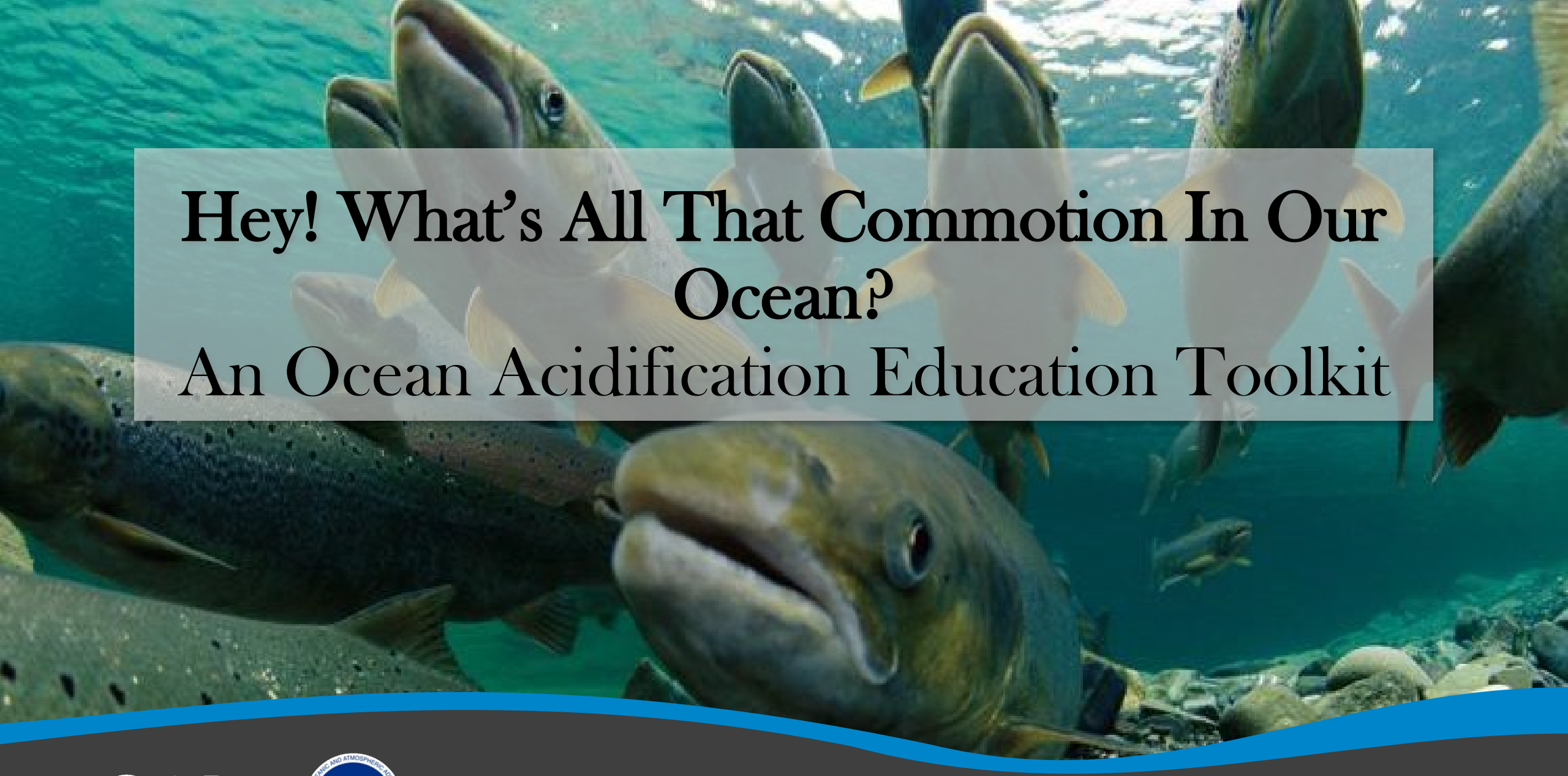


Hey! What's All That Commotion In Our Ocean?

