Grade Level: 9-10
Subject: Math

Blacktail Deer Ratios

ESSENTIAL UNDERSTANDINGS

- Sovereignty
- Lifeways
- Treaties w/ the US

LEARNING OUTCOMES

- Students will be able to examine the blacktail deer population data to determine the ratio of bucks to doe's.
- Students will be able to analyze their findings after completing the sampling activity and explain how their findings varied based on the sample size.

CULTURALLY RESPONSIVE PRACTICES

- Connecting to the lives of students
- Proximity
- Preserving and honoring cultural history
- Student talk, working together and individually

ASSESSMENT

Students will be assessed on their 4 Quadrant Posters and Digital Sample Sizes

Overview

Monitoring and processing data for the animal populations is an important job for the CTGR Natural Resources Department. It ensures that we are helping to maintain a flourishing ecosystem within our Reservation. In this lesson, students will engage in a sampling activity to determine the ratio of bucks and does.

MATERIALS

- Blacktail Deer Ratio Presentation
- Table 5- Sex and Genotypes Data
- Part 2 of Interview with Lindsay Belonga, Wildlife Biologist
- Video Notes Part II
- Brown paper bags (enough for each pair)
- 56 Beans or small slips of paper for each group (16 males and 40 females) Use different colors to represent does and bucks.
- Class Chart
- Partner-Work Data for Sample Sizes
- Note Cards

LOGISTICS

- Where does this activity take place?
  Classroom

- How are the students organized?

  Pairs

TIME REQUIRED

50 minutes

STANDARDS

Understand and evaluate random processes underlying statistical experiments.
S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
S.IC.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
Make inferences and justify conclusions from sample surveys, experiments, and observational studies.
S.IC.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

VOCABULARY

- **Node-** each area or section that is surveyed on the reservation.
- **Ratio-** The quantitative relation between two amounts showing the number of times one value contains or is contained within the other.

Background for Teachers

The Confederated Tribes of Grand Ronde has been working towards regaining and retaining hunting and fishing rights for tribal members since 1983 when the tribe was restored with federal recognition. Today, the tribe has a Natural Resources Department (NRD) that "serves the Grand Ronde tribal membership through responsible stewardship of all-natural resources important to the cultural identity, self-sufficiency, and sovereignty (inherent authority of indigenous tribes to govern themselves within the borders of the United States) of current and future generations." Hunting and fishing rights are important to the tribe because it helps promote land management, land conservation and also allows the tribe to continue to practice cultural ceremonies and activities.

The purpose of this study is to obtain reliable blacktail deer population estimates to help the tribe determine how many additional hunting tags should be distributed to tribal members. Currently, the tribe nor the Oregon Department of Fish and Wildlife have an estimate on the deer population in Oregon. The Trask hunting unit is on reservation land and is open to the public. Over distributing hunting tags in the Trask unit could potentially have a negative effect on the habitat on the reservation.

A panel of seven microsatellites and two sexing markers were used to screen all 269 samples. Of the 269 samples, 89 (33%) produced data at five or more loci in Panel 1. Forty samples (15%) failed at all loci, and the remaining 140 samples (52%) amplified at 1-5 loci. The 89 samples that amplified at ≥5 loci were identified as 56 unique deer, of which 40 were female and 16 were male (1 male: 2.5 females). In addition to the 19 deer that were recaptured within the 2017 data set, several deer sampled in 2017 were previously sampled in 2015 and/or 2016. For the sake of this lesson, we will be using table 2, which gives information on 89 samples that were collected.

A team from NRD was assembled to go out on the reservation to collected fresh deer pellets. The surveyed area consisted of habitats that were freshly logged or the trees were only 0-5 years old. The team covered 403 acres of land. The attached excel sheet labeled 2017 Node Locations. The map shows where each node plot is and how many pellets were collected from that node.

In addition to microsatellite loci, each panel contained 2 markers for sex identification. The markers are repeated twice because you get two genes on the allele, one from each parent. The sample ID's (example BTD17.001) represent the fecal samples that were collected. BTD stands for blacktail deer, while the number 17 stands for the year the data was collected, i.e. 2017. The last three digits indicate the sample number. You will notice that there are some missing samples. That is because not all of the samples that were collected were blacktail deer or the quality of the sample wasn't complete enough to determine it's species. The data on table 2 represents all complete locus, which was only 33% of that data.

