



Reclaiming the Sea from Marine Debris



A three part interactive curriculum dedicated to the awareness and mitigation of ocean plastic

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OVERVIEW

Reclaiming The Sea From Marine Debris

Plastic has become something that people use on a regular basis in our modern lives. Single-use plastics and packing materials make up about 50% of the plastic produced, a large portion of which is not disposed of properly (Parker, 2018). They are discarded into full trash cans instead of recycling bins, tossed out of car windows, or simply dropped on the ground. Unfortunately, most plastics are not biodegradable. They make their way into the ocean, where they float on the surface, breaking down into smaller pieces over time. These small pieces are known as microplastics (U.S. Department of Commerce NOAA, 2016). These microplastics are easily mistaken as food by marine life and end up being ingested by many marine organisms, including the fish we eat. Such debris also pollutes our waterways and leaves a horrendous impact on the biosystems linked to water bodies and similar channels. The floating plastic accumulates in gyres and has grown to the point that the accumulation of plastic covers about 40% of the world's oceans (Moore, 2020).

This is our primary focus in resolving the environmental crisis that deeply affects the ecology of the waterways that surround our planet. The "Marine Debris: Reclaiming the Sea from Marine Debris" Curriculum has been developed to inform and educate participants about the effects of marine debris and plastics. It further accommodates a proactive approach in teaching participants about the mitigation of environmental impacts to initiate change, particularly through the use of the Seabin as an educational tool. Marine debris intervention devices like the Seabin may be great cleaning tools, however, they are not the solution to the marine debris problem which is still proliferating today. The real solution comes from larger societal behavioral change away from using single-use plastics, which must be reinforced at an individual level through education. Thus, the Seabin is extremely valuable because of its ability to both remove debris and assist in educating on how to stop it. This interactive curriculum is divided into a three-part activity that induces practical hands on learning experiences coupled with a STEM approach. This involves identifying what the problem is, what can be done, and how it can be done.



Part I - Introduction to the Marine Debris Problem:

Part One consists of a compilation of the top lessons/curriculum and activities regarding marine debris and plastics. These are very variable and adaptable resources: some in greater detail, some more involved, and some less. We recommend trying to determine your audience ahead of time so you can tailor/choose the material to your "classrooms" and/or teaching styles to help people look at marine debris and the environment in a more critical light. This awareness and information will be incorporated through directly interactive experiences during the following part. To use our guide, have the leader of this educational portion familiarize themselves with the resources we provide. Different portions of the many curricula compiled may work best for your group and you can personalize the material based on your preferences and audience.

Part II - Field Exploration of the Marine Debris Problem Utilizing Marine Debris Intervention Device:

Part Two allows the participants to apply what they have learned during the previous part by participating in a hands-on activity located at the site of your marine debris intervention device. Utilizing this technology and any other technologies available (e.g. drone, ROV) at the site, the participants will be able to experience the effects of plastic and marine debris in their hometown to prompt discussions about the causes and effects. They will also learn how to mitigate the problem in a more sustainable framework that takes into account the environment and the local populace. Depending on the size and interests of the group, other activities, such as clean ups and repurposing projects, may also be planned.

Part III - What You Can Do to Reduce Marine Debris:

Part Three provides information and encouragement on how the participants can incorporate what they have learned into their daily lives, as well as how they can get involved in specialized projects to help save the environment. These changes can be small, such as swapping out single-use plastics for something more sustainable, or bigger projects such as championing the ban of plastic in their hometown. This section includes options to help facilitate open discussions about what participants can do to mitigate the problem of marine debris. It also provides information on how they can educate others about maintaining healthy waterways in their communities. Copies can also be provided to participants who wish to learn more or want to have a comprehensive list of how they can make a difference.



ABOUT THE AUTHORS

Seaside Sustainability, a nonprofit based out of Gloucester, Massachusetts, aims to be a leader in Environmental and STEM Education programs and initiatives with emphasis on plastic mitigation, marine sciences, and education on sustainability in our community. We encourage members of the community, of all ages, to build and nurture a relationship with their local landscapes and seascapes through education regarding the significant costs of environmental degradation, as well as providing resources to develop skills, solutions, awareness, and community involvement to counterbalance society's ecological impacts. We aim to use our ability to utilize and introduce people to new technologies, and use our connections both outside and within our local community to constantly push for improvements in solutions to environmental issues.

Seaside Sustainability has taken an active approach in expanding its sphere of influence over schools and education centers to find the best and brightest of people. The group is composed of a large and robust group of thinkers and achievers who have extended their love for the environment to more critical centers and regions. As it enters a new stage of growth in the coming years, Seaside Sustainability aims to amplify the voice for environmental concerns to more and more communities to bring about an upheaval in the paradigm of sustainable education.





Reclaiming the Sea from Marine Debris



Part One: The Problem "WHAT"

Only 9% of the world's plastic is recycled

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Part 1: The Problem

"WHAT"

Approximately 18 billion pounds of plastic ends up in our oceans every year. This is due to the fact that only 9% of the world's plastic actually ends up being recycled, reused or disintegrated using specialized methods (Parker, 2018). The rest ends up in landfills or finds its way into our waterways and oceans, negatively affecting marine life and ecosystems. These plastics eventually break down into microplastics which are ingested by marine life, which can include the fish that we eat. Microplastics have been shown repeatedly to cause significant harm to wildlife, and studies are now suggesting that humans are also likely to be harmed by consuming foods exposed to these plastics (Loria, 2020).

To combat the gap left by misinformation or disinterest, Seaside Sustainability has compiled Part 1 of the "Reclaiming the Sea from Marine Debris" Curriculum to provide a wide range of the best educational resources available on the topic in order to spread awareness to individuals and develop a general consensus on what is to be done.



Marine Debris “Reclaiming the Sea from Marine Debris” Curriculum/Activity Resources Supplemental Activities

UNDERSTANDING MARINE DEBRIS: GAMES AND ACTIVITIES FOR KIDS OF ALL AGES

Recommended to have on-hand for Elementary School Students or
Younger Groups

The NOAA guide shares a variety of games and activities including a crossword, a word find, and coloring activities. Use these resources to entertain students while introducing vocabulary and ideas related to marine debris prevention. Such activities are a great method to engage students in concepts that would otherwise seem too complex or specific to interpret. This can be used as a take-home activity or the activities can be completed in person (NOAA)

MARINE DEBRIS MAGNETS CRAFT ACTIVITY

Recommended for Elementary Schools

Use this resource to make magnets with marine debris messaging and images. This is a fun craft activity to do with younger students at home or in person. Place these around your classroom or invite students to bring them home! (NOAA)

MARINE DEBRIS COLORING BOOK

Recommended to have on-hand for Elementary School Students or
Younger Groups

This marine debris education program supplement provides a number of different coloring pages with educational pictures and phrases about marine debris prevention, suited for children and infants. Print these out for students to color during the Marine Debris Curriculum, or take them home.

