PRE-CLEANUP OBJECTIVE 2: Inland to Ocean Concept, Ocean Currents and Gyres

In the previous objective, participants learned about marine debris: what it is, where it comes from and what it is made of. This next section will discuss how marine debris travels from land to sea. And once in the sea, how does it travel across oceans?

TRASH TRAVELS THROUGH WATERSHEDS

To show how trash travels from inland waterways to the ocean, participants first need to understand the concept of a watershed.

ASK: How do you think trash travels to the ocean?

- Trash is carried from its original resting spot via wind or rain to storm drains.
- Storm drains carry trash directly to waterways like streams and rivers.
- Following the path of their watershed, those rivers transport the trash to the ocean, resulting in marine debris (EPA).

Gauge participants' understanding of the term *watershed*.

ASK: As a group, can we come up with a definition for the word *watershed*?

"A watershed is the area of land where all of the water that falls in it and drains off of it goes into the same place" (USGS). Watersheds come in all shapes and sizes. They cross county, state, and national boundaries. In the continental U.S., there are 2,110 watersheds; including Hawaii, Alaska and Puerto Rico, there are 2,267 watersheds (EPA).

ACTIVITY: TRACE THE TRASH

OBJECTIVE: Participants will demonstrate how trash travels through an inland watershed and reaches the ocean.

MATERIALS:

- Laminated map of the rivers of the United States (provided) and wet erase markers

INSTRUCTIONS:

1. Ask volunteers to come up to the map and point out where they were born, their favorite place to visit or a location they really want to visit (or any other spot on the map).
2. Using the wet erase marker, have the participant imagine that a piece of trash was dropped on the map and have them trace the path the piece of trash would take by following the paths of the watershed.
3. The participant should eventually trace a path that leads to the ocean.
4. Have multiple participants volunteer to trace their trash.
5. End with a brief discussion about how easy it is for inland trash to wind up in the ocean, even if that is not where it was intended to go.

If you have access to a computer and wish to dive deeper on this topic, check out the USGS website to pin point your groups' watershed **(https://water.usgs.gov/wsc/map_index.html)**, and use the interactive map to trace your unique inland to ocean journey **(http://nationalmap.gov/streamer/webApp/streamer.html)**.

TRASH TRAVELS ACROSS THE OCEAN

SAY: Okay, so now we understand how trash can reach the ocean even from places very far from the beach.

ASK: Does anyone have a guess for what happens once trash enters the ocean?

- Participants may start to discuss the impact to animals, such as "turtles eat it" with this question. While many of their answers will be correct, you are trying to elicit discussion about trash traveling around the world aided by currents and winds.
- Once in the ocean, currents and atmospheric winds carry trash. These systems can transport debris thousands of miles from its original starting point. Factors that affect currents such as seasons and large storms can also affect trash movements (NOAA).

ACTIVITY: CURRENT, CURRENT: WHERE DO YOU GO?

OBJECTIVE: Participants will learn about currents and have the chance to draw where they think a current belongs on the map.

MATERIALS:

- Laminated world map (included) and laminated labeled current map (included)
- Wet erase markers

INSTRUCTIONS:

1. **SAY: Does anyone remember "Crush" from Finding Nemo? He spent a lot of his time in a current.**
2. **ASK: Are there any volunteers who would like to draw a current on the map?**
3. Encourage them not to be shy. Explain that this is a hard activity, but together the group can draw very accurate currents. Volunteers can simply draw a directional arrow pointing in the direction they think the current is flowing.
4. Once volunteers have drawn their current guesses, create the path of an actual surface current by erasing some of the incorrect guesses and joining other guesses. Use the provided map with current names and directions for assistance.
5. Use the map the group created as a visual aid to start to discuss gyres.

OCEAN SURFACE CURRENTS: THE MARINE DEBRIS HIGHWAYS

Surface ocean currents are mainly driven by global wind patterns. You can think of wind as a solid object that scrapes along the top of the ocean and pulls water in the direction that it's blowing. Ocean currents are made more complex because of land masses, the uneven heating of Earth, and the fact that Earth spins about its axis. (NOAA)

“ SAY: Currents are important because they carry nutrients and organisms (like Crush!) throughout the ocean, sustaining countless marine habitats and wildlife.

