



## MUD CREATURE STUDY

**Overview:** The mudflats support a tremendous amount of life. In this activity, students will search for and study the creatures that live in bay mud.

**Content Standards Correlations:** Science p. 293

**Grades:** K-6

**Key Concepts:** Mud creatures live in high abundance in the mudflats, providing food for migratory ducks and shore-birds and the endangered California clapper rail. When the tide is out, the mudflats are revealed and birds land on the mudflats to feed.

**Objectives:**

Students will be able to:

- name and describe two to three mud creatures
- describe the mudflat food pyramid
- explain the importance of the mudflat habitat for migratory birds and endangered species

**Materials:**

**Provided by the Refuge:**

- 1 mud creature display
- 1 mudflat food pyramid poster
- 12 mud creature placemats
- 1 mud creature id. book
- 1 four-layered sieve set
- 1 bucket of mud and trowel
- 1 bucket of slough water
- 12 student microscopes
- 12 petri dishes
- 12 plastic microscope slides
- 12 hand lenses
- 12 microspatulas
- 12 eyedroppers
- 2 pitchers for slough water
- 3 shoebox mud samples
- Zoo

**Provided by the Educator:**

- copies of data sheets (p.190) and pencils, one per student (*optional*)

### TIME FRAME FOR TEACHING THIS ACTIVITY

**Recommended Time:** 30 minutes

**Mud Creature Display** (7 minutes)

- use the Mud Creature Display to introduce students to mudflat habitat

**Mudflat Food Pyramid** (3 minutes)

- discuss the mudflat food pyramid, using poster

**Mud Creature Study** (20 minutes)

- sieve mud in sieve set, using slough water
- distribute small samples of mud to petri dishes
- look for mud creatures using hand lenses
- use the microscopes for a closer view of mud creatures
- if data sheets and pencils are provided, students can draw what they find

### HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

**What are the Refuge's resources?**

- significant wildlife habitat
- endangered species
- migratory birds

**What makes it necessary to manage the resources?**

- Pollution, such as oil, paint, and household cleaners, when dumped down storm drains enters the slough and mudflats and travels through the food chain, harming animals.

**What can students do to help?**

Refuge staff study pollutants found in the Bay to see how they affect wildlife, but we need your help.

- Remember that things dumped down storm drains flow directly to the Bay. Do your part to not pollute
- Learn more about your watershed and what you can do to keep it healthy and tell others what you have learned

