



Grade Level

5th-12th

Objectives

* To develop skills in estimating population sizes.

* To be able to describe fiddler crab behavior.

* To be able to describe sexual selection and provide examples.

N.C. Standard Course of Study

Biology
(Bio.2.1.2,
Bio.2.1.4)

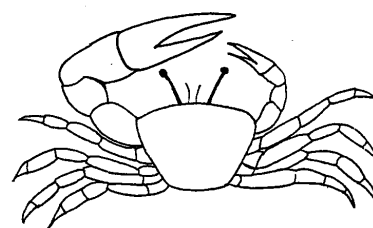
Fiddle Facts

Overview:

Through a classroom exercise and a field activity students will study fiddler crab behavior and learn how populations of organisms are scientifically estimated.

Materials:

- ruler
- quarter
- paper
- pencil
- calculator
- fiddler crab population page (included)



Background:

It is quite a sight to see a colony of fiddler crabs scurrying across a mud flat. These tiny crabs are among the most abundant and interesting of all the animals in the estuary. Fiddler crabs (*Uca pugilator*) are found in large numbers digging holes in the mud flat at low tide. As you approach, hundreds of these tiny creatures momentarily freeze, and then scurry down into their burrows out of sight. If you sit quietly and watch them you will notice that the male crab has a huge claw that it waves back and forth. This movement of the claw is why this crab is called “the fiddler”. Female fiddler crabs are a little smaller, less colorful than the male and lack the large claw.

The eyes of a fiddler crab sit up on stalks away from the body which allows the crab to see in all directions. If a bird flies over a nearby crab colony, the fiddlers will run to the entrances of their burrows using a strange sort of sideways walk. If the bird continues to approach, they will disappear. The males, more conspicuously colored, will be the first to hide from the predators and the last to sneak back out of their burrows once danger has passed.

The burrow serves several purposes for the crab. It protects them from predators, is used during mating, and protects the fiddler crab from the incoming tide. The crab digs a burrow by pushing the legs on one side of its body into the ground, then pulls up a lump of soil and carries it away from the entrance of the hole. The sides of the burrow are constantly smoothed with the walking legs. The fiddler crab will dig its burrow until it reaches the level of ground water where the earth is



moist. When the tide rolls in, the crab pulls sections of soil toward the inside of the burrow with its feet and forms a thick plug over the entrance to the burrow. The fiddler is left inside, dry and protected from the salt water and from predators.

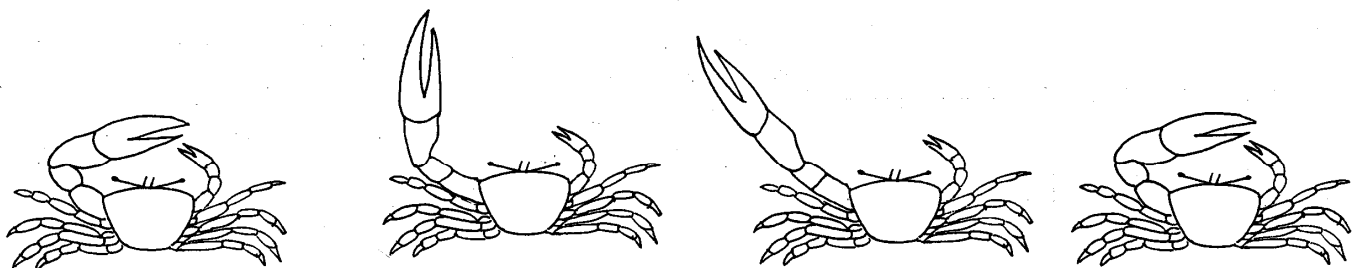
The Big Fight

Sometimes you can see two male crabs carrying out a ceremonial fight over a female or a territory. The two crabs approach each other with a stiff-legged walk (like two cowboys in an old western movie), and take turns hitting each other with their large claws in an attempt to push away or overturn the other crab. These fights are actually a fixed behavior and do not cause either crab serious injury. If one crab dances around with more of an implied threat, it “wins” and the other crab will usually flee into its burrow.

The Mating Dance

Male fiddler crabs also use the large claw to attract a female. The male will situate himself beside his burrow and if a female approaches, the male will repeatedly bow down and vigorously wave its large claw at the female. It seems as if the male is waving and inviting the female over. If the female selects that male as a mate, she will follow him down into the burrow where mating occurs.

Crab waving



Sexual Selection

The huge claw on the male fiddler crab seems to have evolved for two purposes: mate attraction and ceremonial fighting. The claw is so large and cumbersome, that it is of little use to the crab in getting food. Evolutionary biologists believe that the claw of the fiddler crab is an example of sexual selection. Sexual selection occurs when an organism develops a trait that appears to be in opposition to survival but is advantageous to getting a mate.

Charles Darwin believed that as males of a species competed for mates, some of the males would randomly be born with strange characteristics like a large claw. Darwin suggested that females would select these unusual males to mate with because they appeared to be good at surviving even though they had some oddity, and thus the trait stayed around in the gene pool and was passed on to the offspring. There are a number of other examples of sexual selection: horns on a deer, feathers on a peacock, or coloration on a bird.

Part 1: Classroom Activity:

Biologists are often given the task of taking a population census of organisms in order to determine range and health of that population. Often it is not possible to count every single individual or it is too time consuming. For example, on Sapelo Island, Georgia, biologists have estimated that there are more than eight million fiddler crabs per acre. In this activity you will estimate the number of fiddler crabs on a hypothetical mud flat in North Carolina. You want estimation to be as accurate as possible.

- A. Examine the diagram of a fiddler colony. Your task is to estimate the number of fiddler crabs in the total population by taking “random” samples.
- B. Take a quarter and flip the quarter until it lands on the diagram of the fiddler colony. Without moving the quarter, draw a circle around it. Count the number of fiddler crabs that lie within or on the circle you drew and record this number. Number of crabs in **circle 1**: _____ This represents your first random sample.
- C. Repeat the coin toss until you have a total of three fiddler crab samples. Number of crabs in **circle 2**: _____ Number of crabs in **circle 3** _____
- D. Add up your count and divide by three. This gives you the average number of fiddler crabs per circle. **average** _____
- E. Calculate the area of your circle (area = πr^2 or $\sim 4.9 \text{ cm}^2$).
- F. You know the average number of fiddler crabs per circle (part D) and need to estimate the total number of fiddler crabs in the colony. To estimate the total population, multiply your average by 65, since the diagram is about 65 times as big as the area inside the circle. **Estimated population size** _____.
- G. If you combine your results with those from others in your class, you should get something close to the actual number of fiddler crabs on the diagram. Ask ten other people for their results and determine the overall average crab population count.

Estimation 1 _____

Estimation 2 _____

Estimation 3 _____

Estimation 4 _____

Estimation 5 _____

Estimation 6 _____

Estimation 7 _____

Estimation 8 _____

Estimation 9 _____

Estimation 10 _____

Total Average _____

Use your data to answer the following questions:

1. How far from the class average of the ten samples was your estimation of the number of fiddler crabs in the colony?
2. Why did different people get different estimations?
3. How accurate do you think your estimation really was? What errors may have occurred?
4. What other populations would scientists need to estimate rather than actually count?

The North Carolina National Estuarine Research Reserve is a cooperative program between the North Carolina Department of Environment and Natural Resources, Division of Coastal Management and the National Oceanic and Atmospheric Administration.



200 copies of this document were printed at a cost of \$ or \$. per copy.
Printed on recycled paper.

www.nccoastalreserve.net



Fiddler Crab Colony

