

OCEAN!



Part 6:

**Ocean
and
Coasts**

SUSTAINABLE DEVELOPMENT GOALS

developed by

in collaboration with

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PART 6: OCEAN AND COASTS

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Find out More!

For additional resources and activities, please visit the *Ocean!* StoryMap at bit.ly/OCEAN2030.



Planner

<u>Activity</u>	<u>Description</u>	<u>Materials and Technology</u>	<u>Additional Materials</u>	<u>Approximate Timing</u>	<u>Page Number</u>
Task 1: What are the conflicts over coastal spaces and how could they be resolved?					
<i>Discover</i>	Find personal connections to the coast and use a photo collage to help create a system diagram.	<ul style="list-style-type: none"> • Paper • Pen or pencil 	<u><i>Ocean Identity Map</i></u>	25 minutes	198
<i>Understand</i>	Investigate coastal conflicts that are most relevant to you.	<ul style="list-style-type: none"> • Paper • Pen or pencil • Computer (optional) or access to information sources such as a library 		40 minutes	202
<i>Act</i>	Analyze coastal conflicts and reimagine them to be fairer and more balanced.	<ul style="list-style-type: none"> • Paper • Pen or pencil 	<u><i>Ocean Identity Map</i></u>	25 minutes	206



Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Task 2: How can we conserve coastal ecosystems and the benefits they provide?					
Discover	Explore coastal ecosystem services and add them to your <u><i>Ocean and Coastal System Diagram</i></u> .	<ul style="list-style-type: none"> • Pen or pencil • Paper 	<u><i>Ocean and Coastal System Diagram</i></u> <u><i>People and Coasts</i></u>	20 minutes	211
Understand	Learn more about environmental ecosystem services and model how mangroves and coral reefs can help absorb wave energy.	<ul style="list-style-type: none"> • Long, shallow container • Something to absorb water • Water • Small heavy blocks, rocks, or other items • Tape • Piece of colored paper • Scissors 	<u><i>Coastal Ecosystem Services</i></u>	40 minutes	213
Act	Explore and decide on different policy solutions to help resolve the coastal conflict you identified.	<ul style="list-style-type: none"> • Pen or pencil • Paper 	<u><i>Ocean and Coastal System Diagram</i></u> <u><i>Ocean Identity Map</i></u>	20 minutes	219



Meet Your Research Mentor

Meet Dr. Ana Spalding. Ana (pronounced *AH-nuh*) will be your research mentor to help you understand more about the system of Earth's ocean and coasts.

Ana is the director of the Adrienne Arsht Community-Based Resilience Solutions Initiative, based at the Smithsonian Tropical Research Institute. She studies the relationship between people and their environment, especially in marine and coastal areas. Ana has a doctoral degree in environmental studies. However, she also has knowledge and perspectives that come from other parts of her identity. Since Ana is now working with you, it is important to understand who she is.

Ana's Identity Map

Studied environmental studies in the Bocas del Toro Archipelago

Interested in all things ocean! (adaptation, climate, environment)

Director of a new resilience initiative at the Smithsonian

I love the Pacific Northwest

Has lived in Oregon, USA, and Panama City, Panama

The ocean is my happy place

45-year-old female

Mixed race, black and white

Tall-ish with black hair, black eyes, and glasses

Values empathy, honesty, collaboration

Has a dog

National Geographic Explorer

Love traveling with my husband and two kids

I don't know how to cook

I work a lot. Some may say too much.

Deeply sensitive, ambitious, committed to my family

If I could go back in time I would learn how to surf

Enjoys crew rowing, being in nature, and growing flowers



Task 1: What are the conflicts over coastal spaces and how could they be resolved?

A **coast** is where the ocean and a land mass meet. The areas within the shallow water and the areas near the shore are very important for people and many other living things. In this task you will **discover** more about how you and other people relate to the coasts near the ocean. You will investigate to **understand** some of the conflicts over how to use coastal areas. Then you will **act** by determining a sustainable solution to some of these conflicts.

Before you begin the rest of Part 6, think quietly to yourself about Ana's identity map and compare it to your *Personal Identity Map*.

- Are there things you have in common with Ana?
- Are there ways in which you are different from Ana?
- Can you see anything about Ana's identity that relates to understanding the ocean system?

Throughout Part 6 you will notice Ana sharing ideas and experiences with you. She may help you understand better ways to do your research or share some of the research she has done.



Discover: *How do the coasts of the ocean relate to me?*

Coastal areas have been important throughout human history. They are still important today. Coasts are part of the way many people eat, play, work, travel, and live. For example, around 40% of people around the world live within 100 kilometers of a coast. However, even if you don't live near a coast, coasts still affect you. For example, 90% of global trade uses shipping for transportation and lands in coastal ports. In this activity you will think more about the ongoing relationship between your community and coastal areas, whether or not you live on a coast.

