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Cat Fishin'

Tracking Population Decline Using Biology and Algebra

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Grade Level	9th – 12th Grade	**Time Frame**	150 minutes
Subject	Science	**Duration**	2-3 class periods
Course	Biology, Environmental Science		

Essential Question

How do environmental factors affect the health of species in a given area and how can studying species can give an indication of environmental sustainability?

Summary

Students explore causes for the decline in number of giant catfish of the Mekong River system and interpret a set of data taken from 2003 regarding the size and mass of catfish that were caught and tagged. They will display their knowledge in the form of tables, graphs, and pictures.

Snapshot

Engage

Students watch a National Geographic video and take notes.

Explore

Science students read the article titled "Giant Catfish Critically Endangered, Group Says." Math students analyze data from a Mekong Wetlands organization. Then, science students prepare a poster depicting causes for the decline of Mekong giant catfish. Math students prepare a graph by drawing a line of best fit, calculating slope, and writing an equation representing the relationship between mass and length.

Explain

Science students present information to the math students, and math students present information to the science students.

Extend

Math and science students prepare a proposal to continue research of the giant catfish or the Mekong River system.

Evaluate

Each group presents their proposal to the class. Use a rubric to evaluate their presentations.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD304: Determine how the values of variables change as the value of another variable changes in a simple data presentation
IOD502: Compare or combine data from a complex data presentation
EMI401: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Oklahoma Academic Standards (Biology)

B.LS1.6.2: As matter and energy flow through different organization levels of living systems, chemical elements are recombined in different ways to form different products.
B.LS4.2.1: Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2)variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.

Oklahoma Academic Standards (Biology)

ES.ESS3.1.2: Natural hazards and other geologic events have shaped the course of human history; they have significantly altered the sizes of human populations and have driven human migrations.

Attachments

- 1_Cat Fishin Math Prompt - Spanish.docx
- 1_Cat Fishin Math Prompt - Spanish.pdf
- 1_Cat Fishin Math Prompt.docx
- 1_Cat Fishin Math Prompt.pdf
- 2_Cat Fishin Rubric - Spanish.docx
- 2_Cat Fishin Rubric - Spanish.pdf
- 2_Cat Fishin Rubric.docx
- 2_Cat Fishin Rubric.pdf
- 3_Cat Fishin Science Prompt - Spanish.docx
- 3_Cat Fishin Science Prompt - Spanish.pdf
- 3_Cat Fishin Science Prompt.docx
- 3_Cat Fishin Science Prompt.pdf

Materials

- Graph paper, large paper (butcher paper), or large whiteboards
- Appropriate writing tools
- Ruler
- Calculator
- Article for science class (found in Resources section)
- Data for math class (found in Resources section)
- Suggested Engage video from National Geographic: http://education.nationalgeographic.com/media/giant-catfish/

Engage

Students watch the National Geographic video. While they watch the video, have them prepare a summary about the video using the Gist strategy. Once the video is over, have at least five students share their Gist summaries. Consider using the Give Me Five strategy.

Teacher's Note

If the video from National Geographic doesn't work, try watching the video on YouTube instead. It is the same video.

Explore

Science class: Give students the prompt for the activity, which includes the article to read and can be found in the Attachments section. Students read the article titled: "Giant Catfish Critically Endangered, Group Says." In small groups, students prepare butcher paper for a presentation to the math class based on the prompt found in the attachments. Students need to use the butcher paper to make a visual representation depicting the causes for the decline in the numbers of giant catfish in the Mekong. Be sure students know their poster is supposed to speak for itself; they will not be talking as a part of the presentation, except for answering questions. Students should be given the attached rubric so they will understand the expectations and criteria for the assignment.

Math class: Students should be familiar with best-fit lines and the slope-intercept form (y=mx + b) at this point. However, to check for understanding and to activate prior knowledge, you should begin this part of the lesson with a strategy such as I Think/We Think with the question: "What is a line of best fit and how do you find the equation for that line?"

Teacher's Note

If the class needs more help with best-fit lines, here is a video explaining best-fit lines that shows how to determine the equation for the line. Here is a webpage with best-fit line instructions.

Next, give students the attached prompt on giant catfish data. These data come from actual measurements. Students will use the data in the table to make a graph. Using the data on the graph, students will draw a line of best fit and calculate the equation for that line relating length and mass of the fish.

