# **General Lesson Template – Marine Debris Interruptions**

Title: XYZ on the Beach

Driving Question: Where are XYZ coming from, and how can we prevent their escape into the environment?

### Overview:

Describe the marine debris item and its distinguishing features. Set out the task for this unit:

In this lesson, students will determine where this marine debris item is coming from, and the processes which contribute to the material becoming marine debris. Students will propose solutions to interrupt the escape of XYZ into the environment.

### Essential Questions

* What is the original use of XYZ that end up on beaches?
* Why is [harmful material] being used to make the wads, and could other materials be substituted?
* How is the use of XYZ managed, and are there substitutions or processes that could prevent their escape?

### Learning Goals

Students will learn the following:

* Materials are selected for a purpose based on a cost/benefit analysis.
* Understanding the life cycle of a [plastic] item can help identify ways in which the item impacts the environment.
* Systemic changes in practice can reduce human impacts on ecosystems.

### Learning Objectives

Students will be able to:

1. Identify the general source of XYZ found on U.S. beaches,
2. Describe the life cycle of XYZ, and
3. Propose solutions that would interrupt the escape plastic wads into the natural environment.

### Introduction

Define Marine Debris

Introduce the anchoring phenomenon, which is that XYZ is being found on beaches.

Marine debris is a complex, global, environmental problem that negatively impacts ecosystems. Persistent, solid materials that are discarded or abandoned into the marine environment can pose ingestion or entanglement hazards to wildlife, disrupt marine fishing and tourism economies, and pose hazards to human health.

Worldwide, communities are addressing the problem of marine debris by *removing* items from the ocean and beaches, as well as by creating mechanisms that *prevent* materials from becoming marine debris in the first place.

Have you ever found a piece of marine debris on the beach and wondered where it came from? In order to prevent a material from becoming marine debris item, we need to know its story.

**Definition of Marine** Debris - Marine debris is defined as any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes. - [NOAA](https://oceanservice.noaa.gov/hazards/marinedebris/)

**General Resources**

NOAA MD [Prevention projects](https://marinedebris.noaa.gov/current-efforts/prevention)

NOAA MD [Removal projects](https://marinedebris.noaa.gov/current-efforts/removal)

[Oregon Marine Debris Action Plan](https://marinedebris.noaa.gov/regional-action-plan/oregon-marine-debris-action-plan)

### Lesson Procedure

#### ENGAGE

Begin the unit by helping students notice a particular type of marine debris.

* **Field option:** During a student beach or coastal river clean up, students encounter and collect plastic wads. Some marine debris data cards do not include a space for specifically recording XYZ, so the instructor will have to facilitate the sorting effort to help students ‘see’ this particular type of debris. Be aware that students may not find any XYZ during a single beach clean-up.
* **Classroom option:** Show students a video of someone else finding XYZ on the beach, or invite someone to class who can share their experience of finding XYZ on the beach.

In a class discussion or using [Student Worksheet #1](https://oregoncoaststem.oregonstate.edu/sites/oregoncoaststem.oregonstate.edu/files/Curriculum/MDI/md_story_worksheet_1.pdf), solicit students’ initial ideas about what it the plastic item is, and where it may have come from. Ask students to draw and label a possible life cycle or story about this item, which begins with the production of the wad, moves on to its intended use, and the end of life for the material. At which point(s) in the cycle might this material escape into the marine environment?

#### EXPLORE

In this section, students learn more about XYZ. They explore data to find out the degree to which this material is found on beaches, and they learn more about the material(s) used to make XYZ, its potential life cycle, and the potential hazards the debris item may pose to the ecosystem.

