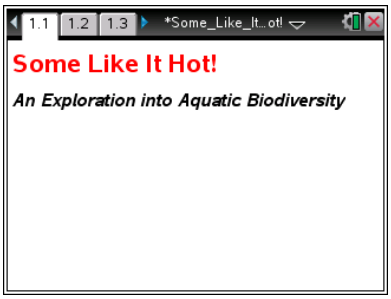
Science Objectives

- Students will simulate adjusting the pH of a lake and draw conclusions about the relationship between pH and biodiversity.
- Students will simulate adjusting the temperature of a lake and draw conclusions about the relationship between water temperature and dissolved oxygen levels in the lake.



Vocabulary

- pH
- aquatic
- biotic
- acid
- base
- abiotic
- terrestrial
- biodiversity
- dissolved oxygen

About the Lesson

In this activity, students will observe model environments, adjust abiotic variables in those environments, observe the results of those adjustments, and then draw conclusions about the effects of the abiotic world on the biotic world.

- As a result, students will:
  - Learn the fundamental meaning of "biotic" and "abiotic" factors and how they impact one another to determine biodiversity.
  - Form a basic understanding of pH and how it affects biodiversity of an aquatic ecosystem.
  - Develop an understanding of the relationship between water temperature and dissolved oxygen levels.

TI-Nspire™ Navigator™

- Send out the *Some_Like_It_Hot.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to have students demonstrate how to negotiate the simulations and to spotlight student answers.
- Collect student responses from assessment items that are embedded throughout the document.

Activity Materials

- Compatible TI Technologies: TI- Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software

Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

Lesson Files:

Student Activity

- Some_Like_It_Hot_Student.doc
- Some_Like_It_Hot_Student.pdf

TI-Nspire document

- Some_Like_It_Hot! .tns

Discussion Points and Possible Answers

Have students read the background information stated on their activity sheet.

Move to page 1.2.

1. After opening the document, students should read the background information on page 1.2.

Move to pages 1.3 – 1.5.

Have students answer questions 1-3 on either the device, on the activity sheet, or both.
These three questions assess the students' background knowledge of biotic factors, abiotic factors and biodiversity. It is recommended that these questions be used for discussion purposes after the students answer them.

Q1. Give two examples of abiotic factors in an environment.

Suggested Answers: water, air, climate, rain, snow, rocks, oxygen, carbon dioxide, etc.

Q2. Which of the following does not belong?

Answer: A. Snow (This is the only abiotic factor in the list.)

Q3. The tropical rain forest would be expected to have a greater biodiversity than the Arctic tundra.

Answer: A. Agree

Move to page 1.6.

2. On page 1.6 are some instructions for the student about the simulation of the aquatic ecosystem. After reading the directions on the page that overlays the lake, the students should close the instruction window by selecting ☒.

   In order to see the impact of changing pH and temperature on the biodiversity of the lake, students should only adjust ONE variable at a time. For example, guide the students to work through the entire range of the pH scale, making observations of the effects of changing the pH. Then, the pH should be reset to 7 and the temperature should be changed. Remind students that if both variables are changed at the same time, it's difficult to determine which is impacting the ecosystem.

Tech Tip: To access the Directions again, select menu or **Document Tools ( ) > Some Like it Hot > Directions.**

Tech Tip: To access the Directions again, select > **Some Like it Hot > Directions.**

Move to pages 1.7 – 1.8.

Have students answer questions 4 and 5 on the device, the activity sheet, or both.

Q4. What are the variables that you can regulate in the simulation? (Select all that apply.)

Answers: A. pH and D. Temperature

Q5. Which of the following are "biotic" factors in the simulation? (Select all that apply.)

Answers: A. Fish and C. Plants

Move to pages 1.9 and 1.10.

Have students answer question 6 on the device, the activity sheet, or both.

3. Have students read the content information about pH on page 1.9. The concept of pH may be new to students, so it is recommended that the teacher take some time to discuss it.

Q6. What do you think we call a solution that has a pH of exactly 7?

Suggested Answer: Neutral

Move to pages 1.11 and 1.12.

4. On page 1.11, the students will read about the meaning of biodiversity. After reading the information on this page, they should move to page 1.12. On this page, they will be instructed to return to the simulation on page 1.6 and review what happens when the pH and temperature of the water are changed.

