THE UNIVERSITY OF MAINE Cooperative Extension

4-H STEM Toolkit

Activity 5: How has the Maine Coast Changed?

Topic: Youth use present day and historic maps to investigate where species live in the Gulf of Maine and draw conclusions about the impact of climate change on native and non-native species.

Time: This activity should take approximately 45-60 minutes to complete.

Materials

- Aquatic Species Fact Sheets (from Activity 1)
- Two each of map A (2020) and map B (1950)
- Map data sheet
- Four sets of species images with velcro – two each for A and B
- Species lanyards
- Map comparison Venn diagram

Learning Outcomes

At the end of this activity, youth should be able to…

1. Name a physical change to ocean conditions in the Gulf of Maine over the last 70 years.
2. Describe how organisms living in the Gulf of Maine have changed and shifted over time.

Background Information

The temperature of the ocean is rising, and that is changing where species live and what species exist along the Maine coast. As the temperatures increase it has caused Maine species to slowly shift the place they call home further north and has allowed species who couldn't previously survive in Maine's cold ocean waters to now call the Maine coast home.

This rising temperature has not only affected where things live, but also the total population of certain species. In Activity 3 youth learn that invasive crab species are able to thrive in warm water, while other native species cannot. This means that as the ocean temperature rises the green and Asian crab populations have been able to increase faster than the native Jonah crab population has.

Vocabulary

- **Habitat:** where a species lives

Methods

Engage

1. Play a game of aquatic species "Who am I?". Place a species lanyard so it hangs down on each participant's back so they cannot see which species is on their card. Use the fact sheet for the food web from Activity 1 for species characteristics, these may need to be shared among small groups.
2. Have youth ask each other yes or no questions to try to identify their species. Example questions: "Does my species live in deep water?" "Is my organism green?" "Do people eat my species?" "Is my species invasive?" "Does my species have any predators?"
3. Using the fact sheet from Activity 1, youth should eventually be able to figure out which species is on their back!
4. Pick one of the plants or animals that lives in open water. Ask: "Would you ever see this species on the beach? Why or why not?" Suggested examples: seaweed is something that you can see on the beach or out on a boat, but large fish like cod are something you do not see at the beach but see in the open water.
5. Now take some time to introduce the idea of a habitat. Example script: "Many animals only live in certain places because they need certain things to survive. A lobster is not seen in tide pools or on a beach because it lives best in deeper water, but a crab can live close to the beach or in the intertidal zone (the area covered by water at high tide and uncovered at low tide) because it can breathe out of water. The place that has the conditions just right for an animal or plant to live is called its habitat."
6. Ask youth to review the fact sheet for the species they had during the game. What is its habitat? What characteristics or adaptations do they think their plant or animal has to make it suited for living in that place?

Video — Activity 5: How has the Maine coast changed? https://youtu.be/5thhupP0FFo

Explore

1. Break youth into groups of 4-5. There should be an even number (either two or four) groups. Half of the groups should work with the map and species cards A and the other half of the groups work with map and species cards B.
2. Pass out the map, map data sheets, and the species card for their map. The data sheets are the same for both but one species set is for the map of today, and the other species set is for the map of 60 years ago. Make sure the species you gave each group match the map they are given! Groups may also find the habitat information on the Aquatic Species Fact Sheets useful to have.
3. Discuss how to read the map. Where is the water deeper? Where is it shallow? Where is it warmer or cooler? How can you tell?
4. Explain that they may have to estimate where the depth and temperature is right for a species, the exact depth and temperature they need may not be labeled on the map.
5. Have the youth look at the data sheets and as a group work together to place all of the species on the map in a place that makes sense.

6. There are multiple places that each species could be placed, and there is not a correct or wrong answer. Make sure that the youth are using the data provided to them to back up their placements. As the youth are completing the activity make sure to ask why they are placing things in certain spots and encourage them to explain thoroughly.
7. If the youth are not liking the velcro dot options, they are also able to place the species anywhere on the map as long as they can back up their choices, just be aware if the map is moved these species are not attached and may fall off or move around.
8. Each group member should be involved, but it is up to youth how they want to divide the labor. They could assign each person a job, one to pick the species card to place, another to read the data sheet for that species and another to locate where it should go and put it on the map. They may also decide to assign each person a particular species they are responsible for learning about and placing all of those on the map; or if they work particularly well together they may decide to do it all cooperatively as a group.
9. As they are placing their species on the map, circulate to help groups who may be struggling with how and where to place their species.

Explain

1. When all of the species pictures are on the maps discuss the process and trends they see on their map. Remember there are two different maps. For now we are not going to compare the two (that will come later) and each group is going to focus on what they did for their own map.
2. Ask groups how they came to place species where they did. How did they make decisions about where to put species when it wasn't obvious where it should go? Did any of the placements surprise them? Do they notice any trends with where species ended up on their maps?
3. Have the youth take a good mental image of their map and try to remember what went where and what species they had. Have them make a prediction for what they think they will see on the maps for the other year. They should be able to justify their prediction with a reason for why they think it will be the same or different.

Elaborate

1. Have the youth switch places, and look at the other groups' maps. They should start by looking at the new map quietly, and think about what they notice. Are there any differences from the map that they helped to create?
2. Youth then talk to the person next to them, have them share what they noticed about what is in front of them. What are the similarities between the maps and what are the differences? Did their neighbor notice anything that they did not?
3. Together with their group, have the youth share what they observed. What was the biggest difference that they found? Was there anything the same about their map and the map that they are now looking at?
4. Hand out a Venn diagram to each group and have them work together to fill it in to organize their observations. You may need to explain how to use the Venn diagram, the differences between the maps go in the outer parts of the circles and the similarities go in the overlapping part of the circles. They may need to go back and forth between the two maps to confirm their observations.

5. Encourage deeper thinking by asking groups questions: "What do you notice about the coastline?" "What do you notice about the species living in the Gulf of Maine?" "Are they the same?" "Do they live in the same places?" "Do you see any differences in where they live or how many there are?" "What do you notice about the water temperature for each map?"
6. Have all the youth get together in one big group, and if possible find a way to display both/all four maps so they are visible to the whole group.
7. Invite the youth to share what they noticed with the whole group. Example questions: "Did both groups notice the same things?" "How are the maps the same?" "How are the maps different?"

Evaluate/Reflect

1. Reflect on why they think there are differences between the maps. It might be helpful to remind the youth which map is from today (A), and which map is from 70 years ago (B). Encourage the youth to think back to how animals travel and what they have learned about how species interact with each other in their ecosystems.
2. The youth are likely to notice that the species have changed location, but there are also differences in the numbers of each species and the temperature of the water has changed. Use targeted questions to guide youth to these insights: "How many green crabs are on each map?" "Why do you think there is a difference?"
3. Discuss if they think human activity could have any influence on these differences. If necessary, remind youth about what they have learned about green crabs, and how their voyage over here was due to human travel. This also could be a time to talk about fishing and lobstering and how that can affect the population of different species. Example questions: "Can you think of other ways humans may influence where and how many species are found somewhere? Explain your thinking." "What do you think would happen if people were allowed to take as many fish/lobster/clams/crabs as they want from the Gulf of Maine? Why do you think that would happen?"

NGSS alignment

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics (Next Generation Science Standards): www.nextgenscience.org/pe/5-ls2-1-ecosystems-interactions-energy-and-dynamics