Population Solver

AiS Challenge

Final Report

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Team Members:

Matt Higgins

Josh Neidigh

Levi Valdez

Executive Summary

Populations of different species of animals are very important to many people in the United States. Some species of animals in the US are doing very well, while others are on the verge of extinction or have extremely small and unhealthy populations. Animals like the White Tail Deer and Snow Geese are doing very well, but others like the Californian Condor and Whooping Crane are not doing that great. Game populations are very important to game managers; they try to get all species at a reasonable population that is not too great nor to low. These people try to find different management plans that will work effectively and efficiently, both economically and environmentally. They also need to know what non-native species would harm native ones, and what non-invasive species would be a plus in our society. With some revision and adaptation this program could be of use to Game Managers and Biologists around the world to find good management plans and predict future populations.

In the early 1960's, the New Mexico Department of Game and Fish and the New Mexico State Game Commission began a program of exotic big game introduction to increase and diversify hunting opportunities. Habitats with low potential for native big game were targeted for exotic introduction. Over a nine-year period beginning in 1969, gemsbok (Oryx gazella) or oryx, a native of Africa, were released into creosote and mesquite brush land areas on the White Sands Missile Range. By the mid 1970's, a self sustaining oryx population was established on the Range and limited hunting was

initiated. Gradual expansion of the population allowed sport harvest on lands immediately surrounding the White Sands Missile Range by 1989. (II)

Program Description:

The goal of this project is to find the population of the Oryx in future years by using a mathematical equation that involves their lifespan, natural deaths, deaths from predators, deaths from diseases, and their birthrate. This program can also be used to find the population of other species in future years.

The New Mexican Oryx:

The Oryx living in Southern New Mexico were imported from Africa in 1966. During the 60's New Mexico's Department of Game and Fish decided to make New Mexico a little more exotic, by importing Gemsbok, Siberian Ibex, and Arabian Ibex. The first 91 Gemsbok were released into the White Sands Missile Range and did much better than expected. The Siberian Ibex were released into the Florita Mountains, near Deming, and the Arabian Ibex were shot out, due to their crossbreeding with domestic goats.

Oryx are well-adapted desert animals. They have a highly efficient digestive system, which is successful in extracting almost all water content contained within the food that they consume. This is a bonus when living in areas where standing and running water is not common. Oryx in New Mexico breed year round, unlike their African cousins who base their breeding season around the wet and dry seasons. They want their calves born during the wet season. The Oryx's gestation period is nine months and once they drop their calves, they are ready to breed again within one to two months. Cows

having twins is not common, but still occurs in many cases. The birth rate based on African studies is 1.2 calves. This is do to their chances of having calves and to the fact that they can breed every ten to eleven months. On top of that females reach a sexual maturity at 1-½ years and then are nearly always pregnant.

The population of Oryx in New Mexico is currently estimated at thirty five hundred to four thousand animals. Oryx have expanded their range North to Socorro and south towards El Paso. A herd of ten to fifteen has moved into the Bosci del Apache Wildlife Refuge near Socorro, New Mexico. The Oryx population seems to stay within the two Mountain Ranges surrounding White Sands Missile Range, the Sierra Mountains and the Salinas Mountains. Oryx did well in New Mexico because it is a dry climate and has an abundance of food. A problem that has come up is that do to the cold winters we have in New Mexico their horns become brittle and broken horns are very common. Oryx have a capillary system above their palate that acts like a radiator to keep their brains from baking in the heat.

Physical Description

Gemsbok is a species of antelope. Oryx are small horse like antelope. Oryx originate from deserts and arid scrublands in Africa and Arabia. Oryx are light in color with dark patches on the face and legs. They have a black “racing stripe” that runs down their sides, near their bellies. They are beige with black or brown markings. A female gemsbok stands more than four feet tall at the shoulder and weighs four hundred to five hundred pounds. There are other smaller species of oryx in Africa, including Beisa, and Beatrix.

When the Gemsbok were first introduced in 1969, New Mexican Game Managers were looking for a good trophy animal to add to this empty quarter of southern New Mexico. Because of the well-adapted life style of Oryx, they thrived in 1992-1996 during drought, while populations of Desert Bighorn and Mule Deer dwindled. Oryx are well adapted to defending themselves, due to them weighing an average of 400 pounds and having horns more than three and a half feet long. Oryx are the only African hoofed animal ever to kill an African Lion. Data has not yet been collected concerning competition between Oryx and native ungulates. Food habit studies suggest that oryx diets overlap extensively with domestic cattle. Competition wit native species for space and water has not been analyzed but wildlife managers on the Range recognize a potential for displacement of native ungulates. Social displacement of ungulates and effects on vegetation also has not been studied.

