Environmental Science

Human Population Growth: The Power of the Pyramids
Objectives
After this lab you should be able to do the following:

- See how population distribution differs by country
- Understand why population distribution differs by country
- Discuss how the population pyramid of a country relates to the growth of that country

Materials
Materials for this lab are:
Internet

Introduction
As long ago as 1789, Thomas Malthus studied the nature of population growth in Europe. He claimed that population was increasing faster than food production, and he feared eventual global starvation. Of course, he could not foresee how modern technology would expand food production, but his observations about how populations increase were important. Population grows geometrically (1, 2, 4, 8 ...), rather than arithmetically (1, 2, 3, 4 ...), which is why the numbers can increase so quickly.

A story said to have originated in Persia offers a classic example of exponential growth. It tells of a clever courtier who presented a beautiful chess set to his king and in return asked only that the king give him one grain of rice for the first square, two grains, or double the amount, for the second square, four grains (or double again) for the third, and so forth. The king, not being mathematically inclined, agreed and ordered the rice to be brought from storage. The eighth square required 128 grains, the 12th took more than one pound. Long before reaching the 64th square, every grain of rice in the kingdom had been used. Even today, the total world rice production would not be enough to meet the amount required for the final square of the chessboard. The secret to understanding the arithmetic is that the rate of growth (doubling for each square) applies to an ever-expanding amount of rice, so the number of grains added with each doubling goes up, even though the rate of growth is constant.

Similarly, if a country's population begins with 1 million and grows at a steady 3 percent annually, it will add 30,000 persons the first year, almost 31,000 the second year, and 40,000 by the 10th year. At a 3 percent growth rate, its doubling time — or the number of years to double in size — is 23 years. (The doubling time for a population can be roughly determined by dividing the current growth rate into the number "69." Therefore, 69/3=23 years. Of course, if a population's growth rate does not remain at this rate, the projected doubling time would need to be recalculated.)

The 2000 growth rate of 1.4 percent, when applied to the world's 6.1 billion population, yields an annual increase of about 85 million people. Because of the large and increasing population size, the number of people added to the global population will remain high for several decades, even as growth rates continue to decline.
Between 2000 and 2030, nearly 100 percent of this annual growth will occur in the less developed countries in Africa, Asia, and Latin America, whose population growth rates are much higher than those in more developed countries. Growth rates of 1.9 percent and higher mean that populations would double in about 36 years, if these rates continue. Demographers do not believe they will. Projections of growth rates are lower than 1.9 percent because birth rates are declining and are expected to continue to do so. The populations in the less developed regions will most likely continue to command a larger proportion of the world total. While Asia's share of world population may continue to hover around 55 percent through the next century, Europe's portion has declined sharply and could drop even more during the 21st century. Africa and Latin America each would gain part of Europe's portion. By 2100, Africa is expected to capture the greatest share.

The more developed countries in Europe and North America, as well as Japan, Australia, and New Zealand, are growing by less than 1 percent annually. Population growth rates are negative in many European countries, including Russia (-0.6%), Estonia (-0.5%), Hungary (-0.4%), and Ukraine (-0.4%). If the growth rates in these countries continue to fall below zero, population size would slowly decline. As the chart "World population growth, 1750–2150" shows, population increase in more developed countries is already low and is expected to stabilize.
Pre-lab Questions

1. Two countries will be assigned to you with basic information. Answer the following questions before class. Use the internet if needed.

2. Complete this statement for each country: The country, ________________, is located ________________ and it is ______(lifestyles, development, etc)_____.

3. Find the estimate of the population of your country today (use most recent data, not predicted population numbers).

4. Answer the following questions:
   a. What is the Crude Birth Rate (CBR)?
   b. What is the Crude Death Rate (CDR)?
   c. Use the following to calculate the rate of increase:

   \[
   \frac{CBR - CDR}{10} = \text{rate of increase}
   \]

   d. Use the rate of increase to calculate the time needed to double the population using the following:

   \[
   \frac{70}{\text{rate of increase}} = \text{doubling time}
   \]

5. On a separate page, construct two data tables that have 5 columns and 23 rows. Give the columns the following headings: Age Group, Number of Males, Percent of Population, Number of Females, Percent of Population. You will record data from the lab in this table.

Procedure

1. Log onto the web and go to www.census.gov. Choose the following Links: People, International > World Population Information > International Database > Summary of Demographic Data

2. Answer the following questions for your country.
   a. What is the life expectancy of your country?
   b. What is the total fertility rate (TFR) of your country?
c. What is the infant mortality rate?
d. How has the population size changed since 1950?

3. Find your country and record the population data for each age group according to the chart you created in the pre-lab. Next, calculate the percent population by dividing each age group by the total population of the country. On the bottom of the chart create a totals row, for the total male population with percent and the total female population with percent. (The two percents should add up to nearly 100.)

4. After completing the chart create a histogram of the percent population using the chart page. Color in your histogram by reproductive status. (0-14 pre-reproductive, 15-44 reproductive, 45+ post reproductive)

5. On your histogram, label the country on the top and add the rate of increase and doubling time to the bottom. Compare your country to other countries before answering the questions on the bottom of the page.

Lab Questions

1. Using the information, separate the countries in your class into the following categories: Zero or Negative Population Growth (population growth less than or equal to zero), Slow Population Growth (rate of increase is more than zero but less than 0.7), Rapid Population Growth (rate of increase is more than 0.7)

2. What did your country’s histogram look like? Did either population have a baby boom? How could you account for the histogram’s shape?

3. Determine the percentage of population that has yet to reach childbearing age. What does this number tell you about future growth in your countries?

4. Using the information graphed on your histograms and your knowledge of the counties, briefly discuss how each country might be helped to come close to ZPG.

Point break down

Title, and objectives – 5 points
Pre-lab Questions – 16 points (4 points each)
Data from Procedure – 15 points
Graphs – 32 points (16 points each)
Lab Questions – 32 points (8 points each)