Chinese Mitten Crabs

The materials provided here are intended to help educators expand upon the Chinese Mitten Crab Resource Guide and use the guide in the classroom. Assign assessment questions as a homework assignment, or use the questions for a classroom discussion or final evaluation.

LEARNING ACTIVITIES

CASE STUDY

"Fishing column: Beware of Chinese mitten crabs"
http://www.sfgate.com/default/article/Fishing-Column-Beware-of-chinese-mitten-crabs-190826.php

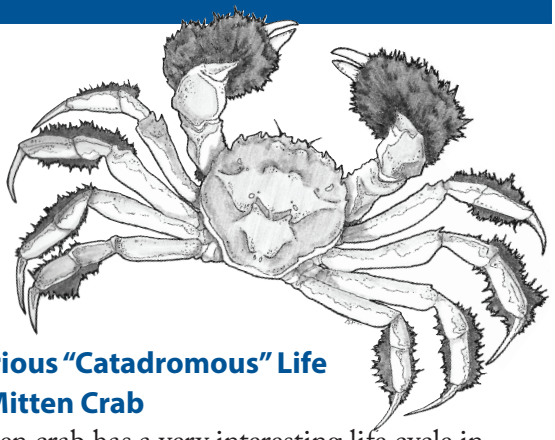
LESSON PLAN

Mitten Crab Lab, available at MenaceToTheWest.org

LEARNING ACTIVITIES

A Crab with "Mittens"

Scientists still don't know for sure the function of the mitten crab's mittens. Horses have hooves; ducks have webbed feet;and turtles have shells; but a crab with "mittens"? For most animals and plants, it is fairly easy to understand why they have certain structures. For example, hooves help a horse rapidly escape danger; ducks use webbed feet to swim; a turtle's shell provides protection;and plants have a cuticle (waxy protective layer of epidermis or "skin") to reduce water loss. But what about those "mittens" (actually, tufts of a fur-like material called setae, which is modified shell material) on the claw of the mitten crab? Think through what a crab needs to live and reproduce and come up with your own theory for what functions mittens provide for the mitten crab. How would you test your theory? Who knows, you could very well be right!



The Curious "Catadromous" Life of the Mitten Crab

The mitten crab has a very interesting life cycle in which the adults live in freshwater most of their lives, but migrate downstream to reproduce in the salty and brackish waters of estuaries. The juveniles then migrate away from the saltwater estuary upstream (in some cases, over 100 miles) into freshwater to live their adult lives until it is time again to reproduce. This life cycle is called "catadromous," meaning "downward-running," and refers to the seaward migration of adults.

Activity Questions & Answers

1 Why do you think mitten crabs have evolved a catadromous way of life?

Catadromous species generally occur in environments where freshwater productivity exceeds that of the ocean. Mitten crabs likely evolved where freshwater habitats provided more resources (nutrients, shelter, etc.) than saltwater or marine habitats. The mitten crab needs access to plenty of food and river banks to burrow. It creates shelters in which to grow, survive, and reproduce. Also, a catadromous life cycle may allow species to escape harsh conditions and predators, and to "weather out" changes.)

2 Think of some advantages and disadvantages that come with a catadromous life.

Advantages: *Access to freshwater and saltwater resources across their entire life cycle offers a wealth of resources available in each habitat. The estuarine environment is suitable for the mitten crab as larvae or juveniles, since they are primarily planktonic and can disperse through ocean currents. Migrating upstream as adults provides additional habitats, protection, and food resources. Disadvantages: Being*

dependent on so many habitats to complete their life cycle can be a disadvantage if one of those habitats is jeopardized or imperiled though pollution, destruction, overfishing, or invasive species. In addition, the crabs must expend energy to undergo a tiring migration, as well as the physiological transition needed to maintain the salt balance (osmoregulation) of their cells, as they migrate from a saltwater to a freshwater environment.

3 What other organisms have catadromous life cycles?

The best-known group of catadromous fishes are the true eels. In these species, females spend their lives largely in freshwater, while males live primarily in the brackish water of estuarine areas. Individuals breed in the seas and die after spawning once. The opposite of catadromous is anadromous. In an anadromous life cycle, the organism will reproduce in freshwater, then migrate to the ocean as adults.

