KELP SAILORS FOR THE SEA

KIDS ENVIRONMENTAL LESSON PLANS

This lesson developed by:

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Clam Jigsaw

Overview:
Students create a cutout model of a clam to investigate the anatomy, physiology and importance of these animals.

Ocean Literacy Principles:

2. The ocean and life in the ocean shape the features of Earth
5. The ocean supports a great diversity of life and ecosystems
7. The ocean is largely unexplored

Key Concepts:

- The shells and internal anatomy of mollusks reveal specialized adaptations for living in marine habitats
- Students will utilize science process skills including observation, communication, and organization

Materials:

- one set of Clam Activity Sheets per student
- scissors
- stapler
- glue
- crayons and pencil

Set-up Prior to Activity:

- Print enough Clam Activity Sheets (3 pages) for each student

Clam Jigsaw (cont.)

Duration:
50-60 min

Physical Activity:
Low

Background:
Clams are mollusks. These animals are found in shallow, fresh and saltwater environments worldwide. They are related to a diverse range of organisms from the illusive octopus to the banana slug in a forest.

A clam is one of the bivalve mollusks (animal with two shells) along with oysters, mussels, and scallops. These animals are some of the most familiar of the mollusk group because of their commercial value. The two valves of the clam are hinged together on one side and open along the other. When closed, two powerful muscles called adductor muscles hold the valves together. Each clam has a mantle or soft membrane layer on the inner surface of the valve. The mantle surrounds the soft body of the clam and makes the shell by extracting calcium from seawater and excreting in the form of a shell.

Most clams lie partly buried in the sand or mud with the hinge up and the shell slightly agape. In this position the animal can extend its fleshy foot and burrow through the mud like a plow. To feed, the clam uses a pair of straw-like siphons, which extend up through the mud into the water column. The incurrent siphon draws water through the clam's body. The gills extract oxygen and strain microscopic food (plankton) from the water. The excurrent siphon shoots out the used water and wastes. Clams also have a heart, liver, kidney, stomach and intestines.

Activity:
Give each student the Clam Activity Sheets, crayons, a pencil and a pair of scissors. If possible, project Clam Activity Sheets for all the students to see. Otherwise, have students follow along as you give these instructions:

1. Drawings A and B
    a. In drawing A, notice the lines on the shell. The two shells are called valves. What do you think the lines indicate? (Answer: Growth/age of a clam) Why is a hard shell important for a clam? (Answer: with limited movement and no other defense, a hard shell protects a clam from being eaten.) Color the valves light brown. (Depending on the class, you can permit students to color their clams any color they like).
    b. Drawing B shows the inside of the valves. Find the lined areas at the top and bottom of each valve. These are where the adductor muscles that help the clam keep its shell closed where attached. How might these be helpful? (Answer: They keep the clam safe from predators.) Color the adductor muscle scars pink.
    c. In drawing B, find the hinge. This holds the clam together and allows the shell to open. Color the hinge dark brown. Find the bumps below the hinge; these are the umbos—the point where the shell started to grown and from where it will continue to grow. Color the umbos gray.
    d. Cut out both drawings A and B. Follow the outlines carefully. Lay side A facedown with

Clam Jigsaw (cont.)