Over 600 people annually are provided with an opportunity to harvest an oryx due to their high success in New Mexico. Since the first hunt in 1974 over 4,000 oryx have been harvested in New Mexico. In addition to 4 major hunt areas on the Range, the department of Game and Fish conducts population reduction hunts within and outside the Range. The department has to conduct these hunts to control population since oryx have no natural predators in New Mexico. Coyotes and Mountain Lions have been known to kill an oryx, but since coyotes are small and mountain lions' ranges are contained within mountainous areas neither species pose a great threat. Other than man, oryx have no effective predators.

DECTECTING POPULATION TRENDS

Aerial surveys are the most efficient means of counting oryx. In order to obtain comparable data from year to year a strict prescription must be followed. Trends identified through surveys will be used to establish annual harvest level requirements. Harvest levels will be increased if oryx counts in core survey areas increase. Harvest levels will be reduced as aerial counts in core area decrease. Population estimates will be generated on an annual basis via methods used to determine the current oryx population. Acquiring population trend data requires consistency in timing, area surveyed, intensity of survey, and observers. Specific survey requirements to standardize data collection include:

- Conduct surveys during the same time period for all survey areas
- Conduct surveys from a fixed-wing aircraft;
- Conduct surveys during December, January, or February when oryx are most active for longer portions of the day, and foliar vegetative cover I minimal;
- Conduct surveys on days with good visibility, wind speeds less than 15 miles per hour, and cloud cover of no more than 25 percent;
- Use the same aircraft type, and preferably the same pilot, each year;
- Cover the same areas within each survey area each year; and cloud cover of no more than 25%;
- Use Global Positioning System navigation and maps of previous survey routes to ensure consistency. (II)

Birth rate=1.2: cpop=3500-4000

By finding the death rates, birth rates and other information dealing with the Gemsbok, we were able to create a mathematical equation to calculate population of the Oryx and other animals. By further examining the equation you should be able to calculate the population of the Oryx in any given year.

In conclusion if the equation works correctly, it could be of use to wildlife biologists and game managers around the world to determine the populations of animals, and the effectiveness of certain programs that aim to control population growth.

Our most significant achievements were learning the Java Language, learning to work iterations and most importantly, each other.

Problems:

We had a couple of problems with the program. One is the development of the C++ program and further changing to Java Version. Upon completion of the programs we were able to develop a small portion of the program. The Population Solver still needs to be developed further with emphasis in the are area of the mathematical model. There is still anticipation to complete the project in the future.

Acknowledgments

We would like to thank some of the people who have helped us. We would especially like to thank Mrs. Crockett for keeping us on track. We would also like to thank Pat Morrow for the information he provided us with.

References

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6. "Oryx Roundup" http://www.wsmr.army.mil/paopage/Pages/Wu%2315.htm
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http://ets.uidaho.edu/wlf488/popstruct.htm

11. “How to compute sex ratios” http://www.ets.uidaho/wlf488/SexRatio3.htm

12. “Age-Specific Pregnancy Rates for some North American Ungulates”

