UNIT 7: TAKING OUT THE TRASH

Ocean Literacy **Essential Principle #6:**

"The ocean and humans are inextricably connected"

4 Fundamental Concepts that explain **Principle #6:**

6D. Humans affect the ocean in a variety of ways. Laws, regulations, and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non- point source, and noise pollution), changes to ocean chemistry (ocean acidification), and physical modifications (changes to beaches, shores, and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

6E. Changes in ocean temperature and pH due to **human activities** can affect the survival of some organisms and impact biological diversity (coral bleaching due to increased temperature and inhibition of shell formation due to ocean acidification).

6F. Much of the world's population lives in **coastal areas**. Coastal regions are susceptible to natural hazards (tsunamis, hurricanes, cyclones, sea level change, and storm surges).

6G. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. **Individual and collective actions** are needed to effectively manage ocean resources for all.

Scope & Sequence: Adjust for your Grade Level—

K - 2	3 - 5	6 - 8	9 - 12

SUGGESTED ACTIVITIES

ACTIVITY 7.1— *"The ocean and humans are inextricably connected"*

Review the first three Fundamental Concepts A, B, and C for **Ocean Literacy Principle #6**. (It was first presented in UNIT 3)

> 6A. The ocean affects every human **life**. It supplies freshwater (most rain comes from the ocean) and nearly all Earth's oxygen. The ocean moderates the Earth's climate, influences our weather, and affects human health.
>
> 6B. The **ocean provides** food, medicines, and mineral and energy resources. It supports jobs and national economies, serves as a highway for transportation of goods and people, and plays a role in national security.
>
> 6C. The **ocean is a source** of inspiration, recreation, rejuvenation, and discovery. It is also an important element in the heritage of many cultures.

Review:

Fundamental Concepts D, E, F, and G for Ocean Literacy Principle #6: ***The ocean and humans are inextricably connected***

Critical Thinking:

- Why should we care about the health of the ocean?
- Whose responsibility is it to "take out the garbage?"

ACTIVITY 7.2— 8 Scientific Practices: *Asking Questions*

The *Next Generation Science Standards* identify 8 Scientific Practices used by scientists, teachers, and students. The first of the practices is **Asking Questions.**

Scientific questions lead to explanations of how the natural world works and can be empirically tested using evidence.

Fundamental Concept 6D lends itself to asking questions of all kinds:

6D. **Humans** affect the ocean in a variety of ways. Laws, regulations, and resource management affect what is taken out and put into the ocean.

Human development and activity leads to:

1) pollution (point source, non-point source, and noise pollution),
2) changes to ocean chemistry (ocean acidification),
3) and physical modifications (changes to beaches, shores, and rivers).
4) In addition, humans have removed most of the large vertebrates from the ocean.

Aside from pollution, here are some of the other human activities that contribute to the deterioration of our oceans: carbon emissions from burning fossil fuels, dumping single-use plastics, oil spills, raw sewage dumps, toxic spills and run-offs, nuclear waste, invasive species, human population growth and settlement, overfishing and bycatch, habitat loss, acidification, mangrove and wetland loss, deforestation, whaling, shark finning, noise pollution, tourism, and an entire global network of giant cargo ships in a hurry.

Critical Thinking:

• What questions could lead to significant changes in human behavior and reverse the damage we are doing to the oceans?

• Understanding what is happening in our environment is often clarified by "Cause and Effect" relationships. For example, if excess carbon is a condition of the oceans, what is the "root cause" of all that carbon? Where does it come from?

• How are each of the human behaviors listed above a root cause of some adverse environmental impact?

📖 **Resource:**

Read: Plastics in the Ocean: Statistics 2020-2021.

ACTIVITY 7.3— Acidification and The Great Barrier Reef

6E. Changes in ocean temperature and pH due to **human activities** can affect the survival of some organisms and impact biological diversity (coral bleaching due to increased temperature and inhibition of shell formation due to ocean acidification).

"The climate and ocean are changing. Carbon dioxide continues to enter our atmosphere because of our collective burning of fossil fuels, and when carbon dioxide dissolves into seawater, drastic changes to ocean chemistry — called ocean acidification — occur. This ongoing process stresses out some marine animals, and could disrupt entire ecosystems as it progresses." *The Ocean Foundation*

This is a prime example of what is meant in Fundamental Concept 6D:

Human development and activity leads to changes to ocean chemistry

Visit the Ocean Foundation website above. Create a chart that demonstrates all the different strategies that are used by the Ocean Foundation to solve the problem of acidification.

