Many scientists conduct scientific investigations in California State Parks . These investigations help solve problems and preserve and protect park resources. Complete the lab sheet so that you can more thoroughly understand the scientific study at which we will be looking.

Scientific Investigation Title

The Research Question

List some hypotheses that might answer the Research Question.

Predict at least three kinds of data that scientists will need to collect to test the hypothesis.

Identify at least two variables that may affect the yearly data that is collected.

List tools/materials/technology scientists might use to collect their data.

What are some challenges that scientists might have as they try to design an experiment around the hypotheses you listed above.

Use this space to write down your observations during the videoconference.

Observations

After the videoconference you should be able to analyze this scientific investigation and write some conclusions based on the data, shared information and observations you have learned.

Conclusions

Use your projector, overhead or blackboard to show the name of the ***Scientific Investigation Title*** and ***Research Question.***

Have students fill in the answers to the questions prior to the videoconference. The answers below are only a few examples of appropriate responses. Use the Observations and Conclusions Worksheet to capture observations during the videoconference and for formulating conclusions afterwards.

Scientific Investigation Title ***Bighorn Sheep and Mountain Lion Radio Tracking***

The Research Question ***What is affecting the survival of big horn sheep in Anza-Borrego Desert State Park?***

Hypotheses that might explain what is happening in the Research Question

Bighorn sheep are being preyed on mountain lions, coyotes and bobcats.

Bighorn sheep do not have enough habitat areas to provide food and water.

Bighorn sheep are getting diseases from domestic animals. (cows and sheep)

Bighorn sheep are being killed by hunters and cars.

Data that scientists will need to collect to better understand the investigation.

Population number of bighorn sheep and mountain lions

Ranges of each population

Survival statistics of lambs each year

Blood & fecal samples

Identify variables that may affect the yearly data that is collected

Amount of rainfall

Temperatures during lambing season

Number of pregnant females

Tools/materials/technology scientists might use to collect their data:

Binoculars, maps, GPS collars, helicopters, cameras, microscopes

Challenges that scientists might have

Locating animals

Accurate population counts over large areas

Determining cause of death

Weather variations

Desert bighorn are stocky, heavy-bodied sheep, similar in size to mule deer. Weights of mature rams range from 125 to 200 pounds (55 to 90 kg), while ewes are somewhat smaller. Due to their unique concave elastic hooves,[3] bighorn are able to climb the steep, rocky terrain of the desert mountains with speed and agility. Bighorn rely on their keen eyesight to detect potential predators such as mountain lions, coyotes, and bobcats, and they use their climbing ability to escape.[4]

Both sexes develop horns soon after birth, with horn growth continuing more or less throughout life. Older rams have impressive sets of curling horns measuring over three feet long with more than one foot of circumference at the base. The ewes' horns are much smaller and lighter and do not tend to curl. After eight years of growth, the horns of an adult ram may weigh more than 30 pounds.[3] Annual growth rings indicate the animal's age. The rams may rub their own horns in order to improve their field of view.[3] Both rams and ewes use their horns as tools to break open cactus, which they consume, and for fighting.[4]

Desert bighorn sheep typically live for 10–20 years. The typical diet of a desert bighorn sheep is mainly grasses.[3] When grasses are unavailable, they turn to other food sources, such as sedges, forbs, or cacti[3]

Desert adaptations

The desert bighorn has become well adapted to living in the desert heat and cold and, unlike most mammals, their body temperature can safely fluctuate several degrees. During the heat of the day, bighorn often rest in the shade of trees and caves.[4]

Southern desert bighorn sheep are adapted to a desert mountain environment with little or no permanent water. Some of the bighorn may go without visiting water for weeks or months, sustaining their body moisture from food and from rainwater collected in temporary rock pools. They may have the ability to lose up to 30 percent of their body weight and still survive. After drinking water, they quickly recover from their dehydrated condition. Wildlife ecologists are just beginning to study the importance of this adaptive strategy, which has allowed these small bands to survive in areas too dry for many of their predators.[4]

Social life

Desert bighorn sheep are social, forming herds of 8 to 10 individuals. sometimes herds of size 100 are observed.[3]

Rams battle to determine the dominant animal, which then gains possession of the ewes. Facing each other, rams charge head-on from distances of 20 feet (6.1 m) or more, crashing their massive horns together with tremendous impact, until one or the other ceases.[4]

Bighorns live in separate ram and ewe bands most of the year. They gather during the breeding season (usually July–October), but breeding may occur anytime in the desert due to suitable climatic conditions. Gestation lasts from 150–180 days,[3] and the lambs are usually born in late winter.[4]

References

1. Caprinae Specialist Group (1996). Ovis canadensis ssp. nelsoni. 2006. IUCN Red List of Threatened Species. IUCN 2006. www.iucnredlist.org. Retrieved on 11 May 2006.

2. McCutchen, H.E. (1995). "Desert Bighorn Sheep". In Stohlgren, T.J. (PDF). The Interior West. In: Our Living Resources: A report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. Washington, D.C.: U.S. Geological Survey. Archived from the original on 2007-10-31.

3. "Joshua Tree - Desert Bighorn Sheep". 2006-08-10. Retrieved 2012-01-21.

4. "Desert Bighorn Sheep of Cabeza Prieta NWR". Cabeza Prieta National Wildlife Refuge. U.S. Fish and Wildlife Service. Retrieved 2007-08-14.