PROTECT OUR OCEAN ACTIVITY BOOK

Recommended for Elementary Schools & Middle Schools

This activity book from the NOAA encourages students to learn about the ocean and why it's so important for people to get involved in protecting it through a number of fun activities, including a crossword puzzle, a coloring activity, and a drawing activity they can complete at home (Martin and Forbes).



Marine Debris “Reclaiming the Sea from Marine Debris” Curriculum/Activity Resources Supplemental Activities

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DID YOU KNOW... BOOKMARK SERIES

Recommended for all ages

The National Oceanic and Atmospheric Administration shares a series of bookmarks that can be circulated in classrooms. With different facts and information on each bookmark in the series, these make perfect placeholders for students' books and textbooks. Pass these out to participants as a great simple and passive way to encourage learning and discussion about our environment and the issues facing the world's oceans (Marine Debris Program).

WASHED ASHORE INTEGRATED ARTS MARINE DEBRIS CURRICULUM

Recommended For All Ages (Art Activities)

This curriculum summary is designed to incorporate artistic education with marine debris awareness through the use of gathered marine debris for use in sculpture and art making. Includes both art theory and artistic exploration and practice alongside specific discussions on marine debris (Artula Institute For Arts and Environmental Education, 2016).

WASHED ASHORE INTEGRATED ARTS MARINE DEBRIS CURRICULUM

Recommended for Educators

This curriculum is designed to provide supporting educational resources to teach participants and volunteers about the “idea that every action counts and offer tangible ways to change individual and community behaviors.” Some of the topics included in this curriculum are *the science of plastics*, *the science of oceanography*, and *lessons in waste reduction* (University of Exeter, 2015)



Educational Videos

VIDEO: THE SINKING OF LOW-DENSITY MICROPLASTIC FIBERS WITH TURBULENCE

Recommended for Education- Middle school and older

A great way to bring the practicality of the work field or real life is by developing it within the classroom. Most people seem to have misconceptions about the longevity of plastics in water, which is why a demonstration can be effective. A lab demonstration that has been developed for students shows how turbulence can make floating, buoyant microplastic fibers sink. This is a great visual aid to display how natural ocean movement can lead to such widespread travel of plastics in the ocean (Parker, 2015).

VIDEO: NOAA MARINE DEBRIS TRASH TALK

Recommended for All Ages

TRASH TALK is a 15-minute video on marine debris that was originally created for World Ocean Day. It consists of six short chapters, each of which answers a different question related to marine debris (NOAA, 2016).

VIDEOS: TRASH TALK, MARINE DEBRIS EVERY FULL MOON: A SUPPLEMENTAL RESOURCE FOR EDUCATORS

Recommended for All Ages

This resource provides supplemental videos in the TRASH TALK series which display issues affecting our oceans and potential solutions to them. This resource can be utilized as a great set of visuals and to infuse a narrative touch to the issues on display for a class (US Department of Commerce, 2016)



Educational Materials for Instruction

Talking Trash and Taking Action

Recommended for Educators- Middle School and Older

This learning guide is designed to be flexible for educators, and provides information and activities that will allow each educator to develop a personalized education program to fit the needs of their students. It seeks to educate readers about ocean trash and how we can all prevent the damage it causes (Ocean Conservatory).

Turning the Tide on Trash

Recommended for Educators- Middle School and Older

This learning guide can be used by educators as they “explore the serious impacts that marine debris can have on wildlife, the environment, our well being, and our economy.” This guide has three teaching units, along with activities, handouts, and discussion questions. It intends to teach students about marine debris, and show them that they can be an important part of the solution (Sheavly, 2012).

From Shore to State House: Marine Debris Undergraduate Course Materials

Recommended for Educators- University and Older

These course materials are designed to promote involvement amongst college students in learning about marine debris issues and working towards eliminating them in a number of ways, most notably through presenting policy alternatives to their legislators. This is an important step in eliminating marine debris issues, and one which many educational materials do not discuss in great detail (Owens, 2016).



Educational Materials for Instruction

[Single-Use Plastics: A Roadmap for Sustainability](#)

Recommended for Educators- High School and Older

This paper details the latest techniques on how we can urge a large variety of individuals and groups of various sizes and types in order to curb the consumption of single-use plastics. It offers "lessons that may be useful for policymakers who are considering regulating the production and use of single-use plastics." This makes it a great look into the process of how regulations on plastics have previously succeeded, and how they can continue to be effectively implemented (Giacovelli, 2018).

[Marine Debris Toolkit For Educators](#)

Recommended for Educators (lots of resources for all ages)

This toolkit provides a way to "engage youth, educate them on the issue of marine debris, provide them opportunities to collect and analyze marine debris in their local community, and compare their results with youth across the nation and world." It can even be used to develop a marine debris monitoring program in your classroom (Nally, Lippiatt, Nachbar, Pollack, 2017).

[Gyre: The Plastic Ocean Lesson Plans](#)

Recommended for Educators

Gyre Lesson Plans offer classroom activity ideas on plastics and the ocean, including a lesson on Effects of Marine Debris on Ecosystems, as well as a PPT on the History of Marine Debris (Center for Alaskan Coastal Studies).

[The Educator's Guide to Marine Debris: S.E. and Gulf of Mexico](#)

Recommended for Educators

This guide is designed to introduce three main categories of marine debris: litter, derelict or abandoned boats, and lost or abandoned commercial and recreational fishing gear. The guide includes: "information about marine debris, lessons useful for middle school levels, and resources on regional and national levels." While initially designed for Southeast and Gulf regions, much of the information contained within is widely applicable (Spence, Bliss, Olsen, and Bell, 2009).



Educational Materials for Instruction

[NAMEPA An Educator's Guide to Marine Debris](#)

Recommended for Educators

This guide, created by NOAA and the North American Marine Environment Protection Association (NAMEPA), provides educators with a tool to help students become more informed on marine debris and encourage environmental stewardship. It can be used in a variety of ways, whether it be as a standalone teaching tool or a supplement to another lesson. It is useful for students belonging to grades K-12, especially those who show an active interest in the STEM fields (Avallon and Feinburg, 2014).