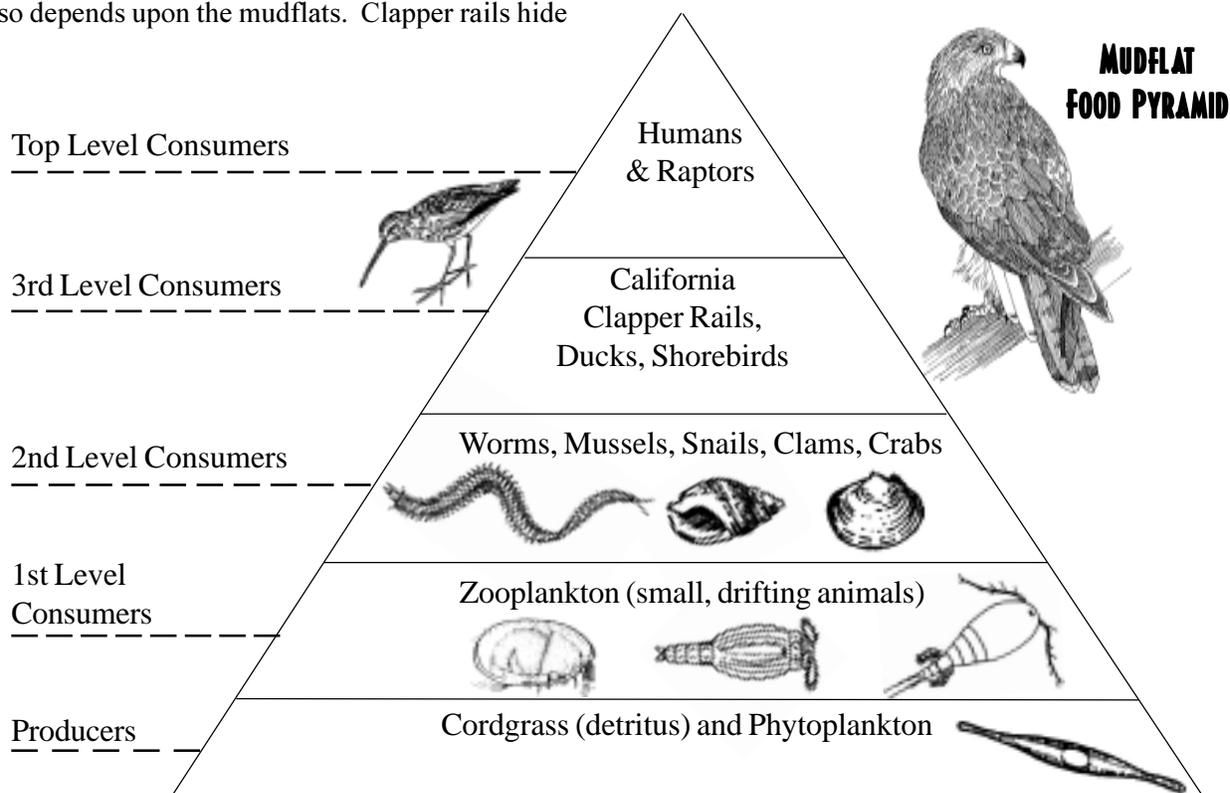


## SUPPORTING INFORMATION FOR THIS ACTIVITY

- Sloughs are “fingers” of San Francisco Bay. They are natural waterways connected to the bay and winding through the salt marsh. Because they are connected the bay, they are a tidal habitat. There are usually two high tides and two low tides each day.
- Mudflats appear in the slough channels and around the edges of the bay when the tide flows out.
- Despite an apparent lack of plants and animals, mudflats support an abundance of life. Thousands of organisms live in the mud!
  - Many of these organisms are microscopic or nearly microscopic, such as ostracods, copepods, and many different kinds of worms.
  - In addition to microscopic organisms, larger, more visible animals inhabit the mudflats as well, such as clams, mussels, snails, and crabs.
- When the mudflats are exposed at low tide, hundreds of shorebirds and waterbirds of varying sizes appear. They probe their beaks into the mud or sweep them across the mud’s surface in search of food - the mud creatures.
- Migratory ducks and shorebirds depend upon the mudflats. They use the San Francisco Bay as a feeding and resting stop as they travel along the Pacific Flyway.
- The California clapper rail, an endangered species, also depends upon the mudflats. Clapper rails hide

and nest in the pickleweed and cordgrass and feed on mud creatures in the mudflats.

- The diversity of mudflat plants and animals results in a dynamic **food pyramid**. A food pyramid explains the loss of energy between different levels of producers and consumers.
  - Cordgrass and **phytoplankton** (small, drifting plants) are producers; they support the entire food pyramid because they use sunlight to make their own food or energy.
  - **Zooplankton** (small, drifting animals) are the first level of consumers; they feed on dead, decomposed cordgrass (detritus) and phytoplankton.
  - **Worms, crabs, snails, mussels, and clams** (the mud creatures) feed on the zooplankton, phytoplankton, and detritus and represent the second level of consumers.
  - This is evident with **birds** (such as ducks, shorebirds, and the California clapper rail), which are the third level consumers, feeding on the mud creatures.
  - A food pyramid always reaches a final level where there are no additional natural predators. In this pyramid, **humans** and **raptors** (such as red-tailed hawks, Northern harriers, and peregrine falcons) are the top level consumers, feeding on the birds that use the mudflats.



---

## HOW TO LEAD THIS ACTIVITY BY FOLLOWING THE "DO, READ, ASK" TEACHING FORMAT

### Outside the Pumphouse

#### **Do**

Meet the students and point out the mudflat where the sample for the study was collected.

#### **Mud Creature Display** -(Inside, 7 minutes)

#### **Do**

Ask the students to sit at the table.