1. Take out your *Ocean Identity Map*.
2. Examine it closely for evidence of the connections between people in your community and the ocean.



3. Form a circle with your team or a smaller group, if your team is more than around five people. Go around the circle listing all the connections between people in your community and the ocean. For example, maybe you share that people in your community like to eat fish from the ocean. Have one team member write down these connections on a piece of paper.
4. Keep going until you can't think of any more connections.
5. Go around the circle again, and this time share how each people and ocean connection also connects to the coast. For example, maybe the fish eaten in your community are caught by a boat that docks on a coast. Write down that coastal connection next to each connection on your paper.
6. Take out a piece of paper or open a digital document and label it "Ocean and Coastal System Diagram."
7. Examine the list of ocean and coastal connections your team created. What do you notice that might be an element you should include in a system diagram about the ocean and the coast?
8. Pick the five or more elements you think are most important and add them to your diagram. Then add and label arrows to show ways the elements relate to one another. Use Figure 6.1 if you need a system diagram example.

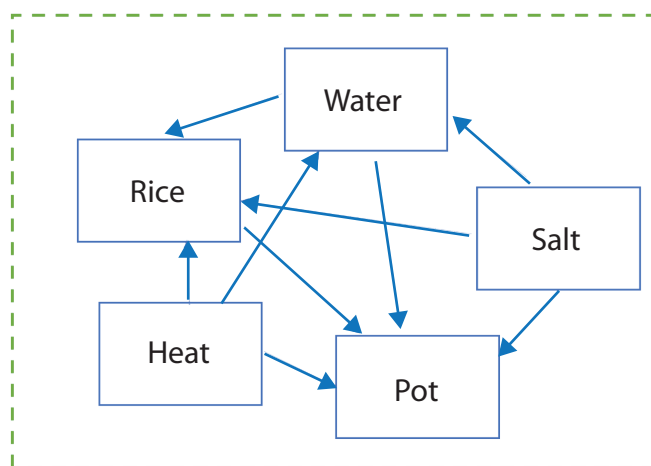


Figure 6.1: Sample system diagram.

9. Read Ana's ideas about the ocean as a system. Use her thoughts to add any ideas you want to your Ocean and Coastal System Diagram.



Ana says . . .

When we think about the ocean as a system, what are we including? For example, are we including cultural perspectives? Many places have relationships with and knowledge of the ocean that goes back thousands of years. For example, many islands of the Pacific have strong voyaging traditions. These perspectives are important when we think about our relationship with the ocean. How do we redefine what is important to know about the ocean to be more inclusive of local customs and traditions and ways? The ocean is a place of connection through voyaging and history and culture.

10. Examine the photos in Figure 6.2 showing some ways people use the coast. Are there ways people connect to the coasts that are not currently on your *Ocean and Coastal System Diagram*? If so, add those elements now.



Figure 6.2: Examples of human connections to the coast—clockwise from top left: a coastal town, a busy port, a crowded beach, an ocean fish farm.



11. Examine the photos again. For each, use the four perspectives—**social**, **environmental**, **economic**, and **ethical**—to identify and add any additional elements or relationships to your *Ocean and Coastal System Diagram*. Use the *Ocean!* StoryMap for support if you need more information about different ways people use the coasts.
12. Examine the photos of coastal ecosystems in Figure 6.3. Do you notice any elements of natural systems that you think should be part of your *Ocean and Coastal System Diagram*? If so, add those elements now. Use the *Ocean!* StoryMap for support if you need more information about different coastal ecosystems.



Figure 6.3: Examples of coastal ecosystems—clockwise from top left: a kelp forest, a mangrove forest, a coral reef, a seagrass bed.

13. Examine your *Ocean and Coastal System Diagram*. Add any relationships you notice between the ways people and other living things use coastal areas. How do they affect one another? Can you draw and label arrows that go both ways to show the relationships?
14. Read Ana's ideas. Why do you think it is important to consider the connections between natural and human systems?



Ana says . . .

My work really focuses on linking the environmental and the social and economic. I think about natural and human systems and the connections between them. There are feedback arrows that go both ways between these systems. The changing ocean affects people and changing people affect the ocean.

15. Turn to a partner and together examine the sets of photos in Figures 6.2 and 6.3. Discuss:
- From the photos, does it seem like there is a separation between human systems and natural systems?
 - Pick one photo from Figure 6.2. How could you imagine it more in harmony with one of the natural systems from Figure 6.3?



