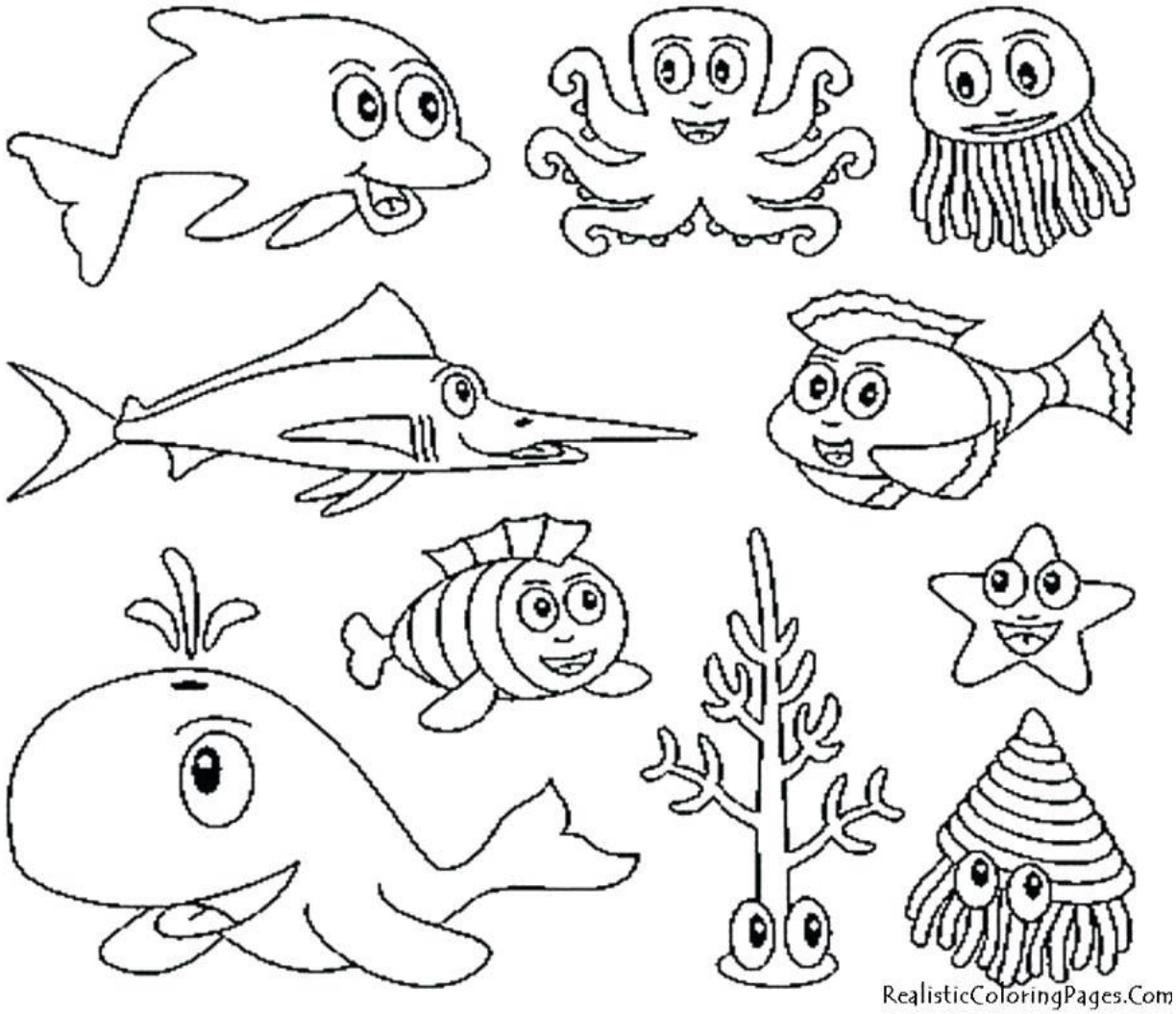
EXPLORATION ACTIVITY -

TEACHER TEMPLATE FOR RECOMMENDED ADVANCED PREPARATION

Purpose: To have students model and visualize the coral reef ecosystem and what plants and animals live in it.

Materials: Example printable pictures of marine life (plants and animals) are within the next 4 pages.



