



Erosion Harbor Cruise

Grade: Grade 5/6

Place of Focus: Boston Harbor

Massachusetts Curriculum Framework for Science and Technology/Engineering Standards

- **5-ESS3-1.** Obtain and combine information about ways communities reduce impact on the Earth's resources and environment by changing an agricultural, industrial, or community practice or process.
- **4-ESS2-1.** Make observations and collect data to provide evidence that rocks, soils, and sediments are broken into smaller pieces through mechanical weathering and moved around through erosion.
- **3-ESS3-1.** Evaluate the merit of a design solution that reduces the damage caused by weather.

Lesson Overview

In this final experience, students will take a two-hour boat cruise around several of the Boston Harbor Islands.

Informed by their experiences modeling beach erosion and exploring Constitution Beach, students will look for signs of erosion throughout the Harbor guided by a scavenger hunt. This is also an opportunity for students to experience a boat ride through Boston Harbor, and a chance to see the city and islands in a novel way.

Essential Question

How do we know something is changing?

Guiding Questions

- Where can we see change happening throughout Boston Harbor?
- Why do we want to measure change?

Learning Objectives

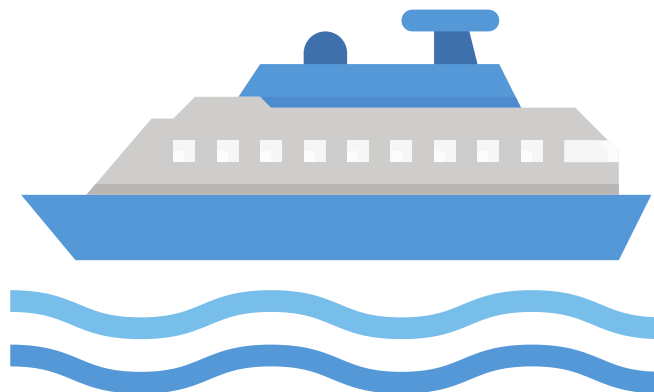
By the end of the lesson, participants will be able to:

- Identify areas of erosion in different locations across Boston Harbor
- Describe the different ways communities use the coast (e.g. recreation, shipping, etc.)
- Identify at least two Boston Harbor islands
- Locate their community within the greater Boston Harbor area
- Create a harbor protection strategy

Lesson Preparations

Time

2-hour boat cruise



Materials and Supplies

Numbered for two classes of ~15 students each

- Harbor scavenger hunt (x30)
- Pencils (x30)
- Clipboards (x30)
- Harbor protection worksheet - included (x30)
- “How can I spot an eroding bluff?” worksheet - included (x30)
- Tarp or sheet
- Travel white board
- White board markers
- Optional:
 - Globe
 - Buddy Bison (NPS mascot)
 - Temporary tattoos/stickers

Lesson Outline

Lesson Motivation / "The Hook"

This is the fourth and final lesson in the Erosion Lesson series. The goal of this lesson is to apply what the students have learned over the previous lessons and explore Boston Harbor for signs of erosion.

Introduction

Opening Circle (15 minutes)

- Group Norms and Safety Rules
 1. Sight and Sound – explain that we are remaining near the area we are currently standing unless you are accompanied by an adult to the restroom. If you can't “see or hear” an adult, you are too far.
 2. Call and Response – review the class' call and response or attention signal if they have one, and establish one if they don't
 3. Keep Track of Trash – be sure to secure any trash or belongings that you have. They can easily blow over the side of the boat and become litter in the ocean.
 4. Boat safety – follow all instructions as shared by the crew

Introduction (cont.)

Notes on Engaging Students on a Boat

This may be some students' first time on a boat. Understand that some students may be nervous boarding the boat, of waves, etc. Gather students together once onboard and introduce them to the crew. The crew should instruct students on safety guidelines, including to always keep two feet on the deck (no running). Other tips are:

- Boats are exciting! *Avoid lecture-style presentations* - instead, our activities are ongoing and small-group or individual based, so students have time to explore and engage.
- Point out landmarks or interesting things that pop up!