Understand: *What are the conflicts between ocean and human systems in coastal spaces?*

Coastal land often has many people who want to use it, often in different ways. Sometimes this can lead to **conflict**, or disagreements between individuals or groups.

- Think to yourself about a time you were near a coast or you were told about someone who had been to a coast. How was the coastal area being used?
- Have a few team members share their answers with the team.
- Discuss with a partner: How do you think that coastal area was being used 100 years ago? How about 1,000 years ago? How do you think it has changed? Use Ana's ideas to help you think about these questions.



Ana says . . .



Coasts are such important places. The oldest human uses of the ocean are food and transportation. That includes exploration and voyaging. Historically, in the Americas coasts are places for discovery. So many cities are located on the coast because they are such important spots. I feel when we just see them as just spots for vacation, we lose a lot of that history. So I encourage everyone to think more about the coasts. Who lived there? Why was this important? There's nature, but there's also people. How do people live in these places?

4. Discuss with your team:
 - a. How do you think the way people have used coastal areas has changed over time?
 - b. What types of conflicts can you think of that might be related to those changes?
5. Use *Coastal Conflicts Investigation* to find out more.

Coastal Conflicts Investigation

Have each team member find an example of a situation where two people or groups wants or wanted to use a coastal space in different ways. For example, maybe one group wants to use an area for a tourist resort and another group wants to use it for fishing. Or maybe a group wants to preserve a mangrove forest and another group wants to build a road. Or perhaps one group wants to put up wind turbines off the coast and another group does not like the way they look.

You can gather information about coastal conflicts through a personal investigation, a news investigation, or an interview. Pick the method that works best for you. Be sure to gather information about:

- a. Who was involved in the conflict.
- b. What the conflict was about.
- c. If you can, how it was resolved.



Personal Investigation

Have you personally experienced a conflict over the way a coastal area is used? If so, write or draw a description of that conflict. Be sure to include the who, what, and resolution of the conflict.

News Investigation

You can use news articles to find out information about coastal conflicts. You can search online, use a local library, or read a newspaper or magazine. If you can, try to gather more than one article about the conflict. Different authors might report the conflict differently, or the conflict may have changed over time. Be sure your news article answers your questions about the who, what, and resolution of the conflict.

Interview

Do you know someone who has experienced a conflict over the way a coastal area is used? If so, you can interview them about their experience. Be sure to include the who, what, and resolution of the conflict. As you plan for your interview, consider:

a. Ways to Record an Interview

- You can interview people many different ways, such as in person, over the phone, using email, or through social media channels.
- You can use audio or video to record an interview.
- You can write or draw to make a record of the ideas that are shared with you.

b. Tips for Conducting an Interview

- Make sure to ask permission to record a person's answers.
- Ask permission to share the interview with the rest of your team, class, or other people in the community. People might be more willing to share if their interview is anonymous.
- If it feels as if someone didn't answer your question, don't be afraid to ask the question again in a different way.
- Let the person you are interviewing answer the questions in the way they want. Be patient. Listen carefully. Understand that they might give answers you didn't ask for or expect.



c. Safety Tips for Interviewing People

- Ask your teacher for guidelines. They will know what is safest in your community.

Physical Safety Tip

Never conduct an interview alone and always be aware of your surroundings. You might want to suggest recording the interview in a quiet public place. If you are reaching out to people using social media, talk to your teacher or another adult about guidelines to keep social media use safe. For example, you may want to only interact with people you already know or you may want an adult to post your questions for you.

Emotional Safety Tip

It can be hard to communicate with other people in the community. You may feel shy or nervous. Someone may tell you they don't want to talk. That's okay! It doesn't have anything to do with you. It just means they don't want to share. You can show them respect by thanking them and moving on to another community member.

6. Have each team member share the conflict they investigated with the team.
7. After a team member shares their conflict, discuss:
 - a. What were the different perspectives of the people or groups involved? As a group, decide whether each different person or group involved in the conflict was most focused on a social, environmental, economic, or ethical perspective, or a combination of different perspectives.
 - b. Which person or group was able to use the area the way they wanted to?
8. Have one person take notes on a class board or somewhere else where everyone can examine the notes. In the notes, include a description of the conflict, the perspectives of the different people or groups involved, and what ended up happening.



9. Take out a piece of paper and use the team notes to help you write or draw your personal answers to the following questions:
 - a. Themes: What themes or main ideas did you notice when your team was discussing the coastal conflicts you investigated? For example, were many conflicts resolved by paying more attention to one perspective or one group?
 - b. Important Perspectives: Were some perspectives or groups treated like they were more important? If so, why do you think that is?
 - c. Fairness: Do you feel the way coastal conflicts were resolved seems fair?