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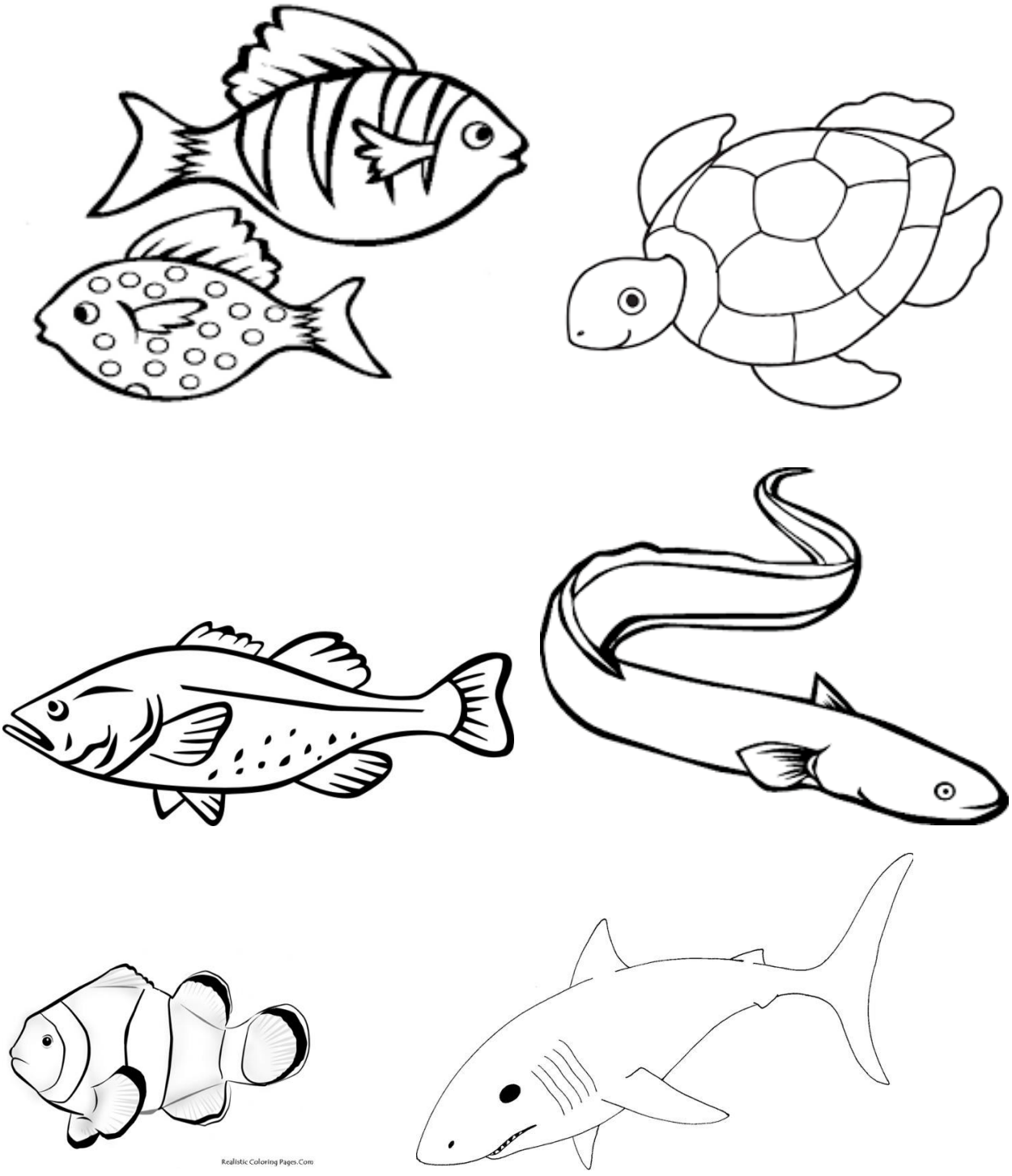

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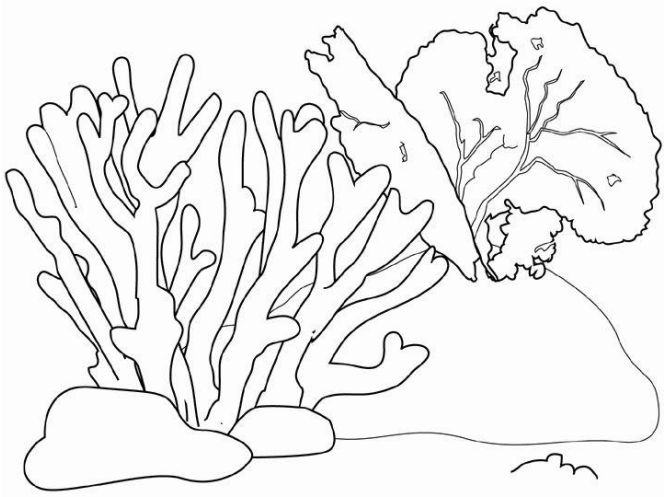