Opening Circle (cont.)

- Tarp Drop: sand, water, wind
 - Split the group into two teams
 - Two staff members hold a tarp up between the two teams
 - One member from each team steps up to the tarp, unable to see the person on the other side
 - Each person at the tarp must mimic one of three options: sand, water, or wind
 - Staff members drop the tarp from between the two team members, revealing their selected elements
 - Treat like rock, paper, scissors: water beats sand, wind beats water, sand beats wind
 - The person who loses each round joins the other team on the opposite side of the tarp
 - Continue until all members are on one side of the tarp

Activity Introduction: Observing Erosion

How do we know something is changing? (5 minutes)

- Explain that today we will be exploring Boston Harbor and viewing islands from the boat (we will not be going onto an island today)
- Recall Lesson 3: How does the coastline here look different from Constitution Beach?
 - We will be *observing* and noting the differences between the coasts and islands, looking for signs of erosion.
- Recall Lesson 2: What might erosion look like in different places?

Lesson Activity: Ongoing Discussions

Things to look for *along the Harbor*

- What kinds of buildings are along the Harbor?
- Who do you see using the Harbor?
 - What do you think they are doing?

Things to look for *on the islands*

- What kinds of buildings are on the islands?
- What kind of habitat(s) are on the islands?
- Do you see any people on the islands?
- Do you see erosion happening on the islands?
 - Where is it happening?
 - How can you tell? (What signs of erosion do you see?)
- What similarities and differences do you see between the Harbor Islands and Constitution Beach?

Lesson Activity: Harbor Cruise Bingo

What kinds of change can we observe around Boston Harbor? (ongoing, duration of tour)

- Hand out one bingo card (included, four per page) to each student
- Have students complete the card throughout the cruise. Any student who gets “bingo” gets a prize!

Lesson Activity: Design a way to protect your city

Using the suggestions on the attached worksheet, have students design different ways their make-believe city could be protected from erosion. The sky's the limit! (15 minutes, suggested post-lunch activity)

- Hand out worksheet to each student
- Have students spend 10 - 15 minutes drawing and designing individually
- Do a pair and share or group share-out of designs. Ask students, “Who or what did you prioritize? Will humans and wildlife be able to get to the water? Would they want to live in this new city?”

Conclusion and Reflection

How do we know something is changing?

Ask the big questions:

- What have we done to observe change? What are some other ideas you might have for observing change?
- How can we observe change as scientists?
- What questions do you have about changes in Boston Harbor?
- How will you share what you've learned with your community?

Logistical note

Please note that this lesson as written requires boat access. Affordable access to boats in Boston Harbor is an ongoing challenge. A boat trip organized for a private group can often be a financial barrier. Below are some resources that we've identified to help get students onto the water. This lesson could also be adapted to a site that allows for views of the islands from land (e.g. Castle Island, Deer Island, or Hull, MA).

Public ferries: MBTA ferries (Hingham/Hull, Charlestown, East Boston, Seaport) [can be accessed with student discount Charlie Cards](#) (M7 Card or S-Card). The [Hingham/Hull route](#) is the best line of service for facilitating this lesson with views of erosion on many of the islands.

Water taxis: can be hired, though are expensive (e.g. Rowes Wharf Taxi).

UMass Boston M/V Columbia Point: UMass Boston's vessel [can be reserved](#) by private groups.

Boston Harbor Now: provides Free Access for Groups through the [Island Pass program](#). Check the webpage frequently and apply early. Applications for the upcoming season (late May - mid October) typically opens in early March.

For more ideas, or to brainstorm, please reach out: info@stonelivinglab.org

HOW CAN I SPOT AN ERODING BLUFF?

This is one of the Boston Harbor Islands over a span of 15 years. As we see different bluffs throughout the Harbor, can you guess which island this is?



I think this is: 

..... Island



This is an overhead view of the same island. Notice how much land was lost from erosion over time. How many feet were lost between 1995 and 2021?

 ft.



