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Krotz Springs Elementary
Krotz Springs, La.

Grade Level:
Middle School (6-8)

Duration:
30 minutes, once weekly
for six to eight weeks.

Subject Area:
Inquiry
Physical Science
Math

Materials:

- Flat surface metric ruler
- Beaker
- Petri dishes
- Pipette
- TV/VCR w/ blank tape
- Paddlefish eggs, fry and/or fingerlings
- Video microscope
- Chart paper
- Pencils, colors
- Transparency sheet
- Fine-tip marker
- Construction paper
- Tape
- Blackline Masters

**Grade/Benchmark/GLE
Science**

6-8/SI-M-A3/6-8
6-8/SI-M-A4/11-13
6-8/SI-M-A5/16
HS/SI-H-A2/4
HS/PS-H-A1/2 (phys sci)

Math

6/M-1-M/18
M-6-M
8/D-1-M/34,35
6/D-2-M/30
7/D-2-M/33
8/D-2-M/41
11,12/D-1-H/17
9/D-7-H/28
10/D-7-H/22

BM = Blackline Master

How Fast Do Paddlefish Grow?



1 of 12

Focus/Overview:

Students will actively collect, record and display data relating to the growth of paddlefish fry using the proper equipment and methods. Students will measure the lengths of members of a sample population of paddlefish to determine growth over a specific period of time. Their findings will be presented in student-created charts and graphs and in written and oral presentations. All measurements will be in metric units mimicking the work of the scientific community.

Background Information:

Paddlefish are rapid growers. They begin as eggs, roughly 2 to 3 mm in diameter, and grow into fingerlings, 25-30 mm long, in just a few weeks.

Paddlefish, one of the largest fish in the United States, can grow to an amazing total length of 2m (7ft) and may weigh up to 91 kg (200 lbs). Studies have found the growth of young paddlefish averages approximately 2.5 cm (1 in) per week, based on environmental conditions. While researchers have noted variances in length and weight from location to location, these differences are not significant.

The rostrum of a paddlefish begins to grow at the end of the fry stage. The rostrum of a fingerling is about half its total body length, but as the paddlefish reaches maturity that ratio changes to about one-third of the total body length. Total body length of a paddlefish is not measured to include the rostrum because it can vary, and there are many hazards that paddlefish may encounter in which damage to the rostrum can occur.

Learning Objectives:

Students will:

- Use mathematics and appropriate tools and techniques to gather, analyze and interpret data gathered during experimentation.
- Develop descriptions, explanations and graphs using collected data.



Procedure:

Set up: Recording growth from one week after hatching

Before recording:

1. Set up TV/VCR in an area that provides room to work. Prepare the equipment according to the manufacturer's instructions.
2. Set up the video microscope to record, and connect it to the TV/VCR following the manufacturer's instructions.

Focus: Activity 1 — Developing method to measure growth.

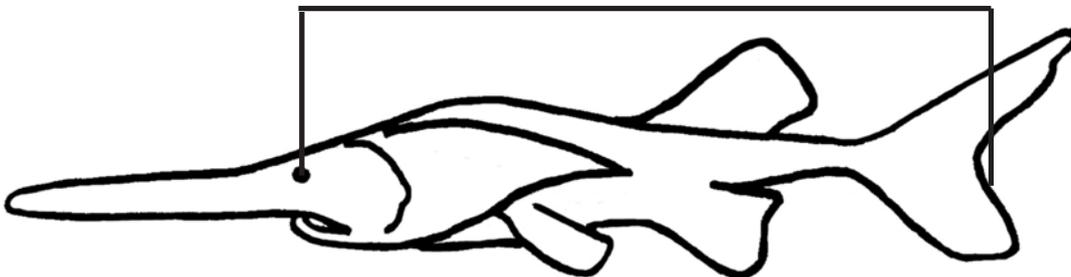
Instruct students to examine paddlefish eggs, recording their observations in science journals. Show them a picture of an adult paddlefish (BMs #1 and #2).