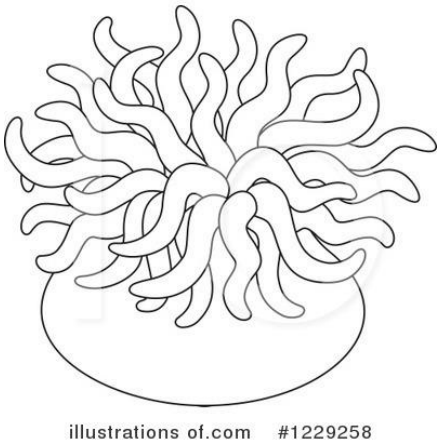

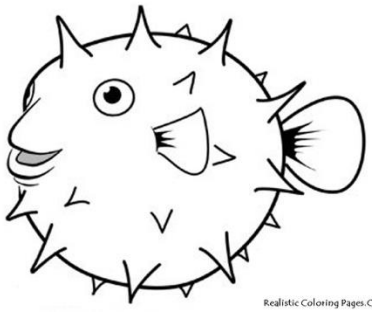

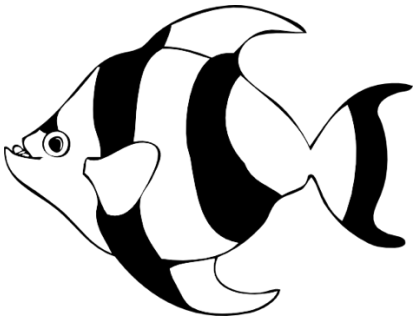

Safety Information: If students are handling hot glue guns, please make sure they are supervised and are aware of how to properly handle one (as they may accidentally burn themselves or others). Please make sure all students are aware of safety risks of scissors, and handle them carefully.

Procedure: Listed above in lesson plan (in the Explore section)

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ELABORATION ACTIVITY - TECHNOLOGY ACTIVITY: Reef Simulator

Purpose: To have students use technology to visualize how human activities interfere with healthy coral reef systems through interpreting graphical representations of data.

Materials: Access to Internet (at least 1 computer/tablet per group)
http://j.whyville.net/smmk/reef/simulation#history

Safety Information: N/A

Technology Activity Procedure:

1. Tell students to go to the website above by writing the website URL on the board or under the doc cam. Prior to conducting the activity, give students the Coral Reef As Endangered Ecosystem Handout so that each group can record their answers.
2. Have each group pick the Overfishing for Food situation (should be the first one on the webpage).
3. Have the groups answer the hypothesis question before checking to see the Immediate, and Short-Long Term Effects.
4. Students should correct or keep their early hypotheses.
5. Have students explore the other situations for the remainder of the time.
6. Finally, collect all group handouts (summative assessment) and have students put away their technology.

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ELABORATION ACTIVITY - NON-TECHNOLOGY ALTERNATIVE

Purpose: To have students interpret graphical representations of coral reef population data through changes in circumstances (human interference).

Materials: Student Elaborate Handout

Safety Information: N/A

Non-Technology Activity Procedure:

1. Hand out Coral Reef As Endangered Ecosystem Handout, and have students complete them in groups. Tell students that the first graph at the top of the page is of a healthy coral reef, with different types of fish, plant, and coral populations.
2. Have students work on their Handouts in groups (3-4). Tell students to work each problem in order, otherwise the handout will not make sense.
3. Depending on time allowances, for extra time, teacher should lead student discussion on results as a whole class.
4. Teacher will then collect the Handouts.

Coral Reefs as an Endangered and Diverse Ecosystem

EXPLORE STUDENT HANDOUTS:

Names:_____

Diorama Worksheet:

To be completed before the Diorama activity.

1. Where are coral reefs found? (type of environment, type of water/current)

2. What animals are usually found in coral reefs?

3. What plants are usually found in coral reefs?

Now turn in this worksheet to your teacher to get it checked before you can work on your dioramas!

