THE UNIVERSITY OF MAINE Cooperative Extension

4-H STEM Toolkit

Activity 2: What's an invasive species? Where did they come from?

Topic: Youth are introduced to the concept of invasive species and explore how species can be transported unintentionally to new geographic locations.

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

Materials

- Aluminum trays
- Presorted bags of beads and pom poms (sorted by what goes in each tray)
  - Green pom-poms: 30-35
  - Blue pom-poms: 120-130
  - Green beads: 80-90
  - Other beads: 160-175
- Plastic cups
- Paper, pencils, colored pencils (optional)
- Computer and projector to show video (optional)

Learning Outcomes

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

1. Describe how species can travel around the globe with human help.
2. Explain the difference between native, introduced and invasive species.

Background Information

Many species that now live on the coast of Maine have not always been here. Green crabs and Asian shore crabs are some examples of invasive species. Invasive species are plants or animals that have been introduced to new areas and do harm those new ecosystems. These crabs traveled to the coast of Maine decades ago with human help. Plants and animals are transported around the globe via planes, trains, trucks, and, most important to this lesson, ships.

Cargo ships play a huge role in transporting plants and animals. Due to their massive size, many small creatures can be attached to or travel in these ships and not be noticed. This is how many of the introduced crab species arrived in Maine; on ships and with human help. These crab species add a new link to the food web and, with few predators, high reproduction rates and voracious appetites, disrupt the native ecosystem of the Maine coast.

Vocabulary

- **Ballast water:** water held in tanks on large ships to provide stability in rough seas
- **Biofouling:** the accumulation of plants and animals on wet surfaces such as the hull of a ship

- **Introduced species:** a organism that has been intentionally or accidentally brought to an area where it is not native
- **Invasive species:** an introduced species that has the potential to do harm to the environment
- **Native species:** the natural distribution of an organism.

Methods

Engage

1. Reflect on what was learned in the first activity. Ask youth to think about what species they learned about. Give the group a chance to share what they remember.
2. After a few species have been named, ask the youth some questions to get them thinking about how animals travel from place to place. Some example questions to start are: "How do animals travel?" "How far can they travel?" "How do land/terrestrial animals travel vs. ocean/marine animals?"
3. Movement activity (if you have the time and space): Name one of the species they came up with at the start of this activity and ask them to travel across the room the way they think that species would move. They could walk like a crab, swim like a fish or fly like a bird, etc.
4. Shift into discussing how humans travel. Start with generally how humans get from one place to another. This could be a continuation of the movement above. Ask youth to walk/crawl/run/skip/swim across or around the room as a person might.
5. Introduce the concept of using machines to aid global travel. Some example questions are:
    a. "How do humans travel long distances?"
    b. "What machines or technology help humans travel?"
    c. "How do humans travel across the ocean?"
    d. "How far do humans travel?"
    e. "How far have you ever traveled?
    f. How did you get there?"
6. Ask the youth to think about the ways in which human travel differs from animal travel. Example questions:
    a. "How does human travel and animal travel differ?"
    b. "Do animals use machines or technology to help them get to where they need to go?"
    c. "Which can travel farther, a person or an animal?"
7. Discuss: "How can human travel affect how animals travel?" There is no right or wrong answer, and it might be difficult for youth to come up with ideas for this. Some examples you could provide are:
    a. Roads are often in the path of where animals want to go. Animals sometimes need to cross them and it can be difficult for them because cars get in the way.
    b. A mouse or chipmunk might build a nest in a car engine and unintentionally hitch a ride to a new location.
    c. Insects will often fly right into car windshields.
8. Automobile examples are often easier for youth to understand, but that does not mean that cars are the only example they will share. If you do not get any marine or boats as examples ask that explicitly now: "How do you think boats affect how animals travel?"
    a. Some examples could be how motorboats create a big wave and this can affect animals swimming nearby, or how in paddle powered boats sometimes seaweed is picked up and moved around.

9. Shift the conversation to big boats, such as cargo ships Example Cargo Ship Image (Flickr) if needed. Ask youth if they think that boats like this can affect how animals travel.
10. Throughout the discussion make sure that youth understand that humans and other animal species can travel. The way humans travel might be different or involve more technology but animals still make their way from place to place. Make sure to note that both animals and humans travel in many different ways and they can both affect each other.