#### **Read**

"We are going to search for and study the creatures that live in the bay mud. But first let's look at the birds that feed in the slough channel when the tide is low and the mudflats are exposed."

#### **Do**

The mud creature display should be set to high tide, with the mud creatures hidden behind the flaps on the display and the birds in the air or in the high marsh.

#### **Read**

"Sloughs are fingers of San Francisco Bay that cover the mudflats at high tide. Sloughs are affected by the tides because they are connected to the bay which is connected to the ocean. Look at this display."

#### **Ask**

**Is it high tide or low tide?** (It is high tide because the slough is full of water.)

#### **Ask**

**? Why aren't the birds looking for food in the slough?** (The water is too deep to reach the creatures living in the mud at the bottom of the slough.)

#### **Read**

"At low tide, when the water has returned to the bay, the mudflats appear in the slough channels. Twice a day, the tide is low and the mudflats appear."

#### **Do**

Remove the high tide cover so that the display is set at low tide. Put the high tide cover away in the box labeled "San Francisco Bay."

#### **Read**

"When the mudflats are exposed (point out the

mudflats sloping down from the marsh to the slough water), hundreds of birds appear. They land on the mudflats and probe into the mud with their beaks."

#### **Do**

Select volunteers to move the birds from the air and high marsh onto the mudflats.

#### **Ask**

**? What are these birds doing on the mudflats?** (Looking for food.)

**? Are they eating mud?** (No, they are eating creatures that live in the mud.)

#### **Read**

"Despite an apparent lack of plants and animals, tidal mudflats support an abundance of life. Thousands of organisms live in the bay mud."

#### **Ask**

**? What do you think lives in the mud?** (Accept all reasonable answers as possibilities.)

#### **Read**

"Let's find out what lives in the mud."

#### **Do**

Select volunteers to open up one flap at a time to expose a mud creature and read the name of the creature. Help the students read the names.

#### **Read**

"These are some of the mud creatures we are going to be looking for. Most of these creatures are not shown as their actual size."

#### **Mudflat Food Pyramid** (3 minutes)

#### **Do**

Hold up the food pyramid poster.

#### **Read**

"All food pyramids must have producers at the bottom.

- Producers support the rest of the food pyramid. Detritus (decomposing plants) and phytoplankton (small, drifting plants) are the producers in the mudflats. Like all plants, they use sunlight to make food or energy.
- Zooplankton (small, drifting animals) feed on phytoplankton and detritus. They are the first consumer level.

- Mud creatures are the second consumer level - they feed on zooplankton, phytoplankton, and detritus.
- Birds (such as ducks, shorebirds, and California clapper rails, an endangered species) eat the mud creatures; they are the third level consumers.
- Animals at the top level of a food pyramid have no natural predators. In this food pyramid, humans and birds of prey (such as Northern harriers, red-tailed hawks, and peregrine falcons) feed on the birds.”

**Ask**

- ? **Why are mud creatures important?** (They provide an important source of food for birds.)
- ? **Do you think mudflats are important to preserve?** (Possible answers - mudflats provide a home and food for many animals, including birds such as the California clapper rail, an endangered species. Humans also eat ducks that feed on mud creatures.)
- ? **What happens when pollution is dumped down storm drains?** (It runs directly to creeks and rivers, which run to the bay. The pollution can end up in the slough and mudflats and enter food chains. Animals, such as the California clapper rail, can be harmed by pollution.)
- ? **How can we prevent pollution from entering mudflat food chains?** (Be mindful of anything we dump down the storm drain. Learn more about our watershed and tell others about what we learn)

**Read**

“Now we will search for creatures in the mud.”

**Mud Creature Study** (20 minutes)

**Do**

Place 3 shoebox samples of mud on table. Students examine these samples first in small groups, using eyes only. Note any creatures in the samples. Remove the samples and place on counter. Hold up the sieve set and show the students that the sieves are stacked with the coarsest screen (largest holes) on top and the finest screen (smallest holes) on the bottom.

**Read**

“I need a volunteer to place a “golf-ball” size mud sample on the top sieve.”

**Do**

Student puts a sample in top sieve with trowel.