Ask, "How long do you think it takes a paddlefish to grow from an egg into a fry? To a fingerling? To an adult? How fast do you think this fish grows?" Allow time for discussion. Ask, "What tools could we use to measure them? What problems do you think we might encounter? What do we have to consider for the safety of the paddlefish? How can we prevent mortality and avoid other problems?" Allow more discussion.

Eventually students may come to the conclusions that: 1) the paddlefish must be kept wet to live; 2) they swim too fast for just the eyes to judge the length; and 3) they may vary in size from one fry to the other. Students predict growth and make a list of tools they could use.

Modeling:

Explain that a sample population is a small group that is representative of an entire population. Demonstrate for students the procedure for measuring the lengths of a sample population, how to record the data, and model the average of the outcomes to get an approximate length of the population. During the demonstration the teacher will model the "Eye-to-Fork" length measurement technique. Measure from the eyespot to the fork of the tail. See the diagram below.





Activity 2 — Sampling and measurement

One week after hatching, and every week thereafter for eight weeks, students will measure the sample population as described above. Throughout the procedure, students will record their observations in their science journals.

1. Students spend about five to 10 minutes observing fry swimming in a petri dish. Ask students to describe how the fish behave.
2. Place the ruler on the table top on a piece of dark paper. Focus the video microscope on the ruler. Place a clean, rinsed petri dish on top of the ruler. Alternative TV ruler method, see BM #3, continue to follow the remaining steps.
3. Use a clean beaker to dip a random sample population from your tank. We use a sample size of five to 10 fry each time.
Caution: Be careful to avoid touching your hands to the water; even clean hands may have contaminants, such as soap, that may adversely affect the aquaria and even kill the population.
4. Carefully pour the population sample into the petri dish (on top of the flat ruler). Reduce water volume to limit movement.
5. Record the population sample with the video microscope and VCR until the whole sample has moved across the ruler and been recorded. For alternative method: freeze fry on the screen by pressing the record button, then use the TV ruler to make measurements, and skip steps #7 and 8. Students observe closely for the shortest time possible to minimize stressing the sample population.
6. Reintroduce the sample population into the tank by gently pouring them from the petri dish back into the tank.
7. Rewind the tape.
8. Play the tape. Pause for each individual and measure eye-fork length of each fry (from eyespot to fork in the tail).
9. On a student-made chart in their journals, students record the individual measurements of each fry. Include the date, time of day and the measure of each individual fry in metric units. Also include weekly average length and weekly growth rate (BMs #4 and 5).
10. Find the average length of the paddlefish fry for each week. Add the lengths of the fish sample population together and divide by the number of fish measured. Record the average on student-made chart.



11. Repeat this procedure weekly or biweekly for the duration of the project.
12. As data are collected, students will graph the average length of the population sample on a student-created graph (BM # 6).
13. After two weeks of measurements are collected and averaged, calculate the growth rate, which is the difference in the average population length between the previous week and the present week. Enter growth rate on a data collection sheet.
14. Create a graph showing the population's rate of growth as the data become available (BM # 7).
15. Draw conclusions. Examine your graphs and make a statement about growth rate.

Note: The following Blackline Masters (BM #4, 5, 6 and 7) may be used for this lesson. However, students should be encouraged to construct their own data tables and graphs independently, correctly labeling variables.

Important points in lesson:

1. What is a sample population?
A small group that represents the characteristics of the whole group.
2. How is the average length of a sample population determined?
By adding the lengths of each member of the sample and dividing by the number of members.
3. How can we calculate the growth rate?
Subtract last week's average length from this week's average length.
4. Why should we use the eye-to-fork measures?
Because the fry, as well as adults, may have varying rostrum lengths.

Assessment:

Use rubrics to assess each student's data collection method and chart and graph construction (BM #8).

Students write weekly journal entries. (BM #8)

Extensions:

- Students design a procedure for determining growth in terms of weight for the paddlefish.
- Students measure the rostrum tip to eye length. Compare these measurements to the eye-fork length.
- Students draw pictures of the weekly changes in the morphology of paddlefish fry.