Emotional Safety Tip

It can be upsetting to think about people being treated unfairly. Discrimination has been happening for a long time and is not your fault. However, you can be part of the solution and can help make the future more fair. It is okay to pause or take a break if you feel upset.

10. Pick one group member or your teacher and give them your papers. You will need them in the next activity.



Act: *How can we reimagine how we relate to coastal systems?*

People have been using and living in coastal spaces for thousands of years. Our relationship with these spaces has changed over time. In this activity you will think about our current relationship and imagine how you would like it to change.

1. Have the person who is holding all the papers from step 10 of the Understand activity read them all out loud, or use another way to share them with the group.
2. Discuss as a group:
 - a. What did you notice about the themes people identified?
 - b. What do you think you could learn from these themes that might apply to other coastal conflicts?
 - c. Are you satisfied or happy with the way decisions are made about coastal conflicts?



3. As a team, write and circle the words “People and Coasts” in the center of a class board or a shared paper.
4. By yourself, think about how you would describe the relationship between people and coastal areas. What do people think is important about using coastal spaces?
5. Have each team member add a word or drawing outside the *People and Coasts* circle to share their ideas about this relationship.
6. Read *At the Smithsonian*. How could Ximena’s experience at the port inspire you to rethink the relationship between the needs of people and ocean ecosystems?



At the Smithsonian

Human infrastructure, such as ports, is designed to benefit people. But could it benefit ocean ecosystems as well? Smithsonian scientists are trying to find out. Ximena Velez, from the Smithsonian Conservation Biology Institute, directs an ocean observatory based in Peru. Her team helps monitor how an international port on the coast of Peru that was designed to ship liquefied natural gas (LNG) has affected the marine habitats there. Ximena says, “Around this port we have five stations, and we measure pretty much everything. We measure the quality of the water, the quality of the sediment we see. We monitor populations of plankton, phytoplankton, different types of fish, sharks, dolphins, and seabirds.”





Figure 6.4: The Biodiversity Monitoring and Assessment Program (BMAP) in Peru.

Ximena's team has noticed something interesting. Port construction included a large **breakwater**, or structure to protect the ship's docking area from tides, currents, waves, and **storm surge**. The design of the breakwater seems to encourage seabirds of all types—cormorants, pelicans, terns, and penguins—to nest there. Ximena jokes, "It is basically a huge apartment building for seabirds." The area has become one of the larger colonies of Humboldt penguins in Peru! There are also a lot of fish, and because of this, frequent visits by dolphins and sharks.

LNG can be a dangerous material, so human access to the port is limited. People cannot visit or fish in the area, which in some ways makes it like a mini-marine protected area. The breakwater has become an unexpected conservation asset for the company that built it, and Smithsonian scientists are learning more about how to balance the needs of coastal human and non-human systems along the coast.



7. Take out your *Ocean Identity Map*. Is there anything listed in the *Connections* between people and the ocean that you think should be part of your *People and Coasts* paper? If so, add that now.
8. Examine your *People and Coasts* document. If there is anything listed that is an important connection between people and the ocean, add that to the *Connections* circle on your *Ocean Identity Map*.
9. Read what Ana says and add any of her ideas that you think are important to remember about the relationship between people and coastal areas to your *People and Coasts* paper.

Ana says . . .



Access—who gets to go to coastal areas? Who gets to enjoy the benefits of what the ocean provides? It is a place of healing and enjoyment and rebirth, for me and for so many people. And to imagine that some people never have access or don't go or don't know. How do we ensure access is not lost? Not just access to fish, but it's access to enjoy, access to recreate, access to connect.

10. As a team, examine your *People and Coasts* paper.
 - a. What parts of this relationship are you happy with? Circle those words or drawings.
 - b. What parts of this relationship do you think should change? Put an X over those words or drawings.
11. Read Ana's ideas about one way she imagines things could be different in how we make decisions about coastal areas. Start thinking about the way you imagine things could be different.



Ana says . . .

Reimagining our relationship with coastal systems can also mean reconnecting people with the ocean. Part of this is through legal means. Many coastal areas have become private and exclude local communities. Maybe a big development, a resort, or a road is built along the coast. People used to live there, but they were bought out. Now those people don't have access to the coast to enjoy it anymore. They also may not have access to economic activities, such as fishing. Imagine a different way forward, if original residents could keep their property rights. That leaves those communities and the traditions that they hold more intact.