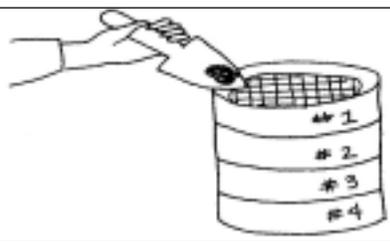
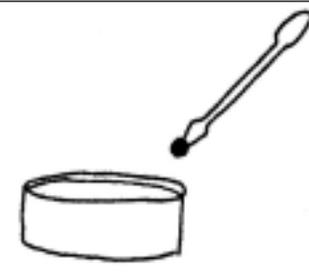
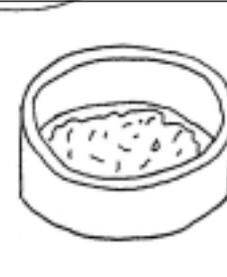
**Read**

“I need another volunteer to pour slough water over the mud.”

**Do**

- When the mud has passed through the top screen, separate the sieves and pass them out to the students. Use tubs underneath to collect drips.
- Students should examine the sieves for animals. If animals can be seen with the naked eye, have students remove them and place them in their petri dishes.
- If animals cannot be seen with the naked eye, scrape a sample from the sieve with the microspatula and place it in their petri dishes.
- Add some slough water to the mud sample and stir it up with the microspatula.

(Note: use a very small amount of mud and slough water for easier viewing. About the size of this dot → ●).

<p>1. Place a golf-ball size mud sample onto the top sieve</p> 	<p>2. Pour slough water over the mud to wash it through the sieves. Use a microspatula to loosen the mud.</p> 
<p>3. Use a microspatula to take a <u>small</u> sample of mud from a sieve and put it in the petri dish.</p> 	<p>4. Add a small amount of slough water to the petri dish. The petri dishes should have very little mud. The water should be almost clear.</p> 

---

**Read**

“First examine your sample with a hand lens. If you find something moving, make a slide and use the microscopes for a closer look. Identify the creatures in your samples by using your mud creature placemat and mud creature ID book.”

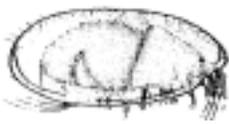
**Do**

Assist the students with the microscopes and help

them identify mud creatures. It is not necessary to know exact names - there are hundreds of species in the mud. **Note:** If data sheets and pencils were provided by the educator, students should draw sketches of what they find.

