EXPLORATIONS

Activity 10

Objectives

- To enter, graph, and analyze growth rate data
- To interpolate and extrapolate from best-fit models
- To research fish growth rates in student's home area
- To compare growth rates of endothermic and ectothermic animals

Something's Fishy

In this activity you will

- examine data about fish.
- graph the data.
- compare the graphs.

Introduction

If you went to a pet store and bought a hamster for a pet, you probably would expect it to remain rather small for its entire life. You would feed your hamster every day and make sure it had enough water, and once it reached a hamster size, it would stop growing and remain that size for the rest of its life. Just imagine if this were not the case, and your pet hamster kept growing for its entire life span! You might end up with a hamster the size of a dog! Of course, hamsters do not grow forever; they have a size limit. This is typical of *endothermic*, or warm-blooded animals. Some animals, however, continue to grow until the end of their life spans. Many *ectothermic*, or cold-blooded animals are like this. The ectothermic vertebrates are fish, amphibians, and reptiles, and many of these animals can continue to grow until they die.

Problem

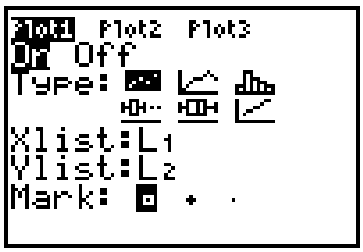
In this activity, you will examine the growth rates of three different species of fish that are commonly caught by people who go fishing. The data table on the next page compares the size and mass for northern pike, walleyed pike, and largemouth bass. You will enter the data for each species in your TI-83 Plus, graph the data, and compare the growth rates of the three species of fish.

Northern Pike Length in cm	Northern Pike Mass in kg	Walleye Length in cm	Walleye Mass in kg	Largemouth Bass Length in cm	Largemouth Bass Mass in kg
60	1.74	36	.46	20	.18
62	1.80	38	.54	22	.26
64	2.00	40	.67	24	.28
66	2.27	42	.70	26	.37
68	2.52	44	.84	28	.49
70	2.77	46	1.00	30	.63
72	2.85	38	1.13	32	.67
74	3.18	50	1.34	34	.84
76	3.48	52	1.39	36	1.00
78	3.82	54	1.56	38	1.27
80	4.15	56	1.77	40	1.52
82	4.26	58	2.03	42	1.81
84	4.64	60	2.29	44	1.89
86	5.06	62	2.36	46	2.23
88	5.47	64	2.61	48	2.57
90	5.60	66	2.95	50	2.99
92	6.07	68	3.24	52	3.11
94	6.59	70	3.62	54	3.59
96	7.08	72	3.73	56	4.10
98	7.58	74	4.11	58	4.65
100	7.74	76	4.53	60	5.23
		78	4.95	62	5.41
		80	5.40		

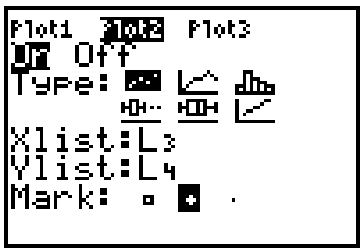
Procedure

1. Press [Y=]. If there are any equations on this screen, press [▼] to place the cursor next to **Y1=**, and then press [CLEAR] to clear the equation. Repeat this sequence to clear all equations.
2. Press [MODE] and make sure the defaults are set.
3. Press [2nd] [FORMAT] and make sure the defaults are set.
4. Press [STAT] [ENTER].
5. Press [▲] to move to the heading **L1**. Press [CLEAR] [ENTER]. Repeat this procedure for any list that has data.
6. Using the data table on the previous page, enter the data into **L1** (northern pike length) and **L2** (northern pike mass). In **L3** and **L4**, do the same for the walleye, and in **L5** and **L6** for the bass.

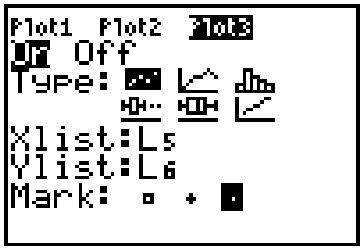
   To do this, type in the first number in **L1** and then press either [ENTER] or [▼] to move down to the next spot in the list. Continue until you have entered all of the northern pike length data in **L1**. When you complete the data from **L1**, press [▶] to move to **L2** and enter the northern pike mass data. Repeat this for the walleye and the bass in the remaining lists.
7. Press [2nd] [STAT PLOT]. Press [ENTER] to select **1:Plot1**. Set your TI-83 Plus as shown at the right.



8. Press [2nd] [STAT PLOT]. Press [ENTER] to select **2:Plot2**. Set your TI-83 Plus as shown at the right.



9. Repeat for **Plot3**. Set your TI-83 Plus as shown at the right.



10. Press WINDOW and make appropriate settings for the size of your graph. Your window must reflect ALL of the data in your lists, because you will be graphing all of the data at one time. A suggestion when setting your window is to set the **Xmax** value slightly lower than the lowest value in your lists, and the **Ymax** value slightly higher than the highest value in your lists. Remember, you have three *x*-lists and three *y*-lists to consider, and you will use one window setting for all of them.
11. Press GRAPH to see your data displayed graphically.

Data Collection and Analysis

Activity 10: Something's Fishy

Name _____

Date _____

Data Analysis

1. When you construct your graphs, what is the independent variable?

2. What is the dependent variable?

3. Which species of fish appears to gain the most mass per cm of length?

4. Suppose that you are out fishing, and you catch a 61-cm fish of each species. Draw what each fish would look like.

Northern Pike **Walleye** **Bass**

5. As a northern pike grows from 68.6 cm to 71.1 cm, how much mass would the fish likely gain?

6. As a northern pike grows from 92.9 cm to 96.5 cm, how much mass would the fish likely gain?

7. What do you notice about the rate of mass gain in each fish? Explain why the mass gain per cm changes as the fish gets longer and longer.

8. Fish of the same species and the same age but found in lakes of much different latitudes may be dramatically different in size. Describe some factors that may lead to these differences.

Extensions

- Find out what your state record and the world record masses are for each of these three species of fish. Using your graphical models, determine the predicted lengths of each of these record fish, and then compare your prediction to the actual lengths, if they are available.

- Draw two graphs of the growth of a pet hamster. Make age the independent variable for each graph. Make length the dependent variable on one graph and mass the dependent variables on the other. Explain why you drew your graphs the way you did. After you have finished drawing the graphs, try to duplicate them using your TI-83 Plus.

Teacher Notes

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Something's Fishy

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Concepts

- Growth rates in ectothermic animals
- Independent versus dependent variables

Data Analysis – Answer Key

1. The independent variable is length.
2. The dependent variable is mass.
3. The species of fish that appears to gain the most mass per cm of length is probably the bass.
4. Drawings will vary. Look for the northern pike to be the thinnest, the walleye to be fatter than the northern pike, and the bass to be the fattest.
5. The fish will likely gain .27 kg.
6. The fish will likely gain .54 kg.
7. Mass gain increases with each cm as the fish gets longer. Rate is not the same because the fish also increases in girth.
8. Some factors that may lead to these differences are: temperature of the water, metabolism of the fish, food sources, and so on.

Extensions – Answer Key

- Answers will vary by location.
- Answers will vary, but all graphs should level off at a certain reasonable size limit for a hamster.