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EXPLORE STUDEN HANDOUT

Names:_____

Coral Reef Ecosystem Handout: [1]

LOCATION: Coral reefs are generally found in clear, tropical oceans. Coral reefs form in waters from the surface to about 150 feet (45 meters) deep because they need sunlight to survive. There are three types of reefs and the types can be found in Hawaii and the Caribbean, or farther offshore in the Indo-Pacific Ocean and Caribbean Sea. *The largest reef in the world, the Great Barrier Reef in Australia is longer than 1200 miles (1900 km). That's longer than the distance between Seattle, WA and Los Angeles, CA!*

HABITAT: Coral reefs need water that is between 68 - 82°F (20 - 28°C), which is often located along the eastern shores of land. Reefs usually develop in areas that have a lot of wave action because the waves bring in food, nutrients and oxygen to the reef. Waves also prevent sediment from falling on the reef. Reefs need shallow warm waters.

PLANTS: The sun is the source of energy for the coral reef ecosystem. As animals eat the plants and other animals, energy is passed through the food chain. Reef building corals work together with microscopic algae, called zooxanthellae, that live within the corals. The zooxanthellae provide oxygen and food to the coral, while the coral polyp gives the algae a home. Besides zooxanthellae, algae and seagrasses are the main types of plants in the coral reef ecosystem. These plants give food and oxygen to the animals that live on the reef. Seagrasses are especially important because they provide shelter for younger reef animals like conch and lobster.

ANIMALS: *Did you know that there can be as many different types of fish in two acres of coral reef in Southeast Asia as there are species of birds on the entire continent of*

[1] **Source for entire document: Kids Do Ecology - Santa Barbara, NCEAS, © 2004, http://kids.nceas.ucsb.edu/biomes/coralreef.html**

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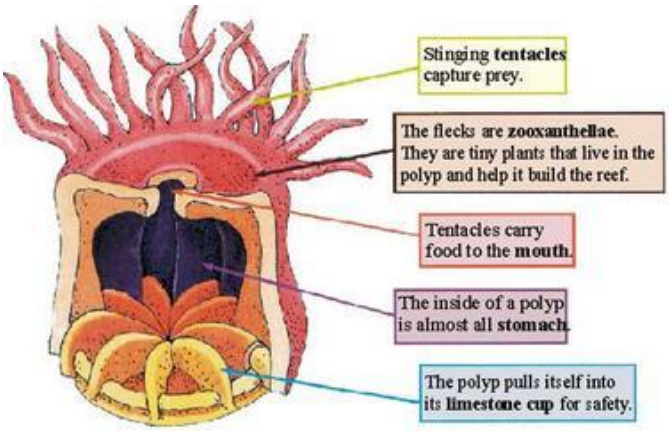
North America? Shocking, isn't it? Coral reefs only make up about 1% of the ocean floor, but they house nearly 25% of life in the ocean. Animals use coral reefs either as a stopping point, as they travel the deep blue sea, or they live as residents at the reef.

The corals themselves are the most numerous animal on the reef. They are tiny organisms called "polyps," that attach themselves to the hard reef and live there forever. The reef is like a giant apartment building in New York City and the coral polyps live together in each apartment. Corals are closely related to sea anemones and sea jellies, and use their tentacles for defense and to capture their prey. Corals can be a variety of colors, white, red, pink, green, blue, orange and purple, due to natural coloring and the zooxanthellae in their tissues.



Other animals that live on the coral reef include sea urchins, sponges, sea stars, worms, fish, sharks, rays, lobster, shrimp, octopus, snails and many more. Many of these animals work together as a team like the coral polyps and zooxanthellae. One example of this teamwork on the reef is the anemonefish and sea anemone. The sea anemone's tentacles provide protection and safety for the fish and their eggs, while the fish protects the anemone from predators, such as butterflyfish.

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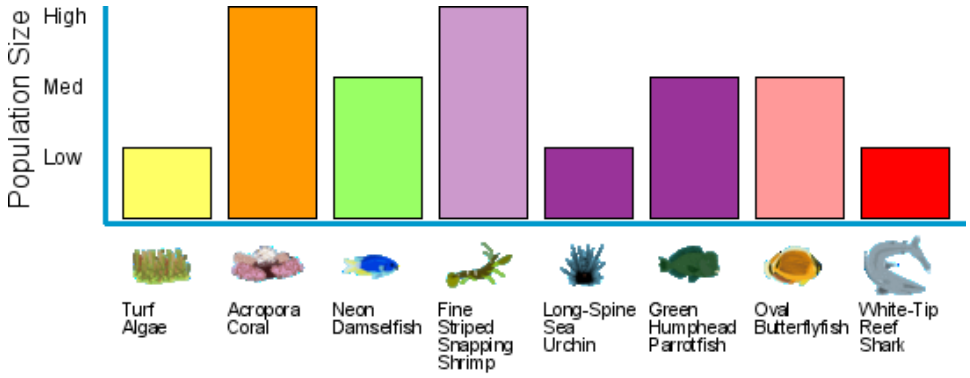
ELABORATE STUDENT HANDOUT