This is the route our boat is taking through Boston Harbor Islands National & State Park. Where else can you spot evidence of coastal change?



STONE
Living Lab

Harbor Cruise Bingo!

Sandy beach	House on the coast	Floating buoy
Fallen tree	Eroding bluff	Business on the coast
Island	Ferry	Wild animal

Harbor Cruise Bingo!

Rocky beach	Damaged seawall	Sailboat
Eroding building	Boat dock	Lighthouse
Airplane	Drumlin	Free space! 

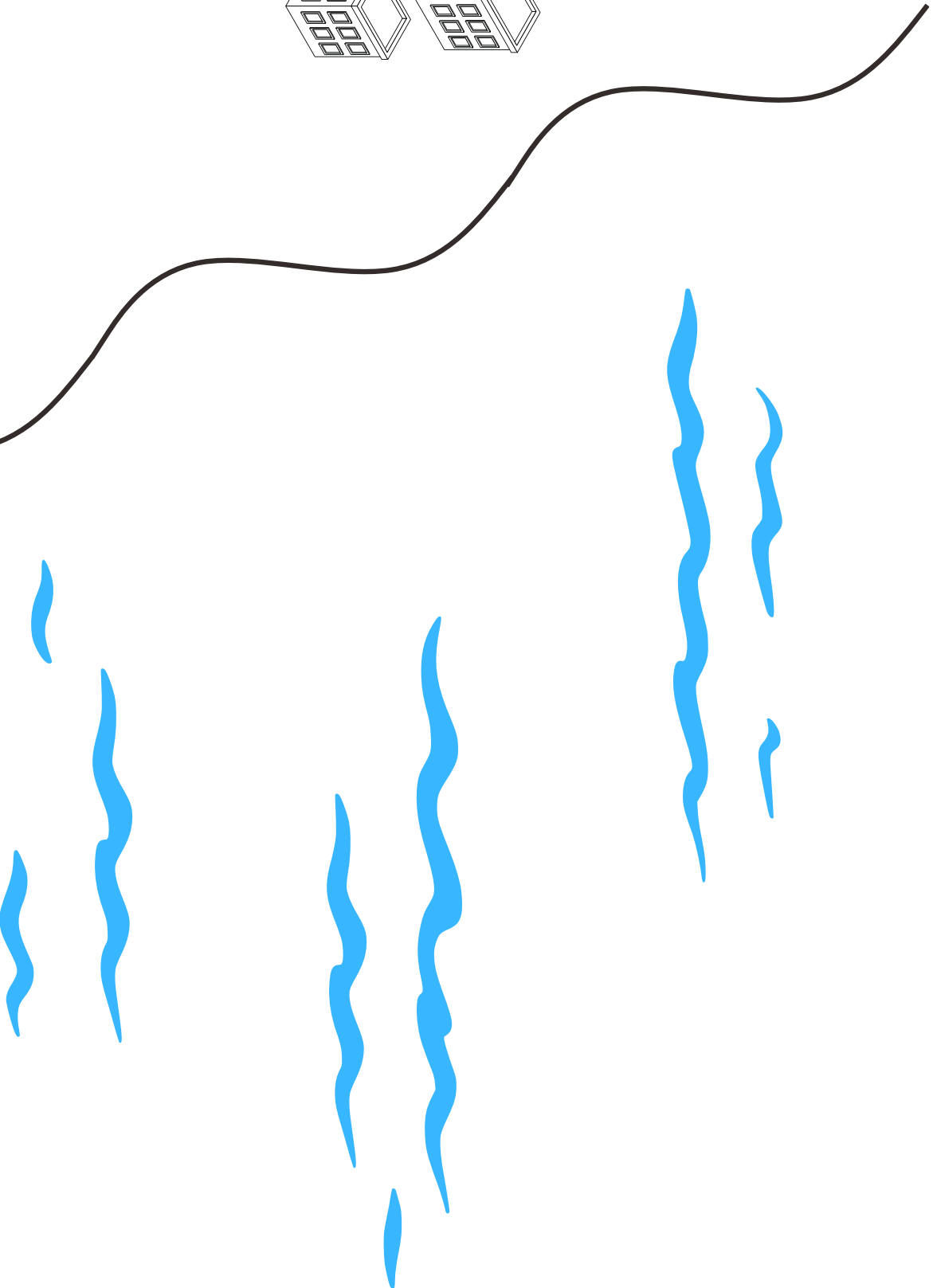
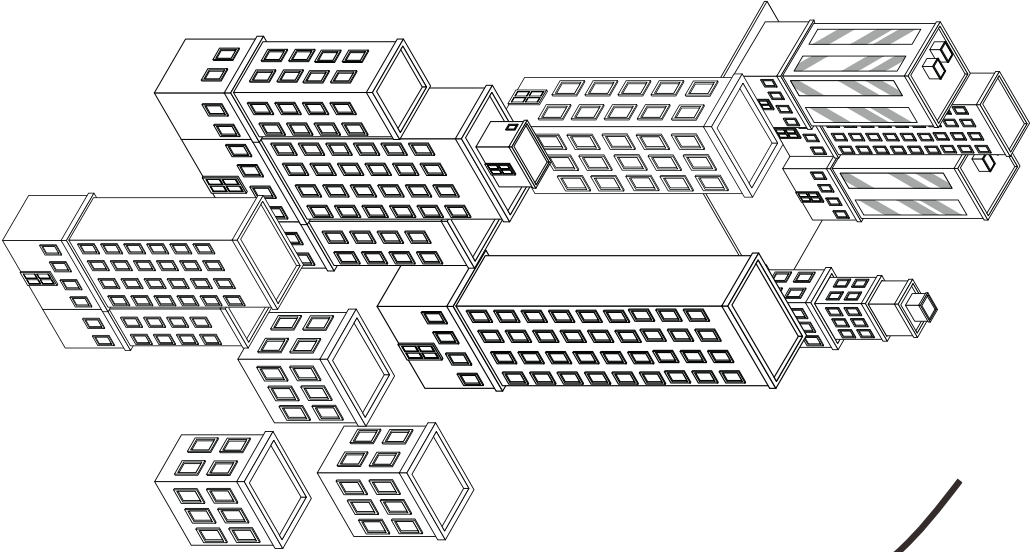
Harbor Cruise Bingo!