TEACHER REFERENCES:

Publications

- Capello, Angela. *Booker Fowler Fish Hatchery and the Story of Finnie the Fingerling*. Louisiana Department of Wildlife and Fisheries Aquatic Education Program: Baton Rouge, La. A coloring/storybook depicting the hatchery's role in the development of specific species of fish, including the paddlefish.
- Reed, Bobby. 1991. "Growth, Fecundity, and Mortality of Paddlefish in Louisiana," *Paddlefish Biology in Louisiana*. Louisiana Department of Wildlife and Fisheries: Baton Rouge, La. A comprehensive study of paddlefish in Louisiana.

Multimedia

- Wills, Betty. *The Paddlefish: An American Treasure* (video). Earthwave Society: Fort Worth, Texas. This video addresses all facets of the life of paddlefish in the United States. It includes information on ongoing conservation efforts and methods, as well as the reasons for the decline of the population and current laws. Summary and ordering information at <http://www.earthwave.org/paddlefish.htm>. Cost \$24.95 plus shipping and handling.

Internet sources

- Cooper, Calene. *Missouri State Aquatic Animal – Paddlefish Model Assembly*. Successlink. <http://www.successlink.org/great2/g661.html>. Accessed June 14, 2004. Lesson plan using model, background information on paddlefish and links to other paddlefish sites.
- Paulson, Nicole and Jay Hatch. *Paddlefish*, *Polyodon spathula*. Minnesota Department of Natural Resources and U.S. Fish and Wildlife Service. <http://www.gen.umn.edu/research/fish/fishes/paddlefish.html>. Accessed June 14, 2004. Discusses the fishes of Minnesota. The site was designed for educational purposes and includes pictures, biology and reasons for paddlefish decline.



Blackline Master #1

Adult Paddlefish



Photo courtesy Richard Condrey



Paddlefish Eggs



Photo by Bobby Reed



Fry

Photo by Bobby Reed

Fingerling



Photo by Rachel Somers



Blackline Master #3

Making a SOAR TV Ruler

How to measure critters you see on TV with Scope-on-a-Rope

1. Tape a transparency sheet to the TV screen.
2. Scope a ruler (in millimeters) with the 30X lens.
3. Record image by pressing the RECORD button.
Play the recorded image back by pressing the PLAY button.
4. Use a marker to trace the millimeter divisions onto the transparency.
5. On your transparency, write the unit size (1 mm for the 30X), the lens magnification 30X, and the diagonal measurement of your TV screen (e.g., 13, 19, or 25 in).

Note: For your measurements to be correct, you must always use your micro ruler with the indicated lens magnification and TV diagonal size.

6. Scope an object. Line up the transparency on the image and use your new TV ruler to measure your object.

Note: You can make a grid on another transparency for calculating area. Remember to record the three important pieces of information on your micro grid: unit size, lens magnification and diagonal measurement of your TV screen.





Blackline Master #4 Student Name _____

Average Population Length

Date of Sampling	Time	Length of Sampled Members in mm	Average Length of Population Sampled