12. Examine the *Hopes* and *Concerns* sections on your *Ocean Identity Map*. Imagine you could change all the items with an X on them on your *People and Coasts* paper. How could you change those harmful parts of the relationship between people and the coast so that your *Hopes* are more likely and your *Concerns* are less likely?
13. Write or draw the change you would like to make next to each item with an X.
14. Consider your whole *People and Coasts* paper. As a team, discuss how you would describe your newly imagined relationship between people and the coast.
15. Fill in the following three sentences with your team's ideas:
 - a. We want the relationship between people and the coast to be described as _____.
 - b. We want people to always remember _____ when making choices about coastal areas.
 - c. We especially want _____ to change.
16. Return to the coastal conflict you identified. Would the resolution be different under your newly imagined relationship?
17. Turn to a partner and share your ideas with each other.
18. With your partner, identify one thing you could do that could help change the relationship between people and the coasts into the one you imagined.



Task 2: How can we conserve coastal ecosystems and the benefits they provide?

As you have learned, people want to use coastal land in many ways. But the natural use of coastal land is also very important, for people and for other living things. In this task you will **discover** how coastal ecosystems provide important benefits to people and other living things on land. Then you will investigate to **understand** more about how ecosystems can affect coastal areas. Finally, you will **act** on what you have learned to protect coastal areas you think are important.



Discover: *How do coastal ecosystems affect people?*

Coastal ecosystems provide important **ecosystem services** to the people and other living things on the land. Ecosystem services are benefits provided by natural areas. For example, ecosystem services from land ecosystems might include the coolness of shade provided by a tree or the ability of grassy areas around waterways to filter out pollution and increase water quality. Now you will think about the ecosystem services of coastal marine ecosystems.

1. With your team, list all the coastal or shallow water ecosystems you can think of. Remember coastal ecosystems you may have learned about earlier in this guide, such as mangroves, coral reefs, kelp forests, beaches, and seagrass beds. If any of these ecosystems are not listed on your *Ocean and Coastal System Diagram*, add them as elements now.
2. Individually, take out a piece of paper and title it “Coastal Ecosystem Services.” Keep this paper nearby for the rest of this activity.
3. By yourself, write down all the ecosystem services you can think of that any of the coastal ecosystems you listed provide. Here are some examples:
 - a. Social, such as benefits related to physical, mental, or emotional health, well-being, culture, education, or a sense of community.
 - b. Environmental, such as benefits related to helping support, protect, or regulate the natural environment.
 - c. Economic, such as benefits related to people’s ability to meet their needs and make money.



- d. Ethical, such as benefits that help make communities fairer.
 - e. If you want, you can use your *Ocean and Coastal System Diagram* to help you think. You may also want to use your *People and Coasts* document and think about whether any parts of that relationship depend on natural systems. You can also use anything you learned earlier in this guide.
4. Gather with a group of three or four in a circle and pass your *Coastal Ecosystem Services* paper to the right.
 5. Examine the *Coastal Ecosystem Services* paper passed to you. Can you think of any ecosystem services you could add? If so, write them down at the bottom of the list. If not, don't worry. If you prefer, your group can just go around the circle and share the different coastal ecosystem services out loud instead of passing the papers.
 6. Pass and add to the *Coastal Ecosystem Services* papers until your paper is returned to you.
 7. Examine your paper closely and discuss with your group:
 - a. What was added?
 - b. Are there any perspectives that are not on your paper?
 - c. Are there ecosystem services that you think are often forgotten or unnoticed by people in your community?
 8. Add to your paper any ways the coastal ecosystem might benefit living things other than people. For example, how might the ecosystem benefit living things on land or in the ocean?
 9. Pass and add to your group papers again, but this time using ways ecosystems benefit other living things. Or, if you prefer, just share your ideas out loud with your group.
 10. After your paper is returned to you, examine it and discuss with your group:
 - a. In what ways are the ecosystem services provided to people and other living things the same?
 - b. In what ways are they different?
 11. Keep your *Coastal Ecosystem Services* paper. You will need it for the next activity.





Understand: How do coastal ecosystems affect coastal areas?

Sometimes people think about the environment as something separate from themselves. They forget that people are part of the environment, and what happens in the environment affects everyone. In this activity you will investigate more about how coastal ecosystems connect to the way the ocean affects the land and the people and other organisms living on it.

1. Read *Environmental Ecosystem Services*. As you read, stop and discuss the questions.

Environmental Ecosystem Services

Coastal ecosystems provide many valuable ecosystem services to people and the planet. If you did Part 2, 3, 4, or 5, you might remember some of these. For example coastal ecosystems:

- Help filter pollution
- Absorb and fix carbon dioxide through blue carbon
- Generate oxygen
- Absorb heat
- Provide valuable fisheries

However, you may not have thought of the way coastal ecosystems can protect land from threats from the ocean itself.

