UNIT 6C. HUMAN POPULATION GROWTH – FLIES LAB

LEVEL	TIME (min.)
Introductory	Ongoing

BENCHMARKS	
Next Generation Science Standards	HS-LS2-1 MS-LS2-1 MS-LS2.A MS-LS2.C HS-LS2.A HS-LS2.C
Common Core State Standards – ELA/Literacy	CCRA.SL.1 CCRA.SL.4
Common Core State Standards – Mathematics	MP.2 7.SP.1

INTRODUCTION:

The decline of the Columbia River salmon can be attributed to several causes, but they are all driven by the current exponential increase in human population growth. We live our lives day by day, and don't notice these increases except when looking back over a lifetime. It is probably beneficial for students to begin to understand the magnitude of the change in human population. In this activity, students plot the change in the population of a vial of flies, and then make analogies between a plot of the flies and that of humans. You should introduce the concept of *carrying capacity* if your students are not familiar with it. The carrying capacity of an environment is simply the maximum number of organisms of a particular species, which the environment can support. When a population grows beyond its carrying capacity, then limiting factors in the environment will reduce the size of the population, bringing it back to a sustainable level.

OBJECTIVE:

- Students will observe and analyze a population of black flies and their ability or inability to sustain themselves in order to critically compare and examine human population growth pattern on earth.

MATERIALS:

- vial of black flies
- graph paper
- STUDENT HANDOUT 6C-1: *Population Information*
- STUDENT HANDOUT 6C-2: *Population Data*
- STUDENT HANDOUT 6C-3: *Population Unit Evaluation*

KEY QUESTIONS:

- Will human populations respond to environmental limits? What might be done to keep human populations from crashing?
- What effect can one have on the size or growth of human populations? Can the earth sustain unlimited exponential growth?
- What is in store for humans if population continues to grow?

PROCEDURE:

1. Set up one vial of flies for your class. Do this about three months before you plan to do the curriculum section. Students estimate the number of adult flies (those which fly) in the vial each week, and record this in a table they maintain themselves. (While students may claim that they cannot make an accurate count of the flies, their estimates are generally consistent with one another.)

2. Once the number of flies starts to increase, have your students graph the data they have tabulated thus far. Have them make room for about 15-20 weeks' worth of data on the x-axis, and estimate the largest number of flies they expect they will count in setting up the y-axis. Later, if they have many more or fewer flies, they can recalibrate the y-axis.

3. The week after starting the graph, have your students make a hypothetical curve, on the graph they have set up, of what they think will happen to the population week by week until the 20th week. This forces them to think about the system they are studying. They plot the hypothetical curve, and label it. After this, they plot each week's data as points, connecting them with a line as they go. They continue to record their counts in their table.

4. Continue this pattern until all of the flies have been dead for two consecutive weeks. Then, hand out STUDENT HANDOUT 6C-1: ***Population Information***, which contains information on the size of the human population from 1650 to 2050. It also contains information about the square mile area of the city of Beaverton. While the curves graphed are generated by data from diverse sources, their shapes (slopes) are similar, and illustrate the influence of population size. (Students collected this data, and it is presented as an example. You should have your students research this information for the town or city where they live.)

5. The next step is to make extra y-axes on the right end of the graph of fly data for human and municipal area data. Ask students to make the data fit the axes. Then, they make another x-axis at the top of the graph for years 1650 - 2050. This creates some confusion, as some students feel they should begin with 1650 on the right, and work to the left. They plot the human population and square mile areas from 1650 to 2050 using this new x-axis. Students use these curves to finish the population project.

6. Now, students work in groups to complete the project. They answer the questions presented in the worksheet, and present their responses to the class. If there is time, have them present their ideas to the class in a seminar format. If not, either have them critique the plans in pairs, or simply post their posters. Use STUDENT HANDOUT 6C-3: ***Population Unit Evaluation*** to evaluate the poster, responses, and graphs for each group.

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STUDENT HANDOUT 6C-1

Population Information

1. Review the table of information in STUDENT HANDOUT 6C-2: Population Data about the human population, and the square mile area of a city.

2. Plot the data in the tables on STUDENT HANDOUT 6C-3: Population Unit Evaluation onto a graph of the human population. Make the y-axis for the square mile area of the municipal area on the right side of your graph. Make the axes the same size as for the human population data. Why?

3. Review all the work you have done so far. As a group, answer the questions below. Write written responses that are legible and thoughtful.

a. Compare and contrast the curves. Are there any overall patterns?

b. The earth has been referred to as a "test tube" because, even though it is very large, it has only itself as a source of food. Does this mean that the human population will respond to environmental limits in the same way as the fly population? What makes you think this?

c. Suppose, for a moment, that the human population could "crash." What might be done to keep this from happening?

d. You are one small group of human beings. What effect can you have on the size of the human population?

e. Present your ideas about how human population growth will affect human life on earth. Will the earth sustain unlimited growth? Will there be changes in the way we live? What we do? What will life be like in the year that you become 50? Illustrate your ideas in a poster. Make the presentation of your ideas a "Plan for the Future."

STUDENT HANDOUT 6C-2

Population Data

Year	Human Population (billions)	Beaverton Area (mi^2)
1650	.5	
1850	1.1	1.1
1930	2.0	
1952	2.6	1.1
1962	3.1	
1975	4.0	
1985	4.9	
2000	6.2	16.0
1600	.5	
1700	.6	
1800	.8	
1830	1.0	
1900	1.6	1.1
1960	3.0	
1978	4.2	
1981	4.5	
2050		30.8

Note: Dates may not be in sequence. Use your graphing skills to discover how to plot them.

STUDENT HANDOUT 6C-3

Population Unit Evaluation

Presentation:

1. Answer each question (3.a-e): _____
2. Participation:_____

Poster:

1. Readable:_____
2. Based on data:_____
3. Reasonable:_____
4. Accompanied by accurate area graph:_____

Individuals:

1. Table of fly data:_____
2. Graph of hypothetical fly data:_____
3. Graph of actual fly data:_____
4. Graph of human data:_____
5. Graph of municipal area data:_____
6. Answers to first set of questions:_____