[Marine Debris STEAMSS Curriculum](#)

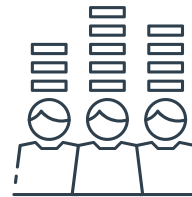
Recommended for Educators for grades 4-12

The Oregon Coast STEM Hub provides many resources for educators, including lesson plans and educational kits. Click below to access curriculum and lesson plans by grade level (Oregon Coast STEM Hub, 2021).

[Grades 4-5](#)

[Grades 6-8](#)

[Grades 9-12](#)



[The Science Literacy Project Standards-Based Curriculum](#)

Recommended for Educators

This detailed set of standards for teaching students about the sciences provides an excellent overview of the many different ways you can integrate science and nature into your classroom (Oakes, 2015).

[World Oceans Day Plastic Pollution Lesson Plan](#)

Recommended for Educators- All Ages

This lesson plan was designed to be used to teach students and fellow community members about plastic pollution while also presenting solutions to the problem and organizing a simple activity (World Ocean Day).





Reclaiming the Sea from Marine Debris



Part Two: The Field Trip "So What"

18 billion pounds of plastic flows into the ocean each year

PART 2: FIELD EXPLORATION OF THE MARINE DEBRIS PROBLEM OVERVIEW

Of the 18 billion pounds of plastic that flows into the ocean each year, approximately 70% is submerged into the ocean (Connolly & Carden, 2018). This debris causes significant damage to the ocean floor. The rest ends up floating on the ocean's surface, finding its way into gyres and creating a "garbage patch" or washing ashore on beaches. A study of three local communities in Massachusetts showed that debris covered about 5% of the shoreline (Massachusetts Office of Coastal Zone Management, 2019). The debris becomes a hazard to both humans and marine life; preventing these dangers is the main focus of this curriculum. Having experienced the impact locally, we aim to demonstrate the issue firsthand and help the participants become passionate about instilling substantial changes.

The main portion of the field trip will involve visiting your organization's Seabin, where the leader of the project will demonstrate how it is currently used. The Seabin is a state of the art machine used to perform waste management at minimal cost. Affixed to the dock, the Seabin moves up and down with the range of the tide, collecting all matter of marine debris. Water is sucked in from the surface with a submersible water pump. The water passes through a catch bag that traps any solid debris larger than 2 millimeters. Oil absorption pads also filter out any surface oil. The now clean water is then pumped back out into the ocean. The objective behind operating these machines is to demonstrate and allow participants the chance to observe how technology is being used to fight against anthropogenic effects and issues of marine debris. Participants will be able to help with emptying and sorting the contents in the Seabin catch bag, sparking group discussions, linking this activity to the materials from Part One.. Depending on time constraints and the size of the groups, there may also be an opportunity for group cleanups and upcycle projects that will help participants to better construe present challenges as well as promote discussion to make a difference. These field trips can also include whatever additional tech resources that are used by your organization. If your organization has additional devices, such as drones or ROV, you can also incorporate them into this part of the program and discussion.



ABOUT THE SEABIN

The Seabin is designed to tackle the growing problem of water pollution and marine debris. The unit uses a pump to create a downward current to capture and hold floating debris, macro and microplastics in the catch bag. Along with these types of debris, the Seabin can be equipped with absorbent pads that can capture petroleum based oils and detergent predominant in most marinas around the world. The Seabin, true to its name, is a powerful and efficient machine that works on a patented suction method common in solid waste management systems. Built for a large array of flows and water types, it can provide useful data on the nature of debris. The Seabin can be installed in calm waters of marinas and ports. The Seabin should be installed in areas outside of boat traffic and where the water level remains above 4 ½ feet. The Seabin runs 24/7 and has the capacity to collect 8.5 lbs trash/day. The Seabin has been functional on several high profile projects across different water bodies and has repeatedly shown success in its various applications (Seabin Project, n.d.).



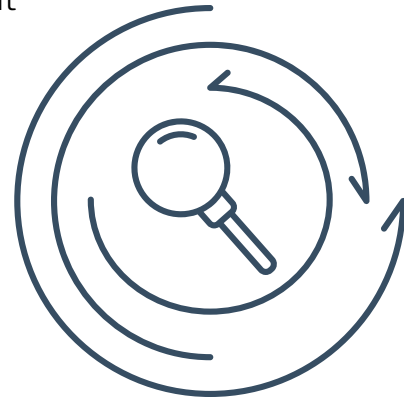
OPTIONAL ADDITIONS

(Optional Tech must be supplied by your organization)

FLIGHT:

If your organization has drones available to use, such as the Flying DJI Mavic Two Zoom drone, a staff member can use it to fly over the water and show the debris floating on the surface or where it has washed ashore (Charlton, 2018).

Drones equipped with a camera that will transmit video screens that can be set up under a tent nearby so the participants can view the footage. The use of drones will give your organization the ability to teach the participants how everything is connected and the vulnerabilities of the ecosystem.



PHOTOGRAPHY & ROVS:

If available, ROVs or other underwater cameras such as the underwater Trident drone with a camera installed can be used to show the amount of debris that has sunk and landed on the ocean floor, as well as how old some of that trash may be. (French, 2017).

OTHER BLUETECH SOLUTIONS:

There are many other types of BlueTech available that can be used with the curriculum. For example, The "Wasteshark," is a drone that floats on the surface of the water and "vacuums" up floating marine debris (RanMarine, 2019). This one can be operated by the participants to allow them to interact with the environment and make collecting trash fun.



OPTIONAL ADDITIONS

(Optional Tech must be supplied by your organization)

The participants will gain first hand experience with the trash and marine debris that is harming the ecosystem while also allowing them to make their own connections to the environment. This can prompt discussions about how the waste enters the ocean, how to prevent it, and what they can do to lessen the amount of waste produced in their homes by not only recycling but reducing consumption of single-use plastics.

During the clean ups and drone missions, any trash and debris that is collected will also be sorted to be disposed of properly at the end of the day. This will all be sorted according to the characterization sheet, however, at the end of the exercise it must be sorted out as trash, compost, or recycling. It is the responsibility of the organizing group to ensure the debris is sorted and properly handled. You may need to check local recycling standards and/or requirements to ensure proper compliance. Other kinds of recyclable items will be put in on- site recycle bins or brought to a suitable recycling location. Following this portion of the event, participants will be able to move into Part 3.

