KEEPING OUR COASTLINES CLEAN

A U.S. Virgin Islands Marine Debris Curriculum







Links to the Next Generation Science Standards, Quick Reference Guide

Curricula by Sub-Section		Middle School						High School					Sci &
		ESS 3-1	ESS 3-2	ESS 3-3	ESS 3-4	ETS 1-1	ETS 1-2	ESS 3-1	ESS 3-3	ESS 3-4	ETS 1-1	ETS 1-2	Engineering Practices
Composition & Abundance	Beach Box Exploration			\checkmark									\checkmark
	Investigating Oceanic Garbage Patches			✓					~				✓
	A Degrading Experience			\checkmark					\checkmark				\checkmark
Sources & Transportation	Watershed Walk	\checkmark		\checkmark				\checkmark					\checkmark
	Sources of Microplastics: Microbeads			\checkmark									✓
Impacts	Entanglement Problems			\checkmark	\checkmark				\checkmark	\checkmark			\checkmark
	Natural Disasters and Marine Debris		✓	✓	✓			✓					✓
Solutions	Linked Beach- Ghut Clean Ups	✓		✓					\checkmark				\checkmark
	Mitigating Microplastics			\checkmark					\checkmark				\checkmark
	Upcycling Plastic Bags					\checkmark	\checkmark				\checkmark	\checkmark	
	Making Connections Through Art			\checkmark					\checkmark				\checkmark

LESSON: Upcycling Plastics

This activity was modified with permission from Oregon Sea Grant's "Upcycling" activity from the Marine Debris STEAMSS (Science, Technology, Engineering, Art, Math, and Social Studies) curriculum (https://oregoncoaststem.oregonstate.edu/sites/oregoncoaststem.oregonstate.edu/files/MD/upcycling-lesson.pdf) which was inspired by Sara Wiener (https://www.youtube.com/watch?v=sIHF109wvk0).

Grade Levels: 5-12

Subject Areas: Marine Biology: Debris Sources, Ecology

NGSS Connections:

- MS-ETS1:
 - ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
 - ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- HS-ETS1:
 - ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
 - ETS1-2. Design a solution to a complex real-world problem by breaking down into smaller, more manageable problems that can be solved through engineering.

Time: Prep: 1-2 hrs; Activity: 1-2 class periods

Description & Objectives: This lesson is designed to be used after completing any of the Composition & Abundance, Sources & Transport, and Impacts lessons. Students will reflect on how much plastic is part of their daily lives and explore creative ways to upcycle plastic bags and other thin, plastic materials into upcycled products to prevent them from potentially becoming marine debris.

Guiding Questions:

- How can people prevent marine debris from getting into the ocean?
- How can people get involved in marine debris solutions?

Key Ideas & Concepts:

- Personal behaviors can influence the amount of marine debris.
- Reducing, reusing, recycling, and upcycling can decrease the amount of marine debris.

Pre-Requisite Skills: Students will need to understand the basics of what plastics are and have basic sewing and mathematical skills.

Teacher Preparation:

• For this activity, many discarded, clean plastic bags or other thin plastic materials are needed. You or your

students will, potentially, need time to collect these materials. Consider assigning this as homework over a few class periods to make sure enough material is collected.

• This activity is appropriate for all ages, but younger students may need adult supervision.

Materials Needed:

- Many discarded, clean plastic bags and other thin plastic materials. Students should bring these in from home. For example:
 - Bread, tortilla, frozen vegetable bags
 - Discarded bubble wrap or plastic air pillows
 - Plastics with colors and pictures on them, like some dog and cat food bags, chip bags
- Plastics to AVOID: produce bags (too thin), most single-use grocery bags, plastics that still have another useful purpose (and don't need to be discarded yet!)
- Scissors
- Roll of parchment paper
- Irons
- Ironing boards
- Sewing machines or sewing materials (if desired)
- Accessory materials such as straps, snaps, buttons, dowels (optional)
- Glue guns (optional)

Teacher Instructions:

- 1. Start with a reflection with your students.
 - Guiding questions: How easy (or hard) was it to collect plastic bags and other thin plastic materials? Are all of the materials you collected actually plastic? Were you surprised by how many materials in your life are made of plastic? In 2016, U.S. Virgin Islands Bill No. 31-0379 restricted the use of plastic shopping bags in the territory. Maybe some of you remember times before and after this event. How do you think this action may have impacted the number of plastic bags in the territory and those potentially becoming marine debris? Does this bill mean there are no more plastic bags in the territory?
 - **Teacher Note:** This is a good time to review what materials are and are not plastic to remind students how much plastic is in our daily lives, and to emphasize that the bill restricts plastic bag use but does not completely ban it.

- 2. Next, lead your students in a discussion of what upcycling is. Upcycling is a way to repurpose discarded products or materials into a product of higher value or quality.
 - **Guiding questions:** What upcycling examples can you think of (e.g., yogurt container becoming a pot for a plant, making a plastic water bottle into a pencil container or a bird feeder)?
 - **Teacher Note:** If there's time, have students complete a web search to explore the many creative ways people upcycle plastic materials. Consider having them complete their own upcycled project using other discarded plastic materials from their home for extra credit.
- 3. Finally, create upcycled plastic panels, which students can craft into different, creative products (examples below).