An Ocean Acidification Education Toolkit

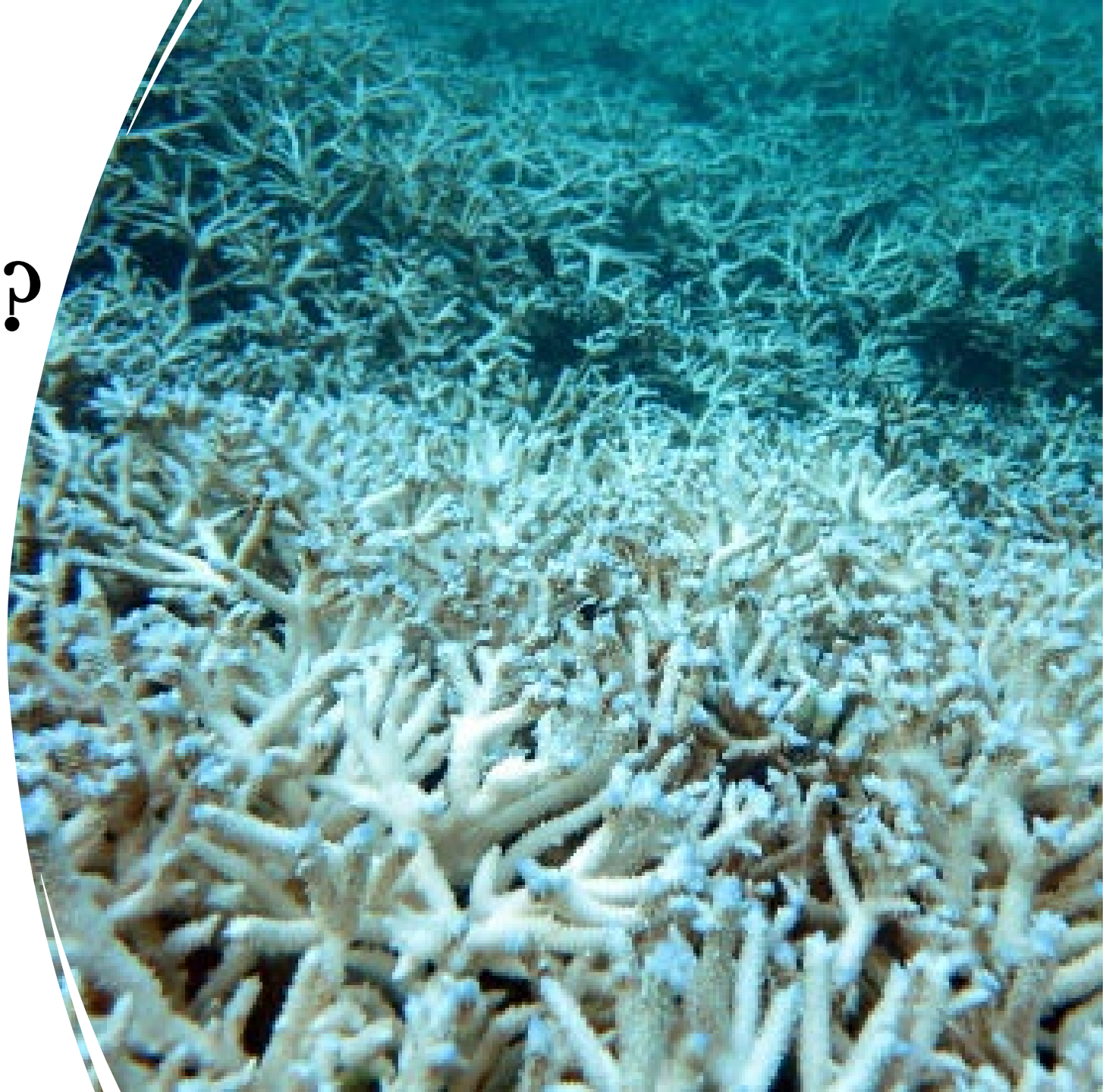
OAP
NOAA OCEAN ACIDIFICATION PROGRAM

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

What is Ocean Acidification?

