Wisconsin Critter Count: Educator Handout

INTRODUCTION

The Wisconsin Department of Natural Resources uses a variety of tools and techniques to monitor wildlife, and to produce population estimates to better inform management decisions. Population estimates are used to look at long term trends, as well as setting harvest limits during hunting seasons for potentially vulnerable species. There are two count methods for generating population information: sample counts and total counts. In total counts, every individual of an intended geographic area is counted. For sample counts, a smaller fraction of individuals are counted and the data is used to interpolate population information for the entire geographic area. In this activity, you will create a model for these two different count methods and explore the advantages and disadvantages to both approaches.

KEY CONCEPTS

- Estimating wildlife populations informs conservation and management strategies
- Mathematical tools enable researchers to estimate populations
- Different conditions can determine which counting methods are more appropriate for determining populations

LEARNING OBJECTIVES

Students will be able to:

- Differentiate between a sample and total count and identify the advantages and disadvantages of each
- Collect data from both a sample count and total count for a population and calculate population densities
- Analyze the variations in data

CURRICULUM CONNECTIONS

Curriculum	Standards
NGSS (April 2013)	LS2-2; LS2-6
Common Core (2010)	RST.11-12.7, SL8.1; SL9-10.1, SL11-12.1, MP.2, MP.4, MP.5
AP Biology (2012-2013)	4.B.3, 4.C.3, Science Practice 1 and 2
IB Biology (2016)	HL Option G.1; G.3; G.4
AP Environmental Science (2013)	II.A, III.A, VII.C
IB Environmental Systems & Societies (2010)	1.1.10, 2.3.2, 4.2.6, 4.3.1
Wisconsin's Standards for Science	SCI.SEP1.A.m, SCI.SEP2.A.m, SCI.SEP2.A.h, SCI.SEP3.B.m, SCI.SEP4.D.m, SCI.SEP4.D.h

SNAPSHOT WISCONSIN

Wisconsin Critter Count: Educator Handout

KEY TERMS

Population, sample count, total count, survey, average, density, distribution, modeling

TIME REQUIREMENTS

Approximately 45 minutes

SUGGESTED AUDIENCE

This activity is appropriate for high school biology (all levels including AP and IB), high school environmental science (all levels including AP and IB), and introductory college biology or ecology

PRIOR KNOWLEDGE

Density, distribution, species, population, data analysis, modeling

MATERIALS

- Landscape sheets: one preprinted landscape sheet per group of 2-3 students
- Lentils or split peas to represent otters: approximately ½ teaspoonful per group
- Student Handout and Otter Fact Sheet
- Calculator
- Ruler: 1 per student group if you choose to have students calculate areas
- Optional, one clear sheet protector per group of 2-3. Note: if unavailable, students should be careful when distributing lentils on the landscape sheet.
- For optional start-up activity, one jar or beaker prefilled with small items such as beans, lentils, coins, or small candies to be displayed to whole class

PROCEDURES

1. Distribute the Student Handout.
2. As an optional warm-up activity, display a jar full of beans, coins or candy in from of the room and have students guess how many items are in the jar. As a class, discuss challenges to knowing actual numbers in the jar and discuss different strategies students came up with to estimate the total number.
3. Instruct students to read the introduction paragraph on the student handout.
4. Have students complete the T-chart on their student data sheet to explore the advantages and disadvantages of sample counts versus total counts for estimating populations.
5. Distribute the “Otter Fact Sheet.”

6. Explain to the class that they will be creating a model (simulation) of the otter population to compare sample versus total count methods for studying wildlife population sizes.
    a. Divide students into groups of two or three
    b. Pass out one landscape sheet per group and an optional sheet protector
    c. Explain the parts of the sheet to the students (counting strips, transects and total landscape area).
7. Have students calculate and record the transect and landscape areas. (If you are pressed for time, provide the calculated areas to students rather than having them complete the calculations).

    Transect area: length x width for each counting strip and then multiply by 2 since there are two counting strips per transect area. Repeat the process for the second transect.

    Area of each transect:

    Transect A: 15.8 cm x 1.6 cm = 25.25 cm^2 x 2 = 50.56 cm^2

    Transect B: 22.9 cm x 1.6 cm = 36.64 cm^2 x 2 = 73.28 cm^2

    Total landscape area: length x width of entire sheet

    Area of entire landscape:

    24.5 cm x 18.2 cm = 445.9 cm^2
8. Provide students with lentils.

    No sheet protector method: place a beaker of lentils and a ½ teaspoon at the front of the room and have one student from each group come up to get their lentils. A level ½ teaspoon is roughly 25-30 lentils. Or count 25-30 lentils per group ahead of time and place in cups.

    Sheet protector method: pour ½ teaspoon (approximately 2.5 mL) of lentils into a sheet protector or into a cup for each group. This can be done ahead of time, or call table groups up to get lentils. There should be around 25-30 lentils per group, but do not reveal this number to the students.

