



WHAT'S THAT QUADRAT?

TIME & AUDIENCE LEVEL

- 45 minutes — 1 hour
- 4th — 6th Grade

VOCABULARY

- Population
- Quadrat
- Population estimate
- Salt marsh
- Fiddler Crab
- Burrow
- Diamondback Terrapin
- Spartina Grass
- Sea oxeye Daisy

MATERIALS

- Marsh graphic
- Worksheet
- Pencil



SUMMARY

Use your math skills just like a biologist! In this activity, students will learn how to estimate population size using the quadrat method. Along the way, they will learn about the salt marshes of coastal Georgia and the animals that live there.

OBJECTIVES

- Learn what a population is and why monitoring is important
- Identify common salt marsh animals found in Georgia
- Use a quadrat method to apply mathematical skills to real world scenarios

BACKGROUND INFORMATION

A **population** is the number of individuals in a species. A population can be for a specific area, region, or even worldwide. To identify how many individuals are in a population, researchers must be able to count or estimate the total number. It is easy to count if the area is small and the organism is large and visible, for example the number of deer in an open field. It is much harder to count in a large area, and even harder if the animal is small. Researchers use many methods to help them estimate population size, and for this activity we will be exploring the quadrat method.

A **quadrat** is a frame, usually a square or rectangle, that is used to isolate one unit of a study area for population surveys. It is placed at random inside the study area and is used as a tool to find the population estimate. A **population estimate** is a calculation to determine the approximate number of individuals in a species. An estimate is helpful when it is impossible to count every individual.

After calculating the population estimate, researchers then divide the total area of their study site by the area within the quadrat. For example, if the study site was 100 square meters and the quadrat was 0.5 square meters, they would divide 100 by 0.5 and get 50. Finally, they would multiply that number by the amount of individuals they counted within the quadrat. Continuing with our example, if they found 3 individuals, they would multiply 50 by 3 and get 150. This means that the estimate population is 150 individuals within the 100 square meter study area. This calculation is quicker and easier than counting every individual.



To bring this activity indoors and learn how to use a quadrat, there is a salt marsh graphic attached to this lesson that has been placed on a grid. Each section of the grid can be considered a quadrat. Using these quadrats, students can practice estimating the population for each species seen on the graphic. Here is some background on salt marshes and the species seen there:

A **salt marsh** is a body of brackish water, a mixture of fresh and salt water, found where the ocean meets rivers and streams. There are approximately 100 miles of salt marsh along Georgia's coast, and they serve important functions such as: absorbing water from tides, providing habitat for many species, and filtering water. In this graphic, you will see a tidal creek running through the middle of the marsh and dry ground on either side.

Diamondback terrapins are a species of semi-aquatic turtle. This means they can be found in water and on land. They are the only species of turtle in North America that can survive in brackish water, and will predate upon smaller species like snails, frogs, fiddler crabs, and small fish in the tidal creeks. They get their name from the diamond-like rings on their backs. They exhibit a variety of different colors and patterns to help them blend into the marsh.

Fiddler cabs are small crabs commonly seen scurrying around exposed marsh popping in and out of their burrows. Each crab digs a **burrow** into the marsh to hide from predators and to stay in when the tide covers their home with water. They get their unique name because males have one large claw that they wave to establish territories. Females have two small claws, so it is easy to distinguish between males and females. For the purpose of this graphic, each crab looks the same with even-sized claws.

Plants that grow in the salt marsh help to keep banks stable despite the changing tides. **Spartina grass**, also known as smooth cordgrass, is a tall, slender grass that grows near tidal creeks on low ground. **Sea Oxe** **Daisy** is a flowering plant that grows further from the tidal creek as elevation increases. Vegetation in the salt marsh provides habitat and food for many animals, and both of these species can be seen in the graphic. Other structures such as sticks and fallen logs also provide important habitat and cover for the animals of the salt marsh.

SET UP

For this activity, instructors should print out the marsh scene graphic and worksheet provided with this lesson plan. Students can share the graphic or each have their own print out.

WARM UP/INDRODUCTORY ACTIVITY

To begin this activity, instructors should start by explaining what a population is. A fun exercise is to have them give their best guess to the population of people in their neighborhood. Next, have them guess the population of their town or city. Instructors can explain how it is easy to count a population within a small space, but much harder across a large area.

GEORGIA STANDARDS OF EXCELLENCE

- MGSE4.OA.1 a
- MGSE4.OA.1 b
- MGSE4.OA.1 c
- MGSE.5.OA.1
- MGSE.5.OA.2
- MGSE6.EE.2

CRITICAL THINKING QUESTIONS/ STEM RESOURCES

- Create your own quadrat! Use PVC pipe, string, or even four stakes to make a square or rectangle. Determine the populations of plants and animals within your yard, neighborhood, playground, or living room.
- In what ways could you help increase an animal or plant population near where you live?
- What did you find? Try using apps like iNaturalist to document the plants and animals you see.