Add any ecosystem services you just read about to your *Coastal Ecosystem Services* paper if they are not already listed.

Stop and Discuss

Discuss with your team: What are threats to coastal land that might come from the ocean? You could think of natural disasters that come from the ocean or long-term changes to the ocean.

Ocean Threats

Threats from the ocean can be dangerous to people and property.



Storms coming from the ocean, such as hurricanes or typhoons, can bring high winds, waves, or a rise in the level of the ocean in that area, something known as storm surge. As you may remember from Part 4, big storms are becoming more common as the ocean heats because of a warming climate.

Earthquakes or undersea volcanic eruptions in the ocean can trigger large waves known as **tsunamis**.

As sea levels rise around the world, there is an increased risk of **erosion**. Erosion on the coasts happens when water or wind wears away the land, which then becomes part of the ocean.

Stop and Discuss

Can you think of any way coastal ecosystems might be able to help protect land from storms, tsunamis, or erosion?

Coastal ecosystems can help protect against storms, tsunamis, and erosion. If those things are not listed on your *Coastal Ecosystem Services* paper, add them now.

2. Read what Ana says. Are there any ecosystem services mangroves provide that you haven't listed yet? If so, add them now.

Ana says . . .



Mangroves are a front-line defense for storms. When a big tsunami happened in the Pacific, scientists and others noticed places that had healthy mangrove ecosystems fared much better than areas where all those systems have been cut down. The fishing community knows that the mangroves are where the baby fish are. I think increasingly, people also know that the mangroves are a source of protection as well. In some cultures, mangroves can have an important cultural or even spiritual meaning.





Figure 6.5: A coastal mangrove forest.

3. Read *Modeling Coastal Ecosystem Protection* and follow the instructions.

Modeling Coastal Ecosystem Protection

Coastal ecosystems can help protect people and other living things on land from ocean water and wave energy during storms and tsunamis. In this activity you will model the protection provided by coral reefs and mangroves.

Gather your materials. You will need:

- A long, shallow container—the longer the better
- Something bigger than your container that can catch any water that overflows, or a place where it is okay if it gets a little wet, or newspapers or something else to absorb any spilled water
- Water
- Small, heavy blocks, rocks, or other items that will fit under the water level
- Tape or something else to mark the placement of your container
- Piece of paper—colored paper works well
- Scissors to cut the paper



To Set Up Your Model

- Fill your container with water to about 5 cm to 10 cm (2 to 4 inches) deep.
- Using tape or something similar, mark two locations around 25 cm (10 inches) apart in the area where you will be doing your model.
- Quickly move your container from one mark to the other. This should create a wave in your container. If it doesn't, move the marks farther apart or move your container more quickly.

Model Mangroves

Mangroves grow in coastal areas and can provide a lot of protection by absorbing the energy of waves during storms and tsunamis.

- Work with a partner. Have one partner bend their fingers and place their hands in the water, resting on the bottom of the container. The partner with their hands in the water is modeling mangroves. Have the other partner move the container to create a wave. Figure 6.6 shows an example.



Figure 6.6: One partner pushes the container from the back to the front line to create a wave that washes over the other partner's fingers.

- Have the partner with their hands in the water share what they felt. Did it feel like their hands absorbed some of the energy from the wave?
- Switch roles and let the other partner feel the wave energy.



Model Coral Reefs

Coral reefs are another important defense against storms and tsunamis. They also absorb wave energy.

- a. Set your model up in the same way with two partners—one with their hands in the water and one to move the container. Only this time, place rocks or other small, heavy items just under the surface of the water in half the space of the container. This will be the model for coral reefs. The person with their hands in the water should place one hand behind the rocks and one hand in front of them. Figure 6.7 shows an example.

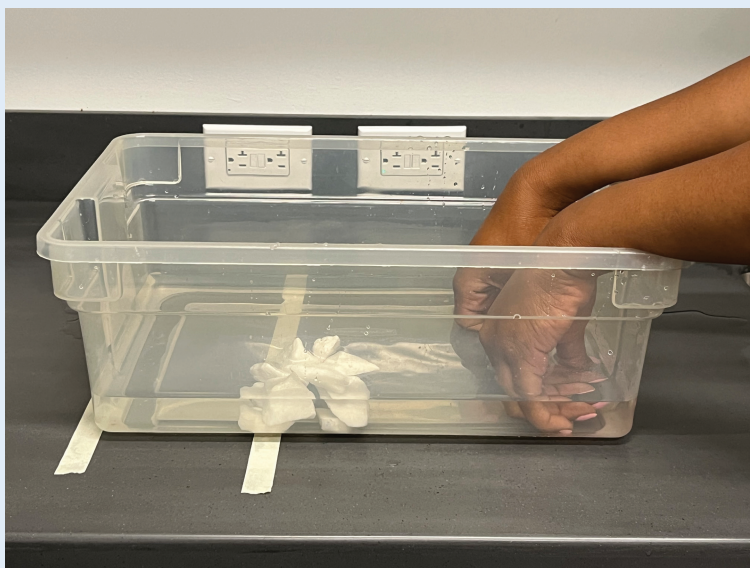


Figure 6.7: Setup for a coral reef model with one hand behind the rocks modeling the coral reef and the other with no coral reef in front of it.