Explore

1. Group students into groups of four to five and pass out a set of materials to each group. Each group gets one tray filled with the pom poms and beads and every student should have a cup.
2. Explain to the youth that you are going to explore one way humans transport animals to new places. Take a moment here to introduce the green crab. Start by asking youth if they remember anything about green crabs from last week. Share that these crabs are native to Europe and traveled to North America, with the help of people, in the mid 1800s and have been in Maine since 1900. Share the Range map of invasive crab (Carcinus maenas) map on the Look Out for Invasive Crab! page (fisheries.noaa.gov/alaska/habitat-conservation/look-out-invasive-crab) on NOAA Fisheries website if it is helpful. If time and equipment allow, show the video, Attack of the Green Crabs (O'Chang Studios/YouTube), (youtube.com/watch?v=5Rcy71DSBus) to introduce green crabs, how they traveled to Maine and their impact on the environment.
3. For this simulation the tray with the pom poms and beads represents the Atlantic Ocean and all the plants and animals living in it. Their cup is a cargo ship traveling across the ocean.
4. Each participant will take a look at the tray and what it is filled with. They need to determine a path to take a scoop with their cup from one side of the tray to the other. They will each take a turn, close their eyes (because ships don't see what they are picking up along the way) and scoop with their cup. Make it clear that the action of them scooping is meant to model a ship traveling across the Atlantic Ocean from Europe to Maine to deliver goods. When they take their scoop their cup should travel from one side of the pan to the other and touch the bottom of the pan as it travels.
    a. Every member of the group should take a turn and then dump the contents of their cup carefully (the beads will roll) onto the table.
    a. Separate what they picked up into different categories, each represents different things:
        - Blue pom poms: water that was picked up along the way
        - Green pom poms: seaweed picked up along the way
        - Beads that aren't green- small animals picked up along the way
        - Green beads: green crabs picked up along the way
5. Ask the youth to compare what they picked up with the other members of their group.
6. After this initial comparison, have youth put any of the pom poms they picked up back into the bin. Example script: "The plants that have traveled over have a difficult time leaving the boat. This boat is only docking in Maine for long enough to unload the supplies and then it will travel back to where it came from. This ship will take the plants back with it. Likewise, the water the boat transported is not a threat (only the living things in it are). The blue and green pom poms can all be put back into the tray."
7. Have the youth focus on the animals they picked up. Have them count: How many green crabs did each individual get? How many green crabs did the group get?

8. Give the youth a chance to share their numbers with the whole group. Example questions: "Did anyone (individual or group) avoid picking up any green crabs?" "Was it easy or hard to accidentally transport a green crab on your boats?" "Did you intend to pick up any green crabs when you took your scoop?" "How did it feel to find out you transported a green crab to a new location? Why did you feel that way?"
9. Once the group has a chance to explore the number of green crabs transported, make connections with their learning from last week by discussing the green crabs impact on the food web. Example questions: "Is bringing a new species to a place it didn't previously live something we want to happen?" "Is having these crabs in Maine beneficial or harmful to the ecosystem? How?" "Do you think these new crabs will compete for food with crabs that are already on the Maine coast?" "Do you think there is enough food to support both native and introduced crabs?" (Answer: The green crabs will compete with the native crabs for food and there is not always enough food for all of the crabs to survive.)
10. Introduce the concept of native species vs introduced species (species that came from a different area, but is not necessarily a threat to the ecosystem) vs invasive species (introduced species that are a threat to the ecosystem). Ask if they think the green crab is native, introduced or invasive and why.