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PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

Level of inquiry:

structured

Investigation Designer:

Seaside Sustainability Seabin Team

Grade Levels:

All



Outline:

- Introductory Discussion: ~30 minutes to outline the learning goals of this session and answer and discuss guiding questions using the knowledge gained from Part I.
- Introduction to Device and HowIt Works: ~15 minutes for participants to watch how the Seabin works, look at the geography of your coast and discuss the result of a visual audit at the site and have participants assist a member of your organization with emptying the catch bag.
- Emptying and Waste Characterization: ~30 minutes with the organization sorting through the trash collected from the marine debris intervention device into recyclable, compostable, and landfill waste and according to the categories outlined in the protocol and characterization sheets,
- Answering discussion questions: ~20 minutes to answer and review activity sheet answers.

Investigation Focus:

In this investigation, participants will further explore the impact of marine debris on coastal ecosystem health, structure, and function. Participants will use the available marine debris intervention device to assist in furthering education on the oceans' debris problem and give a more representative picture of the debris issues facing the local community where the device is located. Individuals will help to empty the device, sort the collected debris, record and analyze data, and draw conclusions about the health of the coastal environment in which the device is located. Participants will observe the role the device plays in reducing debris in the marine ecosystems, and how the outcomes of collected debris vary depending on different variables. The data will be input into the waste categorization tracking program which compiles results in a database to be used for future study and to inform decision making. The waste characterization protocols have been developed by the University of Toronto Trash Team in partnership with Ocean Conservancy which have come together to form the International Trash Trap Network, contributing to the International Coastal Cleanup. More Information on these groups and the documentation which we will include can be found [here](#).



PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

MA State Learning Standards which may be Worked Into This Curriculum:

- 5-ESS2-1. Use a model to describe the cycling of water through a watershed through evaporation, precipitation, absorption, surface runoff, and condensation.
- 5-ESS3-1. Obtain and combine information about ways communities reduce human impact on the Earth's resources and environment by changing an agricultural, industrial, or community practice or process.
- 5.3-5-ETS3-1(MA). Use informational text to provide examples of improvements to existing technologies (innovations) and the development of new technologies (inventions). Recognize that technology is any modification of the natural or designed world done to fulfill human needs or wants.
- 7.MS-LS2-4. Analyze data to provide evidence that disruptions (natural or human-made) to any physical or biological components of an ecosystem can lead to shifts in all its populations.
- 7.MS-LS2-6(MA). Explain how changes to the biodiversity of an ecosystem—the variety of species found in the ecosystem—may limit the availability of resources humans use.
- HS-ESS3-3. Illustrate relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- HS-LS2-7. Analyze direct and indirect effects of human activities on biodiversity and ecosystem health, specifically habitat fragmentation, introduction of non-native or invasive species, overharvesting, pollution, and climate change. Evaluate and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health.



PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

Learning Outcomes:

By the end of the activity, participants should be able to:

- Make predictions and understand how marine debris enters their local marine environment.
- Collect, record, and analyze marine debris data.
- Explain the effects of marine debris on impacted ecosystems.
- Understand the importance of a healthy ecosystem.
- Brainstorm ways to reduce personal waste and environmental impact.
- Gain an understanding of how to properly decide what items to recycle, compost, or throw away.

Activity Sheet:

Pre-Activity:

- Background Information and guiding Questions

Mid-Activity (after emptying device and categorizing):

- Analyzing and Interpreting Data Questions
 - Constructing Explanations
 - Argumentation from Evidence

Concluding Remarks:

- Wrap-Up Questions



PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

Introduction to the Activity

- As you learned in Part 1, marine debris is one of the most widespread pollution problems facing the world's oceans and waterways. It is a global problem, as well as an everyday problem. Massive amounts of consumer plastics, metals, rubber, derelict fighting gear, and other lost or discarded items that are not biodegradable enter the marine environment every day, making marine debris a prominent and increasingly concerning problem. 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. There is not part of the world left untouched by marine debris and its impacts. Marine debris is a threat to our environment, navigation safety, the economy, as well as aquatic and human health. Although it is an immense environmental threat, marine debris is preventable. Participants will begin to explore and collect data on what types of marine debris are in their local communities. While participants will not be able to gather enough data to make definitive conclusions from their one session with the Seabin, this experience will drive discussion and allow for critical thinking. One means of doing this is through the use of Seabin to collect microplastics, unwanted organic or inorganic debris, and trash to illustrate the prominence of pollution in the water. The debris will be sorted and recorded on a provided data sheet.



PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

Adaption to Different Levels of Inquiry:

This activity has natural modifications embedded into the actual design of the lesson. Participants can be as active and as engaged as they wish; they can be directly involved, they can ask or answer questions, or even just watch.

Investigations Steps & Guidelines:

Collecting Marine Debris Sample (using a marine debris Intervention Device):

1. Have participants answer the introductory questions on the Activity Sheet.
2. Follow the Simple or Detailed Waste Characterization Protocol-filling out the Waste Characterization and Data Trapper App-ensure only one person submits if using the app or sending in the form by email.
3. Have participants fill out the Analyzing and Interpreting Data sections of the activity sheet.
4. Show or inform participants of debris data recorded from previous collections
 - a. Draw conclusions and discuss the implications of the presence of these materials in our local oceans.
5. Answer any questions the participants may have about procedures and/or marine debris in general.

Data Trapper App Link:

- App Store / Google Play



PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

Vocabulary which may assist discussion:

- **Algae Blooms:** An algal bloom is a rapid increase or accumulation in the population of algae in freshwater or marine water systems, and are recognized by the discoloration in the water from their pigments. Cyanobacteria blooms are often called blue-green algae.
- **Biodegrade:** Biodegradation is the disintegration of materials by bacteria, fungi, or other biological means. Although, often conflated, biodegradable is distinct in meaning from compostable.
- **Compostable:** Materials made of organic matter that you can naturally decompose and turn into compost. Ex: food scraps, yard clippings, and coffee grounds.
- **Contaminants:** Any physical, chemical, biological, or radiological substance or matter. Some contaminants does not necessarily indicate that the substance poses a health risk.
- **Degradation:** The condition or process of degrading or being degraded.
- **Marine Debris:** Any persistent solid material that is directly or indirectly disposed of or abandoned into the aquatic environment.
- **Microplastics:** Small plastic particles in the environment that are generally between 1 and 5 mm (0.039 and 0.197 in) in length. They can come from a variety of sources, including cosmetics, clothing, and industrial processes.
- **Organic vs. Inorganic Materials:** In chemistry terms, organic means that a molecule has a carbon backbone, with some hydrogens thrown in for good measure. Living creatures are made of various kinds of organic compounds. Inorganic molecules are composed of other elements. They can contain hydrogen or carbon, but if they have both, they are organic.
- **Persistent Solid Material:** Marine debris is defined as any persistent solid material that is manufactured or processed directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes.



PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

Vocabulary which may assist discussion (Continued):

- **Point - Source Pollution:** The U.S. Environmental Protection Agency (EPA) defines point source pollution as "any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack" (Hill, 1997). Factories and sewage treatment plants are two common types of point sources. For the marine debris investigation, discarded plastics from land based litter is the primary source of marine debris.
- **Recyclable:** A material that is able to be recycled to make a new object, Ex: recyclable plastics, aluminum, and glass.
- **Seabin:** A floating waste management technology that uses a method of filtration to collect and remove marine debris and oil from marinas and other bodies of water.
- **Turbidity:** The cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in the air. The measurement of turbidity is a key test of water quality.
- **Volume:** The amount of space and object take up (measured in mL or cubic units).



PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

Introductory Guiding Questions (some refresher from Part II)

- Q1: What is marine debris?
 - A: Marine debris is persistent solid material that is either intentionally or unintentionally disposed of or abandoned in the marine environment. Marine debris can be anything in large, abandoned vessels to tiny microplastics less than 5mm in length.
- Q2: Where have you seen marine debris before?
 - A: Beaches, rivers, lakes, sewers, etc.
- Q3: What do you think is the most common type of debris found at our site?
 - A: The Seabin catches many types of materials, but some of the most common are cigarette butts, plastic bags, food wrappers, plastic bottles, microplastics as small as 2mm, contaminated weeds, and hydrocarbons collected from the oil pads. You may need to readdress this question at the end of the assessment once you have emptied the bag.
- Q4: Where does it come from and how did it get into the ocean?
 - A: Marine debris can either come from land or the ocean either by getting dropped, blown, or washed into the ocean. Most of the marine debris found on our beaches comes from storm drains and sewers which lead to the ocean, as well as recreational beach activities such as picnicking. Another major source of marine debris is abandoned or discarded fishing gear that is left in the ocean.
- Q5: Where does debris end up after it is in the ocean?
 - Marine debris can become washed up on beaches, clumped together in large ocean patches, or ingested by marine life. This debris on land and sea pose huge threats to marine life which can become easily entangled or choke on the debris. Abandoned fishing gear is especially dangerous since much of the equipment, such as nets, were meant to catch and entangle marine life. Microplastics often sink and settle on the bottom of the water body whether that be an ocean or a lake.



PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

Introductory Guiding Questions (some refresher from Part II)

- Q6; What do you think is the purpose of a Seabin?
 - The main purpose of a Seabin is to remove marine debris from the water, but it is also incredibly important for collecting data and educating the public. Education about marine debris is vital to spreading awareness and encouraging change to happen at a much larger scale than the Seabin is physically capable of doing.
- Q7: How can technology be used to prevent or create solutions to marine debris and can you think of any?
 - A; Technology can be used to clean up the existing marine debris, and also develop alternatives to plastic products in order to limit marine debris in the future. Technologies such as the Seabin and Wasteshark can clean up the debris at a relatively small scale, but other technologies are in development to remove the larger patches of marine debris from our oceans. Examples of technological development for plastic alternatives include the use of nanotechnology to create more protective and water resistant cardboard and paper, genetic engineering of natural fibers to create better plastic alternatives from hemp, flax, jute, and advanced chemical processes to create biodegradable plastics. Also, technologies such as storm drain trash capture devices and large scale plastic skimmers such as Mr. Trash Wheels have been implemented.
- Q8: What are the potential inputs of coastal marine debris at this location and what geographical or developmental features might contribute?
 - A: Each location will have a different answer. It is recommended that you perform a Visual Audit of the site as detailed by the Toronto Trash Team in the attached document. You can either do this with your group, or you can do this ahead of time and use results to inform participants.



PART 2: SEA BIN MARINE DEBRIS INVESTIGATION

Constructing Explanations (discussion questions)

- Q1: What did you notice about the contents of the device we analyzed?
- Q2: How can you explain the presence of these particular inorganic materials?
What are their possible origins and/or pathways they followed to end up in this particular stretch of ocean?

Argumentation from Evidence

- Q1: Can you construct an argument that supports the claim that marine debris is a problem affecting our watershed? Use evidence from your collected data to support your answer.

Wrap Up:

- Q1: What was your personal "Ah-Ha" moment?
- Q2: What things can YOU do in your life to limit your contribution to marine debris?
- Q3: Who else in your life can you share these day to day goals with, and how can they help your efforts?



Marine Debris Investigation

Participant Activity/Instruction Sheet

Background Information & Guiding Options

Participants should get into small groups (2-3 people if safe to do so) and use the information learned in Part I of the Curriculum .

What is marine debris?

Where have you seen Marine Debris in your life?

What do you think is the most common type of debris found at our site:

Where does marine debris come from and how does it get in the oceans?



Background Information and Guiding Questions/ Analyzing and Interpreting Data

Where does marine debris end up once it gets into the ocean?

What do you think is the purpose of the Seabin?

How can technology be used to prevent or create solutions to marine debris and can you think of any?

What are the potential inputs of coastal marine debris at this location and what geographical or developmental features might contribute?

ANALYZING AND INTERPRETING DATA:

Constructing explanations:

What did you notice about the contents of the device we analyzed?

How can you explain the presence of these particular inorganic materials (both in our sample, as well as in the ocean at large? What are their possible origins and/or pathways they followed to end up in this particular stretch of ocean?



Argumentation from Evidence/ Concluding Remarks

ARGUMENTATION FROM EVIDENCE:

Can you construct an argument that supports the claim that marine debris is a problem affecting our watershed? Use evidence from your collected data to support your answer.

CONCLUDING REMARKS

Wrap-Up:

Get together with a partner (if safe to do so) and do a pair-share on your above responses and the findings of this investigation.

Below, after discussing with each other, write your partner's responses to the following questions:

What was your personal "Ah-Ha" moment?