http://www.ets.uidaho.edu/wlf448/AgeSpec1.htm

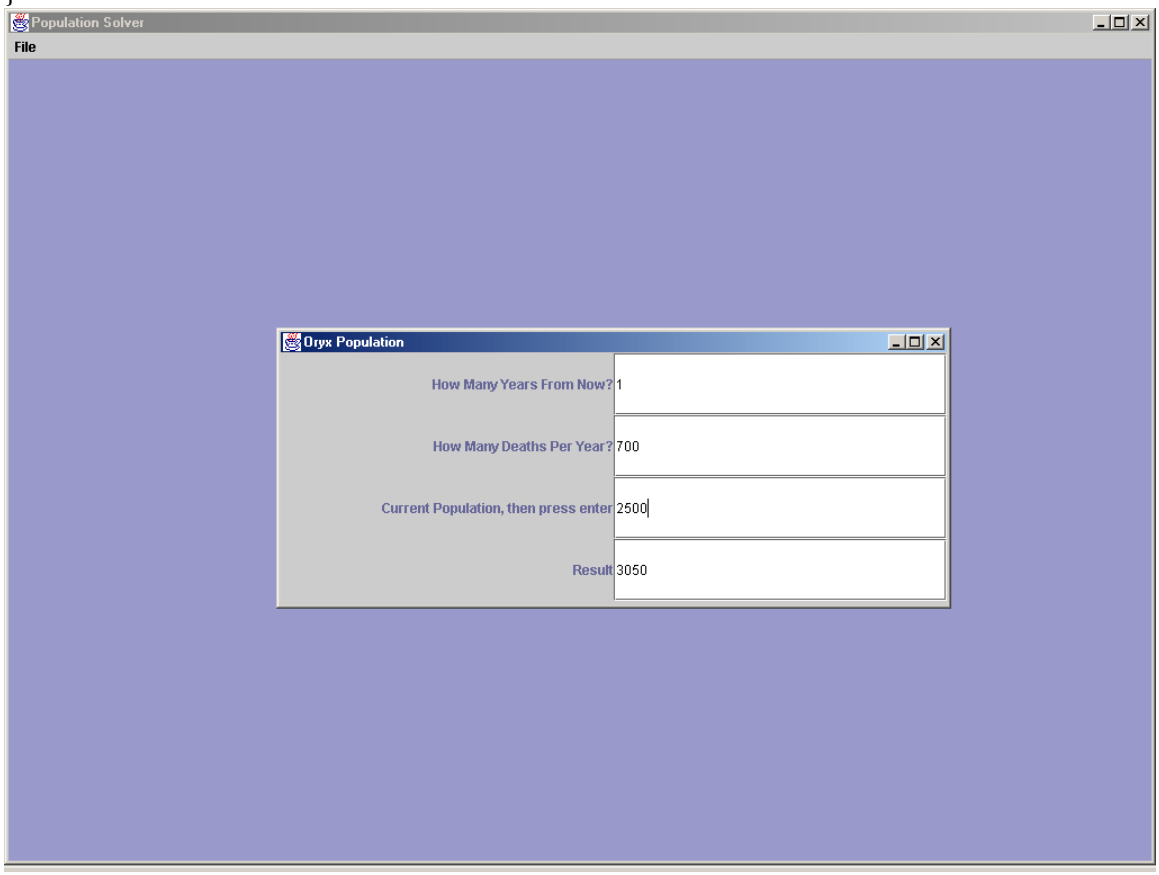
Program

```
// Start of Population Solver in Linux GNU \ GUI
// Program Name: PopSolve.java
// Class Names:
// Class Names:
// Class Names:
// Built, designed and made by: Levi Valdez and Mesa Alta
//      Junior High Challenge Students <AiS Challenge Team 053>

// Java core packages:
import java.awt.*;
import java.awt.image.*;
import java.awt.print.*;
import java.awt.font.*;
import java.awt.event.*;
import java.awt.datatransfer.*;
import java.awt.color.*;
import java.io.*;
import java.math.*;
import java.util.*;
import java.text.*;
import java.text.DecimalFormat;
import java.applet.*;
import java.lang.*;

// Java extention packages:
import javax.swing.*;

public class PopSolve extends JFrame {
   private JDesktopPane oryxDesktop;

   // set up GUI
   public PopSolve()
   {
      super("Population Solver");

      // create menu bar, menu and items
      JMenuBar bar = new JMenuBar();
      JMenu addMenu = new JMenu("File");
      JMenuItem newFrame = new JMenuItem("New Session");

      addMenu.add(newFrame);
      bar.add(addMenu);

      setJMenuBar(bar);

      // set up oryxDesktop
      oryxDesktop = new JDesktopPane();
      getContentPane().add(oryxDesktop);

      // set up listener for newFrame menu item
      newFrame.addActionListener(

      // anonymous inner class to handle menu item event
      new ActionListener() {
```