Blackline Master #5 Student Name _____

Weekly Growth Rate Data

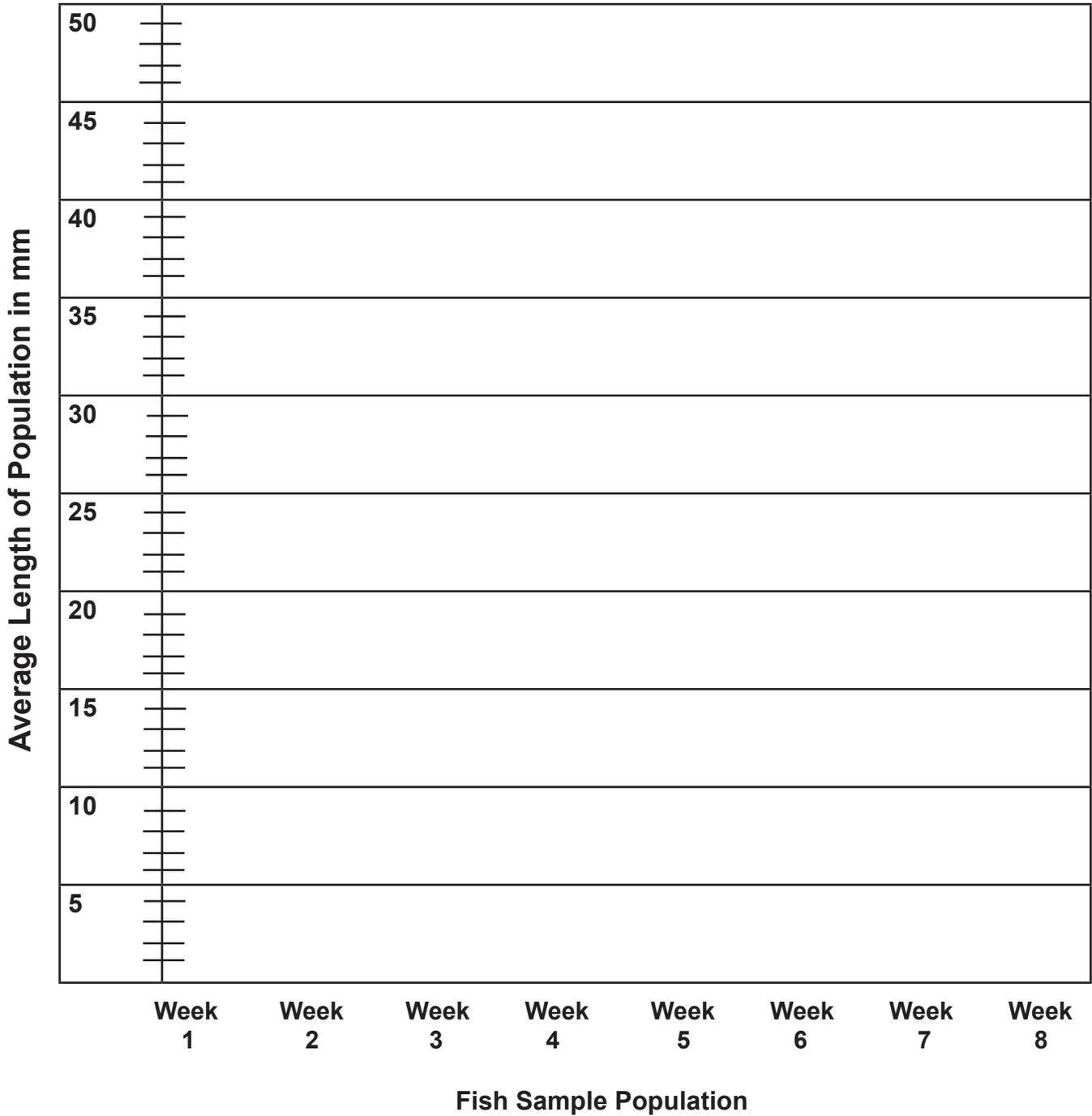
Date of Sample One	Average Length of Sample One	Date of Sample Two	Average Length of Sample Two	Growth (Difference in Wk 1 and Wk 2)



