

Adaptations From the Depths: Octopus

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Adaptations From the Depths: Octopus
Flower Garden Banks National Marine Sanctuary



Overview of Learning Experiences

Key Concepts: Marine organisms adapt to their habitats in a variety of ways. Octopi, for example, have developed their own unique strategy of camouflage. They can change almost instantly to match the color and texture of their surroundings—even sporting stripes or a stippled texture in an attempt to blend in with their environment. And, since octopi have no rigid skeleton, they can squeeze through the tiniest openings and holes in the ocean floor to hide. As a last resort, they can use jet propulsion and a black cloud of ink as a diversion for an escape.

TEKS

- 3.9** The student knows that species have different adaptations that help them survive and reproduce in their environment.
- (A) observe and identify characteristics among species that allow each to survive and reproduce.
 - (B) analyze how adaptive characteristics help individuals within a species to survive and reproduce.

Engage

- Students will observe and list examples of camouflage in nature, especially in the marine environment.

Explore

- Students will identify camouflage as a means for survival.
- Students will describe and identify different types of camouflage.

Explain

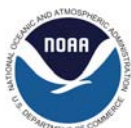
- Students will identify camouflage as an example of adaptation and describe the importance of adaptations.

Elaborate

- Students will describe and identify characteristics that allow members of a species to survive.

Evaluate

- Students will demonstrate how camouflage works in the environment.



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What Is It?

ENGAGE:

Materials needed for the class:

- A variety of large pictures that show land animals using camouflage. Be careful to select animals that your students already know.
- A variety of large pictures that show marine animals using camouflage.
- A sheet of heavy paper, the same size as your largest pictures, with a small window cut from it.
- Chart paper in the same format as the handout
- Chart markers
- Octopus video

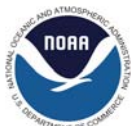
Materials needed for each student:

- Handout – *Animals That Use Camouflage*
- Learning Log
- Pencil

Teacher Notes: *Students need to build learning connections from the familiar to new information. It is important to allow students to identify the concept of camouflage in animals they are familiar with, then move to animals in the marine environment that utilize similar strategies.*

Procedure:

1. Place the “window” page over one of your pictures so that only a portion of the picture is visible through the opening. Show the picture to the class. Ask students to guess the identity of the animal, then reveal the full picture. Repeat this process with each of your pictures. (*Students should discover that all objects or pictures are not as they seem to be.*)
2. Ask students if they know what is meant by camouflage. Explain that camouflage is a way to hide in the environment.
3. Brainstorm with the students to create a list of animals that use camouflage in nature, starting with the land animals from the pictures used earlier.
4. Distribute the *Animals That Use Camouflage* handout to students.
5. Record the names of these animals inside the circle on the chart while students record the same information on their handouts. If students mention names of animals that do not seem to use camouflage, list these outside the circle on the chart and have students do the same on their handouts.
6. *Most students will have had experiences with land animals, not marine animals. Lead students to think of marine animals.* Show students the pictures of camouflaged marine animals used earlier in the lesson. Help them identify these animals then add them to their handouts. Encourage students to think of other marine animals that use camouflage as well.
7. Show the octopus video so that the students can see camouflage in action.
8. Have students use their Learning Logs to write down any questions they have about animals that use camouflage as a way to survive.



Animals That Use Camouflage

ALL ANIMALS

Animals That Use Camouflage



Sand Box Animals

EXPLORE I:

Materials needed for the class:

- Overhead projector
- Transparency of *Sand Box Animals* work page
- Transparency marker

Materials needed for each group:

- 1 shallow box (such as a copy paper box lid or *Coke* flat)
- Sand, enough to cover the bottom of the box
- Several different grades of sandpaper

Materials needed for each student:

- Scissors
- Pencil
- Crayons
- Safety goggles
- Learning Log

Teacher Notes: *This activity gives students a concrete experience with the abstract concept of camouflage. Allow the students to explore with sand, and sandpaper cut-outs to discover what allows animals to blend in with their environment and what does not. This is a simulation of how animals may hide in their environment by taking on the color, texture and even shape of rocks and sand commonly found on the ocean floor. Explain that although we are studying camouflage in sand, camouflage can occur among rocks, in the water, on a reef, etc. Discuss how this model is and is not like the real world.*

Procedure:

1. Divide students into groups of four and distribute all of the supplies except sand.
2. Require all students to put on their safety goggles and take this opportunity to discuss why this is important. (*Sandpaper is made with sand. Sand can cut the surface of the eye.*)
3. Have students design and cut out a variety of sandpaper marine animals that they think would be well camouflaged on a sandy ocean bottom. Allow time for them to manipulate and explore the materials. Monitor students' needs and offer various suggestions as to what shapes, colors, and textures they might use to investigate.
4. Pour sand into each of the boxes and ask the students to spread it around until the entire bottom of the box is covered.
5. Have each group of students place its animals in its box of sand, then rate how well the different animals blend in.
6. Ask students to record, in their Learning Logs, what they discovered and what method they used to evaluate how effectively the animal was hidden. They can use descriptions, drawings, etc. *The top half of the transparency can be displayed as a model for the students' journal notes (cover the bottom half to prevent distraction).*



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7. Once observations are complete, direct student attention to the overhead transparency. Let one person from each group record which of their animals was considered the best camouflaged. Have the students from each group explain what shape, color, and texture were used to hide that animal.
8. Discuss the results: What characteristics do all of the best choices have in common? Are they all of the same grade of sandpaper? The same color? The same shape? Why do you think that happened?
9. Have students consider how their models are and are not like real marine animals and use this information to complete the t-chart on the overhead transparency. Ask the students to make similar notes in their journals.



Sand Box Animals

1.

Animal _____

Color _____

Shape _____

Texture _____

3.

Animal _____

Color _____

Shape _____

Texture _____

2.

Animal _____

Color _____

Shape _____

Texture _____

4.

Animal _____

Color _____

Shape _____

Texture _____

How are the models **like** real marine animals?

How are the models **different from** real marine animals?



Gooze Moves

EXPLORE II:

Materials needed for each group

- Gooze – PREPARE AHEAD
- Containers in a variety of shapes (i.e. cylinder, cube, rectangular prism)
- 2 funnels with different size openings
- Stopwatch
- Octopus video

Materials needed for each student:

- Handout – *Gooze Moves*
- Learning Log
- Pencil

Teacher Notes: *Octopi can quickly change shape, color, and texture to blend in to their environment. In this Explore activity, students will use gooze to discover how an object can change shape and how that shape change can help it squeeze through small openings.*

Prepare Ahead:

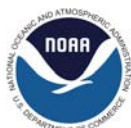
To make Gooze you will need to combine equal parts white school glue and liquid starch. Mix together thoroughly then knead with your hands until you get a consistency that holds together and is not sticky. You may have to play around with the amounts as the temperature and humidity on any given day can affect how things mix together. If the mixture is too sticky, add a little more starch and mix some more. The final mixture should pull away easily from the sides of the container and fall right into your hand when the container is turned upside down.

Procedure:

1. Divide students into groups of four and distribute their supplies.
2. Have each group select a timekeeper.

Part A:

3. Allow the students to discover how the gooze can adapt and change shapes by placing it in different containers. Have one student in each group mold the gooze into a ball, and then place it inside one of the containers.
4. Tell students to observe the gooze until it stops moving.
5. Repeat steps 3 and 4 for each container, allowing a different student to place the gooze in the container each time.
6. Once all of the shapes have been tested, ask the students to use their observations to answer the handout questions for Part A.



7. Discuss the students' answers. How is the gooze able to take the shape of the containers? (*Very flexible and moldable*) How is this like an octopus? (*No rigid skeleton*) Is this a good model for how an octopus can change its shape? Why or why not? (*No, an octopus has arms that stick out from the center of the body. Yes, it's very flexible like an octopus. No, an octopus can decide where to go. No, an octopus can propel itself. Students may have other answers that are equally valid, but require them to justify their answers.*)

Part B:

8. Allow students to discover how the gooze can move from one place to another by letting it flow through a funnel.
9. Have the students place the funnel with the larger opening over the top of an empty container so that the sides of the container support the funnel.
10. Have one student mold the gooze into a ball, and then place it in the funnel.
11. As soon as the ball is placed in the container, the timekeeper should start the stopwatch and time how long it takes for the gooze to flow completely into the bottom container.
12. On Part B of the handout, each student should record the amount of time it took.
13. Repeat steps 9-12 using the funnel with the narrower opening.
14. Show the octopus video and have students think about how this activity relates to the video.
15. Ask the students to use their data and personal observations to answer the handout questions in part B.
16. Discuss the students' answers. How is the gooze able to move from the funnel to the container below? (*Very flexible and moldable*) How is this like an octopus? (*No rigid skeleton*) What do the different size funnels represent in this model? (*Different size openings in the reef*) Do you think an octopus would move more quickly through a smaller or larger opening? (*An octopus can fit through a larger opening more quickly.*) Why might this be important? (*Needs to escape quickly from predators*) Is this a good model for how an octopus can change its shape? Why or why not? (*Yes, the gooze flows through the larger opening more quickly, just like an octopus. No, the octopus controls its movements and can go back out. Students may have answers that are equally valid, but require them to justify their answers.*) In the video, why was the octopus having trouble finding a hiding place?
17. Ask students to record, in their Learning Logs, any thoughts they have about how an animal can quickly change its shape and why this would be useful.