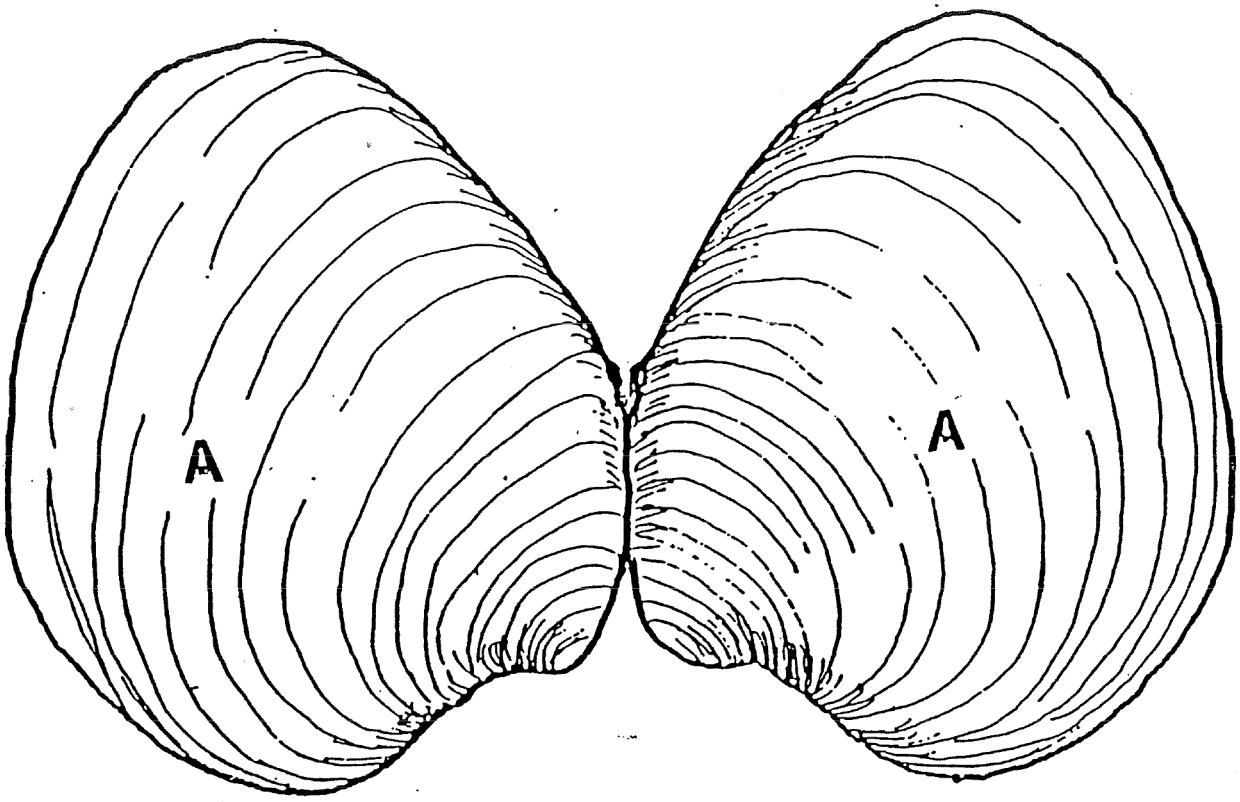
the white side up. Place side B on top with the letters right side up. Make sure the umbos are aligned. Now glue Drawings A and B together.

2. Drawings C and D
    a. On both drawings C and D, find the adductor muscles and color them pink. On both drawings C and D, find the siphons at the top. Color the siphons yellow. One side of the siphon sucks water into the clam. This is called the incurrent siphon. It brings in water, which carries food and oxygen. The other side or excurrent siphon pushes water carrying waste and carbon dioxide out of the clam. How might a clam feed when its body is buried in the mud or sand? (Answer: By extending the siphon up into the water to feed.)
    b. On drawings C and D color the remaining area purple. This is the mantle. The mantle is the soft membrane layer that makes the shell.
    c. On drawing C, the lines between the adductor muscles are called the pallial lines. This is where the mantle is attached to the shell. What might happen if a piece of sand gets between the shell and the mantle inside a clam? (Answer: The mantle secretes hard layers around the sand to make a pearl. Pearls are made of the same calcium material as a clam or oyster shell.)
    d. Cut out drawings C and D. Lay side C face down, white side up. Place side D on top of C with the letters right side up and siphons matching. Now glue C and D together.
3. Drawings E and F
    a. On drawings E and F, again color the adductor muscles pink.
    b. On drawings E and F, find the wedge-shaped sections along the outer-most edge and color it orange. This is the foot. The foot is a strong muscle that can stretch out and push or pull the clam around. Since the clam can feed by drawing water into itself, why does it need to move at all? (Answer: To relocate to a better feeding place or to escape predators.)
    c. On drawing E, find the lined gills between the adductor muscles and the hinge. Color them red. The gills do three important things. They absorb oxygen and release carbon dioxide. They also help to catch food particles and move them to the clams mouth. What would be small enough for clams to eat? (Answer: phytoplankton)
    d. Drawing F shows a cross section of the stomach, intestines, kidney, heart and other internal organs. A clam's heart has three chambers instead of four like a mammal's. Within the stomach is a crystalline style that releases a substance that helps to break down the clam's food. Color each organ a different color.
    e. Cut out drawings E and F carefully. Lay E face down with white side up. Place F white side down with the letters right side up. Make sure that the pieces are correctly aligned. Now glue E and F together.
4. Putting it all together
    a. Place A-B on the table with the B side up.
    b. Place C-D on top of A-B with the D side up.
    c. Place E-F on top of D with the F side up.
    d. Make sure that the hinges of our clam line up. Fold the three drawings in the middle and staple along the hinge line. Check to be sure everything is in order. The pages should turn like this: A,B,C,D,E,F,F,E,D,C,B,A. Enjoy your clam!