Adapted from Wikipedia. Original information can be found at: http://en.wikipedia.org/wiki/Desert_bighorn_sheep

PORTS

Parks Online Resources for Teachers and Students

The mark and recapture method is a process used by scientists to estimate animal populations. They capture a specific number of animals of the chosen species, then collar, mark or tag these animals and release them so that they can be recognized later. The scientists then go back and count animals in a given area where they had collared, marked or tagged them. Some of these animals may be marked and some of them may not. The scientist uses a simple ratio to calculate the total population of the species.

Explain Mark and Recapture

Before you begin your experiment, discuss with the class the importance of the mark and recapture method in biology. The data collected helps scientists estimate current populations which can then be compared with earlier studies to figure out if a population is expanding or decreasing. The information garnered from these mark and recapture methods can lead to important animal protection programs.

Materials needed

- A brown paper bag with 100 pinto beans for each research team.
- (Team size is up to you)
- A jar with beans of a different color. Students will exchange their original beans with the number of these "marked" beans and add them back into their bag.
- Bighorn Sheep Population Count Data sheet
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The Bighorn sheep population field study

You are the lead biologist and you will assign each research team a number of Bighorn sheep (pinto beans) they are going to "mark". (15, 20, 25, or 30) The more they mark, the more accurate their population estimates will be. You can have the whole class mark same amount or set up half (Team A) which will mark 20 and half (Team B) mark 40. You can then do averages within Team A and B and compare the results.

1. Have the teams pull out the number of pinto beans you have chosen to "mark" and replace this amount with the different colored beans, which will represent the "marked Bighorn sheep". They can fill the Marked (M) column on the Bighorn Sheep Population Count Data Sheet with this number all of the way down. This symbolizes how scientists will capture an animal, mark it and then re-release it into the wild.
2. You are going out to see how many sheep you can find. *Field biologists do this with binoculars and radio collars. The number they find each year will vary but their goal is to find between 20 and 40 and scientists use consistent territory ranges each year.*
3. Walk the teams through the first count and capture, then have them repeat 9 more times for a total of 10 samples.
4. Without looking, have one student "capture approximately 30 sheep" by pulling a handful of beans out of the bag. Have your students make an estimation of the amount while doing this. This is their first sample (Year #1). Have them record this number in the Captured column (C) . This represents how scientists will count animals and record those with tags or radio signals to get a population estimate. If any of the captured Bighorn sheep are "marked", record them in the Recaptured column (R).

IMPORTANT NOTE : If there are no marked Bighorn sheep, they put a 1 in the Recaptured column (R).

5. Replace all the beans (marked and unmarked Bighorn sheep) to the bag.
6. Explain that one year of data is not very useful. Successive years are necessary and scientists have to use consistent territory ranges each year.
7. You will now do 9 more samples, representing the next 9 Years of population counts. Record the number captured each time in the Captured column (C) and the number that were marked in the Recaptured column (R)
8. After they have done 10 samples have them do the math for each sample.

Population Estimate = M x C/R

Marked animals x captured animals/recaptured equals population estimate.

9. Have students find an average from their 10 population estimates.

Mark & Recapture

The mark and recapture method is a process used by scientists to estimate animal populations. They capture a specific number of animals of the chosen species, then collar, mark or tag these animals and release them so that they can be recognized later. The scientists then go back and count animals in a given area where they had collared, marked or tagged them. Some of these animals may be marked and some of them may not. The scientist uses a simple ratio to calculate the total population of the species.

Bighorn Sheep Population Field Study

The lead biologist (your teacher) is going to give you a population of Bighorn sheep and the number of Bighorn sheep to capture and "mark".

Pull out the number of Bighorn sheep (beans) you are supposed to capture. Replace them with "marked Bighorn sheep" (beans of another color). Fill the Marked (M) column on your chart with this number of marked sheep all of the way down. This symbolizes how scientists captured an animal, marked it and then re-released it into the wild.

Now you are going out in the field to find as many Bighorn sheep as you can to try to get an estimate of their population. *Field biologists do this with binoculars and radio collars. The number they find each year will vary but their goal is to find between 20 and 40 and scientists use consistent territory ranges each year.*

SAMPLE #1 - Have one member of your team carefully capture 20-30 Bighorn sheep by pulling out a handful of 30 beans. Make an estimation to try to get as close to 30 as possible. This is your first count, Year 1. Record this number in the Captured column (C) for Year #1. If any of the beans are of the different color (marked Bighorn sheep), record them in the Recaptured column (R) for Year #1.

NOTE: If there are no marked Bighorn sheep in your sample put a 1 in the Captured column.

Replace all the beans (marked and unmarked Bighorn sheep) to the bag. Repeat the capturing process 9 more times. Each time represents another year of population counting and capturing. For each year, record the total number Captured (C) and the Recaptured (R).

Use the following formula to find the population estimate.

M x C/R = Population Estimate

Marked animals x ***captured animals/recaptured*** equals ***population estimate***.

What is the average of your 10 population estimates?

Count the total amount of beans in your bag to get the actual population.

Graphing Data

Make a graph of each of the sample population estimates.

Use population numbers for the x axis and the 10 year sample for the y axis.

Bighorn Sheep Population Count Data Sheet

SAMPLE	(M) MARKED (same #for all)	(C) CAPTURED	(R) RECAPTURED	Population Estimate (M x C/R)
YEAR #1				
YEAR #2				
YEAR #3				
YEAR #4				
YEAR #5				
YEAR #6				
YEAR #7				
YEAR #8				
YEAR #9				
YEAR #10				

Graphing Data

Make a graph of sample population estimates.

Use the 10 year sample for the x axis and the population estimate for the y axis.