Video — Activity 2: What is an invasive species? Where did they come from?
https://youtu.be/nDlOMGSQYek

Explain

1. Discuss the ways that cargo ships may inadvertently carry plants and animals across the ocean. Explain that large ships can have 'stowaways' that don't get seen and get transported unintentionally with the cargo. Ask youth how they think this might happen.
2. Have youth think about what the hull, or bottom, of a ship looks like when it has been in the ocean without being cleaned for a long time. It is covered in sea life, like seaweed and barnacles. This is called biofouling and is one way plants and animals may be transported from one port to another.
3. Explain also that large ships, like cargo ships, pump water, called ballast water, from the sea into tanks to help provide stability in rough seas. The ballast water is then pumped out, along with any tiny plants and animals growing in it, into other ports when it is no longer needed. Many marine species (both plants and animals) start their life cycle as plankton and can be transported this way without even knowing they are there.
4. Discuss: "How is what you did today similar to a cargo ship traveling across the ocean?" "When you took a scoop with your cup did you intentionally pick up any green beads?" "Do you think cargo ships intentionally transport species to new places?" "What could you do differently to avoid picking up green beads with your cup?"
5. Do the simulation again with any strategies or changes that they came up with as ways to avoid picking up green beads.
6. As before, count the beads. Were they able to pick up fewer green beads with the changes they made? Do they think cargo ships could make changes to transport fewer species?

Elaborate

1. Have youth apply what they have learned through their model to explore how we can prevent invasive species from spreading in the real world. Example script: "Now that we have seen an example of how humans have helped animals travel around the globe, can we brainstorm some ideas on how we can prevent this from happening?"

2. Have youth brainstorm with their group how they would prevent the transport of species in the ocean on ships. This could be a change in how the boats operate while doing their job or something they could invent to prevent transporting unwanted plants and animals.
3. Have youth share with the whole group any solutions they came up with.
4. Ask youth if they think there are laws or regulations that could be put in place to prevent the spread of invasive species and what might be the challenges of implementing these changes? Some real world examples are:
    - **a.** International maritime regulators have worked to develop regulations to treat ballast water before it is dumped back into the ocean to try to prevent introducing marine species to new places.
    - **b.** Some countries are also exploring regulating cleaning protocols for large ship's hulls to prevent biofouling contributing to the movement of invasive species.
    - **c.** Unfortunately, the spread of marine species can be hard to regulate since oceans are connected together and it takes the cooperation of many different governments world wide.

Evaluate/Reflect

1. Make connections to other bodies of water found in Maine. Unintentionally transporting plants and animals is a problem on small recreational boats that travel on lakes and rivers, too. Ask youth to think about how this could be prevented. Example questions: "How would you apply what we learned about cargo ships to recreational boats?" "How could boaters prevent the spread of plants and animals from one lake to another?" "Have ever heard about laws and regulations to prevent animals and plants from moving to new places?"
2. Introduce current boat laws in Maine by sharing the flier with the participants: Infested Ramp Sign (JPG) (maine.gov/dep/water/invasives/images/2012infestedrampsign.jpg)and also pages 8 and 9 from the State of Maine Department of Inland Fisheries and Wildlife's The Boater's Guide to Maine Boating Laws and Responsibilities (PDF) (maine.gov/ifw/docs/maine-boating-laws.pdf). Example script: "Maine currently has laws in place to make sure species aren't allowed to travel between bodies of water with human help. The best way to remember this is 'clean your boat before you float.' Maine boat laws require you to clean your boat before going into the water so no stowaways can be transported from waterbody to waterbody."
3. Wrap up today's learning by asking some reflection questions: "What can you do to help animals stay in their natural habitat?" "Can you think of any other examples of animals traveling long distances?" "Can you think of any other laws similar to the boating law we learned about? (does not need to be boat or waterway related, think of 'Buy is where you burn it' for campfire wood)" "What is something new you learned today?" "How do you feel about species moving from place to place?" "How can movement be beneficial? How can it be bad for an area?" "Why should we care if species move from their natural habitats?"

Extension

Create a sign or poster to:

1. Explain their new rules for the scooping game and how to not collect green crabs.
2. Inform the public about cleaning your boat and/or not dumping bait to protect waterways from invasive species.

3. Have youth research another invasive species found on the Invasive Species page (Maine.gov) or on the Invasive Pests page (Maine.gov Got Pests) and create a sign, poster or slogan to warn others about the dangers of introducing that species to the ecosystem and what steps they can take to prevent the spread of that species.

NGSS alignment

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics: www.nextgenscience.org/pe/5-ls2-1-ecosystems-interactions-energy-and-dynamics