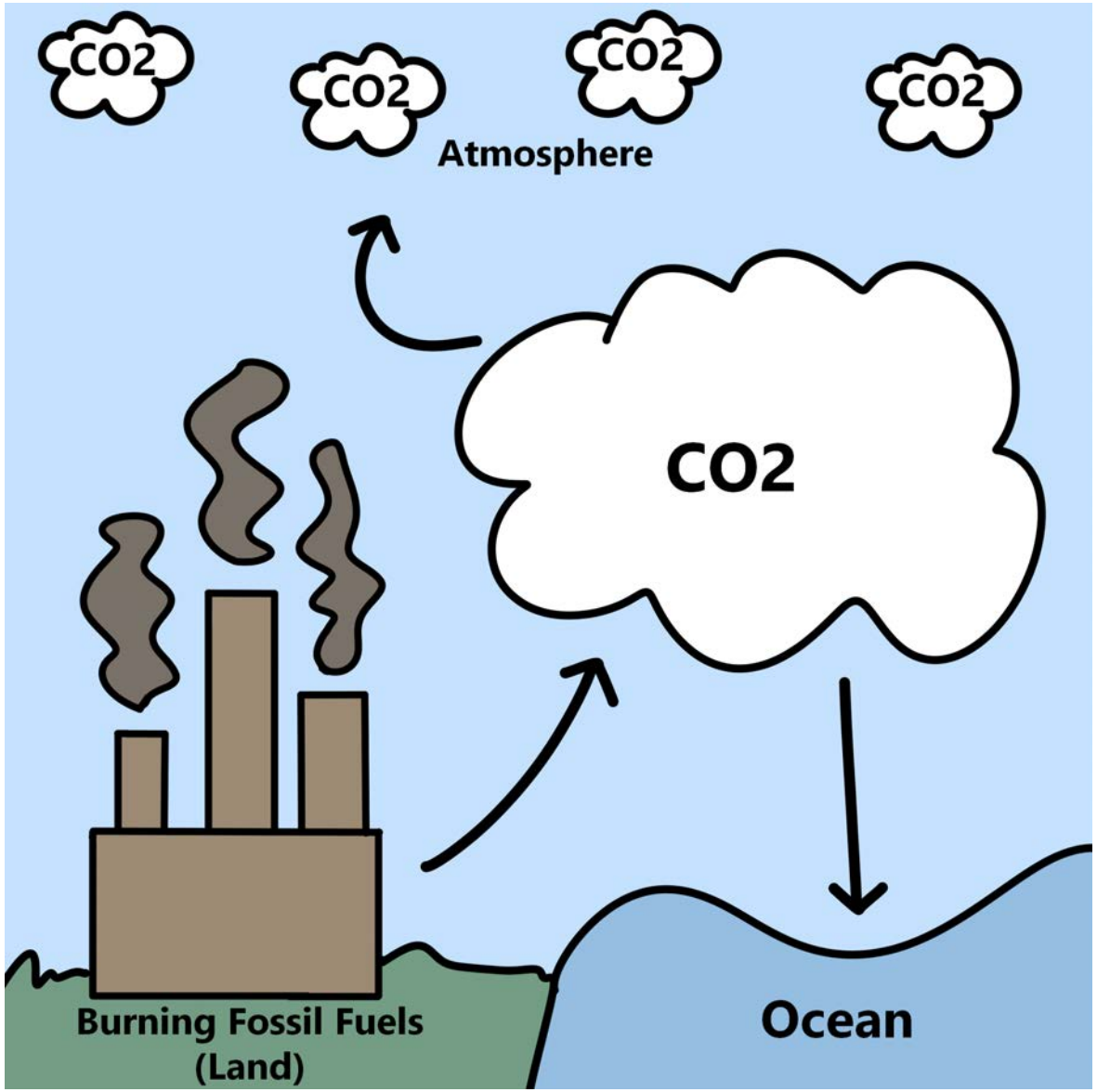
Ocean acidification is **a reduction in our ocean's pH** due to a series of **chemical reactions** that occur from the **uptake of atmospheric carbon dioxide**.

When the ocean absorbs carbon dioxide from the atmosphere, **chemical reactions happen, increasing ocean acidity**.