Camouflage Concepts

EXPLAIN I:

Materials needed for the class:

- Overhead projector
- Plain transparency
- Transparency marker
- Octopus video
- Video clips of marine animal camouflage

Materials needed for each group:

- Sand box animals
- Container of gooze

Materials for each student:

- Learning Log
- Pencil

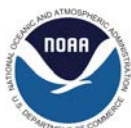
Teacher Notes: *This is an excellent time to monitor what the students learned from the activity and check for misconceptions. At this time, the students do most of the talking.*

Procedure:

1. Explain that camouflage is an adaptation for survival. An adaptation is a characteristic that enables an animal to live where it lives and do what it does. Some animals have more adaptations than others. Each type of camouflage is a separate adaptation.
2. Discuss with students what they learned about camouflage in the previous two activities (*Sand Box Animals*, and *Gooze Moves*). Use the words adaptation, camouflage, texture, etc. throughout the discussion. Have the sand box animals and gooze available. Play the octopus video again, for reference.

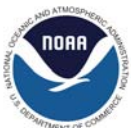
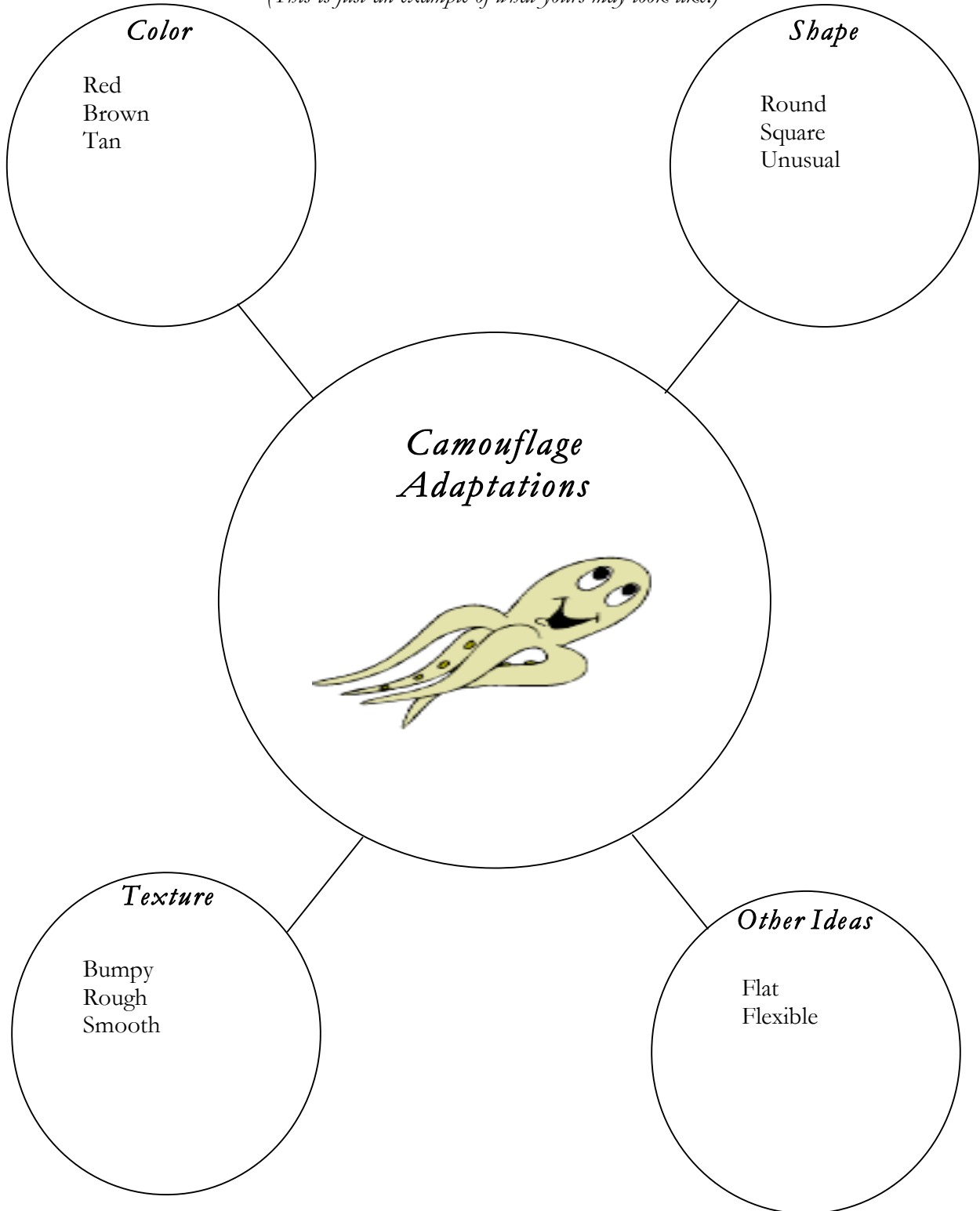
Possible discussion questions: *Which color animal was best camouflaged in the sand box? Which texture of animal was best camouflaged in the sand box? Which animal shape was best camouflaged in the sand box?*