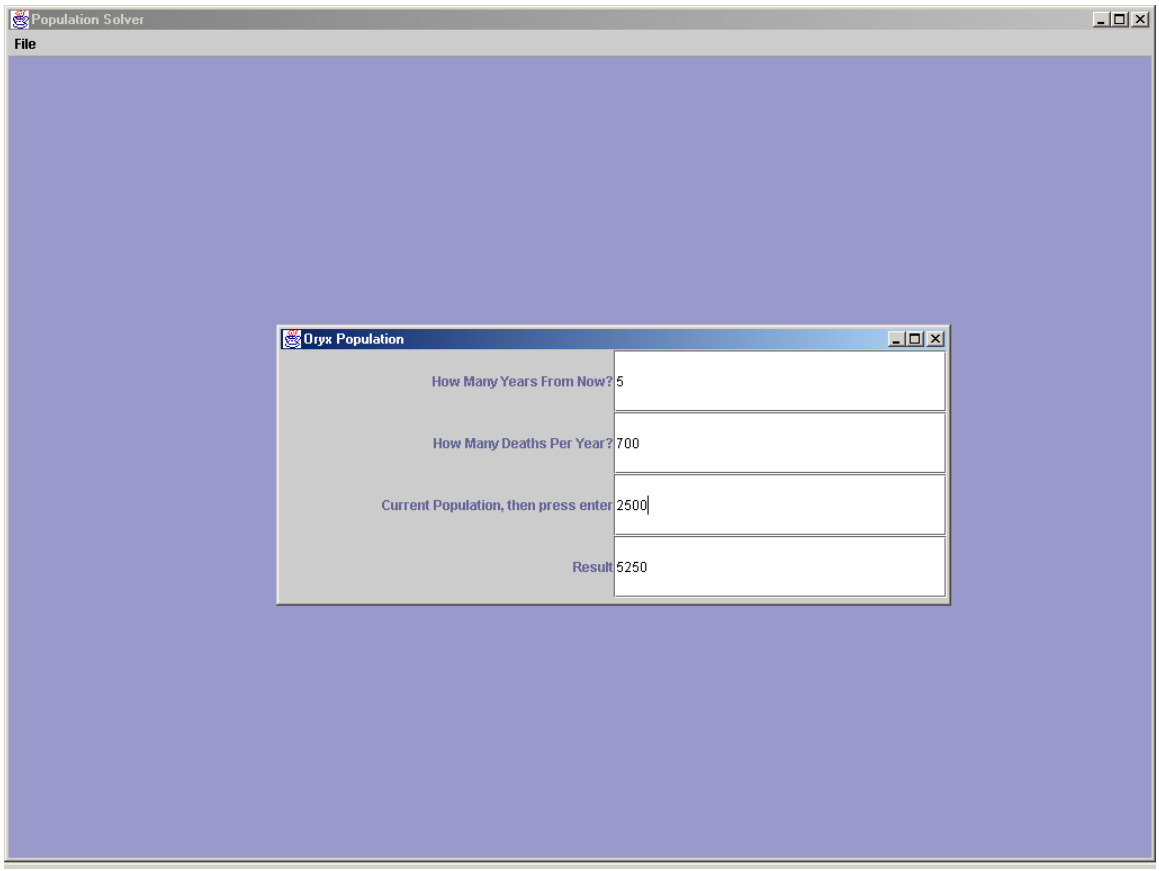
```
            // display new internal window
            public void actionPerformed(ActionEvent event) {

               // create internal frame
               JInternalFrame frame = new JInternalFrame(
               "Internal Frame", true, true, true, true);

               // attach panel to internal frame content pane
               Container container = frame.getContentPane();
               OryxStart panel = new OryxStart();
               container.add(panel, BorderLayout.CENTER);

               // set size internal frameto size of its contents
               frame.pack();

               // attaxh internal frame to desktop and show it
               oryxDesktop.add(frame);
               frame.setVisible(true);

            }

         } // end anonymous inner class

         ); //end call to addActionListener

         setSize(600, 440);
         setVisible(true);

      } // end constructor

      // execute application
      public static void main(String args[])
      {
         PopSolve application = new PopSolve();

         application.setDefaultCloseOperation(
         JFrame.EXIT_ON_CLOSE);
      }

   }  // end class PopSolve

   // class to display text on a panel
   class OryxStart extends JFrame
      implements ActionListener {

      private JTextField inputField1, inputField2, inputField3, outputField;
      private int number1, number2, number3;
      private double result;

      public OryxStart()
      {
         super("Oryx Population");

         Container container = getContentPane();
         container.setLayout(new GridLayout(4, 2));
```

```
    // contstuct text fields

    container.add(
    new JLabel("How Many Years From Now?", SwingConstants.RIGHT));
    inputField1 = new JTextField(10);
    container.add(inputField1);

    container.add(
    new JLabel("How Many Deaths Per Year?", SwingConstants.RIGHT));
    inputField2 = new JTextField(10);
    container.add(inputField2);

    container.add(
    new JLabel("Current Population, then press enter", SwingConstants.RIGHT));
    inputField3 = new JTextField(10);
    container.add(inputField3);
    inputField3.addActionListener(this);

    container.add(
    new JLabel("Result", SwingConstants.RIGHT));
    outputField = new JTextField();
    container.add(outputField);

    setSize(600, 250);
    setVisible(true);

}

// process events
public void actionPerformed(ActionEvent event)
{
    DecimalFormat precision3 = new DecimalFormat("0");

    outputField.setText(""); // clears the output field


    try {
        number1 = Integer.parseInt(inputField1.getText());
        number2 = Integer.parseInt(inputField2.getText());
        number3 = Integer.parseInt(inputField3.getText());

        result = (((number3 / 2 * number1) - (number2 * number1)) + number3);
        outputField.setText(precision3.format(result));
    }

    // process improperly formatted input
    catch (NumberFormatException numberFormatException) {
        JOptionPane.showMessageDialog(this,
        "You must enter a valid integer",
        "Invalid number format",
        JOptionPane.ERROR_MESSAGE);
    }
}

// excecute third part
```

