Fish Migration

Unit Plan

[Edit]

Graphing and interpreting graphs is the basis of this online inquiry unit. There is cross content integration of concepts and skills including non-fiction reading, interpreting visual data, journal writing, and use of technology. Through this mini-unit students learn about ocean technology tools, how scientists represent tracking data, Striped Bass habitat, food chain, and migration.

Students explore the migration of Striped Bass; including how we track Striped Bass, what we have learned about them, where they like to go based on water temperature and food availability, and what migration really means.

Skills students will develop:

- graphing basics
- interpret field research data
- play interactive which explains fish tagging and tracking using passive acoustics
- utilize technology to build migration track online in Flash
- analyze satellite imagery
- refine thinking and develop scientific reasoning

Major concepts developed:

- understanding of why animals migrate
- factors that determine why animals migrate
- seasonality of the ocean
- life cycle of striped bass
- technological advances that have allowed scientists to track marine life

NJ Core Curriculum Standards Covered:

5.1 Science Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

C. Reflect on Scientific Knowledge: Scientific knowledge builds on itself over

time.
5.1.4.C.1 Scientific understanding changes over time as new evidence and updated arguments emerge.
CPI: Monitor and reflect on one's own knowledge regarding how ideas change over time.
5.1.4.C.2 Revisions of predictions and explanations occur when new arguments emerge that account more completely for available evidence.
CPI: Revise predictions or explanations on the basis of learning new information.
D. Participate Productively in Science: The growth of scientific knowledge involves critique and communication, which are social practices that are governed by a core set of values and norms.
5.1.4.D.1 Science has unique norms for participation. These include adopting a critical stance, demonstrating a willingness to ask questions and seek help, and developing a sense of trust and skepticism.
CPI: Actively participate in discussions about student data, questions, and understandings.
5.1.4.D.2 In order to determine which arguments and explanations are most persuasive, communities of learners work collaboratively to pose, refine, and evaluate questions, investigations, models, and theories (e.g., scientific argumentation and representation).
CPI: Work collaboratively to pose, refine, and evaluate questions, investigations, models, and theories.
5.3 Life Science: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.
C. Interdependence: All animals and most plants depend on both other organisms and their environment to meet their basic needs.
5.3.4.A.1 Living organisms interact with and cause changes in their environment.
5.3.4.C.1 Organisms can only survive in environments in which their needs are met. Within ecosystems, organisms interact with and are dependent on their physical and living environment.
5.3.4.C.2 Some changes in ecosystems occur slowly, while others occur rapidly. Changes can affect life forms, including humans.

Unit Plan

Click here to see a visual display of the unit for ease in planning. A detailed discussion of each lesson is included below.

The mini-unit is written so that students progress as a class with the teacher facilitating the rate of progress and shifting between student work at the computer to group and whole class discussions. This unit can be done with each student at their own computer, in small teams (preferred), or as an entire class working with a white board.

Journal questions have been strategically placed throughout the mini-unit so students have the opportunity to stop and reflect on their learning. Many of these questions can be utilized as class discussion topics and are a great opportunity for formative assessment. There are hands-on activities that can be done (outside of the web-based environment) to further increase student understanding.

The units are designed to allow adaptability and customization to the needs of different groups of students. Core activities of the unit (in a recommended sequence) constitute the main flow of the unit, while discovery activities provide extension opportunities. The following unit progression is suggested with timing based on an 5th grade reading level and a 45 minute class period.

Student journals can be printed each day for teacher review.

Overarching Question for the Unit

Do fish have favorite places to swim?

Lesson 1 (Computers online)

[1 class period]
Where are the Fish?

Web Pages: 1-8

To jump directly to this page, click on "1. Where are the Fish" under Investigation in left navigation bar

2 journal questions, 1 group discussion, 1 class discussion

Optional Discovery: Thermometers: What's the Scale?
Optional Discovery: Life Cycle of Striped Bass

Topics Covered
- Where do your students like to swim? Do they swim there in the winter?
- Do fish have favorite places to swim?
- Explanation of how tags are inserted in Striped Bass to track where they swim (StriperTracker flash game)

Discussion:
This unit begins with a video of an Atlantic Ocean beach (Belmar, NJ). The first question is, "Where do you like to swim?" Many students enjoy swimming in crashing salty waves while others prefer swimming in a calm pool. Students stop and have a group discussion about their favorite place to swim. Can they swim in their favorite place in the winter? For those students living in northern states, unless the pool is indoors, they will have to travel south to go swimming. While this seems obvious, these questions lay the foundation that students have a favorite place to swim and sometimes it's too cold so they have to travel somewhere else to swim.