Review the resources presented in ***Activity 4.2***

- Aren't the oceans designed to absorb carbon?
- How does the carbon cycle work?
- Explain the relationship between climate change and the ocean. Explain the science.
- Research the meaning of carbon *sink* and carbon *sequestration.*
- What are some of the sources of excess carbon in the ocean?
- How does the burning of fossil fuels contribute to excess carbon in the sea

Research the Great Barrier Reef Foundation.

- Why (*and how*) are they fighting to protect the coral reefs?
- Where is the Barrier Reef located?
- What is a reef and what is it made from?
- Why is a reef essential to the ocean ecosystem?
- What is threatening the reefs?

Discuss this Video from GOES on Saving the Coral Reefs

ACTIVITY 7.4— Climate SOLUTIONS: Carbon Capture

"The climate and ocean are changing. Carbon dioxide continues to enter our atmosphere because of our collective burning of fossil fuels, and when carbon dioxide dissolves into seawater, drastic changes to ocean chemistry — called ocean acidification — occur. This ongoing process stresses out some marine animals, and could disrupt entire ecosystems as it progresses." *The Ocean Foundation*

Create a chart: that demonstrates all the different strategies that are used by the Ocean Foundation to address the problem of acidification.

Research: the many promising, innovative, man-made solutions for capturing and sequestering carbon. Google examples of how carbon his literally being pulled out of the atmosphere.

Research "Blue Carbon" and learn how kelp beds, mangroves, wetlands, and even the giant whales are essential to the ocean's role in storing carbon.

Watch this video about the role of PLANKTON in absorbing carbon and reversing climate change.

📖 **Resource:**

Here is a resource from MIT that enables educators to tailor lesson activities for their students: it is called "Today I Learned about Carbon Capture."

ACTIVITY 7.5— Hurricane Katrina

> **6F**. Much of the world's population lives in **coastal areas**. Coastal regions are susceptible to natural hazards (tsunamis, hurricanes, cyclones, sea level change, and storm surges).

Research the background story of Hurricane Katrina:

• Why was the damage so widespread?
• Why would a hurricane, a natural phenomenon, be harder on low income communities and communities of color?
• Why did so many people choose not to evacuate?
• How did the government contribute to the crisis?
• Why do hurricanes continue to threaten coastal communities?

📖 Resource:

• **Spike Lee:** "When the Levees Broke"
• **HBO Documentary** by Edward Buckles, Jr: "Katrina Babies"
• **Documentary** by James Bills: "A Refuge of Last Resort"

ACTIVITY 7.6— The Catalina Dump Sites

In October 2020, the Los Angeles Times reported about a massive dump site off the coast of LA, near the Catalina Islands:

> *"...a largely unknown chapter in the most infamous case of environmental destruction off the coast of Los Angeles—one lasting decades, costing tens of millions of dollars, frustrating generations of scientists. The fouling of the ocean was so reckless some said, it seemed unimaginable."*

In follow-up during the summer of 2022, the Times reported;

> *"After an exhaustive historical investigation into the barrels of DDT waste reportedly dumped decades ago near Catalina Island, federal regulators concluded that the toxic pollution in the deep ocean could be far worse — and far more sweeping — than what scientists anticipated."*

There is now plenty of reliable reporting about the dump sites and what is currently

being done about it.

INVESTIGATE the status of the DDT dumped off the Catalina Islands. Start Here. And Read More Here. Scripps Institute of Oceanography is researching the dump site, and you can find what they have learned HERE.

DISCUSSION: As a citizen, who can you contact to get more information about the danger posed by these barrels of leaking DDT, and what you can do about it?

• Who is the Environmental Protection Agency (EPA) and what is their purpose? Read what the (EPA) Agency has reported HERE.

ACTIVITY 7.7— Shipwrecked

Activity 7.6 addressed Dump Sites in the Pacific Ocean.

One other surprising source of ocean pollution, is also an interesting metaphor for humanity's relationship with the sea: **shipwrecks**.

The ICUN reports that "there are an estimated 3 million sunken vessels in the ocean, over 8,500 of which are classified as 'potentially polluting wrecks."