3. Using the discussion information, complete a *Camouflage Concept Map* on the overhead, using the example provided on the next page as a guideline. Have students generate the label for each sub-category (i.e. types of camouflage such as color, texture, shape, movement, orientation) then give examples of each.
4. Have students duplicate the concept map in their Learning Logs.
5. Show the students a short video of other ocean animals using camouflage as a defense mechanism. This time ask the students to tell you where in the video they see examples of camouflage adaptations.



Camouflage Concept Map

(This is just an example of what yours may look like.)



Hide and Seek

EXPLAIN II:

Materials for class:

- Overhead projector
- Clear glass baking dish
- Water
- Different colors of ink, paint or food coloring
- Eyedroppers



Materials for each group:

- Permanent markers in a variety of colors

Materials for each student:

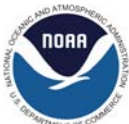
- Small picture of an octopus cut from a transparency – PREPARE AHEAD
- Learning Log
- Pencil

Teacher Notes: *Students have already worked with models that help explain octopus texture, color, and shape. In this activity, they will be challenged to create a model that explains how an octopus uses ink to conceal its presence so that it may escape from its enemies.*

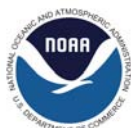
Prepare Ahead: Copy Octopus Patterns page onto a clear transparency. Cut transparency so that each octopus is separate. Repeat this procedure until there is one octopus for each student.

Procedure:

1. Divide students into groups of four and distribute their supplies.
2. Place the octopus picture on the overhead with the glass dish full of water on top of it.
3. Turn on the overhead and show students what it looks like. The octopus is plainly visible. This represents an octopus in the ocean. *Be sure to clarify with students that although the octopus is placed under the dish for the purposes of this activity, an octopus cannot climb under the ocean. However, if you place the octopus model in the water, it will float around and hinder the function of this model.*
4. Ask each student to color an octopus using the permanent markers.
5. Show students the variety of ink/paint/food coloring available. Challenge each group to decide what colors would effectively hide a majority of their octopi.
6. Have each group develop a hypothesis and a testing procedure, and then record it in their Learning Logs. Remind them that a hypothesis is a statement saying what they think will work. The testing procedure is how they will determine if their hypothesis is correct.
7. Allow one group to explain their hypothesis and how they will test it. Then, have them test the hypothesis in front of the class. All students should record the results in their Learning Logs.
8. Discuss the group's hypothesis and testing procedure. Was the hypothesis clearly stated? Was the testing procedure well developed and easy to follow? Was it an appropriate testing procedure for the hypothesis?
9. Clean out the glass dish and refill it with fresh water.
10. Repeat steps 7-9 with each of the other groups.
11. Ask the students to summarize their findings in their Learning Logs.



Octopus Patterns



Sea Globe

EXPLAIN III:

Materials for each group:

- Clear plastic bottle or jar with lid (ex: 10 oz. mustard jar)
- Clean sand, enough to cover the bottom of the jar
- Oil-based clay (not play dough), enough to hold octopus to bottom of jar
- Transparency picture of an octopus from Hide and Seek activity
- Water

Teacher Notes: *This activity allows students to discover that lying flat on the bottom or under the sand is an effective way to hide from potential prey or predators.*

Procedure:

1. Divide students into groups of four and distribute their supplies.
2. Tell students that they will be creating a water globe to demonstrate how an octopus hides.
3. Ask each group to select an octopus from the previous activity and attach it to the inside of the jar lid using a small piece of clay.
4. Instruct students to pour clean sand into the bottom of the jar then fill the jar most of the way to the top with fresh water.
5. Have students place the lid, with the octopus attached, onto the top of the jar and secure it tightly.
6. Allow students to gently shake up the sea globes then place them upside down on the table so that the sand settles down around the octopus.
7. Ask students to observe what happens as the sand settles and record the observations in their Learning Logs.
8. Allow students to reposition the octopus or try different color octopi, and then record their new observations in their Learning Logs.
9. Allow each group to demonstrate and explain their results to the class. Discussion should lead the students to understand that an animal's orientation (position) can make the difference in how well it is hidden in the environment.