Currents are also important because they regulate Earth's climate. The Gulf Stream Current brings warm water from the equator along the east coast of the United States and eventually toward England. This current keeps Northern Europe much warmer than many places as far north.

Currents, both at the surface and deep within the ocean also carry trash.

Circular currents cause the accumulation of marine debris in specific areas.

- Gyres, or large rotating ocean currents, can trap trash and marine debris at their centers. This can also happen on a smaller scale as a result of eddies and other factors (NOAA).
- Gyre currents rotate clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. Worldwide, there are five major subtropical oceanic gyres: the North and South Pacific Subtropical Gyres, the North and South Atlantic Subtropical Gyres, and the Indian Ocean Subtropical Gyre. (NOAA)
- One of the most well-known gyres is the North Pacific Gyre. This area is also referred to as the “Great Pacific Garbage Patch” and has received a great deal of media attention.

“ ASK: Has anyone ever heard of the “Great Pacific Garbage Patch”?

“ ASK: What do you think this “garbage patch” looks like?

Participants may start to describe a large floating island of trash.

The name “Great Pacific Garbage Patch” has led many to believe that this area is a large and continuous patch of easily visible marine debris, like an island that is visible from space. This is not accurate.

Higher concentrations of trash items can be found in this area, along with other debris such as derelict fishing nets, but most of the debris are actually very small pieces of plastic (NOAA).

The garbage patch is not so much an island as it is a plastic soup. Imagine the garbage as the vegetables and the ocean as the broth.

Just like in soup, the pieces of trash in the gyre collect at different levels in the water column, not just at the surface.

The debris is continuously mixed by wind and wave action and widely dispersed both over huge surface areas and throughout the top portion of the water column (NOAA).

The North Pacific Gyre is well known for the debris that has gathered at its center; however it is not the only plastic soup—marine debris accumulates in every ocean gyre.

ACTIVITY: MAKE YOUR OWN GYRE

OBJECTIVE: To understand that oceanic currents create gyres and to show how trash travels through those currents, accumulates within the gyre, and may be sent back to shore.

MATERIALS:

- A medium size circular container or bowl (pie tin, plastic food storage container, etc)
- A lightweight breakfast cereal (Lucky Charms works well) or another collection of small items that float.
- A spoon
- Water

INSTRUCTIONS:

1. Fill the container ¾ of the way full of water.
2. Explain to participants that this bowl represents the Pacific Ocean and the sides of the bowl represent land masses, such as Asia and North America.
3. Add a small handful (no more than ¼ cup) of the cereal to the water. The cereal represents marine debris.
4. Using a spoon, stir the water in a circular motion for about 10 seconds, keeping the spoon near the edges of the bowl.
5. Remove the spoon from the water and watch what happens—the cereal will follow the "currents" and then some will begin to accumulate and group together at the center of the currents while others will be shot out of the current and will stick to the sides of the bowl.
6. Explain to the participants that this represents what happens to trash when it travels through ocean currents and into a gyre. The trash can accumulate at the center of the gyre (like the "Great Pacific Garbage Patch"), or it can be sent back to shore, where it collects on beaches far away from where it originated.
7. (Optional): If you have enough materials available, split the participants into groups and allow each group to do the experiment on their own. The groups will see the same results.

GO CLEAN UP THE GYRE?

ASK: Do you think we can clean up the ocean gyres by removing all the trash?

SAY: Unfortunately, the situation is much more complicated:

- Never stationary: The ocean and gyres are always moving and changing throughout the year.
- Difficult to see: Much of the debris is small pieces of plastic that cannot be easily spotted or collected. Other debris, like derelict fishing nets and traps, are difficult to remove without special equipment.
- Other marine life: These areas are also abundant with marine animals, some very small—even microscopic—that make removing only the trash difficult.
- Cost: The gyres are so immense that the cost of cleaning just 1% would cost anywhere from $122 to $489 million a year! (NOAA)