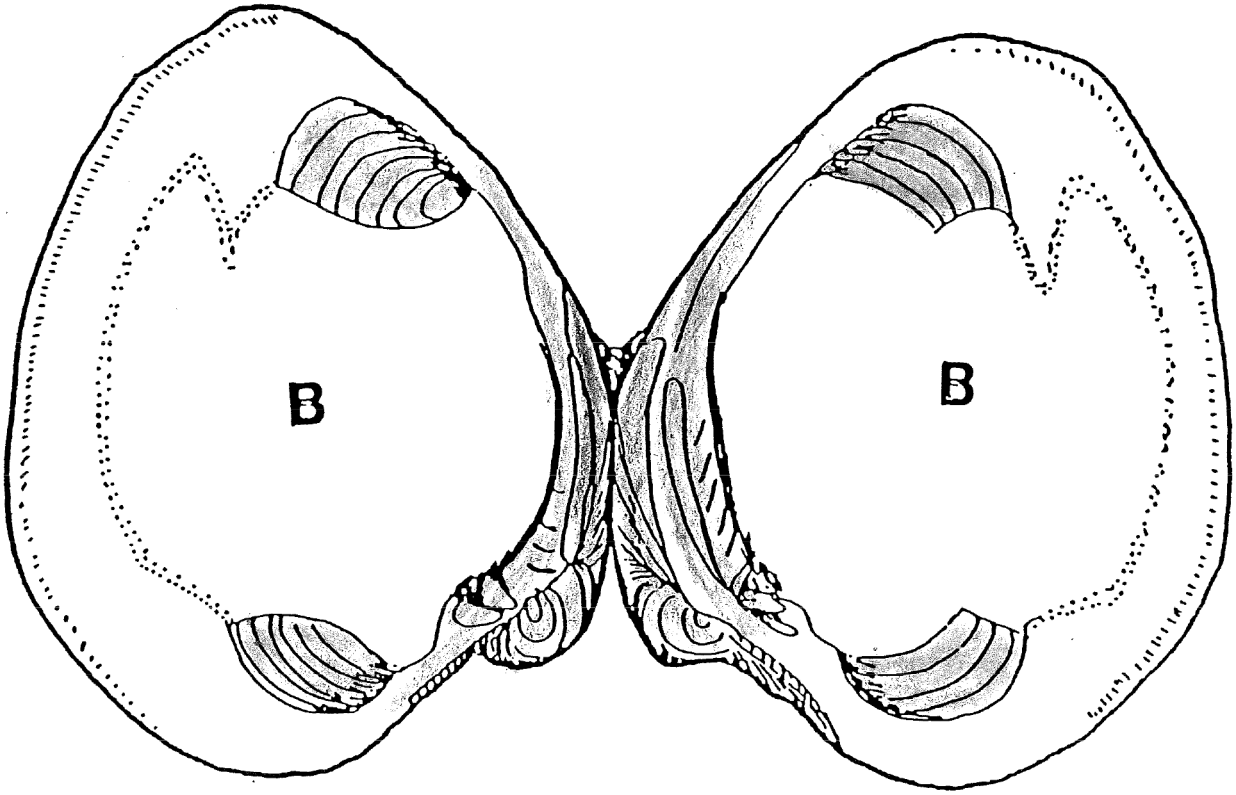
Clam Jigsaw (cont.)