Possible discussion questions could include:

Which color was best to hide the octopus and why? Which color was the least effective and why? What position hid the octopus the best? Vertical or horizontal?



Ocean Animal Research Paper

ELABORATE:

Materials for Class:

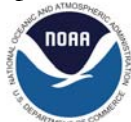
- A variety of resources for research (i.e. web sites, books, articles, pictures, slides)
- Photos and video clips from previous activities
- Resource materials from the Flower Garden Banks National Marine Sanctuary transparency of *Ocean Animal Research* sheet
- Overhead projector
- Overhead markers

Materials for each student:

- Handout - *Ocean Animal Research*
- Handout - *Ocean Animal Research Paper Grading Rubric*
- Writing paper
- Pencil

Procedure:

1. Ask the class to brainstorm and make a list of marine animals that use camouflage. *Students may have difficulty naming marine animals.* List the animals on the overhead so that the entire class can see. *Allow this list to grow as the discussion continues.* (Examples: hermit crabs, flounder, butterflyfish)
2. Show students photos and video clips from the previous activities and ask the students to identify different types of camouflage that animals use to survive. Responses may include color, shape, texture, movement, orientation, flexibility, etc.
3. Review vocabulary words and post them in a visible location in the room (i.e. adaptations, camouflage, texture, orientation, etc.).
4. Have each student choose a marine animal to research and find out how it uses camouflage.
5. Provide students with a variety of resources (i.e. books, pictures, articles, web sites, etc.) and opportunities to gather information on their marine animals. For suggestions, see the list of references at the end of this packet.
6. Instruct students to use the *Ocean Animal Research* handout to guide their research and record their findings. *Be sure to show students the first two sections of the grading rubric that will be used to evaluate this part of the project so that they know what is expected of them.*
7. On the overhead, model how to use the research sheet using information about the octopus.
8. Use section one of the *Ocean Animal Research Paper Grading Rubric* to evaluate the students' research skills before they proceed to the next step.
9. Instruct each student to write a five-paragraph research paper on his/her selected animal. This will include one paragraph for each of the categories outlined on the *Ocean Animal Research* handout, an introductory paragraph and a conclusion. Remind students to reflect on the different types of camouflage mentioned above to help them in writing their research papers. *Be sure to show students the last three sections of the grading rubric that will be used to evaluate this part of the project so that they know what is expected of them.*
10. Give students an appropriate amount of time to research and write their papers.
11. Use the *Ocean Animal Research Paper* grading rubric to evaluate the students' papers.



Ocean Animal Research

Physical Characteristics	Life Characteristics	Habitat
1. Where does it get its name?	1. What does it eat?	1. Where in the world does it live?
2. Size (height, length, weight)	2. How does it move?	2. Describe its habitat.
3. Colors	3. How does it protect itself?	3. What are its natural enemies?
4. Unusual characteristics	4. Does it live alone or in a group?	4. What other problems does it have?
5. How are the male and female different?	5. How does it reproduce its young?	5. Where does it have its babies?



Ocean Animal Research Paper Grading Rubric

RESEARCH:

Amount of Information

- _____ 1. 1 or more topics are not addressed.
- _____ 2. 1 or more topics are not addressed. Of the topics that are addressed, most questions are answered.
- _____ 3. All topics are addressed and most questions are answered.
- _____ 4. All topics are addressed and all questions are answered.

Sources

- _____ 1. Some sources are not accurately documented.
- _____ 2. All sources are accurately documented, but many are not in the desired format.
- _____ 3. All sources are accurately documented, but a few are not in the desired format.
- _____ 4. All sources are accurately documented in the desired format.

PAPER:

Quality of Information

- _____ 1. Information has little or nothing to do with the main topic.
- _____ 2. Information clearly relates to the main topic. No details and/or examples are given.
- _____ 3. Information clearly relates to the main topic. 1-2 supporting details and/or examples are given.
- _____ 4. Information clearly relates to the main topic. Several supporting details and/or examples are given.

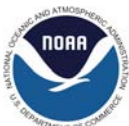
Organization

- _____ 1. Information appears to be disorganized.
- _____ 2. Information is organized, but paragraphs are not well constructed.
- _____ 3. Information is organized with well-constructed paragraphs.
- _____ 4. Information is very organized with well-constructed paragraphs.

