

Student Pages: Individual Activity

Instructions for this Activity

You will be given an excel file that contains 6 datasets. Before you open your excel file, read the information and instructions in these Student Pages carefully.

Each excel dataset includes real-world data on the grizzly bear population in the Greater Yellowstone Ecosystem (GYE) collected by the Interagency Grizzly Bear Study Team (IGBST). They collected these data to evaluate and monitor population trend, abundance, reproduction, and geographic distribution of the grizzly bear population in the GYE.

Before the grizzly bear population in the GYE can be considered for delisting, it must meet the following 3 Demographic Recovery Criteria:

Demographic Recovery Criterion 1

"Because 48 adult females with cubs of the year is equivalent to a population of approximately 500 total individuals (IGBC, p. 43), we are establishing a target number of 48 adult females of the year. This target number shall not go below 48 for any two consecutive years. For genetic reasons (Miller and Waits 2003, p. 4338) it is desirable that the total population of grizzly bears in the GYA be maintained above 400 bears. To assure that this goal is met and in order to adopt a conservative approach, the total population will be maintained at or above 500 grizzly bears. The estimate of 48 adult females with cubs of the year will be calculated by the IGBST based on model averaging described in the Supplement to the Reassessing Methods Document (IGBST 2006, pp.2-10)."

Demographic Recovery Criterion 2

"Sixteen of 18 bear management units within the Recovery Zone must be occupied by females with young, with no two adjacent bear management units unoccupied, during a 6-year sum of observations. This criterion is important as it ensures that reproductive females occupy the majority of the Recovery Zone and are not concentrated in one portion of the ecosystem."

Demographic Recovery Criterion 3

"For independent females (at least 2 years old), the current annual mortality limit, not to be exceeded in 2 consecutive years and including all sources of mortality, is 9 percent of the total number of independent females. For independent males (at least 2 years old), the current annual mortality limit not to be exceeded in 3 consecutive years and including all sources of mortality, is 15 percent of the total number of independent males. For dependent young (less than 2 years old), the current annual mortality limit, not to be exceeded in 3 consecutive years and including only known and probable human caused mortalities, is 9 percent of the total number of dependent young."

ADDITIONAL INFORMATION ABOUT THE DELISTING PROCESS: The goal of the Endangered Species Act (ESA) is to recover species back to the point where they no longer need federal protection.

When a species is listed as Threatened or Endangered, management is moved from the state wildlife agencies to the federal US Fish and Wildlife Service. Before any listed species or population can be delisted, the US Fish and Wildlife Service evaluates the following 5 factors:

1. Is there a present or threatened destruction, modification, or curtailment of its habitat or range?
2. Is there overutilization for commercial, recreational, scientific or educational purposes?
3. Is there disease or predation?
4. Is there inadequacy of existing regulatory mechanisms?
5. Are there other natural or human-caused factors affecting the population's continued existence?

Okay, let's get started! Go ahead and open your excel file entitled "GYE Grizzly Bear Datasets". This excel file includes 6 Datasets.

Each data set has a title, a description of column labels (located at the bottom of each table), and **instructions located in a BLUE BOX**. Because it might be difficult to read the instructions in the excel file while also doing what the instructions tell you to do, we have also provided all data set instructions at the end of this Student Page (look for the blue boxes on the last 2 pages!).

STEP 1: Demographic Recovery Criterion #1

- This Demographic Recovery Criterion includes **3 datasets (Dataset 1, Dataset 2, and Dataset 3)**

First, read the short paragraph that describes Recovery Criterion #1 again (**it's located a few paragraphs above this paragraph**) so you know why you are evaluating these data.

Start with Dataset 1 first. What data does this table include? What data are missing?

In most tables in these 6 datasets, you will see that some cells are highlighted in **yellow** and some cells are highlighted in **green**. All cells highlighted in yellow require you to do a calculation to fill in the cells. Some calculations are more difficult than others. For hints about how to do calculations, you can click on the little red triangles that are hiding inside some of the cells.

All cells highlighted in green require you to find and fill in the missing values. No calculations needed for green cells. Where do you find the values for cells highlighted in green? They are located in a different, but corresponding, data set within the GYE Grizzly Bear Dataset excel file. For example, the values for the green cells in Data set 1 can be found on Data set 2. So, in order to complete Dataset 1, you will need to calculate values in Dataset 2 and then transfer those values to Dataset 1.

Okay, go ahead and follow the instructions in the blue box for Dataset 1. **Definitions for column headings are provided at the bottom of each table.** For example, the definition of "Cubs of the Year" is this: cubs that were born during the year of observation. So an adult female with cubs of the year will have cubs with her that are between 0-12 months old on the day that she was observed in the wild by a grizzly bear biologist.

For now, don't worry too much about what exactly things like "Minimum Population Estimate" mean; this information will be provided to you when you begin the Student Group Activity.

When you have completed Dataset 1, complete the instructions for Dataset 2, and move on to Dataset 3. Follow the instructions in the blue box for Dataset 3.