Discussion:

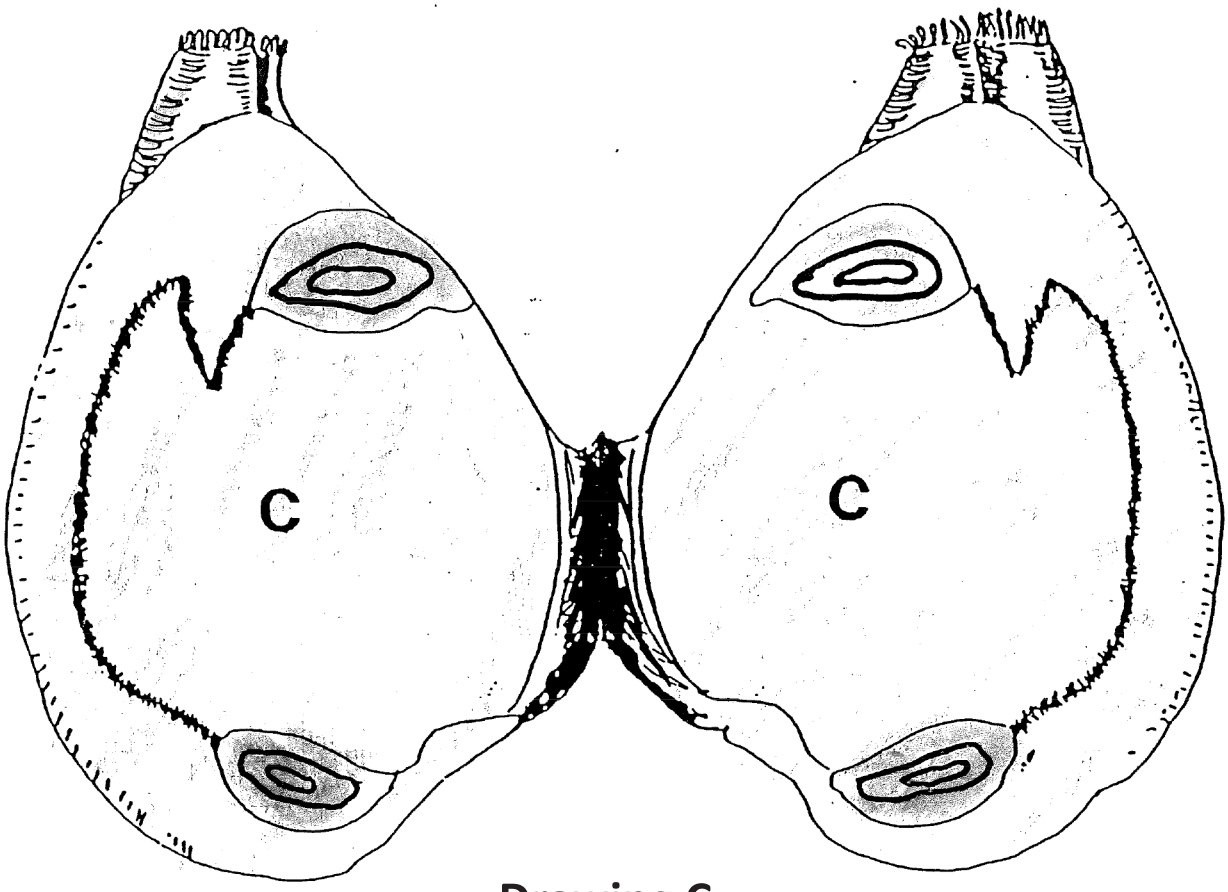
1. Have students position their clam as it would be for digging through the mud (hinge up). How does a clam move? (Answer: By extending and contracting its foot).
2. What animals eat clams? (sea otters, bat rays, sea stars, moon snails, sea gulls and other birds, people). How do these predators overcome the protective shell of the clam to get at the meat? (Answer: Sea otters often crack the shells with a rock. Sea gulls will drop them from a height on a hard surface to shatter the shell. Sea stars are able to pry apart the adductor muscle with their own strong stomach muscle. People use a hammer or nutcracker, or are able to steam or cook the clam to release the adductor muscle and open the shell).
3. What part of the clam do you eat? (Answer: the foot). By comparison, what part of an abalone do you eat? (Answer: the foot). How about an octopus or a squid? (Answer: the tentacles and the mantle).
4. Many people collect shells as a hobby; there are close to 100,000 kinds of shelled mollusks! (However, often they have to take the living animal in order to get the shell. Do you think this is right? What about collecting shells to sell at seaside resorts for commercial profit? Do you think this is okay? How could we protect mollusks that are becoming endangered because of human collecting?)