9. Demonstrate how to disperse lentils on the landscape sheet.

    No sheet protector method: one person cups the lentils into both hands about 10 cm above the landscape sheet and in one motion, pulls their hands apart to distribute the lentils. Runaway lentils should be returned to the landscape sheet randomly.

    Sheet protector method: make sure the landscape sheet is in a sheet protector and hold vertically while another student pours in lentils. Then hold the protector horizontally on a table with one hand holding the opening closed and rapidly shake or wiggle the setup for a few seconds to distribute them.

10. Each group should disperse the lentils. Tell students that if lentils bounce off of the landscape sheet, they should toss them back onto the sheet randomly.
11. Tell students that once they are dispersed they should not move the lentils until they are finished with their sample count and their total count.
12. As a class, establish the criteria for counting lentils within the transects. Examples include: don't pick up lentils as you count, or a lentil has to be all the way in the counting strip to be counted. Students then complete their counts in the transect areas. Students will do their sample counts first.
13. Students should record the numbers of lentils for each transect on their student worksheet.
14. To calculate the density of lentils for each transect:

    Density of lentils = number of lentils / area of the transect

15. To calculate the average density for an individual landscape:

    Average density = (transect A density + transect B density) / 2

16. To estimate the total number of otters in an individua landscape:

    Total number of otters = average density * area of landscape

17. Now have students do a total count of their otters. Students should count all of the lentils on their landscape sheet and record their data.
18. Students should answer question 13 on their worksheet. If you are short on time, students can move right to sharing their data and answer the question later.
19. Students should share their individual data with their classmates.
20. Students should clean up their workspace and answer the remaining questions.
21. Once students have the class data, they should calculate the total area for the class:

    Total area for class = landscape area calculated in Table 1 x number of groups in class

22. Students should calculate the estimated density of otters for the class using the **sample count** data: Total number of otters from the sample count total calculated in Table 3 divided by the total area for the class.
23. Students should calculate the actual density of otters for the class using the **total count** data: Total number of otters from the total count column in Table 3 divided by the total area for the class.

TEACHING TIPS

- Lentils or split peas are recommended because they have one flat side, which eliminates some bouncing. Other beans or small objects can also be used.
- Sheet protectors can be used to set up the activity so the lentils are stored between classes if you have multiple classes throughout the day. The lentils can be poured out into a cupped hand if it is easier for students to do the dropping technique of lentil distribution, then returned to the sheet protector
- If you do not have sheet protectors, have a beaker of lentils and a ½ teaspoon at the front of the room and have one student from each group come up to get their lentils. Or you can count out 25-30 lentils per group ahead of time and place in cups.
- Some curricula require students to use the mark-recapture method of population sampling. If your students are familiar with that method, or plan on doing it soon, discuss the differences in the methods and why different methods are more appropriate for different species and conditions. How well would mark-recapture work for otter population counts at this scale?

ANSWER KEY

The majority of answers for this worksheet are dependent on student results, but things to consider for several of the answers are addressed on the following pages.

18. Look at the calculations above. How similar were the numbers between the sample and total counts for the whole class data?

Answers will vary, but generally the sample estimates of otter numbers are higher than the total count.

19. In the sample count method, did any issues arise? If so, what did your group do to address the issues?

Answers will vary, but possible issues include lentils clumping together, one transect was closer to the release of the lentils so it received more than the transect farthest away, or lentils on the line were counted by one person and not the other.

20. What issues do you think researchers might encounter when conducting sample count and how would they address these issues?

Sampling methods have assumptions about how they are being implemented. For example, it is assumed that the lentils are randomly distributed, that there are no lentils migrating in or out of the population, etc. Scientists use a number of methods, and the assumptions have been identified for each method. If conditions exist that violate the assumptions, then the method isn't valid for that situation.

23. Think about other species of Wisconsin wildlife. Are there any other species that aerial surveys may work well for? What about some species that aerial surveys would not work well for?

A possible species that may work well is deer, as they are large mammals that could be visible from aircrafts that the DNR wants better population estimates for (if students are thinking strictly of looking for animals tracks and not individuals, deer would not be appropriate for aerial). Some possible answers for species not suited for aerial surveys could be ones whose tracks or individuals are not clearly visible from aircrafts.

24. A goal of Snapshot Wisconsin is to provide another tool for generating wildlife population estimates. What are some advantages and disadvantages of using trail cameras for population estimates?

Some possible advantages students may list are having 24/7 collection of data from trail cameras, cost reduction for aerial surveys, and not having surveys be dependent on weather. Some disadvantages students may list are inaccuracy with identifying otters (against mink, muskrats, etc.), cameras may not be located near otter territory, or biases if trail cameras aren't evenly spaced across the state.

25. Discuss any modifications you could make to this model to better represent an otter count in Wisconsin.

A possible answer could include incorporating a variable to account for variable weather (i.e., put "blind spots" on the landscape sheet where lentils would not be visible due to lack of snow).