



LESSON 3

Mud Flats

Grades 4 – 7

(Based on a lesson by Gloria Snively “The Mud Flat” on page 265 of *Beach Explorations: A Curriculum for Grades 5-10.*)

Objectives

- To identify evidence of animals that live in a mud flat.
- To name at least 3 animals that live in mud flats.
- To make predictions about an animal’s adaptations and habitat needs
- To identify challenges to living in a mud flat

Materials

Video: *The Biology of the Seashore*, Biomedia Associates (www.ebiomedia.com).

Video: *The Biology of Annelids*, Biomedia Associates.

Book: *Beach Explorations: A Curriculum for Grades 5-10* by Gloria Snively, Oregon Sea Grant Program and Washington Sea Grant Program, 1998.

Book: *Between Pacific Tides* by Edward Ricketts, Jack Calvin and Joel W. Hedgpeth, Stanford University Press, 1985.

Jar of mud and water with plastic ocean creature in it (with secure lid).

Jar of sand and water with plastic ocean creature in it (with secure lid).

Drawings or photos of ghost shrimp, mud shrimp, lug worm, echiuroid worm, bamboo worm, pea crab, scale worm, heart shaped cockle, mud clam, dog whelk, hairy gilled worm, sea cucumber (Some excellent drawings and photos are in *Between Pacific Tides*).

Photos showing a mud flat, sandy beach and rocky shore.

Concepts

- Mud flats exist on most protected shores where currents and wave action do not carry the fine sediment away.
- Though few different species of animals live in mud flat habitat, there are large populations (numbers) of these highly specialized animals.
- There are many worms, clams and snails in mudflats but few crustaceans.

Activities

1. Introduction to mud flats

Show sections of the videos: *The Biology of the Seashore* and *The Biology of Annelids*.

Discussion notes:

- Strategies for survival in the mud include using hemoglobin pigments to lock up the limited available oxygen.
- Feeding by filtering is an important strategy, especially by clams.
- Worms and clams dominate the muddy substrate.
- Polychaetes worms have many bristles. They have side flaps called parapods and fingerlike gills. The parapods may be different shapes depending on where the worm lives. They can use them for digging paddles. Some can pull their parapods in to be more streamlined and move more easily.

Where can an animal live in a mud flat?

A: They can live on the surface or in shallow burrows beneath the surface.

What makes it hard to live in a mud flat?

A: Low oxygen, wind, wave action, fresh water, pollution, salinity, sun, snow, ice, difficulty moving, no hard surfaces for attachment, food gathering is hard work.

2. Being stuck in mud

Ask students if they have ever been stuck in mud. What was it like? How did they get out?

Ask students to move around the room as if they were walking in mud as deep as their



ankles. How difficult is it to move? Have them freeze and then try walking again in deeper and deeper mud. It is up to their knees, waist, over your head... Discuss how difficult it would be to move, as the mud got deeper.

3. Living in a mud flat

Think about what it would be like to live in a mud flat – the smell, how much space there is, how hard it is to move around, etc.

What would it be like for animals to live in a mud flat?

A: There isn't much oxygen in mud. It smells strong because of the bacteria breaking down decaying matter. It creates an environment so low in oxygen few organisms can survive. The lack of oxygen creates the rotten egg smell. It would also be hard to move and breathe.

What adaptations help them live in a mud flat?

A: Thin shells or skin, live at the surface or near the surface, burrows open to the surface, tubes or siphons to the surface, builds its own house.

Few of the animals here breathe through their skin and many fish and crabs can't survive because the mud would clog their gills.

Animals that burrow under the surface are safe from wave action, mud protects them from extreme temperatures and there is little danger of drying out.

4. Animals that live in a mud flat

What are some signs that there is life in the mud flat?

A: Holes, coiled worm castings, empty shells, slime trails.

Why couldn't rocky shore creatures live in a mud flat?

A: There is nothing for them to attach to. Unless there are some rocks around, the barnacles, chitons, mussels, sea urchins and sea stars can't live in the mudflat.