Students are asked to write in their journals whether they think that fish have a favorite place to swim. Students are asked to explain why they think that, aka to support their idea with evidence. Some students may have direct experiential evidence, for example they went fishing during the Striped Bass run off the coast of New Jersey. Some students may have seen it in a movie. Some students may have heard someone talk about it or they read about it. Some students may have no idea at all so they are just guessing. It's good for students to recognize why and how they know what they know.

Students walk through the Fish Tagging Game where they see how Striped Bass are caught and have a tag inserted inside them when scientists conduct tracking studies. The time it takes a student to get through the Tagging Game depends on how long it takes them to catch a large enough Striped Bass and how quickly they read.

Tip: The arrow buttons on the keyboard control the fishing rod. Once a student has caught a fish, they must push the up arrow to reel it in. Once that happens, a popup box will walk them through the rest of the fish tagging explanation.

Lesson 2 (Kinesthetic activity)

[1 class period]
This activity models buoys hearing fish transmitters.

Click here for Activity

Discussion:
This activity provides the students with a conceptual understanding of buoy range without going into sound propagation in water. The fish tag will transmit at regular intervals. If the fish is within the range of the buoy, the buoy will "hear" the signal and transmit that information. Doing this activity gives the students a frame of reference for looking at the illustrations and understanding what is happening in the Tracking Striped Bass interactive, as well as introduces them to graphing skills they will use in the Tracking Striped Bass interactive.

Lesson 3 (Computers online)

[1-2 class periods depending on the typing rate of your students.]
See how the fish are tracked using transmitters and receivers
Introduction to Sea Surface Temperature (SST) data

Web Pages: 9 -13
To jump directly to this page, click on "2. Tag a Striped Bass" under Investigation in left navigation bar

Optional Discovery: Fish Tagging Data
Optional Discovery: Color Scale ~ Check it EVERY time

Topics Covered
• How Striped Bass tags work to allow scientists to gather information about where a particular fish is located
• Map of results from StriperTracker Research Project buoys in southern NJ
• Using Sea Surface Temperature (SST) data to determine look for fish without tagging them

Discussion:
Students can visually see how the tag sends a sound wave at a particular frequency into the water which the buoys can "hear" with receivers. Students use their mouse to make the fish swim in the area. The transmitter inside the fish sends out a signal which is picked up by a nearby buoy and counted as a hit.

Once the fish has swum for about a minute or so, have the student pull up the data table that see which buoy received the signal and at what time by clicking on the button in the lower left corner named "Show Data." The students can then interpret the information in the table based on what they know just happened.

Often, the teacher will demo this and have the fish stay around one particular buoy for the last 20 seconds or so. Then this information is easy to see on the data table. If a fish is not within range of any buoy, it will appear as a gap in time.

Students should print their data table and create a histogram (bar chart) of how many times the fish visited each buoy. **Click here** for a template grades 3-5. Students record how many times a fish visits each buoy with a histogram. **Click here** for a template grades 6-8. Students plot data over time to see the track of the fish.

Sea Surface Temperature is a measurement from satellite of the water temperature in the top millimeter of ocean water.

Extension: Lesson 4 (Computers online)

[1 class period]
Using SST data to predict where Striped Bass may be located
Students revise their predictions when new arguments emerge that account more completely for available evidence

Webpage 13-18
To jump directly to this page, click on"3. How to Read a SST Map" in left navigation

3 journal questions, 1 group discussion

Topics Covered
- Using temperature data to determine probable fish location

- Collaborating with others to predict fish location
- Revising predictions due to arguments of others based on evidence
- Interpreting real-time SST maps from the Rutgers University Coastal Ocean Observation Lab

Discussion

The "How to Read a SST Map" page includes a rollover that explains what student may see in a SST map. It may be helpful to show this to the entire class using an interactive whiteboard. The scale is Fahrenheit on the left and Celsius on the right. Point out to the students that land is grey and clouds usually show up as a scramble of colors or white. The state lines are not indicated on the map but Maine and NJ are labeled so students can get an idea of location.

The SST map focuses on the Northeast coast. The students are asked to find NJ on the map and read the color scale to determine the coastal water temperature (43 F or 6 C) so that they can determine whether or not they'd like to go swimming. Then the students get to look at the SST data from today. This page may take a little longer to load as the SST map is actually being retrieved from Rutgers University Coastal Ocean Observation Lab.

After the students are familiar with looking at SST maps, they are asked based on what we know about the preferred temperature for Striped Bass, where they could find the fish. They will probably be in the areas of yellowish-green to yellow. The orange colored water is too hot for them. During the group discussion, students get to share ideas about where they think the fish will be. In the discussion, students will be defending why they thought the way they did. Often different scientists can look at the same data and come up with different conclusions. As long as their ideas are supported by evidence, their ideas should be considered; however, there may not be 100% agreement within the group. After the group discussion, students are given the opportunity to change their answer based on anything they learned during the group discussion.