4 Do you know of any organisms that have an anadromous life cycle?

One of the best-known examples is Pacific salmon. Other examples include sturgeon, sea trout, three-spined stickleback, and shad.

5 What are the advantages and disadvantages of an anadromous life cycle?

See above answer to Question 3. "The contrasting directions of migration can largely be explained by the relative availability of food resources in ocean and freshwater habitats. Oceans are more productive than freshwater in temperate latitudes, and anadromous species predominate. In contrast, catadromous species generally occur in tropical latitudes where freshwater productivity exceeds that of the ocean."[1]

[1]Aquatic Productivity and the Evolution of Diadromous Fish Migration." Gross et al. *Science* 2 March 1988: 1291-1293. DOI: 10.1126/science.239.4845.129)

Crab Quest

Go on a Crab Quest to look for and identify crabs on the Oregon coast. See how many native species and how many invasive species you can find. Do you think you will find a mitten crab on the coast? It is unlikely that you will find a Chinese mitten crab on the Oregon coast, for two reasons:

1. They are not yet known to exist in Oregon; however, they could easily be introduced! People can help prevent the impacts by not transporting mitten crabs and by looking out for and reporting them. It is very important that you report any findings of suspected mitten crabs through 1-800-INVADER and the reporting website www.oregoninvasiveshotline.org.
2. Chinese mitten crabs spend most of their adult lives upstream in freshwater. They return in a mass migration to breed once a year, in the late fall or winter. You may find the European green crab, though!

Mitten Crabs Town Hall Debate: Dine on a Delicacy to Divert a Disaster?

What if people enjoy eating Chinese mitten crabs and are willing to pay lots of money to buy them? Debates over establishing a fishery for Chinese mitten crabs in California are highly contentious. Chinese mitten crabs in North America are undesirable because of their invasive harmful characteristics, but Chinese mitten crabs are also highly prized for food. Some suggest that heavy harvesting and eating Chinese mitten crabs is a perfect scenario for controlling their populations in areas they have invaded. The California Department of Fish and Game has not allowed a commercial fishery because this could lead to people introducing them in new areas. Indeed, the question of a fishery is a complex one and deserves careful consideration and research.

Should we establish a fishery for mitten crabs? Have students represent the different groups involved, such as potential fishermen, potential buyers, consumers, the U.S. Fish and Wildlife agency, a local "friends of the river" group, and biologists. Lead them in a "town hall"-type meeting to decide whether it is a good idea to establish a fishery, and if so, how to regulate it.

Debate Questions

Some important considerations for students as they debate:

- It is important to determine whether there is a viable market for the crabs. What kind of crabs are consumers looking for, and do we have them? Will people want to buy them?
- Is there proof that a fishery will actually reduce the population of mitten crabs?
- Mitten crab populations naturally fluctuate. How can the fisheries be maintained in years when mitten crab populations are low?
- How can we ensure that people won't want to introduce the crab into uninvaded systems to begin a new fishery?
- Mitten crabs cause extensive damage and populations do need to be reduced. If we don't start a fishery, what are other viable alternatives to mitten crab control?

SPECIES GUIDE ASSESSMENT QUESTIONS AND ANSWERS

1 Where did the Chinese mitten crab originate?

Around China and Korea in the Yellow Sea.

2 Where can the Chinese mitten crab be found in the United States?

San Francisco Bay and the Sacramento-San Joaquin River Delta in California.

3 Where is the North American population from?

Germany, via China.

4 How was the crab transported across the world?

It is most likely that larvae were transported in ships' ballast water.

5 What type of habitat are Chinese mitten crabs most commonly found in?

Coastal rivers and estuaries.

6 What does catadromous mean?

The adults live in freshwater most of their lives, but migrate downstream to reproduce in the salty and brackish waters of estuaries. The juveniles then migrate upstream, away from the saltwater estuary, in some cases over 100 miles, into freshwater to live their adult lives until it is time again to reproduce.

7 Name three characteristics of Chinese mitten crabs that negatively impact the environment or local economy.

1. Burrow into banks, which can increase flooding or damage equipment.

2. Prey on or compete with native organisms for food sources.

3. Get tangled in fishing nets.

8 What is a possible management technique?

Set traps upstream of dams so that when the crabs go around the dam, they will be caught in the trap.