- b. Have the first partner move the container from the back line to the front line to create a wave. For this model, the hands in the water are just a way for you to feel the difference in wave energy. Can you feel the difference of wave energy hitting the hand behind the coral reef model and the one with no coral reef model in front of it?
- c. Switch roles.
- d. Now that you have felt the difference, it is time to try and measure it.
- e. Take out your piece of colored paper and cut it to fit the width of your container.
- f. If you want a tool to help you measure, you can make small marks up the side of the paper every centimeter. Or you can draw a skyline of buildings, if you would like.



- g. Place the paper just above the level of the water at the end of the container where the wave will hit. Figure 6.8 shows an example.

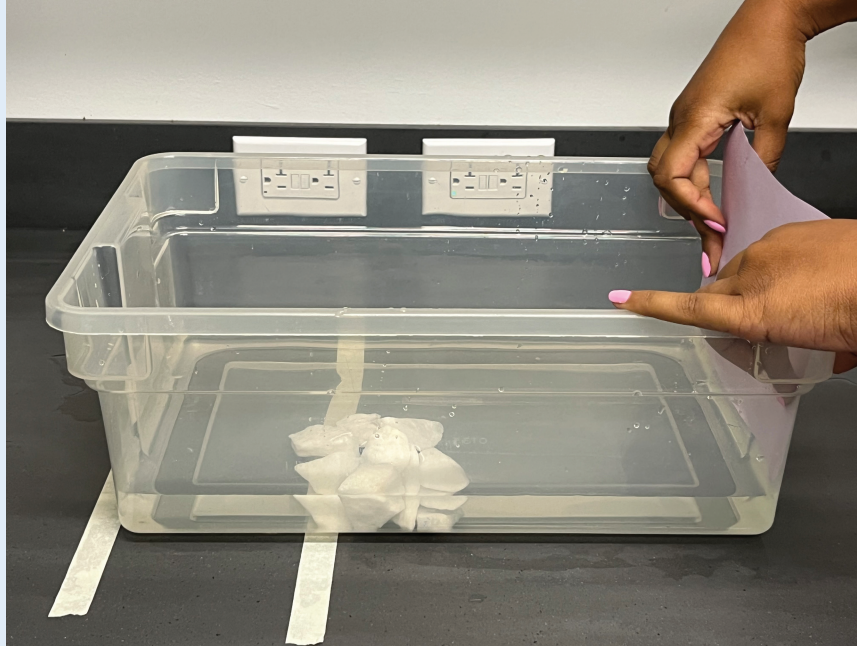


Figure 6.8: Using a piece of paper to measure the height of the water hitting the end of the container.

- h. Create your wave by moving the container and notice how far up the paper the water goes all the way across.
- i. Discuss with your partner:
- Is it the wet mark on the paper the same on both sides—behind the coral reef and on the open side?
 - If not, how does that relate to your model of the coral reef?

4. Discuss with your team:

- a. How does this model show the impact of storms and tsunamis on people living on the coast?
- b. How do you think mangroves or coral reefs could help protect human communities?
- c. What might be some advantages of protecting a community using a natural solution like mangroves instead of human-built solutions like a sea wall?





Act: *How will we change the way we manage coastal areas?*

Managing coastal areas can be difficult, with many different perspectives to balance. In this activity you will think about some of the tools that can be used to manage coastal areas.

1. Think again about the coastal conflicts you investigated in Task 1. You can have each person use the conflict they investigated, or choose one to think about as a team.
2. Take out your *Ocean and Coastal System Diagram* and use it to identify any elements of natural or human systems that are part of your coastal conflict.
3. Think about how these questions relate to the conflict you are considering.
 - a. What are the important ecosystems that need to be conserved?
 - b. What are the important human systems that need to be conserved?
 - c. Can you think of any way to balance the needs of the ecosystems and the humans in this conflict?
4. Read *Coastal Policy Ideas*. Are there any policies that might help with your conflict?

