**Lesson 4: Mountain Sheep**

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

Project ID: \_\_\_\_\_\_\_\_\_\_

Period: \_\_\_\_\_\_\_\_\_\_

Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_

**Lesson 4: Mountain Sheep**

**1. Introduction:** Mountain sheep are found in the Rocky Mountains of the United States and Canada. The males have large curved horns. Generally the sheep are found in herds of many females and only one mature male. The males compete for females to reproduce in the way shown in the video you will see. Male sheep live from 9 to 12 years.

Recently people have noticed a change in the mountain sheep population. Specifically, in comparison to the sheep of 25 years ago, the average size of the male sheep’s horns is smaller. Scientists know for certain that the sheep’s horns do not fall off, and the sheep do not lose and re-grow their horns. But something is happening so that the sheep’s horns are smaller than they were 25 years ago.

For more information on this, read Evidence 1 in pairs:

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| --- |
| **Evidence 1: How have mountain sheep changed in the last 25 years?**  Ram Mountain in Alberta, Canada, is home to a population of mountain sheep. Biologists from the University of Quebec have studied these mountain sheep for 25 years. They wanted to know if the population of mountain sheep was changing. Each year for 25 years, they captured 95% of the sheep population in June and measured each sheep’s horn size. Each sheep was tagged with a colored plastic ear tag. Most sheep were first tagged at the age of 1, when they were still not adults. When adults were captured, their age was determined by counting the number of rings on their horns, because sheep add one ring every year.  Over 25 years of collecting data on the sheep, the biologists found that the average horn size of male sheep in the population became 25% to 30% smaller. For example, 4-year-old male sheep in 1980 had an average horn size of 27 inches, but 4-year-old male sheep in 2005 had an average horn size of 19 inches. Sheep at every age from 1 year old to 12 years old showed an average decrease in horn size from 1980 to 2005. |

**2.** In pairs, ask each other two questions each to make sure you both understand the important points of Evidence 1.

**3.** Discuss with your group how good this piece of evidence is (0, 1, or 2). Be sure to listen to what everyone in your group thinks and to discuss each person’s ideas.

**4.** In this lesson, you will develop a model to explain why the size of the male sheep’s horns is smaller today than 25 years ago. You will use 5 pieces of evidence to develop your model.



**5.** You have already read Evidence 1. Next, in groups, complete Evidence 2 through 5 on the computer. Make sure to answer all the questions in your pairs as you go through each piece of evidence.

**6.** In groups, discuss this question and individually write your best answer: What do you conclude from Evidence 3?

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**7.** In pairs, using the evidence you just read, make a model showing what is happening to the mountain sheep population. Use the large paper your teacher will give to you. Make sure that others will be able to understand your model.

**8.** Write individually: How good do you think your model is, and why do you think so? Write at least 4 reasons.

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**9.** In groups, explain your models to each other. Then discuss:

A. How well does each of your models fit your class’s criteria for good models?

B. Are there changes you could make to make your models fit the criteria even better?

**10.** Next you will discuss some of the models in class.

**11.** Use red ink to make changes in your model based on the class discussion.

**12.** Your teacher will present you with a model (Model A) that is trying to explain what is happening to the population of sheep. Individually, answer this question:

How good is this model? Write your best reason.

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**13.** Now you will discuss Model A as a class.

**14.** Next your teacher will present you with 3 more models that are also trying to explain what is happening to the population of sheep.

**15.** Discuss with your group: Which model do you think is best? Then complete an arrows diagram for the evidence and the 3 models.

A. In groups, discuss each evidence and which rating and which arrows are best. Ask each other questions; give lots of reasons; listen to and think about each person’s ideas.

B. After discussing each evidence, individually write your rating and arrows on the diagram.

Before you begin, what questions should you be asking each other as you think about the arrows and the evidence goodness ratings? Be sure to ask each other these questions.

**ARROWS DIAGRAM**

|  |  |  |  |
| --- | --- | --- | --- |
| **Evidence Goodness** | **Model B** | **Model C** | **Model D** |
| **1. Changes over 25 Years**  http://www.mnh.si.edu/exhibits/mammals/Bighorn.GIF |  |  |  |
| **2. Horn growth**  **http://orgs.usd.edu/esci/age/_images/natural_clocks/antlers/rams.jpg** |  |  |  |
| **3. Trophy Hunting** |  |  |  |
| **4. Offspring** |  |  |  |
| **5. Hunter’s Blog**  **http://animaldiversity.ummz.umich.edu/site/resources/phil_myers/ADW_mammals/Artiodactyla/bighorn2299.jpg/medium.jpghttp://animaldiversity.ummz.umich.edu/site/resources/bruce_gill/Oviscanadensis2.JPG/medium.jpg** |  |  |  |

**16.** Discuss in your pairs:

A. Which model is best, based on the evidence? Provide reasons during your

discussion.

B. How well does the better model fit your class’s criteria for good models? Discuss

as many criteria as you can.

C. What new criteria would you add to your class’s list? Are there any criteria that

should be changed?

**17.** Now, individually, circle which model you think is best:

Model B Model C Model D

Write an argument to support the model you chose. Write to someone who may not agree with you. Use your argumentation rubric to help you write your argument.

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