Sandy beach	Fallen building	Island
Rocky beach	Eroding bluff	Business on the coast
Floating buoy	Ferry	Boat dock

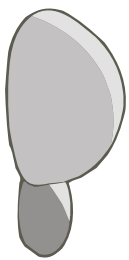
Harbor Cruise Bingo!

House on the coast	Free space! 	Drumlin
Eroding building	Wild animal	Lighthouse
Airplane	Sailboat	Damaged seawall

Design a way to protect your city from erosion

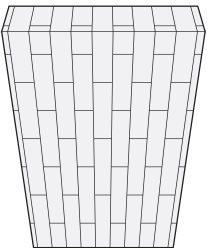


Welcome to the city of:



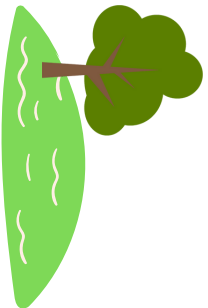
Boulders

- ✓ Pros: Slow down waves, create habitat for wildlife
- ✗ Cons: Need heavy equipment to build, can't prevent flooding from sea level rise



Seawall

- ✓ Pros: Stops waves and prevents flooding from sea level rise
- ✗ Cons: Humans and animals can't get past it, difficult to build, can't change it once it's built



Island

- ✓ Pros: Slows down waves, provides habitat for wildlife, space for parks, adapts to change
- ✗ Cons: very difficult to build an island if you don't already have one!



Salt marsh

- ✓ Pros: Slows down waves, absorbs flood water, provides habitat for wildlife, adapts to change
- ✗ Cons: takes time to grow, need space to plant



Create your own!

What could you create to help prevent erosion and flooding?