The Effect of Climate Change on Fishes

Grade Level: 7

Subject Area: Life Science

Virginia Standards of Learning: LS. 11, LS. 12

Objectives:
Students will:

- Learn the basic principles of climate and climate change
- Learn about the temperature needs of fishes
- Understand the impacts that climate change can have on aquatic organisms and humans

Summary:
Students will play a game in which they represent a fish species that must adapt its distribution in response to changing water temperatures. Students will make decisions about where and how much to move along the Atlantic Coast of North America in order to stay within the temperature ranges required for survival of their species.

Vocabulary: climate, climate change

Materials:

- Large tarp with game board mapped out on it using permanent marker and duct tape OR whiteboard or chalkboard with game board drawn on it
- Fish playing cards (12 total); printed, cut out, and laminated – you will need 12 magnets and tape if you are using the game board on the chalkboard
- PowerPoint – included, hard and electronic copy
- Computer for displaying PowerPoint
- Projector for displaying PowerPoint
- Prizes for winners (optional)

Procedure:

* There are two ways in which you can play this game with your students. If you have a place with ample floor space, you can use a large tarp with the game board mapped out on it. In this form, the students stand in each block on the tarp and hold their fish card. The student moves up and down the game board in this format. If you do not have much space, you can draw the game board on a chalkboard or whiteboard. You will need to tape magnets to the back of each fish card

Compiled in 2010 by education staff at the Chesapeake Bay National Estuarine Research Reserve in Virginia for use in the B-WET *Chesapeake Studies in the Classroom* program. This lesson was modified from the *Ocean Home – Swimming Fishes* lesson by Jason Turnure and Jason Werrell. You can view this activity at: http://coseenow.net/blog/ocean-home-swimming-fishes/

for this format. Each student will place their fish card in the appropriate block on the game board and will move the card by hand.

*If you have more than 12 students, you can pair them up and have two students represent one species. You could also run two game boards at the same time or you could create additional columns on the game board and create more fish species.

Preparation

The following is a diagram of how the game board should be set up:

Northern Regions ↕ Southern Regions

Cooler Waters ↕ Warmer Waters

9A	9B	9C	9D
8A	8B	8C	8D
7A	7B	7C	7D
6A	6B	6C	6D
5A	5B	5C	5D
4A	4B	4C	4D
3A	3B	3C	3D
2A	2B	2C	2D
1A	1B	1C	1D

The game board consists of four columns (A-D) each with 9 rows. See the included PowerPoint (at the end of this lesson guide and on the CD) for a description of the game board and instructions on how to play the game (slides 8-36).

Introduction

1. Discuss climate change, its effects on our planet, and the temperature needs of fishes with your students before starting this game. You can use the first few slides in the PowerPoint presentation provided at the end of this lesson guide and on the included CD to help with this discussion. Slides 1-7 include introductory information.

Activity

1. Use the PowerPoint included at the end of this guide and on the CD to conduct this activity. Instructions on how to play the game are included in the notes section of each slide. You do not have to play all 10 rounds; however, we suggest that you play at least 5 rounds in order to observe changes in distribution and survival of species.

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Wrap Up

At the end of this game, water temperatures along the Atlantic Coast are much warmer than they were in the beginning. The colder water regions (blue and purple) have been completely lost, and only warm-to-temperate water temperatures still exist. There are many outcomes to this game; however, the most common outcomes are listed below:

- All of the cold water species (blue and purple) go extinct because they ran out of water temperatures to survive in.
- There are fewer species on the board than at the beginning of the game. Some went extinct because they could not adapt fast enough or correctly to the changing conditions or they ran out of water temperatures they could survive in (like the cold water species). Some may have gone extinct because of the volcanic eruption. Sometimes, natural events take place that lead to mass die-offs of organisms. Often these events happen so quickly that species cannot adapt to the new conditions. Rapid cooling of the water temperatures as a result of the eruption occurred over a 10 year period – it takes millions of years for species to adapt to changing conditions.
- Species that have larger temperature ranges (three colors versus two) usually survive better than species with smaller ranges, and temperate (medium temperature) species usually survive best because they can live in a little bit cooler or a little bit warmer water – they don't require the extremes.
- The distribution of species along the coast will probably change. Species that occurred in the Southern regions at the beginning of the game may now be able to occupy areas a little more North. Species that occurred in the middle of the coast may now have to occupy regions further North to avoid warmer waters.

Overall, climate change and warming temperatures have the potential to affect species survival and distribution. The species that exist and the ones that exist in our area may change as a result of climate change. The striped bass and summer flounder that everyone loves to fish for in the Chesapeake Bay may have to move out of the Bay area to find waters more suited for their survival. This has implications for our economy as many people rely on several species of fish for their livelihoods. If the fishes move out of the area or die-off, people's jobs could be at risk. Climate change is happening relatively rapidly. It is occurring at a rate faster than the rate species can adapt to changes in climate. Therefore, climate change has the potential to have severe impacts on many aquatic and land-based organisms.

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