Creating upcycled plastic panels:

First, demonstrate how to make flimsy plastic bags into strong plastic material:

- 1. Set up ironing and sewing stations around the room and assign an adult to staff each station at all times. Depending on the age of the students, the adult may do the actual ironing, or may supervise the student as he/she irons.
- 2. Place a large piece of parchment paper on the ironing board.
- 3. Obtain three newspaper bags (or similar) any layer them on top of each other on the parchment paper. This gives you six layers of plastic.
- 4. Cover the bags with another large sheet of parchment paper. Now all the plastic is between parchment paper. Important: the iron will only touch the parchment paper, not the plastic directly.
- 5. Apply a constantly-moving medium-hot iron to the top of the parchment paper to melt the plastic together. The plastic may shrink somewhat. If the plastic does not melt, increase the heat setting on the iron.

The result is a sturdy piece of plastic in the size of one of the original bags. This is the base plastic panel that the students can use to make their projects. Panels can be ironed together to make larger panels, or cut down to smaller sizes.

Next, demonstrate how to decorate the sturdy panels:

- 1. Obtain a sturdy panel and bring it to the workspace
- 2. Cut out colorful pieces of plastic materials and arrange them on top of the base panel as desired.
- 3. Cover the entire panel with a piece of clear plastic. This step is not always necessary, but this extra layer of clear plastic serves three functions:
 - a. It keeps the little pieces of plastic in place as you move your materials from your workspace to the ironing board,
 - b. Some colorful plastics are actually printed and smear when heated, and the extra plastic helps minimize that smearing and,
 - c. The extra layer of plastic adds strength to the material.
- 4. Bring the project to an ironing board and place it on top of a piece of large parchment paper.
- 5. Cover the project with another piece of large parchment paper. Now all the plastic is between parchment paper. Important: the iron should only touch the parchment paper, not the plastic directly.
- 6. Apply a constantly-moving medium-hot iron to the top of the parchment paper to melt the plastic directly.
- 7. Repeat as necessary if you want to add more decoration. You may not need more clear plastic (step #3) if you are only adding a few new details.
- 8. To keep the project flat, place the warm project from the ironing board between two flat boards to cool.

Make upcycled products:

Once the material has been decorated, it is ready to be engineered into an upcycled product. Depending on the age of the students, the time available, and the number of sewing materials (or optional sewing machines), projects can vary from very simple to very complicated.

- Simple project ideas:
 - O Placemats, coasters: decorate a panel and cut out the desired shape with scissors
 - Class flags: each student can decorate a panel which can be sewn or glued onto a dowel, or strung onto a line.
- Intermediate projects:
 - Carnival or classroom decorations: following the class flags idea above, create banners, flags, or art to decorate your classroom or a carnival float.
 - Small bag: fold a panel in half and sew the edges to make a pouch. Provide straps that can be cut to length and sewn on each edge, or have the students make the straps out of strips of sturdy base material.
 - Card or coupon holder: see photos for construction ideas.



Examples of card or coupon holders created from upcycled plastic materials (Photo credit: Oregon Sea Grant).

- Advanced projects:
 - Hanging art: Cut two large pieces of plastic in the shape of a chosen design (e.g., fish, whale, starfish, etc.), sew the edges together and stuff with plastic to give it three dimensions. Hang from the ceiling. Students may contribute decorated panels to make one large piece of art. Note: if you are using clear plastic to make the object, you will be able to see the stuffing inside.
 - Shopping bag: Examine a reusable shopping bag to see how it is engineered and then create your own version by sewing your sturdy plastic panels together. Note: this can take a long time, especially if the student is not familiar with using a sewing machine.
 - Costumes (for Carnival, Halloween, or other occasions): Combine panels together to create large pieces of plastic "fabric." Examine the piece of clothing you are trying to create to see how it is engineered, or look up sewing patterns online. Using a sewing machine to sew together your plastic panels.



Examples of reusable bays created from upcycled plastic materials (Frioto credit. Oregon s

Clean up and closing discussion:

Collect all the little pieces of unused plastic again at the end of the work session and save them for a future session. Display the upcycled projects in an "exhibit" for classmates to appreciate.

- **Guiding questions:** Did all plastics "behave" in the way that was expected when heated? What types of plastic worked best? Which did not work well? Categorize plastics according to the characteristics that make them ideal for these types of upcycling projects. Share your recommendations with other upcycling engineers.
- Optional activity: A few days after the project, talk to students again about the plastics they use around their homes.
 - Guiding questions: Are they looking at plastics differently now than before the project? Are they hesitating to throw out certain materials? Can we upcycle ALL the discarded plastics in our home? How else can we minimize discarded plastics? Discuss ways to reduce the use of single-use plastics.
- Optional activity: Have students compare and contrast the designs of their upcycled projects.
 - **Guiding questions:** Which design features provided added strength or functionality to the design? What design features were innovative? How does their design compare to others?

Teacher Notes:

- Plan the activity in a well-ventilated large room. Because of the use of irons, this activity is ideal for family groups, older students or younger students who have several adult helpers that can be in charge of irons and optional sewing machines.
- Students may discover that different plastic materials have different qualities, and that not all plastics melt in the way they might expect. Some plastics shrink funny and distorted or get rough and bubbly. Experimentation is the best way to find materials that work best.
- This activity could be combined with the lesson "Making Connections Through Art."
- For inspiring stories of local solutions to marine debris read the Spotlight: Community Transfer Projects: Turning New Knowledge into Action at the Local Level in the U.S. Virgin Islands, and the five associated spotlights.