Names:_____

Coral Reef As An Endangered Ecosystem Handout:
(Source: http://j.whyville.net/smmk/reef/simulation#history)

The graph below shows some populations of species that live in a **healthy coral reef.**

Healthy Reef



Situation:

Overfishing For Food: when people catch too many fish from a reef to eat.

A fishing company wants medium and large reef fish to sell at fish markets. Every day they take thousands of these fish from the reef.

1. Create a hypothesis as a group for the situation above based off the description listed above, at the right. Your hypothesis relates back to the graph at the beginning of the handout.

I hypothesize that_____ population will decrease. (Choose only one answer)

A. all the fish

B. only the larger fish (Green Humphead Parrotfish and White-Tip Reef Shark)

C. the larger fish (Green Humphead Parrotfish and White-Tip Reef Shark) and the Acropora Coral

D. none of the species

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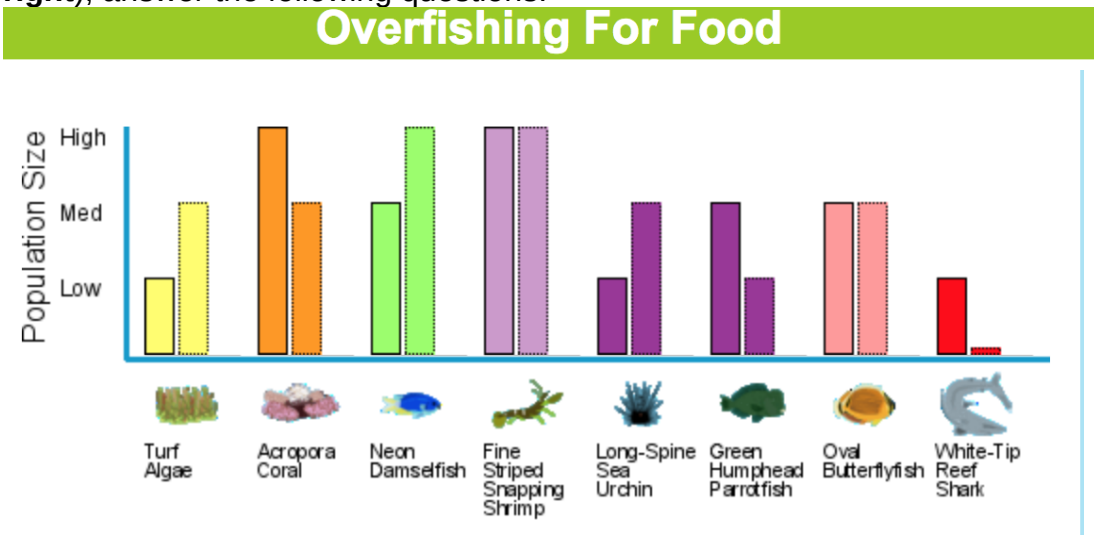
The graph below shows the immediate effects of overfishing for food. From comparing the "Healthy Reef" column (on the **left**) to the "Overfishing For Food" column (on the **right**), answer the following questions:



2. The Neon Damselfish population _____
   A. Increased
   B. Decreased
   C. Stayed the same

3. The White-Tip Reef Shark and Green Humphead Parrotfish populations _____
   A. Increased
   B. Decreased
   C. Stayed the same