Research:

Perhaps the most famous shipwreck is the *Titanic*. Research some others. Which is the oldest, the deepest, the most mysterious. What shipwreck is the closest to where you are right now?

📖 **Resource:**

• **Popular Mechanics:** Less Than 1% of the World's Shipwrecks Have Been Explored
• **NOAA:** 6 Surprising Shipwreck Facts•
•**Smithsonian:** When Wrecks Become Reefs

ACTIVITY 7.8— All Hands on Deck!!!

You may not have made the mess in the Great Garbage Patch. You didn't pollute the waters or destroy the mangroves or drive the carbon levels that are affecting the climate. But make no mistake, the responsibility to clean up the mess is yours and mine!

> **6G**. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. **Individual and collective actions** are needed to effectively manage ocean resources for all.

Is the general population aware of the damage that human communities are doing to the ocean? How could you find out? How could you become an advocate for the oceans?

Review all of the Scientific Practices, especially #1, #3 and #4.:

• Practice #1 is *Asking Questions*

• Practice #3 is *Planning and Carrying Out Investigations*

• Practice # 4 is *Analyzing and Interpreting Data*

Here is an activity that will require all three of these skills and more.

Conduct a Survey:

Develop a series of 5 very general questions that could quickly test the knowledge, understanding and values of a random sampling of the population. For example:

• Do you believe there is a garbage patch in the ocean the size of Texas?
• Is the ocean getting colder or warmer as a result of climate change?
• Why not just burn all of our trash?
• What happens if the ice caps melt?
• What harm can plastic do to the ocean?
• Are there people who benefits from these crises?

Stand on the Boardwalk or in a shopping center and ask random people of all ages, genders, nationalities and races if they would answer your survey questions.

Afterwards, look at all the responses. Create your own data and draw some conclusions about what the average person knows about the ocean.

Critical Thinking:

• How do you think that proximity to the ocean might affect answers to your survey. In other words, what if you gave this same survey to random people in South Dakota, or the mid-west, or Tennessee?
• How can we educate the general population about our ocean's health?
• What are some of the actions that an individual can take to protect the ocean?
• What actions have you been inspired to take?

ACTIVITY 7.9— Who Can Save the Ocean?

Re-read "Concept D" from **Ocean Literacy Principle #6**:

> **6D. Humans** affect the ocean in a variety of ways. Laws, regulations, and resource management affect what is taken out and put into the ocean.
>
> Human development and human activity lead to:
>
> 1) pollution (point source, non- point source, and noise pollution),
> 2) changes to ocean chemistry (ocean acidification),
> 3) and physical modifications (changes to beaches, shores, and rivers).
> 4) In addition, humans have removed most of the large vertebrates from the ocean.

Critical Thinking:

Scientists have consistently identified the behaviors required to reverse the effects of human activity on our environment. What are some of their recommendations?

Discuss:

• Why haven't their recommendations been put into place?
• Who is getting in the way?
• What are the political and financial incentives for ignoring these threats to our environment?

• Who benefits from human behaviors like fracking and off-shore drilling, overfishing, and polluting waterways that empty into the sea?
• Who suffers the most when politicians ignore the scientists?

📖 **Resource:**

• **Read:** World Leaders are waking up to the Ocean's Role in a Healthy Planet
• **Read:** What is the UN High Seas Treaty and why is it needed?
• **Read** about Ocean Conservancy and their efforts to advocate for marginalized communities.
• **Read** about ICF International, and how business and governments can work together to address the climate crisis on a global scale.

ACTIVITY 7.10— Hell or High Water: Students Who Lead

Research some of the many youth leaders from around the world who have kept the pressure on their elected representatives to take decisive action on environmental initiatives. Why is it so important for young people to continue to advocate for action to protect our oceans?

• Watch the documentary— *"Come Hell or High Water: the Battle for Turkey Creek."*

Discuss:

• What are the social dynamics at play here?
• Are there other examples of communities seeking environmental justice? ***(Activity 2.8)***
• How can one unelected citizen inspire an entire community to take a stand against actions that are detrimental to their children's health?

📖 **Resource:**

• **Voices of Youth**

• **Bridge the Gulf Project**

• **Read** *The Climate Book*, written by Greta Thunberg. The book addresses climate change, its effects, and the potential solutions. It compiles ideas, thoughts and essays from some of the world's leading scientists and activists in the field. It will be a valuable resource in any classroom library.