What things can YOU do in your life to limit your contribution to marine debris?

Who else in your life can you share these day to day goals with, and how can they help your efforts?





Reclaiming the Sea from Marine Debris



PART THREE: What we can do now, "Now What"
1800 pieces of plastic litter floating on every square
kilometer of the world's ocean

Seaside Sustainability, 127 Eastern Ave, Gloucester, MA, 01931
Info@seasidesustainability.org 978.381.3302 www.seasidesustainability.org

PART 3: What You Can Do to Reduce Marine Debris/ Is Marine Debris an Issue Here?

WHAT YOU CAN DO TO REDUCE MARINE DEBRIS

After your trip with your organization, you will probably have questions about where to proceed ahead with your new knowledge of the marine systems. What other problems are our oceans and the environment generally facing, what causes these problems, and what can you do to help? Here, in Part Three, we would like to explain all of this to you, and prepare participants to tackle more intrinsic problems that plague the waterways. These include all the small things you can do in your own life to major global efforts and how you might be able to help them.

IS MARINE DEBRIS AN ISSUE HERE?



In order to see if and how marine debris directly affects communities, the staff at Seaside Sustainability has evaluated our local harbors in Beverly, Salem, and Gloucester to assess the extent of floating marine debris. Seaside's team found that not only was there a vast amount of floating marine debris, there was also washed up trash and plastic concentrated at the seawalls and riprap onshore. Additionally, plastics that have sunk to the sea bed present an interesting and difficult challenge. Your organization can give a better idea of your local trash picture by conducting your own visual audit of the site. It is important to note that individuals as well as cities/towns are able to significantly help mitigate this problem by preventing the waste from ending up in our waterways in the first place. It all begins with us. Waste ends up in our waterways, eventually ending up far downstream and into the ocean in a variety of ways. These means are especially prevalent in our coastal communities and occur due to the following factors:

- Plastic production / packaging
- Unfiltered storm drains that lead directly to the ocean
- Seasonal wind
- City/town-wide recycling and trash systems with completely uncovered bins that allow debris to be blown into the waterways and the streets
- Overflowing public trash receptacles
- An undefined system of constant trash removal from the streets
- Intermittent street sweeping



PART 3: What You Can Do to Reduce Marine Debris/ Is Marine Debris an Issue Here?

- Oceanside parks
- Oceanside birds attracted to trash and transporting it to water
- Heightened levels of tourism
- An uninformed, undereducated, and/or apathetic community of people
 - Littering
 - Voting for those who don't want to help aid these environmental issues
 - Flushing sanitary products, or other prohibited items, down the toilet
 - Buying products with unrecyclable materials
- An apathetic and/or under-educated commercial fishing industry



Work towards Plastic Bans!/ What you can do:

WORK TOWARDS PLASTIC BANS!

Getting in touch with your town's representative is one of the most direct and effective ways to incite change in your community. Representatives have the power to draw up legislation that can create real change in your own neighborhood. Seaside Sustainability has developed a Plastic Ban Guide which can be utilized to inform people on how to get plastic bans passed in local municipalities. Seaside Sustainability was instrumental in the passing of bans in Gloucester and Rockport, MA, with Rockport's single-use plastics bans being one of the most comprehensive in the country. We use our expertise to guide anyone through the process, and it is completely free and can be found [here](#).

WHAT YOU CAN DO:

Use the Seaside Sustainability's Disposable Plastic Ban Guide to get local plastic legislation passed. The link to the guide can be found [here](#). This is a free guide which we have created based off of Seaside Sustainability's experience in this field.



What you can do (continued)

Also, more informally, you could find your representatives and write or reach out to them/their office using these steps:



Identify your local representative visit:

www.house.gov/representatives/find-your-representative and enter your zip code. You will be given the name, contact information, and website address of your own representative. To find the phone number of your representative, visit http://clerk.house.gov/member_info/mcapdir.aspx and look for your local rep's name.

Reach out:



Send a carefully drafted email directly to your local representative at their government-issued email addresses. Conduct thorough research and cite multiple credible sources in your letter to present a more intriguing point. Be formal and be sure to revise your letter before sending out a finalized email. You can use Seaside Sustainability's Letter Writing Template to help guide your writing. If you would prefer to speak to your local representatives on the phone, prepare the points that you would like to discuss with them beforehand. Allocate a reasonable amount of time to the call in the case that your conversation lasts for an extended period of time.

Follow up:



Continue to keep the conversation alive. Reach out to your local representative multiple times after sending your initial email. Ask what progress has been made to address your concerns, and how you can help accelerate the process. Do not hesitate to ask questions!



Plastic Toiletries!

Around 23,000 tonnes of toothbrushes end up in landfill every year, as well as 2 billion disposable razors (England, 2010). These products are a big danger to marine life. Other toiletries contain microplastics in their ingredients

WHAT YOU CAN DO:

Avoid toiletries containing polypropylene or polyethylene, which are commonly added to products such as toothpaste, facial scrubs, and body washes. These ingredients have microplastics that harm the wildlife that consumes them.

Instead of tossing a plastic razor in the trash every month, consider switching to a razor that lets you replace just the blade or even a straight razor. Not throwing out a plastic handle will add up quickly to help in waste reduction.

Swapping out your plastic toothbrush for a bamboo one is an easy way to reduce your plastic waste. One billion plastic toothbrushes are thrown out every single year, creating about 50 million pounds of waste annually. There have not been any scientific research results that plastic toothbrushes perform better than bamboo ones. Just like plastic toothbrushes, bamboo brushes need to be replaced fairly often (about every 3 months), but the handle of a bamboo toothbrush only takes about 6 months to biodegrade back into the soil. On the other hand, a plastic toothbrush will never biodegrade and will remain in the environment forever. Just be sure to research products ahead of time to make sure they're ethically produced, as deforestation of bamboo is a major issue currently in parts of Asia (Pilcher, 2004).

Upcycle your plastic toiletries. There are many ways you can make use of plastic toiletries that would otherwise become waste, such as:

- Turning a plastic shampoo bottle into a cell phone charging caddy.
- Making a plastic bottle necklace out of a plastic bottle, paint, and spare chains, or a thread.
- Making a hanging storage bin out of lotion bottles.
- Making different crafts out of spare plastic toiletries instead of throwing them away, such as this recycled owl kids' project.