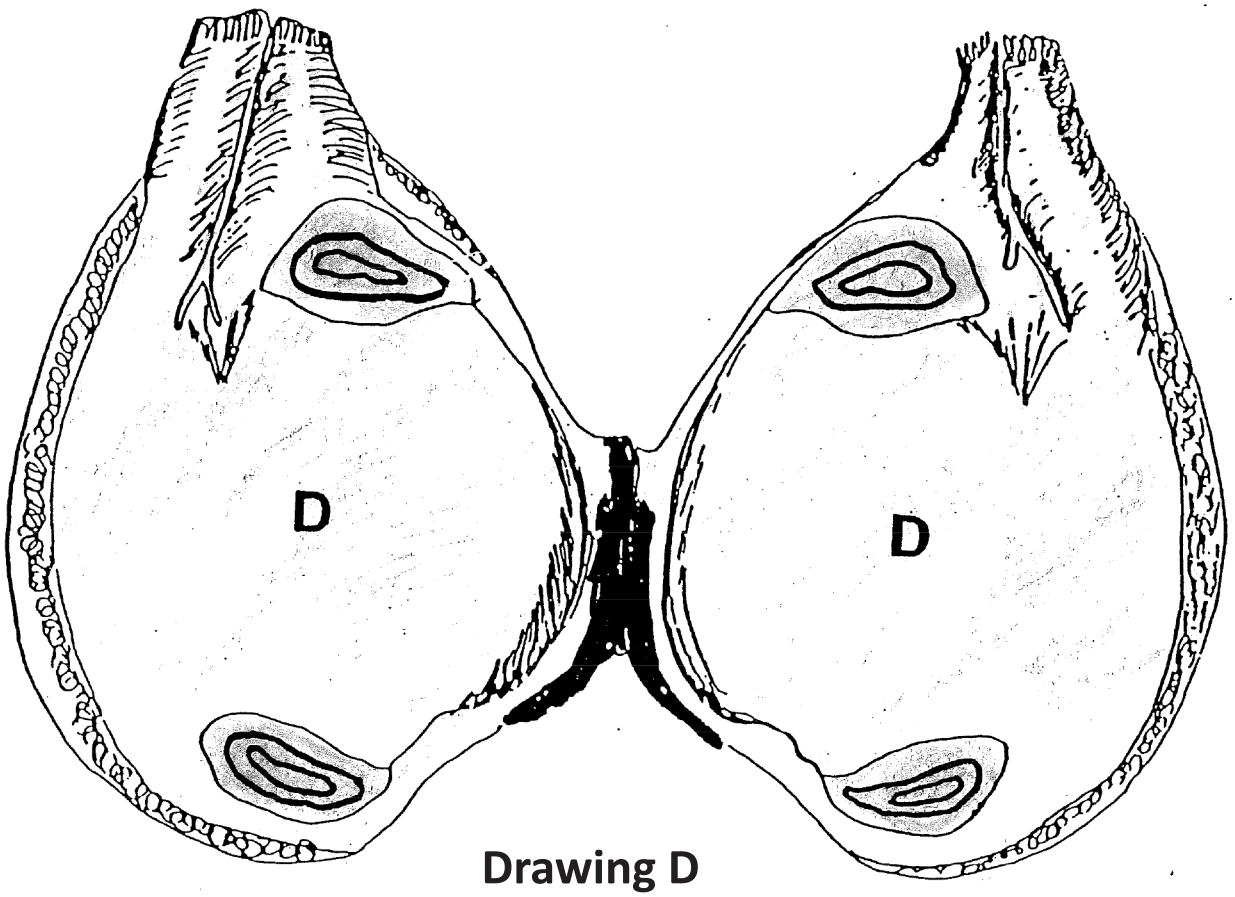
Drawing A



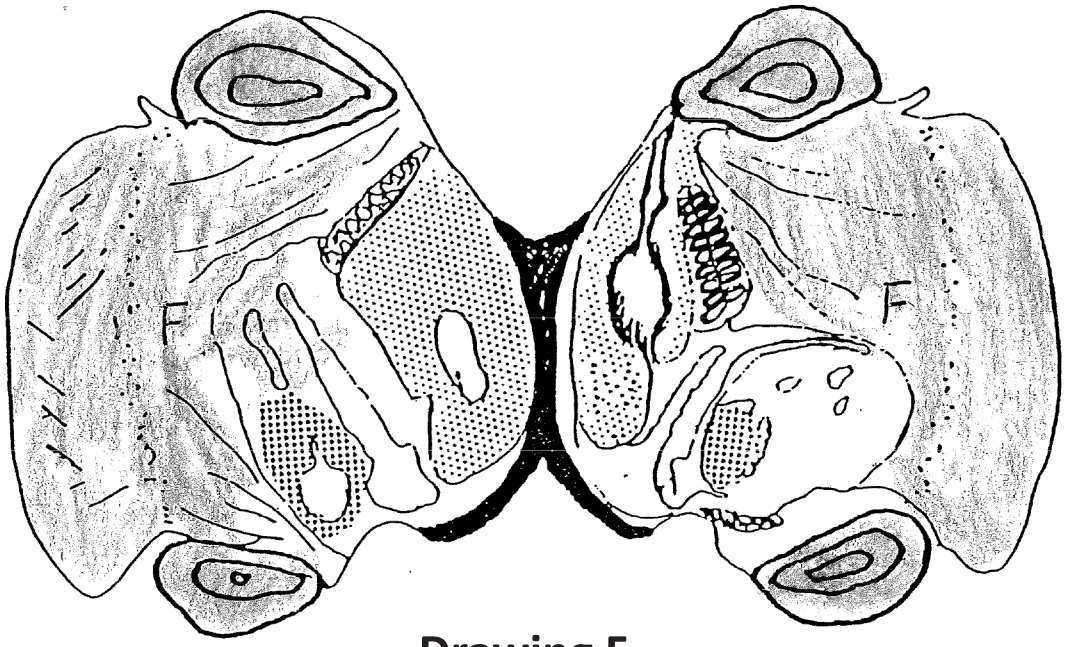