**Quantifying XYZ on beaches** – Have students explore data from beach clean-ups to assess where, when, and how many XYZ are found on local beaches. This may include data collected by the students themselves, by local beach clean up crews/organizations, or datasets available online. Connect with locals who participate in beach clean-ups hosted by organizations and ask they have found and/or quantified XYZ. For example: [SOLVE Oregon](https://www.solveoregon.org/), [Surfrider](https://oregon.surfrider.org/), or [Oregon Shores Conservation Coalition](https://oregonshores.org/)

**What is the material made of?** – Marine debris items are by definition solid and persistent.

If the material is made of plastic, the [*Plastics and the Plastic and Life Cycle*](https://oregoncoaststem.oregonstate.edu/sites/oregoncoaststem.oregonstate.edu/files/Curriculum/MDI/plastics_and_the_plastic_life_cycle.pdf) resource sheet may be helpful for finding lessons and readings to teach students about plastics and the life cycle assessments of plastic products. As students learn more about the material, they may use [Student Worksheet #2](https://oregoncoaststem.oregonstate.edu/sites/oregoncoaststem.oregonstate.edu/files/Curriculum/MDI/md_story_worksheet_2.pdf) to make modifications to their original life cycle drawing as necessary. This worksheet can be reused and modified as needed throughout the unit.

**XYZ impacts on [marine] environments** – How is XYZ debris harmful to wildlife, ecosystem health, human health, etc? Does the impact change as the materials stays in the environment and/or breaks into small pieces?

#### EXPLAIN

In this phase, students discover the original use of XYZ and how the material is handled. They can begin looking for ways to interrupt the escape of XYZ into the environment.

**Make the connection** – Describe the intended use for XYZ prior to it becoming marine debris. Who uses XYZ and how and where is it used? What physical characteristics of XYZ (material, shape, size, etc.) are important to its function? Learn about the industry and what is important to XYZ users.

**XYZ as Debris** - Others may have already described the problem of XYZ debris and have identified ways that the debris is generated. These may or may not apply to your local area.

**Local Industry Connection** – Identify people in the local community who are involved in the XYZ life cycle. They may have a direct connection in that they manufacture, sell, or manage XYZ. Or they may regularly interact with people who have those direct connections, Ask students to make a list of questions they would like to ask these local experts about their ideas for solutions for the XYZ debris problem. See if an industry member would be willing to participate in an in-person or virtual visit to the classroom. If possible, plan a student field trip to a site where students can observe XYZ used for its original purpose so they can get ideas about potential ways the material could end up in the environment.

#### ELABORATE

Students identify ways to interrupt the escape of XYZ, including cost/benefit analysis of potential solutions.

**Exploring Possible Solutions** – Have students learned of proposed solutions from their research or interviews? Solutions may involve changes to the way XYZ is used or managed, educating users, developing policy solutions, exploring ways to reuse or recycle materials, finding another method or material to substitute for XYZ, etc.

**Students Propose Solutions** – Students use what they have learned about XYZ to propose a possible solution for the problem. The students may create proposals with a specific audience in mind: current users, future users, or organizations that interact with users. Students may describe a method to interrupt the local escape of XYZ that has been identified or implemented in other regions, or the student may propose a related or novel idea.

Have students redraw the life cycle of XYZ to include their solution(s).

#### EVALUATE

In this section, students share solutions with stakeholders to get their feedback, and then revise their proposals as necessary. Ideally, industry members and students can come up with a Next Step that they can work on together to move forward with making the solution a reality.

For example:

* Design and share a prototype of a solution.
* Share identified best practices with decision-makers to encourage their adoption in new areas.
* Identify a shovel-ready project for the Oregon Marine Debris Action Plan
* Develop outreach messages to share solutions to industry and policy makers
* Implement data collection system for XYZ in Oregon to track changes over time

### Next Generation Science Standards

**Performance Expectation(s):**

MS-ESS3-3 - Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

HS-ESS3-4 – Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

**Science & Engineering Practices:**

Asking questions and defining problems

Constructing explanations and designing solutions

**Disciplinary Core Ideas:**

ESS3.C: Human impacts on Earth systems

ETS1A: Defining and delimiting and engineering problem

ETS1B: Developing possible solutions

**Crosscutting Concepts:**

Cause and Effect

Stability and Change