Mechanics

- _____ 1. Many grammatical, spelling, or punctuation errors.
- _____ 2. A few grammatical, spelling, or punctuation errors.
- _____ 3. Almost no grammatical, spelling, or punctuation errors.
- _____ 4. No grammatical, spelling, or punctuation errors.

Differentiation for special populations may include several types of projects with the same content criteria established for the research paper. For instance, a poem, acrostic, play or skit, commercial, etc.



Diorama

EVALUATE:

Materials for Class:

- A poster of the Flower Garden Banks National Marine Sanctuary as a possible model.

Materials for each group:

- Glue
- Scissors
- Crayons
- Markers
- Map pencils
- Tissue paper
- Construction paper
- Clay or play dough
- Shoebox
- Any other “junk items” that students can use to make the diorama

Teacher Notes: *The students’ products should illustrate an understanding of how camouflage can be used as a means of defense or for obtaining food.*

Procedure:

1. Instruct students to build their own coral reef habitats within their shoeboxes, using the provided materials.
2. Have students add animals that would be found in this habitat, demonstrating various examples of camouflage. Students can draw or create the animals using the provided materials.
3. Allow each student to give an oral presentation about his/her diorama and the examples of camouflage it includes.
4. Discuss how the dioramas are different or similar to the real animals or habitats.
5. Use the *Diorama* grading rubric to evaluate the students’ projects and presentations.



Diorama Grading Rubric

Accuracy of Content

- _____ 1. Several of the reef elements are not represented accurately.
- _____ 2. All but 2 of the reef elements are represented accurately.
- _____ 3. All but 1 of the reef elements are represented correctly.
- _____ 4. All of the reef elements are represented correctly.

Knowledge Gained

- _____ 1. Student can NOT correctly explain or identify uses of camouflage as represented in the diorama.
- _____ 2. Student can correctly explain uses of camouflage as represented in the diorama, with prompting.
- _____ 3. Student can easily and correctly explain 1-2 uses of camouflage as represented in the diorama.
- _____ 4. Student can easily and correctly explain 3 or more uses of camouflage as represented in the diorama.

Creativity

- _____ 1. Little thought was put into making the diorama interesting. Included 0-1 examples of camouflage.
- _____ 2. Student tried to make the diorama interesting. Included 1 example of camouflage.
- _____ 3. Student put some thought into making the diorama by representing a variety of objects. Included 2 or more examples of camouflage.
- _____ 4. Student put a lot of thought into making the diorama as shown by creative use of materials and variety of objects represented. Included 3 or more examples of camouflage.



References

Amazing Animal Disguises. Sowler, Sandie. Alfred A. Knopf, New York, 1992. Has a few examples of sea creatures. ISBN 0-679-82768-4

A good resource for land and sea camouflage.

Animal Camouflage. A Closer Look. Powzuk, Joyce. 1990 Bradbury Press, New York, 1990. ISBN 0-02-774980-0

Uses the blue ring octopus for concealing coloration and disruptive coloration, a batfish for disguise, and kelp crab for masking. Overall a good book on camouflage, although these animals are not found in our local ocean environment.

Animal Camouflage. The Animal Kingdom. Penny, Malcolm. The Bookwright Press. New York, 1988. ISBN 0-531-18166-9

Animal Clues. Drew, David. Crystal Lake. Rigby Books. IL. 1988. No ISBN #

Animal Defenses. Penny, Malcolm. The Bookwright Press. New York, 1988. ISBN 0-531-18192-8
Good background information.

Animals That Live in the Sea. The National Geographic Society. Library of Congress. 1978. ISBN 0-87044-264-3

Camouflage, Nature's Defense. Ferrell, Nancy Warren. Franklin Watts. USA, 1989. ISBN 0-531-10688-8

A good resource for color changes, counter shading, disruptive coloration and false eyespot.

Hard-To -See Animals. Fowler, Allan. Children's Press. NY, 1997. ISBN 0-516-020548-X

A few examples of marine animals.

Hidden Animals. Drew, David. Rigby Books. IL 1988.