Students work in small groups to prepare a presentation for their counterparts, who are doing a similar activity in science class that hour. The catch is that math students will NOT be allowed to use any visual aides during their presentation. They have two minutes to explain using only words, the graph, and trend line to the science students observing. The goal is for the science students to produce the graph after only listening to the math students. Students should be given a copy of the attached rubric so they will understand the expectations and criteria for the assignment.

Teacher's Note

It is important that each class has the same number of groups because during the Explain portion of the lesson, a math group will be paired with a science group (for example, group A math is paired with group A science).

Explain

Teacher's Note

Math and science classes will combine so the groups can present their data to each other. A classroom large enough to accommodate all groups will be needed, or half of the groups can meet in the science classroom and half of the groups can meet in the math classroom.

The math groups and science groups meet to give their presentations. It is important each group follows the directions given on their prompt because the other class' groups do not know the task they have been given. While the math students are talking, the science students need to be recreating the graph with a best-fit line relating length and mass. Math students try to identify the problems facing the giant catfish by interpreting the data and information on the science students' butcher paper poster. The only thing math students know about the catfish before the two groups meet is that they can grow to be very large. The only thing the science students know about the size of the giant catfish before the math presentation is that they are large, but they have no quantitative value for the actual size of the giant catfish.

Teacher's Note

Monitor students’ progress and listen for correct use of academic vocabulary, such as x-axis, y-axis, best fit, slope, y-intercept, kilogram, centimeter, trend, variable, extinct, endangered, threat, decline, ecology, population, and so on.

Extend

Math and science classes remain together and in their same groups. Using the Chain Notes strategy, tell students to write this clause at the top of the paper as a prompt for the activity: "To help save the giant catfish of the Mekong River from extinction . . . " After the chain notes are complete, students should have some ideas that will help guide them in the next part of this activity.

Teacher's Note

Pass out the science prompt handout to all groups so they will each have a copy of the article about the giant catfish to reference when generating a research plan.

In the same groups, issue the following prompt to students: "Working together, develop a research plan to continue Zeb Hogan's work. Think about what questions you still have and how best to investigate those questions along with what kind of data you want to collect and how you will use this data." Math and science groups work together on this task, but each student is responsible for submitting their own work in the form of an abstract for their research proposal.

Teacher's Note

Have students refer to the research question section of the rubric so they will understand the expectations for this activity.

Evaluate

- Students are back in their normally scheduled class for this portion of the lesson, but they remain in their groups.
- Using an Inverted Pyramid strategy, students should come up with a research proposal for their group to share with the class.

Teacher's Note

Students will still turn in their own research abstracts, but they will just present one research proposal as a group. Students should look for the best aspects of each individual student's abstract when formulating their whole group's presentation for the class.

- The audience should come up with at least two questions to ask each group, based on their presentations.
- After presenting, the group answers questions posed by classmates.
- The process continues until all groups have presented their research plans.
- Use the suggested rubric to grade each group on their presentations.
- Individual abstracts can be assessed by any method you deem appropriate, including the attached rubric.

Resources

- K20 Center. (n.d.). Chain Notes. Strategies. https://learn.k20center.ou.edu/strategy/52
- K20 Center. (n.d.). Gist. Strategies. https://learn.k20center.ou.edu/strategy/3289
- K20 Center. (n.d.). Give me five. Strategies. https://learn.k20center.ou.edu/strategy/150
- K20 Center. (n.d.). I think / we think. Strategies. https://learn.k20center.ou.edu/strategy/141
- K20 Center. (n.d.). Inverted pyramid. Strategies. https://learn.k20center.ou.edu/strategy/173
- Link to YouTube video in case the National Geographic link doesn't work: https://www.youtube.com/watch?v=_JvRyYyMoA8
- Research: http://www.mekongwetlands.org/assets/BIODIVERSITY/Regional/Giant%20Catfish/R.B.2-9.%20GiantCatfishseries_HoganZ.pdf
- Video explaining best fit lines: https://www.youtube.com/watch?v=ugmhjwAQDIE
- Website explaining best fit lines with an example: http://mathbits.com/MathBits/TISection/Statistics1/LineFit.htm