Move to page 1.13 – 1.17.

Have students answer questions 7-11 on the device, the activity sheet, or both.

Q7. How do temperature and pH affect each other?

Answer: D. Temperature and pH do not affect each other.

Q8. In general, there is a greater diversity of fish when the water is warmer.

Answer: B. Disagree

Q9. As the water becomes more acidic, the diversity of fish decreases.

Answer: A. True

Q10. 20°C is the same as about 68°F. Your body temperature is about 98.6°F. Predict what your body temperature is in °C.

My body temperature is about _____°C.

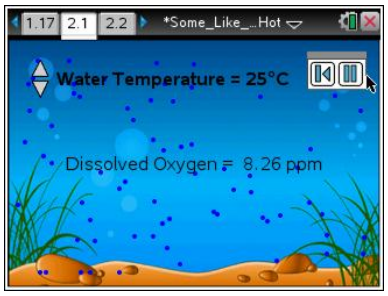
Acceptable Range of Answers: 35–40°C.

Q11. Now go back to the simulation and change the temperature of the water so that it is the same as your body temperature. What do you observe?

Sample Answer: The number of fish decreases dramatically at 35°C and 36°C. No fish survive at 37°C and above.

Move to page 2.1 for the simulation on dissolved oxygen.

5. After finishing the first simulation and all of the questions, the students should move to the second simulation, which deals with the relationship between water temperature and the levels of dissolved oxygen in the water. The process for the students will be the same as in the first simulation.



Move to pages 2.2 – 2.8.

Have students answer questions 12-18 on the device, the activity sheet, or both.

Q12. What happened to the amount of dissolved oxygen as you increased the temperature of the water?

Answer: The amount of dissolved oxygen decreased when water temperature was increased.

Q13. What happened to the amount of dissolved oxygen as you decreased the temperature of the water?

Answer: The amount of dissolved oxygen increased when water temperature was decreased.

Q14. Which term do you think best describes the relationship between water temperature and dissolved oxygen levels?

Answer: B. Inverse

Q15. Fish such as salmon and trout need a lot of oxygen to survive. Which water temperature do you think would be best for these fish?

Answer: D. 10 ^{o}C

Q16. In which of the following environments would you expect to find the most salmon and trout?

Answer: B. in mountain rivers and streams

Q17. Catfish have a lower oxygen requirement than many freshwater fish. In which state do you think catfish would thrive?

Answer: A. Alabama

Q18. Why do you think it would be difficult to have salmon and catfish together in the same aquarium?

Answer: Salmon and catfish have different water temperature and dissolved oxygen

requirements. Salmon have a high need for oxygen, so they could not survive in the warm waters that catfish prefer.

Move to page 2.9.

6. On page 2.9, there is a graph of the data that was collected automatically as the students made changes to the water temperature in the simulation. Spend some time with the students analyzing the graph.

Tech Tip: To modify the scale of the *x* and *y*-axes, place two fingers on the screen and then drag your fingers away from each other or towards each other parallel to the axis.

Move to pages 2.10 – 2.11.

Have students answer questions 19 and 20 on the device, the activity sheet, or both.

Q19. Which words could be placed in the blanks below to make the statement true? (Select all that apply.)

As water temperature goes _____, the dissolved oxygen level goes _____.

Answers: B. up; down and C. down; up

Q20. Predict what would happen if the water continued to get warmer and warmer.

Answer: A. The dissolved oxygen levels would continue to drop.

Move to page 2.12.

7. The final page of the activity shows the student the actual data that was collected as they made changes to the temperature of the water in the dissolved oxygen simulation.

TI-Nspire Navigator Opportunities

Make a student a Live Presenter to demonstrate how to adjust the pH and temperature of the water. The questions in the activity may be distributed as Quick Polls or used as a formative or summative assessment

Wrap Up

When students are finished with the activity, retrieve the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show will be utilized to give students immediate feedback on their assessment.
- Summative assessment will consist of questions/problems on the chapter test.

Extension

If a Vernier Dissolved Oxygen Sensor is available, you could experimentally determine that cold water is able to hold more dissolved oxygen than warm water. Half-fill a bottle with warm water and shake it for a few seconds, then test the dissolved oxygen level. Next, do the same with cold water.