Drawing B



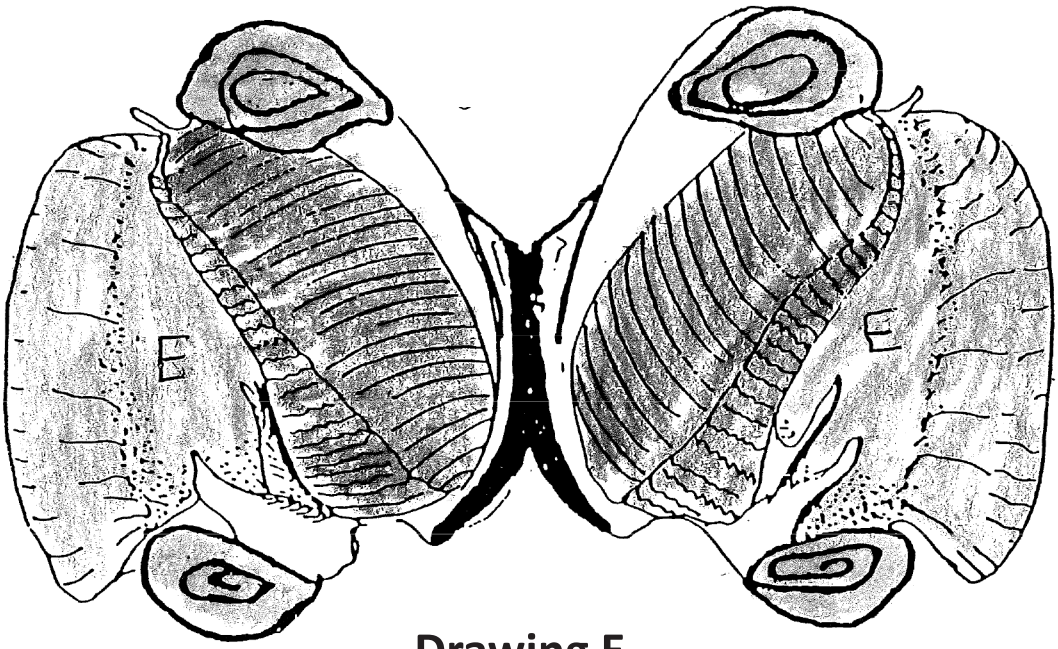
Drawing C



Drawing D



Drawing F



Drawing E