When you're done with Datasets 1-3, take a break! Whew! You're done with datasets related to **Demographic Recovery Criterion #1!**

STEP 2: Demographic Recovery Criterion #2

- This Demographic Recovery Criterion includes **1 Dataset (Dataset 4) and 1 Figure**

Now you are ready to begin evaluating data for **Demographic Recovery Criterion #2**. Read the short paragraph about the Demographic Recovery Criterion #2 so you know why you are evaluating these data. Then, open **Dataset 4** and look at **Figure 1**. Follow the instructions in the blue box, located to the right of the table in Dataset 4.

STEP 2: Demographic Recovery Criterion #3

- This Demographic Recovery Criterion includes **2 Datasets (Dataset 5 and Dataset 6)**

Now you are ready to begin evaluating data for **Demographic Recovery Criterion #3**. Read the short paragraph that describes the Demographic Recovery Criterion #3 again so you know why you are evaluating these data. Open **Dataset 5** and follow the instructions in the blue box. When you have completed Dataset 6, open **Dataset 6** and follow the instructions in the blue box.

That's it! At this stage of the game, you might have some questions about some of the data and you might not completely understand why you created all those graphs. No worries. Things will become clear during the Student Group activity, which happens next.....

INSTRUCTIONS in BLUE BOXES FOR DATASETS

Dataset 1

Instructions

- 1) Fill in the missing values for the "Minimum Population Estimate" for years 2007-2014: to find these missing values look in Dataset 2 (use values you calculated for "Estimated Total Population Size")
- 2) Make a graph showing "Minimum Population Estimate" for years 1991-2014
- 3) Calculate lambda for each consecutive 2-year time period (i.e., fill in the yellow-shaded cells in column D)
- 4) Make a graph showing estimated lambda for each consecutive 2-year time period during years 1992-2014

Dataset 2

Instructions

- 1) Calculate "Estimated Total Population Size" for each year (hint: click on little red triangle in cell F6)
- 2) You will need the values you just calculated to fill in missing values on Dataset #1
- 3) Make a graph showing the "Annual Size Estimate" for independent females (hint: you may need to make a new table) by year, along with upper and lower 95% Confidence Intervals (CI)

Dataset 3

Instructions

1. Calculate the "Unduplicated females with COY" using the Chao2 equation

$$N_{\text{Chao2}} = m + \frac{f_1^2 - f_1}{2(f_2 + 1)}$$

2. Make a graph showing "Unduplicated females with COY (corrected estimate using Chao2)" for each year 1983-2014

Dataset 4

Instructions

- 1) Calculate the "Annual Total" for each year 2001-2012 (complete cells in Row 26)
- 2) Calculate the "6-year Running Averages" for each year 2001-2012 (complete cells in Row 27)
- 3) Calculate the "Number of years the BMU was occupied 2007-2012" (Complete cells in Column U)
- 4) Make a bar graph showing the number of years each BMU was occupied during 2007-2012
- 5) Make a line graph showing the Annual Totals for each year (how many BMUs were occupied each year?)

Dataset 5

Instructions

1. Fill in missing values for the cells highlighted in green; look in Dataset 1 to find missing values
2. Calculate 4% of the "Minimum Population Estimate" (fill in cells in column J)
3. Determine whether or not the "Year result" for Human-caused mortality for "All Bears" was "Under" or "Exceeded" the 4% of the "Minimum Population Estimate" (fill in cells in column K)
4. Make a graph showing "4% of Minimum Population Estimate" and "Human-Caused Mortality" for All Bears during years 1991-2006
5. Calculate 6-year running averages of human caused mortality for "All bears", "Female", and "Adult Female" and the Human-caused mortality for "All bears", by year (fill in the cells in Columns F, G, and H)
6. Make a graph showing the "6-year running averages of human-caused mortality" for "Adult females" for years 1991 - 2006

Dataset 6

Instructions

- 1) Fill in missing values for the cells shaded in green; get values from Dataset 2
- 2) Calculate the "Annual mortality limit" for each population segment for each year (fill in cells in Column K)
***look under these instructions for mortality limits**
- 3) Determine whether or not the "Mortality threshold year result" was "Under" or "Exceeded" (fill in cells in Column L) for each N segment for each year was met.
- 4) Make a graph showing "Estimated total mortality" and "Annual mortality limit" for Independent females for years 2007-2014
HINT: you may need to create a new table
- 5) Make a graph showing "Estimated total mortality" and "Annual mortality limit" for Independent males for years 2007-2014
- 6) Make a graph showing "Estimated total mortality" and "Annual mortality limit" for dependent young for years 2007-2014

Annual mortality limit:

Independent females: 9% of annual size estimate of independent females

Independent males: 15% of annual size estimate of independent males

Dependent young: 9% of annual size estimate of dependent young

Written by Dr. Melissa Reynolds-Hogland/Bear Trust International
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