

## **Lesson 2: Population Dynamics – Class Checkup Results**

### **Master List of Documents**

#### Teacher Resources:

- Overview (Introduction, Key Concepts, Student Level, Skills, Objectives)
- *Population Dynamics – Class Checkup Results*
  - *Graphing Options (pages 1-3)*
- Georgia Life Science (Grade 7) Standards Correlations
- Georgia Biology (Grades 9-12) Standards Correlations
- Georgia Environmental Science (Grades 9-12) Standards Correlations

#### Student Worksheets:

- *Population Dynamics – Class Checkup Results*
  - *Background – The Average Monarch Butterfly*
  - *Background for Further Investigations – Sample Size & Relationships Between Variables*
  - *Materials and Procedures*
  - *Table I – Class Results*
  - *Tables II & III – Summary of Class Results (Class Totals & Class Averages)*
  - *Table IV – Male Monarch – Size and Fat*
  - *Table V – Female Monarch – Size and Fat*
  - *Table VI – Monarchs Infected with OE – Size and Fat*
  - *Table VII – Monarchs Not Infected with OE – Size and Fat*
  - *Blank Table with Forewing Length, Mass, and Fat*
  - *Discussion/Analysis*
- *Monarch Physical Rating Scales (pages 1 and 2)*  
(See Lesson 1: Checkup Time – Give Your Monarch a Physical!)

## Lesson 2: Population Dynamics – Class Checkup Results Overview

### Introduction:

This is a great lesson to encourage inquiry-based learning and incorporating mathematical calculations into the middle and high school life science curriculum. In this follow up activity to Lesson 1 (*Checkup Time – Give Your Monarch a Physical!*), students will compile and analyze data for the class's monarch population. Initially students will combine the information from the individual monarch physicals into one data table (Table I). Then students will calculate means, medians, modes, and percentages for various characteristics and subpopulations (using Tables II and III). Circle and bar graphs may be created using data from these tables. Students will then answer questions concerning the traits of a typical member of the population. In addition, they can compare individual butterflies to the average monarch.

Once the basic activity has been completed, there are many options for further investigation. In general, the characteristics of the monarch population will determine the direction of additional analysis, but this is also a great opportunity for students to engage in inquiry, attempting to answer questions of their own choosing! Students may look at the effect that parasite infection or gender has on monarch size. They may analyze the relationship between mass and forewing length. Within this activity there are a number of data tables available to assist student interpretation of relationships between different monarch characteristics. The handy *Graphing Options* charts lay out graphing parameters and data sources for teachers and students. With the *Further Investigations* section we have provided teachers with the flexibility of assigning topics or allowing students to pick their own topic.

This is a supplemental activity for participant of Project *MonarchHealth*. For more detailed information on monarchs, OE parasites, and the *MonarchHealth* project, there are additional details online at <http://www.monarchparasites.org/>

### Key Concepts:

- Scientists use mathematics to analyze data.
- Scientists use mean, median, and mode to define average.
- Individual monarch butterflies are not the same.

### Student Level:

- Middle school
- High school

### Skills:

- Data collection
- Calculations of mean, median, mode, and percentages
- Graphing
- Data analysis

### Objectives:

Students will collect and analyze data about the physical characteristics of a population of monarch butterflies. They will make mathematical calculations and graphs to describe the population and a typical member of the population. Students will also investigate relationships between traits.

**Population Dynamics – Class Checkup Results**  
**Graphing Options – Page 1 of 3**

**Pie Charts:**

Title	Source of Data	Graphing Categories	
		# of Categories	Types of Categories
<i>Percent of Raised and Wild Monarchs *</i>	<i>Table II – Class Totals</i>	2	Percent Raised Monarchs, Percent Wild Monarchs
<i>Percent of Monarchs Infected and Not Infected with OE *</i>	<i>Table II – Class Totals</i>	2	Percent of Monarchs Infected with OE, Percent of Monarchs Not Infected with OE
<i>Percent of Male and Female Monarchs *</i>	<i>Table II – Class Totals</i>	2	Percent of Male Monarchs, Percent of Female Monarchs
<i>Percent of Monarchs with Different Amounts of Wing Wear</i>	<i>Table I – Class Results</i> (percent calculations needed)	5	Percent of Monarchs with Wing Wear Scores of 1, 2, 3, 4, and 5
<i>Percent of Monarchs with Different Amounts of Wing Damage</i>	<i>Table I – Class Results</i> (percent calculations needed)	5	Percent of Monarchs with Wing Damage Scores of 0, 1, 2, 3, and 4
<i>Percent of Monarchs with Different Amounts of Fat</i>	<i>Table I – Class Results</i> (percent calculations needed)	4	Percent of Monarchs with Fat Scores of 1, 2, 3, and 4

\* Graph for the Main Activity

**Population Dynamics - Class Checkup Results**  
**Graphing Options – Page 2 of 3**

**Bar Graphs:**

Title	Data Source	X Axis			Y Axis
		Label	# of Categories	Categories	
<i>Percent of Monarchs with Different Characteristics *</i>	<i>Table II – Class Totals</i>	Characteristics	3 pairs	Raised and Wild, Infected with OE and Not Infected with OE, Male and Female	Percent of Monarchs
<i>Number of Monarchs with Different Amounts of Wing Wear</i>	<i>Table I – Class Results (counting required)</i>	Wing Wear Score	5	1, 2, 3, 4, and 5	Number of Monarchs
<i>Number of Monarchs with Different Amounts of Wing Damage</i>	<i>Table I – Class Results (counting required)</i>	Wing Damage Score	5	0, 1, 2, 3, and 4	Number of Monarchs
<i>Number of Monarchs with Different Amount of Fat</i>	<i>Table I – Class Results (counting required)</i>	Fat Score	4	1, 2, 3, and 4	Number of Monarchs
<i>The Effect of Sex on Adult Body Mass</i>	<i>Table IV – Male Monarch – Size and Fat, Table V – Female Monarch – Size and Fat</i>	Sex	2	Male and Female	Mean Mass (g)
<i>The Effect of Sex on Forewing Length</i>	<i>Table IV – Male Monarch – Size and Fat, Table V – Female Monarch – Size and Fat</i>	Sex	2	Male and Female	Mean Forewing Length (cm) **

\* Graph for the Main Activity

**Population Dynamics - Class Checkup Results**  
**Graphing Options – Page 3 of 3**

**Bar Graphs (continued):**

Title	Data Source	X Axis			Y Axis
		Label	# of Categories	Categories	
<i>The Effect of OE Infection on Adult Body Mass</i>	<i>Table VI – Monarchs Infected with OE – Size and Fat, Table VII – Monarchs Not Infected with OE – Size and Fat</i>	OE Infection	2	Infected and Not Infected	Mean Mass (g)
<i>The Effect of OE Infection on Forewing Length</i>	<i>Table VI – Monarchs Infected with OE – Size and Fat, Table VII – Monarchs Not Infected with OE – Size and Fat</i>	OE Infection	2	Infected and Not Infected	Mean Forewing Length (cm) **

**Line Graph (Option for Further Investigations):**

Title	Data Source	X Axis	Y Axis
<i>The Relationship Between Mass and Forewing Length</i>	<i>Table I – Class Results</i>	Mass (g)	Forewing Length (cm) **

\*\* Forewing length is measured and graphed to the nearest tenth of a centimeter.