The data in the body of the excel sheet show the specific alleles the microsatellite primers target. Meaning if that allele shows up, we know it's a blacktail deer and that the number is unique to that individual. For example, BTD17.001 matches BTD17.005 which shows us that it's the same deer because their alleles are the same. The alleles also show us which deer are male and which ones are females. This helps us identify the ratio of female to male deer on the reservation.

Opening

Have students review the blacktail deer data from the day before. Go over any questions that students may still have or that were unanswered from the previous day.

To help students remember what they learned in the previous lesson, utilize a “give one, get one” activity where students share information with other students.

Activity

1. Begin the Data Ratios Presentation. Have students watch - Part 2 of the Interview with Wildlife Biologist Lindsay Belonga. Students can take notes using the Video Notes Part II Document.
2. The goal of this activity is for students to use sampling techniques to determine the ratio of bucks to does. In the sample with 89 data points, 56 were individual deer. Of those 56 individual deer, 16 were male (bucks) and 40 were female (does). This means for every 2 bucks (28%) there are 5 females (72%).
3. Students will do a simulation using paper bags to represent a node and slips of paper or beans will represent the deer. All of the bags should be set up the same. For example, 56 beans or slips of paper, with 16 marked as male and 40 marked as female.
4. Working in pairs, have students take sample sizes of 7, 21, 35 and record how many males/females they draw. “Deer” should be placed back into the bag between simulations but not during a sample size simulation. Students will record their data on the Partner-Work Data for Sample Sizes document.
5. Have students determine total bucks and total does in each simulation for each sample size and calculate the percentage of male and female.
6. Have students record their data on the Class Chart so they can see the data from all groups. See digital table in slide show.
7. Before analyzing the whole class data, ask the students to use their own sampling to make a prediction of the percentages of bucks and does in the population.
    a. On what did they base their prediction?
8. Show the class data for “Sample Sizes of 7” to the class. As a class, analyze the data.
    a. *What do you notice about the data? Why do you think that is true? How accurate do you feel your prediction would be? If these questions don’t come out, ask the following questions. What do you notice about the variance in the percentages when the sample size was seven?*
9. Now show the class data for the “Sample Size of 21”.
    a. *What do you notice about the data? How is the variance different from the sample size of 7? How accurate do you feel your prediction would be if you based it on this sample size?*
10. Repeat the analysis with the “Sample Size of 35”.
    a. *Which sample size showed the most variability? Which sample size showed the least variability? On which sample size would you rather base your prediction? Explain your thinking.*
11. Use the class data to make a prediction on the percentages of bucks and does in the sample. On what did you base your prediction and what influenced your thinking? What is your prediction now that you have looked at many samples?

Closure

On a notecard have students complete an Exit Ticket activity:

Explain how sampling part of a population can give you information on the whole population. Make sure you summarize the mathematics used to predict information about the population

Differentiation

- When having students do the sampling activity it can be helpful to mark the bags ahead of time and let students assume that each bag has a different amount of beans in the bag. It is also helpful to collect the bags from students before the end of the lesson so that they cannot count the beans before making their predictions.

Extension

- Students can research data collections and collection strategies from other organizations such as the United States Fish & Wildlife department and Oregon Department of Fish & Wildlife.

Notes/Other

Jan Michael Looking Wolf's or Grand Ronde Canoe Family audio tracks can be played as background music while students are working. These audio tracks can be found on Spotify or Apple Music.

Jan Michael Looking Wolf: Spotify and Apple Music
Grand Ronde Canoe Family: Spotify and Apple Music

Appendix

Blacktail Deer Ratio Presentation:
https://docs.google.com/presentation/d/1vxIuQNtHCcSa2BwQuoZM8RPg7wvztwH1vdNUba_norw/edit?usp=sharing

Table 5- Sex and Genotypes Data:
https://drive.google.com/file/d/1wWAWrsKbX8Y0rkY9nUZQ3KQCDLQWyBmN/view?usp=sharing

Part 2 of Interview with Lindsay Belonga, Wildlife Biologist:
https://drive.google.com/file/d/1T1zmfCDWmFK_GCtmGHScZXkd1GvJihlZ/view?usp=sharing

Video Notes Part II:
https://drive.google.com/file/d/1Cf3bWwMqz4SG8cPOd436dyXG3XQf_UTD/view?usp=sharing

Class Chart:
https://drive.google.com/file/d/1a5qR4gkNmLvQWaCpm--xzZFC8ohoF9BU/view?usp=sharing

Partner-Work Data for Sample Sizes:
https://drive.google.com/file/d/1cRm6Lj1TXpWRtYj3Zyuktgyri-m7mvkZ/view?usp=sharing