Burning Fossil Fuels

- Our ocean absorbs ¼ of CO_2 from our atmosphere
- Uncontrolled (rampant) CO_2 from fossil fuels has increased ocean acidity
- Increased acidity affects the amount of $CaCO_3$ available for calcifying organisms



Shell Building Animals

$$Ca^{2+} + CO_3^{2-} \rightarrow CaCO_3$$

Calcium ion + Carbonate ion →
Calcium Carbonate (shell or skeleton)

Module I

Our Ocean: The Giant Sponge

Materials

- ❑1 Water filled Balloon
- ❑1 Balloon filled with Air
- ❑Lighter (long-necked)

Uncontrolled (rampant) Carbon Dioxide

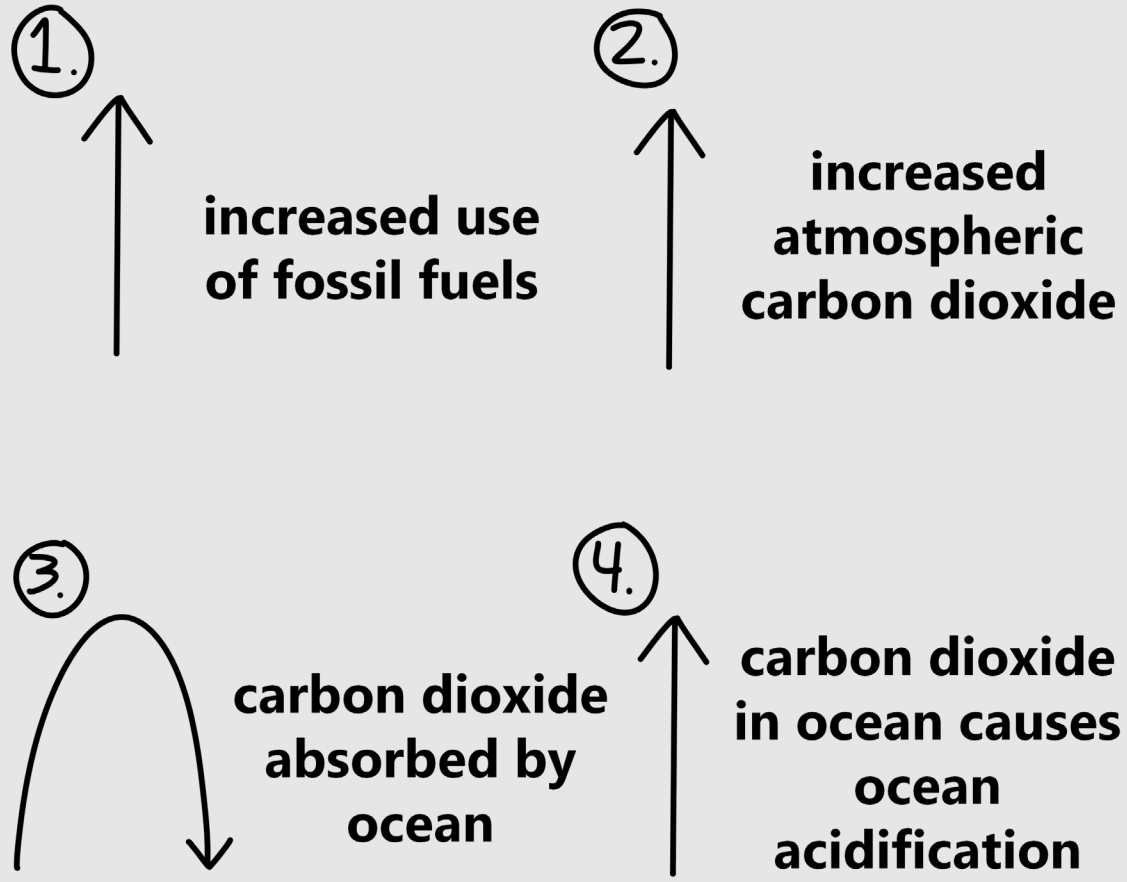
Carbon dioxide released in large amounts, very quickly from the burning of fossil fuels

Regular (natural) Carbon Dioxide

Carbon dioxide released from and used for normal life processes, like breathing and photosynthesis

OA Chain-Reaction Example

- 1. As we increase our use of fossil fuels,
  - 2. Atmospheric CO_2 concentrations increase,
    - 3. Oceans absorb atmospheric CO_2,
- 4. An increase in oceanic CO_2 results in ocean acidification



Supporting Questions

Name:

Date:

Module 1: Our Ocean: The Giant Sponge

Thinking Space: Use this area to write down your thoughts to help you answer questions about today's activity.

What is carbon dioxide? Where does it come from?	
Is our breathing 'regular' or 'uncontrolled' carbon dioxide?	
What are some things that use/burn fossil fuels?	
Prediction: What do you think will happen when I hold the lighter, as it burns a fossil fuel, up to the balloon filled with air? Will it pop?	
What will happen if there is more carbon dioxide from fossil fuels in our atmosphere? Will our ocean soak up more, the same amount of, or less carbon dioxide?	