Blackline Master #6

Student Name _____

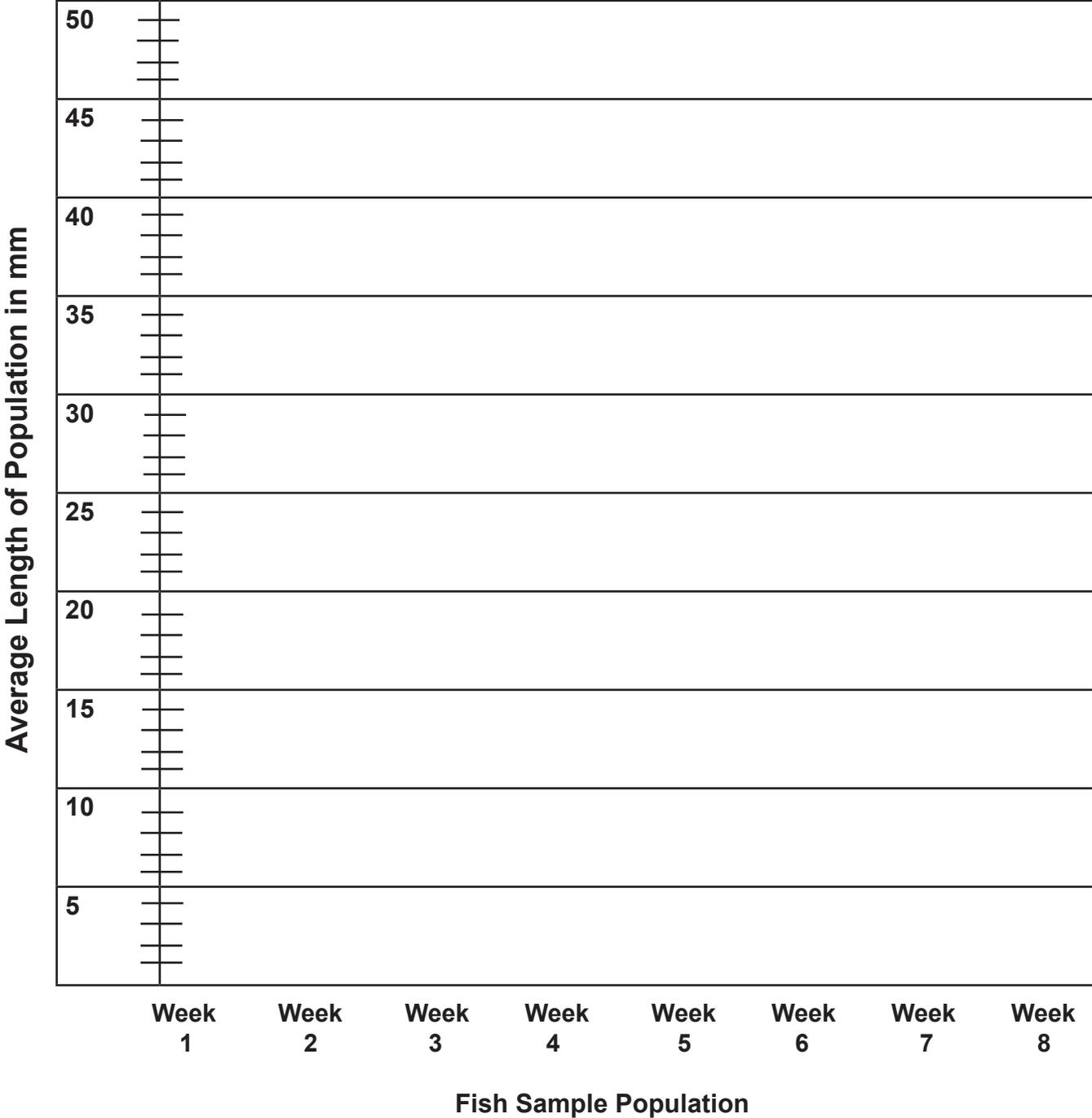
Graphing Average Weekly Paddlefish Length





Student Name _____

Graphing Growth Rate





Journal Rubric – How Fast Does A Paddlefish Grow?

Entry Topic: Observations, data, charts and graphs of paddlefish growth and conclusions drawn by students.

- _____ 0 pts. No effort – nothing written.
- _____ 4 pts. Student makes good observations noting changes in morphology of the fish, not limited to and including drawings and written descriptions.
- _____ 4 pts. Student collects data in chart form.
- _____ 4 pts. Student constructs bar graph of weekly average population growth.
- _____ 4 pts. Student constructs a line graph depicting change in average population length over time.
- _____ 4pts. Student draws logical conclusions based on recorded data, in paragraph form.
- _____ 2 pts. Student's work is neat and easy to read.

Point Assignment _____

Date _____

Student Name _____

Total possible points: 22