**At the end of the activity, have students clean their equipment and reset their stations.**

## MUD CREATURES



Ostracod



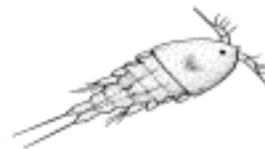
Shrimp



Isopod



Amphipod



Copepod



Crab



Polychaete



Oligochaete



Nematode



Clam



Mussel



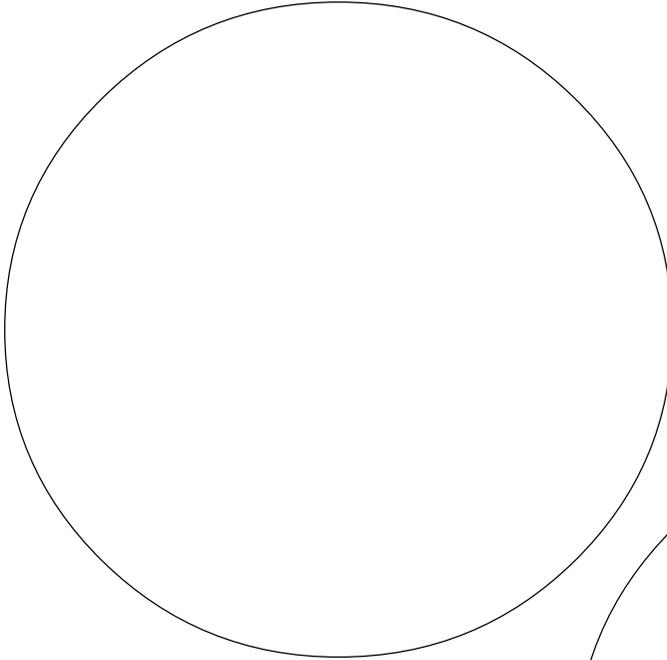
Snail

**Hints for finding mud creatures:** Look for creatures swimming on the surface of the water in the mud bucket and in the shoebox samples. You can extract these with an eyedropper. Look for worms stuck on the bottom of the sieve. You can use the microspatula to remove creatures from the sieve set. Some creatures are very small. You may want to use a hand lens to get a closer look in the sieve. Refuge staff will also try to provide you with a “zoo” for a starter set of creatures. Save some of the found creatures from each rotation in the “zoo” so you will always have something for the students to observe. Use the video microscope and TV to make a creature feature showing the creatures to all the students. NOTE: Video microscope and TV should be handled by adults ONLY.

# MUD CREATURE DATA SHEET

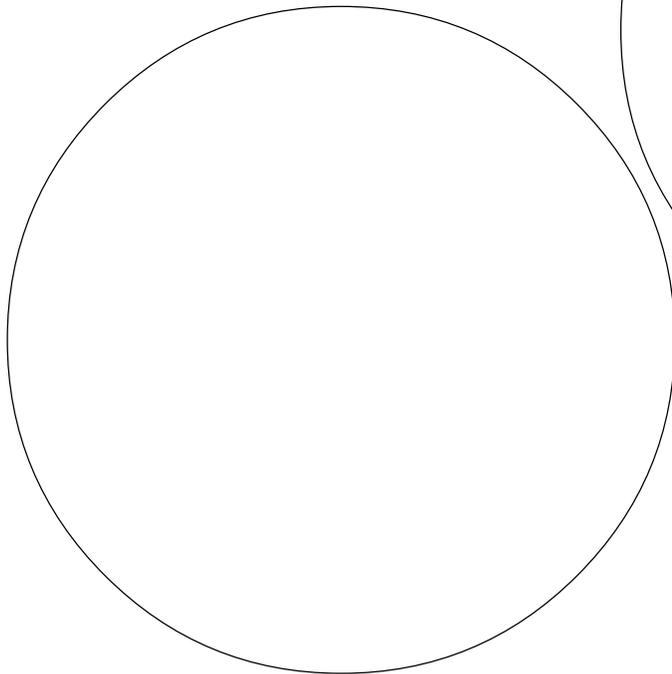
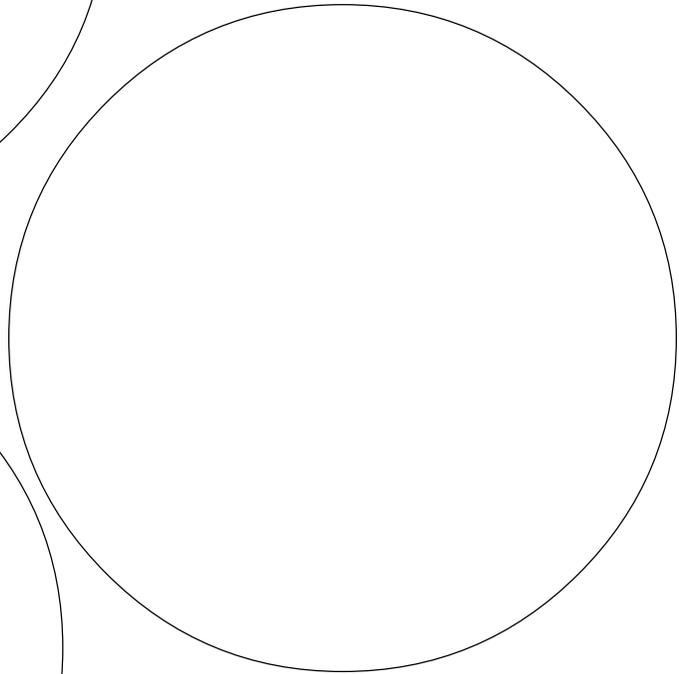
Student Name: \_\_\_\_\_

Draw and identify any mud creatures that you discover.



Name: \_\_\_\_\_

Name: \_\_\_\_\_



Name: \_\_\_\_\_