Name:

Date:

Module 1: Our Ocean: The Giant Sponge

(Page 2)

What are some things that our ocean provides us with?	
What change is happening in our ocean because of uncontrolled carbon dioxide?	
What are some ways we can lessen the amount of uncontrolled carbon dioxide in our ocean?	

Discussion Points

- Define burning of fossil fuels as a human activity
- Explain *Uncontrolled* Carbon Dioxide vs. *Regular* Carbon Dioxide
- Explain that our ocean soaks up carbon dioxide like a ‘giant sponge’ from our atmosphere. Can use chain reaction illustration above as an example.
- Importance of a healthy ocean and the resources it provides for us.
- Our ocean is soaking up a lot of uncontrolled carbon dioxide which is causing a change to happen called ocean acidification. Use chain reaction example:
  - ↑increased use of fossil fuels
  - ↑increases atmospheric carbon dioxide
  - ↷absorbed by our ocean
  - ↑increased carbon dioxide in our ocean = ocean acidification
- Ocean acidification affects our ocean and the living conditions for marine creatures and ecosystems to which we are connected

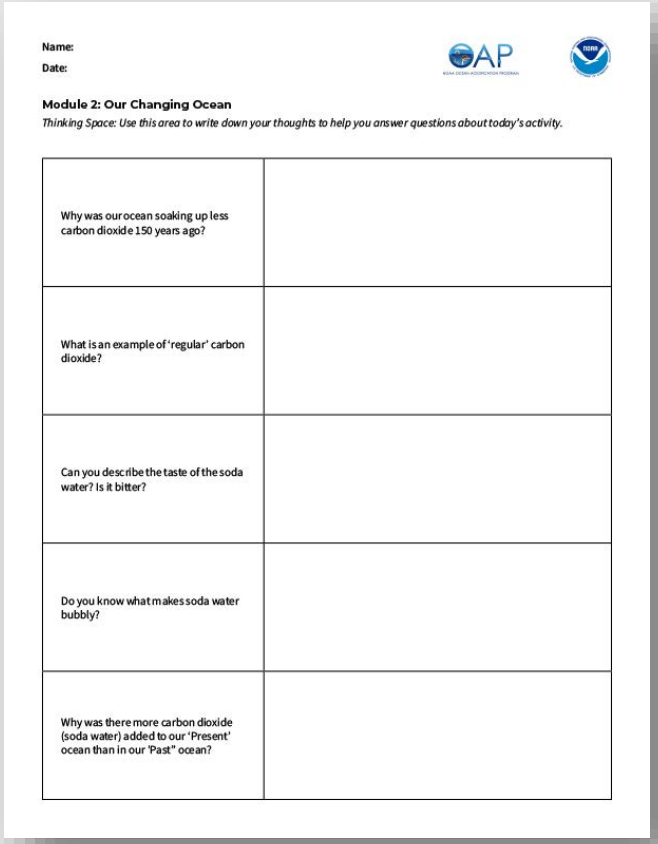
Module II

Our Changing Ocean

Materials

- ❑ 2 Labeled Containers (Past, Present)
- ❑ Blue food coloring or Bromothymol Blue Indicator (Optional)
- ❑ Soda Water
- ❑ Spring Water
- ❑ Stir Spoons
- ❑ Small Cups