How to Hide an Octopus and Other Sea Creatures. Heller, Ruth. Grosset and Dunlap, Inc. New York, 1986. ISBN 0-448-10476-8

Octopus. Carrick, Carol. Clarion Books. New York, 1978. ISBN 0-8164-3207-4

Underwater Weapons. Animal Weapons. Stone, Lynn. M. The Rourke Press, Inc. Vero Beach, Florida 32964. 1996. ISBN 1-57103-162-6



Master Materials List

1. ENGAGE: WHAT IS IT?

Materials needed for the class:

- A variety of large pictures that show land animals using camouflage. Be careful to select animals that your students already know.
- A variety of large pictures that show marine animals using camouflage.
- A sheet of heavy paper, the same size as your largest pictures, with a small window cut from it.
- Chart paper in the same format as the handout
- Chart markers
- Octopus video

Materials needed for each student:

- Handout – *Animals That Use Camouflage*
- Learning Log
- Pencil

2. EXPLORE I: SAND BOX ANIMALS

Materials needed for the class:

- Overhead projector
- Transparency of *Sand Box Animals* work page
- Transparency marker

Materials needed for each group:

- 1 shallow box (such as a copy paper box lid or *Coke* flat)
- Sand, enough to cover the bottom of the box
- Several different grades of sandpaper

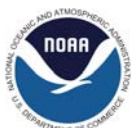
Materials needed for each student:

- Scissors
- Pencil
- Crayons
- Safety goggles
- Learning Log

3. EXPLORE II: GOOZE MOVES

Materials needed for each group

- Gooze – PREPARE AHEAD
- Containers in a variety of shapes (i.e. cylinder, cube, rectangular prism)
- 2 funnels with different size openings
- Stopwatch
- Octopus video



Materials needed for each student:

- Handout – *Gooze Moves*
- Learning Log
- Pencil

4. EXPLAIN I: CAMOUFLAGE CONCEPTS

Materials needed for the class:

- Overhead projector
- Plain transparency
- Transparency marker
- Octopus video
- Video clips of marine animal camouflage

Materials needed for each group:

- Sand box animals
- Container of gooze

Materials for each student:

- Learning Log
- Pencil

5. EXPLAIN II: HIDE AND SEEK

Materials for class:

- Overhead projector
- Clear glass baking dish
- Water
- Different colors of ink, paint or food coloring
- Eyedroppers



Materials for each group:

- Permanent markers in a variety of colors

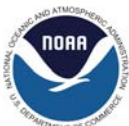
Materials for each student:

- Small picture of an octopus cut from a transparency – PREPARE AHEAD
- Learning Log
- Pencil

6. EXPLAIN III: SEA GLOBE

Materials for each group:

- Clear plastic bottle or jar with lid (ex: 10 oz. mustard jar)
- Clean sand, enough to cover the bottom of the jar
- Oil-based clay (not play dough), enough to hold octopus to bottom of jar
- Transparency picture of an octopus from Hide and Seek activity
- Water



7. ELABORATE: OCEAN ANIMAL RESEARCH PAPER

Materials for Class:

- A variety of resources for research (i.e. web sites, books, articles, pictures, slides)
- Photos and video clips from previous activities
- Resource materials from the Flower Garden Banks National Marine Sanctuary
- Transparency of *Ocean Animal Research* sheet
- Overhead projector
- Overhead markers

Materials for each student:

- Handout - *Ocean Animal Research*
- Handout - *Ocean Animal Research Paper Grading Rubric*
- Writing paper
- Pencil

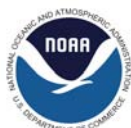
8. EVALUATE: DIORAMA

Materials for Class:

- A poster of the Flower Garden Banks National Marine Sanctuary as a possible model.

Materials for each group:

- Glue
- Scissors
- Crayons
- Markers
- Map pencils
- Tissue paper
- Construction paper
- Clay or play dough
- Shoebox
- Any other “junk items” that students can use to make the diorama



NATIONAL SCIENCE EDUCATION STANDARDS (NSES)

All Grades

Content Standard A: Science as inquiry

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Grades 3-4

Content Standard C: Life Science

- Characteristics of organisms
- Organisms and environments

Grade 5

Content Standard C: Life Science

- Structure and function in living systems
- Diversity and adaptations of organisms

OCEAN LITERACY PRINCIPLES

5. The ocean supports a great diversity of life and ecosystems.

(d) Ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

TEXAS ESSENTIAL KNOWLEDGE AND SKILLS (TEKS)

Grade 3

(3c) Represent the natural world using models and identify their limitations, including size, properties, and materials.

(4a) Collect, record, and analyze information using tools.

(4b) Use safety equipment as appropriate, including safety goggles and gloves.

(10a) Explore how structures and functions of plants and animals allow them to survive in a particular environment.

Grade 4

(3c) Represent the natural world using models and identify their limitations, including accuracy and size.

(4a) Collect, record, and analyze information using tools.

(4b) Use safety equipment as appropriate, including safety goggles and gloves.

(10a) Explore how adaptations enable organisms to survive in their environment.



Grade 5

- (2c)* Collect information by detailed observations and accurate measuring.
- (2d)* Analyze and interpret information to construct reasonable explanations from direct (observable) and indirect (inferred) evidence.