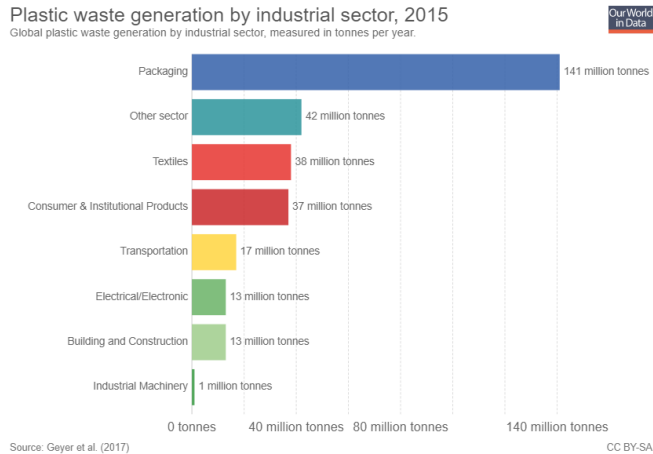


[A link to plastic upcycling tutorials can be found here.](#)



Reduce Plastic Packaging!

141 million metric tons (310 Billion pounds) of plastic packaging are disposed of per year making it the most common source of plastic in landfills and a danger to marine life (Ritchie, 2018).



WHAT YOU CAN DO:



- Shop for items in jars, cans, cardboard boxes, paper (check if it's recyclable first as it may be plastic coated or infused) or cardboard cartons, and other reusable, more easily recyclable, and/or biodegradable options.
- Buy items packaged in biodegradable plastic alternatives. These are usually plant-based, and companies often advertise their use of these alternatives.
- Spread information on the issues with plastic packaging and alternatives people can use and support.
- Support plastic packaging bans and/or regulations. The more widespread these become, the fewer businesses will choose unsustainable packaging for their products.
- Upcycle plastic packaging: Make a phone holder for when your phone is charging. Reuse plastic packaging: Ziploc bags can usually be washed and reused, and many containers can be used to store household items.



Reduce Plastic Packaging!

Cont.

WHAT YOU CAN DO:

- Consuming less, in general, is one of the simplest yet most impactful ways to help. The United States makes up about 5% of the world's population but produces 25% of the world's waste (Forbes, 2006).
- With plastics being used to package so many products, the best way to help is to simply buy fewer products. Try using more reusable products, repairing products before buying new ones, buying second-hand, and exchanging unwanted/unneeded products with friends, family, etc.
- Bring your own food storage containers to restaurants for leftovers, and use reusable containers when bringing food on the go.
- Disposable food containers are typically very high in volume, making them a terrible contributor to landfills. If you have nowhere to put such a container, replace disposable plastic and styrofoam containers with cardboard ones.
- Buying items second-hand is another great method as well to cut down on plastic wastes. New toys and especially electronic gadgets come with all kinds of plastic packaging—from those really hard-to-crack shells to twisty ties.
- Search the shelves of thrift stores, neighborhood garage sales, or online postings for items that are just as good when previously used. Not only will you save a few bucks, you will also reduce the amount of plastic packaging you bought.



Reduce Plastic Bottles and Cups!

One million plastic bottles are bought around the world every minute and the number will jump another 20% by 2021 (The Guardian, 2017). Scientists believe that plastic bottles can take as much as four hundred and fifty years to decompose in the ocean, meaning that waste produced will linger for a long time.



WHAT YOU CAN DO

- Use and carry a reusable bottle made of sustainable materials (such as glass, steel, cardboard, or metal). Discourage plastic bottle and cup usage in your family, school, community, work environment, and local businesses. Help people you know to become informed on alternative products and other ways to reduce the usage of single-use plastics. Bring your own thermos to the coffee shop, and encourage businesses to offer discounts to people who bring reusable containers for their purchases.
- Recycle plastic bottles by following these steps:
 - Check the bottom of the bottle → Take the cap off → Rinse the bottle with water → Remove the label and plastic seal if necessary → Repeat the process for the other bottles. → Consider crushing the bottles to save space if you have a lot of them → Place the bottles into a bag.
- Make sure to check your local recycling laws to determine the best way to dispose of plastic bottles. In the state of Massachusetts, all plastic bottles and containers can be recycled. Make sure that the bottles are clean before putting them in the bin (Recycle Smart, 2020). Some cities and states have rules and regulations regarding how certain Number Symbols can be recycled. For further details on your city's recycling laws, check the city website and follow the directions listed there.



Reduce Plastic Bottles and Cups!

WHAT YOU CAN DO:

- Show your support for plastic bottle bans and/or regulations in your community, and collaborate with others to promote these policies. By improving sustainability in government policy, waste usage can be majorly reduced on a large scale.
- Upcycle your used plastic bottles:
 - Create planters
 - Create a pencil organizer or a basket
 - Create a piggy bank
- A link to plastic bottle upcycling tutorials can be found [here](#).
- Use refilling stations whenever possible, and encourage your school, local businesses, and other densely populated parts of your community to provide free water filling. Imagine how many bottles one person who uses disposable bottles for water will use in a year, and then think about how many people use disposable bottles for their water. With these two things taken into account, it's easy to see how the amount of plastic that one of these stations can prevent from becoming waste adds up fast. This is especially true when the station is in an area where a large number of people inhabit the region.



Utilize Reusable Bags!

According to estimates, five billion to one trillion plastic bags are used around the world every year. By 2050, scientists estimate that there will be more plastic in the oceans than fish. This is an alarming number (The Washington Post, 2016).

WHAT YOU CAN DO:

Use and carry a reusable shopping bag, and encourage others to do the same.

When you don't have a reusable bag with you, use paper bags from stores if they're available. Help and inform your family, friends, community, etc. on the benefits to them and the environment by using more sustainable products.



Find and shop at stores that offer cash credit for bringing your own bags.

Recycle plastic bags by following these steps:

- Remove receipts, gum, and other debris in the plastic bags. Check that all the bags are free of debris.
- Confirm the bags have #2 or #4 plastic symbols on them. The symbol should be printed on the front or bottom of the plastic bag.
- Collect the bags in one large garbage bag.
- Bring them to a bag collection bin.

Encourage local stores to stop offering plastic bags, or to charge fees for using them.

Petitions can help with this, as businesses save money through discontinuing the use of plastic bags, but are afraid that doing so will lose them, customers. By showing that people support this choice, they'll feel more confident in making the switch.