Show photo or drawing of a ghost shrimp.
Discussion notes:

One of the most interesting creatures that live in the mud flat is the ghost shrimp. It is well adapted for living in a burrow. Each pair of legs is specialized to do a different job – feeding, digging, swimming and grooming!

Activity Stations

Set up the 5 stations around the classroom. Split the students into 5 groups. They will go to each station and answer questions on their worksheets.

Station 1. Mud and Sand

Shake the jar of mud and water first, then shake the jar of sand and water. Put them both down and observe.

What happens to the particles of mud?

A: The water is very cloudy and it doesn't get clear. The particles of mud don't settle back to the bottom.

Can you see the creature in either jar?

A: You can see the model fish in the sand jar but not the mud jar.

How is mud different from sand?

A: The mud particles are much finer than the sand. The sand settles to the bottom and the water doesn't get cloudy when you shake it.

What is it like for the animals that live in the mud?

A: It would be hard to see or move now.

Station 2. Adaptations of Mud Flat Animals

Have students look at the photos or drawings of these mud flat animals: lugworm, mud shrimp, heart cockle, mud clam and bamboo worm.

Which animals make a U shaped burrow?

A: Lugworm, mud shrimp.

Which animals have a shell and siphons open to the surface?

A: Heart cockle, mud clam.

Which animal has the name of a tree that pandas like to eat?

A: Bamboo worm. The worm's body looks like bamboo.

Look at the pictures of these animals that live in a mud flats. Which of the following adaptations do they have – an animal may have more than one adaptation (from page 231 of *Beach Explorations*)? Write the number of the adaptation(s) beside the animal.

1. Shells
2. Protective shields or leathery skin
3. Tubes or siphons to the surface
4. Builds a protective shell house
5. Lives inside another animal
6. Anchoring device

Heart cockle • 1, 2, 3, 4

Dog whelk • 1

Mud clam • 1, 2, 3, 4

Bamboo worm • 2, 3, 4, 5

Mud shrimp • 2, 3, 4

Lug worm • 2, 3, 5

Station 3. Adaptations of Sand, Gravel and Mud Flat Animals

Look at the pictures of these animals that live in a mixed sand, gravel and mud habitat. Which of the following adaptations do they have – an animal may have more than one adaptation (from page 231 of *Beach Explorations*)? Write the number of the adaptation(s) beside the animal.

1. Shells
2. Protective shields or leathery skin
3. Tubes or siphons to the surface
4. Builds a protective shell house
5. Lives inside another animal
6. Anchoring device

Armored Scaleworm • 2

Hairy Gilled Worm • 3, 4

Orange Sea Cucumber • 2, 6

Green Burrowing Anemone • 3, 6

Pea Crab • 5

Horse Clam • 1, 2, 3, 6

Station 4. Mud Flat, Sandy Beach and Rocky Shore

Look at the cross section of a mud flat (page 265 of *Beach Explorations*).

Why do you think all the animals but one are burrowed under the ground?

A: There is nothing solid to anchor to or hide under at the surface so burrowing provides some protection.

What are some differences between a rocky shore, sandy beach and mud flat?

A: The rocky shore has lots of different animals and lots of places animals can live. The sandy beach is like the mud flat, except that there is more wave action on the sandy beach. There are few rocks for animals to attach to or hide under and many animals live under the sand or mud. Some animals on a sandy beach move in and out with the tide.

Look at the photo or drawing of a echiuroid worm, one inhabitant of mud flats.

Why do you think the echiuroid worm is called the innkeeper?

A: The worm has a burrow that other animals live in, like the pea crab and scale worm. By living in the burrow, these animals are protected from predators and eat leftovers from the echiuroid worm's meal.

What is a slime net? How do you think it is used?

A: A slime net is made by the echiuroid worm to catch animals for food. When the worm has caught some creatures, it eats them and the slime net as well. Any scraps that fall down the burrow are eaten by the other creatures living in the burrow.

Conclusion

- Go over the answers to the questions at each Activity Station.
- Review mud flat animals, their adaptations and challenges to living in a mud flat.
- Organize to go on a field trip to a mud flat.
- Students may want to study one organism in greater detail.