- (2f)* Communicate valid conclusions in both written and verbal forms.
- (4a)* Collect, record, and analyze information using tools.
- (4b)* Use safety equipment, including safety goggles and gloves.
- (9a)* Observe the way organisms live and survive in their ecosystem by interacting with the living and non-living elements.
- (10a)* Compare the structures and functions of different species that help them live and survive.



Animals That Use Camouflage

ALL ANIMALS

Animals That Use Camouflage



Adaptations From the Depths: Octopus
Flower Garden Banks National Marine Sanctuary



Sand Box Animals

1.

Animal _____

Color _____

Shape _____

Texture _____

3.

Animal _____

Color _____

Shape _____

Texture _____

2.

Animal _____

Color _____

Shape _____

Texture _____

4.

Animal _____

Color _____

Shape _____

Texture _____

How are the models like real marine animals?

How are the models different from real marine animals?



Gooze Moves

PART A:

1. How is the gooze able to take the shape of the containers?
2. How is this like an octopus?
3. Is this a good model for how an octopus can change its shape? Why or why not?

PART B:

Wider Funnel

Time: _____

Narrower Funnel

Time: _____

4. Through which funnel did the gooze travel the fastest?
5. What do the funnels represent in this model?
6. Do you think an octopus would move more quickly through a smaller or larger opening?
7. How is this important for an octopus to survive?
8. Is this a good model for how an octopus can change its shape? Why or why not?



Adaptations From the Depths: Octopus
Flower Garden Banks National Marine Sanctuary



Octopus Patterns



Adaptations From the Depths: Octopus
Flower Garden Banks National Marine Sanctuary



Ocean Animal Research

Physical Characteristics	Life Characteristics	Habitat
1. Where does it get its name?	1. What does it eat?	1. Where in the world does it live?
2. Size (height, length, weight)	2. How does it move?	2. Describe its habitat.
3. Colors	3. How does it protect itself?	3. What are its natural enemies?
4. Unusual characteristics	4. Does it live alone or in a group?	4. What other problems does it have?
5. How are the male and female different?	5. How does it reproduce its young?	5. Where does it have its babies?



Ocean Animal Research Paper Grading Rubric

RESEARCH:

Amount of Information

- 1. 1 or more topics are not addressed.
- 2. 1 or more topics are not addressed. Of the topics that are addressed, most questions are answered.
- 3. All topics are addressed and most questions are answered.
- 4. All topics are addressed and all questions are answered.

Sources

- 1. Some sources are not accurately documented.
- 2. All sources are accurately documented, but many are not in the desired format.
- 3. All sources are accurately documented, but a few are not in the desired format.
- 4. All sources are accurately documented in the desired format.

PAPER:

Quality of Information

- 1. Information has little or nothing to do with the main topic.
- 2. Information clearly relates to the main topic. No details and/or examples are given.
- 3. Information clearly relates to the main topic. 1-2 supporting details and/or examples are given.
- 4. Information clearly relates to the main topic. Several supporting details and/or examples are given.

Organization

- 1. Information appears to be disorganized.
- 2. Information is organized, but paragraphs are not well-constructed.
- 3. Information is organized with well-constructed paragraphs.
- 4. Information is very organized with well-constructed paragraphs.

Mechanics

- 1. Many grammatical, spelling, or punctuation errors.
- 2. A few grammatical, spelling, or punctuation errors.
- 3. Almost no grammatical, spelling, or punctuation errors.
- 4. No grammatical, spelling, or punctuation errors.



Diorama Grading Rubric

Accuracy of Content

- _____ 1. Several of the reef elements are not represented accurately.
- _____ 2. All but 2 of the reef elements are represented accurately.
- _____ 3. All but 1 of the reef elements are represented correctly.
- _____ 4. All of the reef elements are represented correctly.

Knowledge Gained

- _____ 1. Student can NOT correctly explain or identify uses of camouflage as represented in the diorama.
- _____ 2. Student can correctly explain uses of camouflage as represented in the diorama, with prompting.
- _____ 3. Student can easily and correctly explain 1-2 uses of camouflage as represented in the diorama.
- _____ 4. Student can easily and correctly explain 3 or more uses of camouflage as represented in the diorama.

Creativity

- _____ 1. Little thought was put into making the diorama interesting. Included 0-1 examples of camouflage.
- _____ 2. Student tried to make the diorama interesting. Included 1 example of camouflage.
- _____ 3. Student put some thought into making the diorama by representing a variety of objects. Included 2 or more examples of camouflage.
- _____ 4. Student put a lot of thought into making the diorama as shown by creative use of materials and variety of objects represented. Included 3 or more examples of camouflage.