Coastal Policy Ideas

A policy is a set of ideas or procedures to guide actions and decision-making. In coastal management, there are many different types of policies. Which one might be useful for your coastal conflict?

Marine Protected Area

A marine protected area is an area of the ocean that is set aside and protected from some uses. Often, commercial activities, such as drilling for oil and fishing, are not allowed in marine protected areas.

Community-Led Decision-Making

This happens when people in the local community lead the process of making decisions about the coastal areas around them. It can be helpful having people who are very familiar with the problem and the possibilities for solutions decide how to proceed.



Integrated Coastal Management

Often people working on issues about coastal land and issues about the ocean are in two separate groups. There can be value in pulling together these groups, as well as the people most affected, to make decisions together. Some Indigenous groups traditionally managed coastal ecosystems by thinking together about an area of land from the mountains to the ocean. This enabled them to maintain connections between those areas and manage them as a whole.

Decision-Making Based on Ecosystem Services

One way to make choices is to consider the ecosystem services provided by coastal ecosystems. This can help make the economic case for preserving natural areas.

Changes in Control

Over time, there have been many changes about who can make decisions and manage coastal areas. Many coastal areas used to be managed by coastal communities. Now, often national governments claim control over areas from the shoreline to 320 kilometers (200 miles) offshore. In some places, Indigenous groups have started managing the coastal areas around their traditional lands. Deciding who is in charge of an area or creating a structure to allow multiple groups to be involved can sometimes help resolve a conflict.

5. Discuss with your team:
 - a. Would one or more of the coastal policy ideas help with your conflict?
 - b. If not, are there other ideas you can think of that might help?
6. Take out your *Ocean Identity Map* and remind yourself of your *Hopes, Concerns, and Ocean Goals*.
7. Imagine you were put in charge of managing your conflict.
 - a. What is the first thing you would do?
 - b. What are some things you think are right and fair that you would make sure to do?
8. Read Ana's ideas about some of the policy ideas. Do any of them change your mind about what you think might work?



Ana says . . .



How do we achieve effective conservation? Marine protected areas are a really important tool for conservation. But they cannot be just a paper park, meaning they're approved on paper but not managed or monitored. Effective conservation calls for highly and fully protected areas that limit what people can do in that space.

How do we achieve that outcome without excluding people? What are ways that marine areas can be used sustainably by people? It makes sense to exclude oil and other type of harmful activities. But could a marine protected area include wind farms? Maybe. Could it include a certain level of fishing? Probably. How do we balance that?

How do we balance conservation with sustainable use? How do we include activities on land in ocean conservation decisions when government agencies in charge of those two things are so divided? Almost always it is two agencies in two separate buildings thinking about things from two different perspectives. There are few chances for agencies to consider both land-based and ocean activity together. Often a development plan literally ends at the coast. Sometimes the public can come in and comment on the plans after they are made, and that can be a powerful tool. But it would be much better to have both those perspectives together when the plan is made to begin with.

Coastal communities can change the way they manage development and their relationship with the coast. For example, revamping coastal areas in urban spaces and creating spaces for connection with the ocean. Or working with local communities to really limit development and create situations that work for local people and ecosystems.

9. Think about your **circle of influence**. A circle of influence is people or groups who you might be able to influence. How could you work with your circle of influence to change the way coastal conflicts are solved? For example, perhaps you could:
 - a. Talk to your friends and family about what you learned about the way coastal conflicts are resolved.



- b. Get involved with a group that is trying to help with coastal conflicts you think are important.
 - c. Try to influence the policies put in place by contacting government officials.
10. Pick one thing you can do and put it into action.
11. Keep your *Ocean and Coasts System Diagram*. You will need it in Part 7.

Congratulations!

You have finished Part 6.

Find out More!

For additional resources and activities, please visit the *Ocean!* StoryMap at bit.ly/OCEAN2030.



Glossary

This glossary can help you understand words you may not know. You can add drawings, your own definitions, or anything else that will help. Add other words to the glossary if you would like.

Breakwater: A structure built in a coastal area to protect against tides, currents, waves, and storm surge

Circle of influence: People or groups who you might be able to influence or cause to change their mind or behaviors

Coast: Where the ocean and a land mass meet

Conflict: Disagreement between individuals or groups

Economic: Concerned with money, income, or the use of wealth

Ecosystem services: Benefits that an ecosystem or natural area provide to people

Environmental: About the natural world

Erosion: When water or wind wears away the land, which then becomes part of the ocean

Ethical: The fairness of something

Social: The interaction of people in the community and their education, health, and well-being

Storm surge: A rise in the level of the ocean in an area where there is a storm

Tsunamis: Large, destructive waves