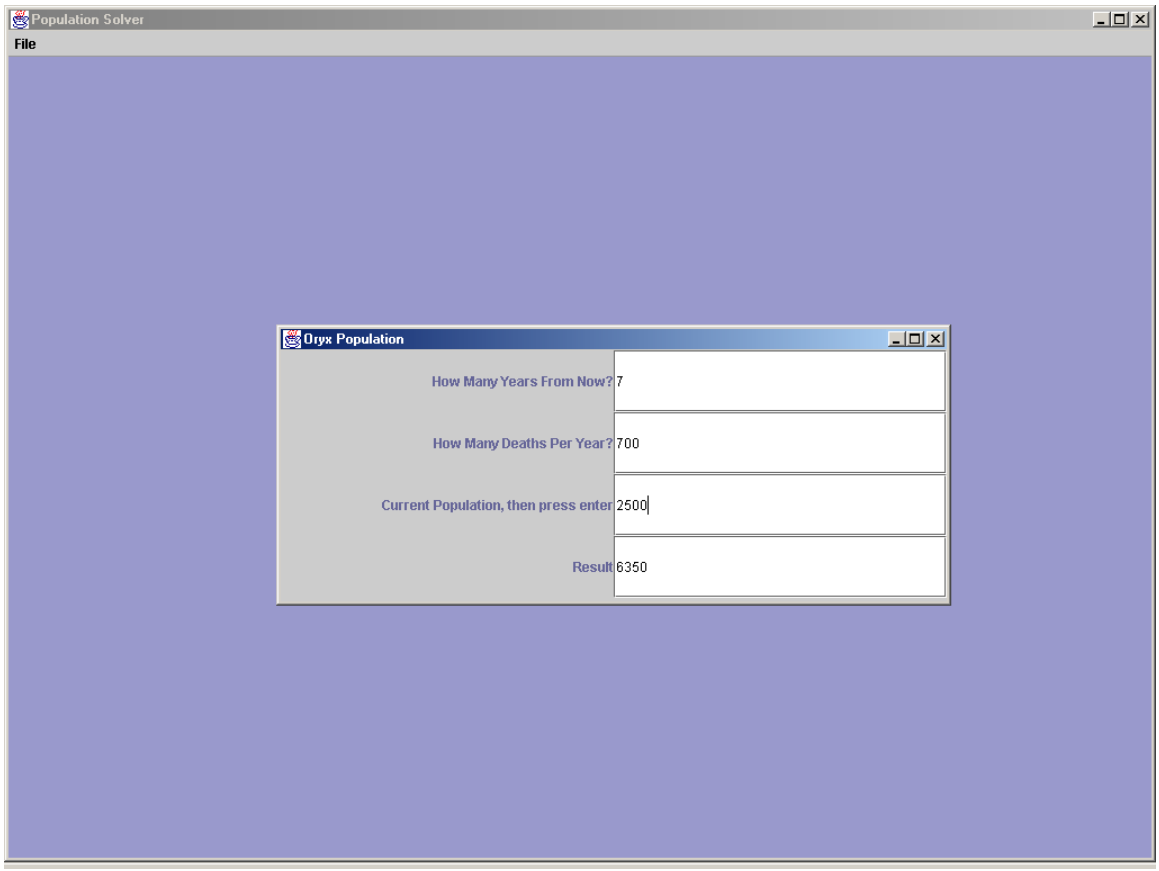
```
   public static void main(String args[])
   {
      PopSolve application = new PopSolve();

      application.setDefaultCloseOperation(
      JFrame.EXIT_ON_CLOSE);
   }

}
```



Population Solver With 1 Year From now



Population Solver with 5 years from now



Population Solver with 7 years from now.