REFERENCES/RESOURCES

- <https://smile.oregonstate.edu/sites/smile.oregonstate.edu/files/schoolyardquadrats.pdf>
- <https://www.sciencelearn.org.nz/resources/2318-making-and-using-a-quadrat>
- <https://coastalgadnr.org/salt->

CONTACT INFORMATION

214 Stable Road
Jekyll Island, GA 31527
(912) 635-4141
gstc.jekyllisland.com

ACTIVY PROCEDURES

To bring this activity indoors, instructors will use the provided graphic and worksheet. After explaining populations and how they are estimated, instructors should prompt the students to look at the marsh graphic. Each component should be explained (tidal creek and dry ground) along with each species (diamondback terrapins, fiddler crabs, spartina grass, and sea oxeye daisy). After students understand the salt marsh and what they are looking at, it is time to practice estimating populations!

For this activity, students will be estimating the population of fiddler crabs in the marsh scene. They will be able to compare their estimate to the actual population and see how close it was. They will also answer critical thinking questions about the fiddler crabs and how they interact with their environment.

In the marsh scene, there is a grid to represent each quadrat space. Each grid is labeled with a letter and number in the lower left-hand corner. Each column is given a letter and each row is given a number. The prompt for this activity is to use quadrat section C3. Students will need to:

- Count the number of sections in the scene to find total area (15)
- Count the fiddler crabs in quadrat section C3 (2)
- Dive the total area (15 sections) by the number of sections they counted fiddler crabs in (only one quadrat section was counted)
- Multiply that number (15 /1 = 15) by the number of fiddler crabs they counted in section C3 (15 x 2 = 30)

Students should get an estimated fiddler crab population of 30 individuals. They can then count the actual total number of fiddler crabs (28) to see the accuracy of the estimate.

After completing the activity, instructors can show the formula they have just worked through located on the bottom of the worksheet. It can and be applied to the other species in the scene for additional practice.

Quadrat Method Population Estimate Formula:

Estimated Population = (total area of study site/area of quadrat) x number of individuals counted in quadrat

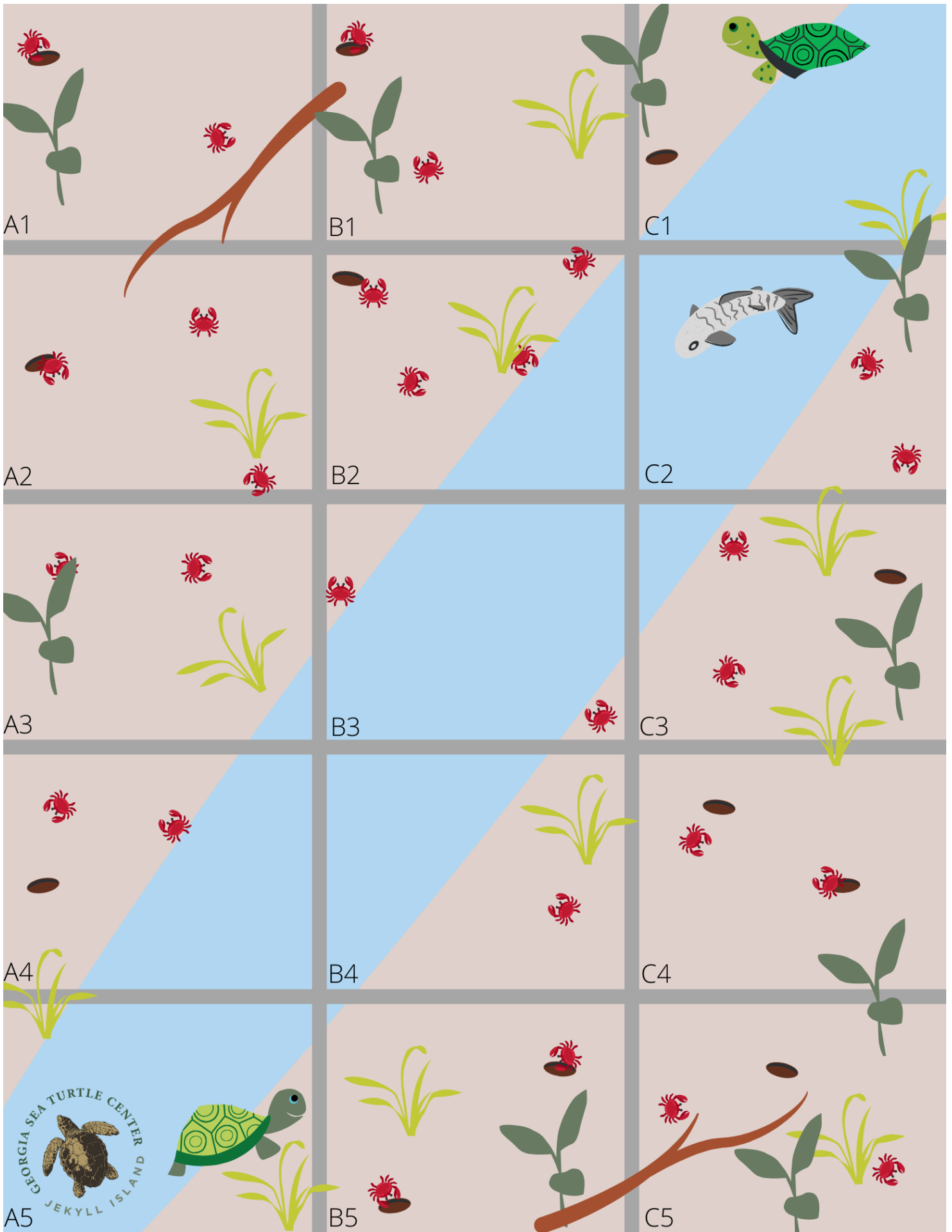
This formula can also be expressed as:

$$N = (A / a) \times n$$

WRAP UP/CONSERVATION MESSAGE

It is important to know population size in order to make conservation decisions. For example, conservationists need to monitor endangered species to know if their population is increasing or decreasing. A nature park needs to know how large populations are to make sure there is enough good quality habitat.

Keep practicing! Pick a different species and quadrat section to count it in, then see how accurate your population estimates are.





What's That Quadrat Activity:

Let's see how many fiddler crabs are in the marsh scene!



1. How many sections are there in this quadrat grid? _____
2. Count only the fiddler crabs in section C3. How many are there? _____
3. Do you think this is close to the actual number of fiddler crabs in this scene? Yes No
4. Let's see if you're right! Divide the total number of sections (answer to Question 1) by how many sections we counted fiddler crabs in for question 2. _____
5. Multiply your answer to question 4 (total number of sections/1) by how many fiddler crabs you counted in section C3 (answer to question 2). _____
6. Congratulations! You found your population estimate for fiddler crabs. Now, find the actual population by adding all the fiddler crabs in each section. _____
7. Was your population estimate close to the actual population? Yes No
8. What environmental factors may influence where fiddler crabs are?

9. Are there places fiddler crabs may be that we can't see? What about predators that may cause the fiddler crabs to hide?

Now you know the formula!

To find a population estimate, use:

$$(Total\ Area / Area\ surveyed) \times \#\ of\ Individuals$$

Keep Going:

The quadrat method can be used to find the population estimate for all types of plants and animals! Try it with the other organisms you see in the marsh scene!



Legend:

Fiddler Crab:



Burrow:



Diamondback Terrapin:



Spartina Grass:



Sea Oxeye Daisy:



What's That Quadrat Activity:

Answer Key:

1. How many sections are there in this quadrat grid? **15**
2. Count only the fiddler crabs in section C3. How many are there? **2**
3. Do you think this is close to the actual number of fiddler crabs in this scene? Yes **No**
4. Let's see if you're right! Divide the total number of sections (answer to Question 1) by how many sections we counted fiddler crabs in for question 2. **$15 / 1 = 15$**
5. Multiply your answer to question 4 (total number of sections/1) by how many fiddler crabs you counted in section C3 (answer to question 2). **$15 \times 2 = 30$**
6. Congratulations! You found your population estimate for fiddler crabs. Now, find the actual population by counting all the fiddler crabs in each section. **30**
7. Was your population estimate close to the actual population? **Yes** No
8. What environmental factors may influence where fiddler crabs are?

Possible answers: fiddler crabs are not seen in the water, are not near predators, may be seen more often where there are structures like fallen sticks or grasses to hide near.

9. Are there places fiddler crabs may be that we can't see? What about predators that may cause the fiddler crabs to hide?

Possible answers: Fiddler crabs may be hiding in burrows, under vegetation, under structures like fallen sticks. Predators that fiddler crabs are avoiding in this scene can be diamondback terrapins, large fish, or other crabs.

Actual population counts for the other species found in this marsh scene quadrat activity:

Species:	Actual Population:	Location:
Diamondback Terrapin	2	Crawling out of the tidal creek to explore marsh
Spartina Grass	11	Growing close to the tidal creek
Sea Oxeye Daisy	9	Growing further from the tidal creek
Fish	1	Swimming in the tidal creek