4. The Acropora Coral population _____
   A. Increased
   B. Decreased
   C. Stayed the same

5. Based on your results from Questions 2-4, was your hypothesis correct? Why or why not?

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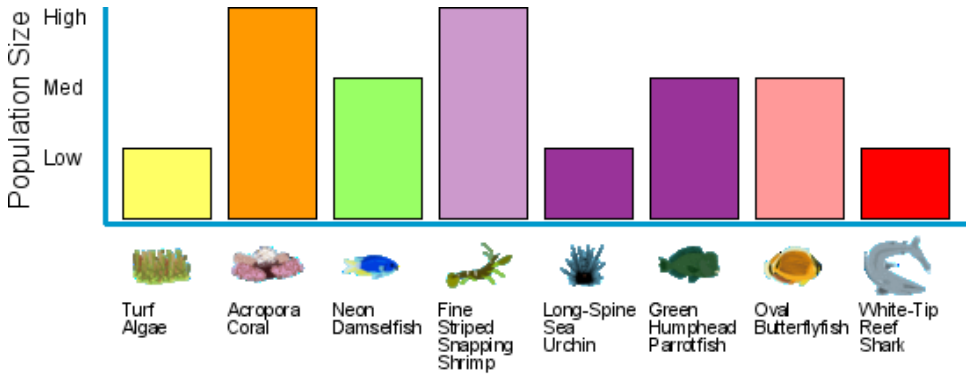
ELABORATE TEACHER HANDOUT (KEY)

Names:_____

Coral Reef As An Endangered Ecosystem Handout:

The graph below shows some populations of species that live in a **healthy coral reef.**

Healthy Reef



Situation:

Overfishing For Food: when people catch too many fish from a reef to eat.

A fishing company wants medium and large reef fish to sell at fish markets. Every day they take thousands of these fish from the reef.

1. Create a hypothesis as a group for the situation above based off the description listed above, at the right. Your hypothesis relates back to the graph at the beginning of the handout.

I hypothesize that_____ population will decrease. (Choose only one answer)

A. all the fish

B. only the larger fish (Green Humphead Parrotfish and White-Tip Reef Shark)

C. the larger fish (Green Humphead Parrotfish and White-Tip Reef Shark) and the Acropora Coral

D. none of the species

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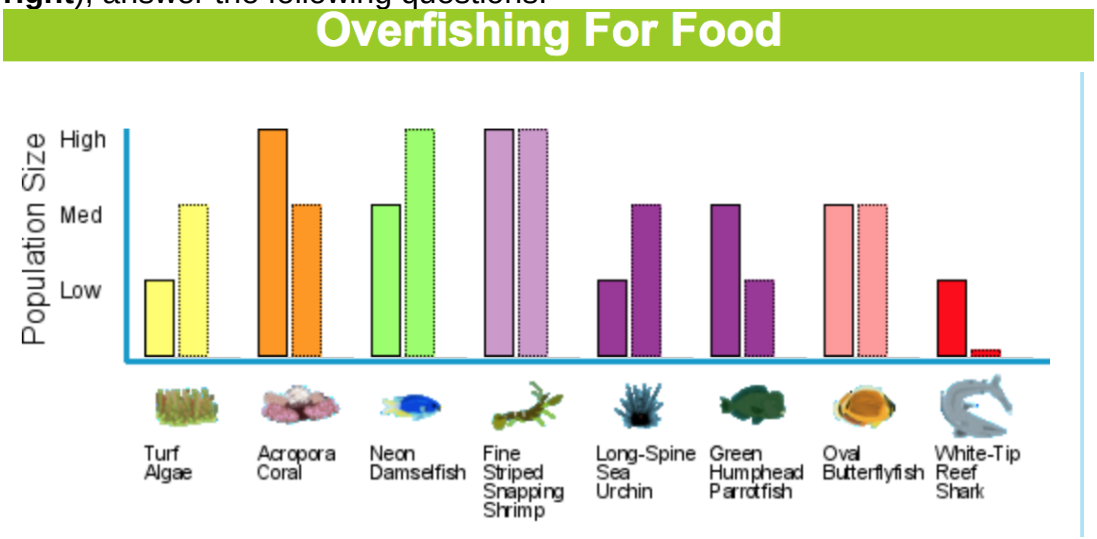
(Source: http://j.whyville.net/smmk/reef/simulation#history)

The graph below shows the immediate effects of overfishing for food. From comparing the "Healthy Reef" column (on the **left**) to the "Overfishing For Food" column (on the **right**), answer the following questions:



2. The Neon Damselfish population _____
   D. Increased
   E. Decreased
   F. Stayed the same

3. The White-Tip Reef Shark and Green Humphead Parrotfish populations _____
   D. Increased
   E. Decreased
   F. Stayed the same

4. The Acropora Coral population _____
   D. Increased
   E. Decreased
   F. Stayed the same

5. Based on your results from Questions 2-4, was your hypothesis correct? Why or why not?

Student explanations will vary.

- If correct then possible justifications include: the fishing company wanted all the medium and large fish.
- If incorrect, then possible justifications include: I thought all the fishes would be sold by the fishing company.