Supporting Questions



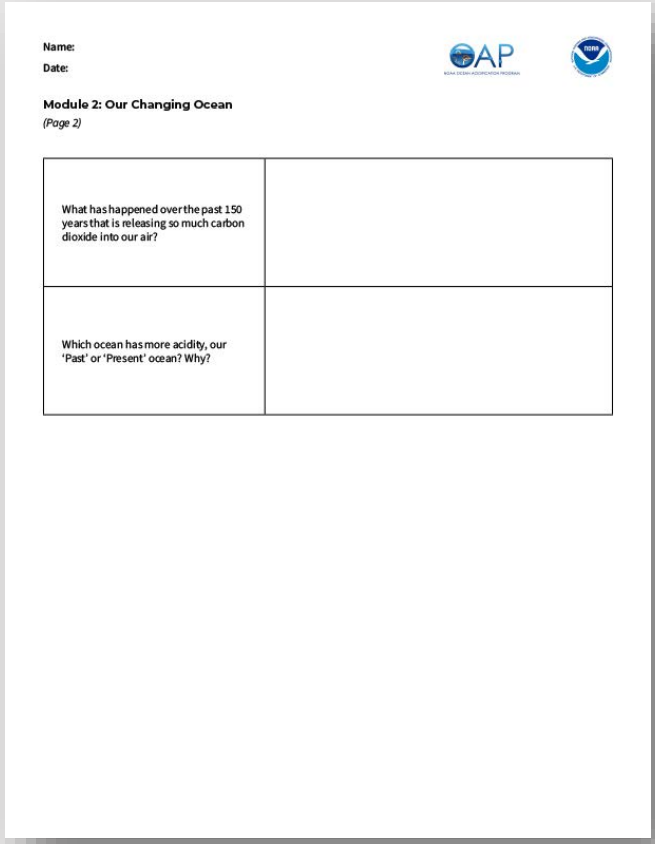
Name:

Date:

Module 2: Our Changing Ocean

Thinking Space: Use this area to write down your thoughts to help you answer questions about today's activity.

Why was our ocean soaking up less carbon dioxide 150 years ago?	
What is an example of 'regular' carbon dioxide?	
Can you describe the taste of the soda water? Is it bitter?	
Do you know what makes soda water bubbly?	
Why was there more carbon dioxide (soda water) added to our 'Present' ocean than in our 'Past" ocean?	



Name:

Date:

Module 2: Our Changing Ocean

(Page 2)

What has happened over the past 150 years that is releasing so much carbon dioxide into our air?	
Which ocean has more acidity, our 'Past' or 'Present' ocean? Why?	

Discussion Points

- Think of carbon dioxide like a lemon. It is naturally acidic. Carbon dioxide in our ocean increases its acidity. This is called ocean acidification
- Our present day ocean has more carbon dioxide than it has in a very long time
- There is more uncontrolled carbon dioxide being absorbed by our ocean today which is increasing its acidity.
- 150 years ago during the Industrial Revolution, innovations were created like electricity and cars that burned fossil fuels
- Increased acidity is changing ocean conditions. Some sea creatures are having a negative response to or challenged by this change

Module III

Swim, Snack, Sink

Materials

- ❑ White Stickers
- ❑ Red Stickers

Pteropod

A small mollusk or snail that has wing like structures it uses to swim around, often called the ‘butterfly of the sea’

Calcium carbonate

an important building block for marine animals like pteropods, crabs, and oysters to make their shells

Name:

Date:

Module 3: Swim, Snack, Sink

Thinking Space: Use this area to write down your thoughts to help you answer questions about today's activity.

What happened when ocean acidification came into the game?	
Could ocean acidification affect how many pteropods are available for salmon to eat?	
Could ocean acidification lessen the amount of salmon/food our ocean provides us with?	
How might ocean acidification affect the amount of food our ocean provides us with?	
How can we responsibly manage our ocean to protect it for future generations?	

Supporting Questions

Module IV

Senseless Salmon!

Materials

- ❑ Blindfolds

Instructions

- Pass out a blindfold to each player
- Divide groups of 4 -6 players
- 1 player will not be blindfolded and will serve as the spotter for the group and give directions by using only their voice (guiding without touch).
- The spotter will have the blindfolded players arrange themselves from shortest to tallest
- The team that does this the fastest is the winner!

Name:

Date:

Module 4: Senseless Salmon

Thinking Space: Use this area to write down your thoughts to help you answer questions about today's activity.

What did the blindfolds or not being able to use touch to direct the blindfolded players help you realize about how important a sense of smell is to salmon?	
If salmon had a dulled sense of smell because of ocean acidification how could this affect humans?	
How can we protect marine life, such as salmon and ecosystems, like the rivers and ocean they live in?	

Supporting Questions

Ocean Acidification
Ocean Ambassador Pledge

I will help lessen ocean acidification by doing some of the things on this list and making less carbon dioxide from fossil fuels. By taking this pledge, and as an Ocean Ambassador, I am taking responsibility for the health of our ocean.

When you complete an activity from this pledge, cross it off your list!
Many of these activities are healthy for you and also protect our ocean!