Lesson 5 (Computers online)

[1 class period]
Fish migration path interactive

Web Pages: 19-21
To jump directly to this page, click on"4. Temperature & Time to Find Fish" in left navigation

1 journal question, 1 class discussion

CAUTION: If students leave page 19, they will lose the work they've done in the interactive. There is a place for them to type their name (upper right corner) and print their work before leaving the page.

Topics Covered
- Using monthly temperature averages to determine Striped Bass location throughout year along the eastern seaboard
- Migration tracks of animals

Discussion:
The fish migration path interactive map shows 3 areas indicated by colored upside-down triangles. Massachusetts is purple, New Jersey is red, and North Carolina is blue.

When the students click on one of the triangles, the monthly average water temperature graph will pop up. The graphs are color coded to the locations/triangles. Students need to figure out which area has the temperature range that Striped Bass prefer during which months.

To help them read the graph, they can click on the yellow Best Water Temp button (lower left). The preferred water temperature range shows up in a yellow band across the graph. When they click on the blue button labeled Months at 20 – 23 C, the months when you find these water temerpatures are highlighted in a blue column. Students can then record which months have the preferred temperature in the data table under the location column and in the month row by clicking in the cell to make a check mark.

The data table should hold their check marks as long as they are on this webpage. Try to get them to finish analyzing the graphs and filling in their data table in one class period. Then they can add their name (top right corner) and print this page for later use if you are running out of time.

If you still have at least 10 minutes, the students should click on "TABLE COMPLETE!" in the upper right corner of the data table. A new set of directions will pop up.

When students click on the white circular Months button, a row of month icons will appear across the interactive. They should left click, hold and drag each month, which they have data for in their data table, to a spot on the map that

corresponds to the correct location in the ocean. Students then use the crayon, by left clicking on the crayon, to draw a path the fish may follow based on preferred water temperature, as shown by the chronological order of the month icons. There is no location that has the preferred water temperature of 20-23C for the months of January, February, March, and December. There is a discovery that explores where Striped Bass go during the winter months.

Lesson 6 (Computers online)

[1 class period]
Food also determines Striped Bass location

Web Pages: 22 - 32
To jump directly to this page, click on"5. Striped Bass Migration Path" in left navigation

1 journal question, 1 class discussion

Optional Discovery: First Look at Photosynthesis
Optional Activity: Photosynthesis Model models the process of photosynthesis
Activity | Slides

Topics Covered
- Other factors besides temperature may influence where fish live: food
- Marine food web
- The process of photosynthesis
- Finding phytoplankton in the ocean from space
- Interpreting chlorophyll concentration maps as an indicator of the amount of phytoplankton in an area
- Students refine their ideas on where Striped Bass may be found based on preferred temperature information and phytoplankton information

Discussion:
Other factors influence where Striped Bass live including food availability and dissolved oxygen. We do not introduce dissolved oxygen in this unit. Because satellites can detect chlorophyll in the ocean and we know that chlorophyll is found in phytoplankton, we can determine the amount of phytoplankton in an ocean area based on the concentration of chlorophyll. Where there is phytoplankton, there is zooplankton, and then smaller fish, squid, and crabs which Striped Bass eat. So where we find chlorophyll, we'll find Striped Bass.

On page 30 the scale numbers are difficult to see in the comparison image. The temperature is the same image for July that they have been looking at all along, so they can use the colors they identified (yellowish-green to yellow) for preferred water temperature. The units for the chlorophyll concentration are not familiar to students. The unit mg/m3 is milligrams per cubic meter. For this comparison, you can use the colors to indicate very little chlorophyll (an indicator of low amounts of food available is purple) to lots of chlorophyll (lots of food is brick red).

If your students are interested in the units, you can show your class a cubic meter by using 12 meter sticks and placing them in the shape of a box (4 students each hold one vertical side and the end of the meter stick that makes the top of the box). Students are always amazed at how large a cubic meter is compared to just the meter stick. You can use beans, paper holes, or anything else small to represent the phytoplankton.

Lesson 7 (Computers online) ~ Optional Extension

[1 class period]
Migration tracking of various marine life

Web Page: 33
To jump directly to this page, click on"7. Satellite Tracking" in left navigation

Topics Covered
● Tracking of other marine animals (sea turtles, whales, sharks, dolphins…) using other websites. Your class can simply observe their tracks, use the websites' lessons, or follow an animal over a period of time to see where it travels.