If you use paper bags, there are many different ways you can repurpose them after a trip to the store. With a pair of scissors, you can turn paper bags into wrapping paper, envelopes, book covers, and more. If you have a compost pile, shredded paper bags make great brown material (Huffstetler, 2020).

Bring your own garment bag to the dry cleaner. Businesses love when customers bring reusable bags of any kind as it saves them time and money, and as more people get on board with the idea, businesses are likely to offer discounts for those with reusable bags or even discontinue the use of disposable plastics.



Utilize Reusable Bags!

WHAT YOU CAN DO:

- Use reusable lunch boxes rather than Ziploc bags, and wash Ziploc bags to reuse them whenever possible. Unless your food spoils inside of the bag, you can almost definitely wash and reuse these products at least once, which means you're cutting your plastic waste in half in one area. In the case of foods with very little residue, these bags can be used several times. Just be sure to properly dry them to avoid mold growth, as this is an easy problem to avoid but can quickly ruin your plans and your food.
- Support legislation that can help to reduce the use of plastic bags. Similar to legislation regulating plastic bottles, this will quickly lead to large-scale changes.
- Upcycle plastic bags by considering the following methods:
 - Create a plastic bag jump rope
 - Create a plastic bag pencil pouch



A link to plastic bag upcycling tutorials can be found [here](#).



The Flaws in Plastic Straws!

Around 500 million straws are disposed of in the US alone every day. A 2019 study showed that 8.3 billion straws polluted the ocean in that year alone (Gibbens, 2019).

WHAT YOU CAN DO:

- Use reusable or compostable straws: metal, glass, bamboo, straw, ceramic, and/or paper. They're marine life friendly, as they will typically either decompose before they can reach the ocean or will be too heavy to be blown by wind out of a landfill and into the ocean (Koonin, 2018). According to a study from 5 Gyres, paper straws break down in 6 months, meaning they're less likely to be consumed by wildlife (2017). Paper is also less likely than plastic to harm marine life if ingested, as it is a non-toxic material and carries minimal risk of becoming a potential choking hazard.



- It is also necessary to assist in educating those around you on the dangers of plastic straws and alternative products they can use. Getting members of your community involved will help to reduce waste short term, and will urge local businesses to reduce their plastic straw distribution and waste. To further implement changes in your community's plastic straw waste, encourage local restaurants to discontinue the distribution of plastic straws, unless requested by a customer. This practice is growing in popularity, and benefits businesses as well as the environment in many cases (Shaw, 2018).



- Propose a city or town ordinance to improve policies on plastic straws. Bans, taxes, and subsidization of businesses that sell reusable and sustainable alternatives can all help to reduce plastic consumption in your area.
- Upcycling plastic straws can be done in these ways:
 - Make a pen/pencil or stylus holder by taping a straw to your notebook or tablet cover.
 - Create a colorful lampshade by pasting straws all around the lamp.

A link to straw upcycling tutorials can be found [here](#).



Say No to Styrofoam!

Styrofoam is toxic to you and your environment. Cutting down will improve your health and help the planet.

WHAT YOU CAN DO:

- Cut styrofoam cups and packaging from your consumption, especially involving food and drinks. Styrofoam is typically used for hot drinks and for microwaveable foods, but heating styrofoam releases chemicals that are linked to several diseases and ailments. Even without considering the environmental benefits, eliminating the use of styrofoam is in everyone's best interest (Safer Chemicals, Healthy Families, n.d.). Bringing reusable containers for food you don't finish at a restaurant is one method. You can also use a thermos for your coffee, and avoid products pre-packaged in styrofoam to help you reduce your styrofoam usage (Kinhal, n.d.).
- Help to pass laws and regulations which ban and/or regulate the use of styrofoam. Styrofoam takes up 25-30% of landfill volume in the world (Collier County Government, n.d.). It never biodegrades and is likely to blow into the ocean. It can float long distances across the water, threatening wildlife as it passes through their habitat. Styrofoam is often overlooked when discussing harmful products, with plastic bags and straws making up the majority of bans and regulations regarding harmful consumer products. Ignoring the dangers of styrofoam is extremely dangerous (Collier County Government, n.d.).
- Help to reuse styrofoam pellets: While ideally, the use of styrofoam would simply stop, one of the best short-term ways to reduce its usage is to organize or contribute to the collection of it by businesses. Styrofoam pellets, or "packing peanuts" are collected for reuse by many businesses (Kinhal, n.d.). Donate your own to keep them from becoming waste, and help to set up the collection of them in local businesses anywhere you can. Businesses that use a lot of this packaging will save money too, so it shouldn't be too hard to get them on board.



Sea of Smoke!

2.4 million cigarette butts were collected in the 2017 International Coastal Cleanup, making them the most numerous littered item in the world (Thorbecke, 2018).

WHAT YOU CAN DO:

- If you're struggling to quit, at least ensure you dispose of all waste from your cigarettes properly. If there's no trash can, ashtray, etc. near you, carry them in your pocket. Using (and reusing) a ziplock bag, or something similar, will make it easy to hold on to your cigarette butts until you dispose of them properly, without dirtying your clothes by throwing it loosely into a pocket. Just make absolutely sure that the cigarette is 100% put out before doing this to ensure that there is no risk of your clothing catching fire.
- Push for your town, school, office, etc. to install and/or keep public ashtrays or other disposal receptacles made for cigarettes. With smoking becoming less and less common over time, such receptacles are often not installed anymore, and the existing ones often being removed. While they're less needed than before, smoking is still common enough that removing or neglecting to install these will undoubtedly lead to an increase of litter in the area. Initiatives to discourage smoking are great, but the removal of these receptacles only discourages proper disposal (Thorbecke, 2018).
- Encourage your family and friends to stay away from smoking. If they do smoke and have trouble quitting or simply refuse to, teach them ways to dispose of their cigarettes properly. Many people have the mentality that all of the health risks of smoking won't affect them, but without proper disposal, everyone is impacted by the environmental damage that cigarettes can cause. (Ocean Conservancy, 2020).



Start at the Store!

We've gone over the major products to avoid, but there are some more consumer habits which are often overlooked that can help reduce waste. By 2050, overseas shipping could contribute to almost 10% of global greenhouse gas emissions (Transport & Environment, 2020).

WHAT YOU CAN DO:

- Purchase your nonperishable items in bulk. Bulk products will save large amounts of packaging, so long as the bulk purchase isn't just a large number of individually packaged products. It also often saves money and time to purchase in bulk. Buying perishables in bulk should be avoided unless all of the products will definitely be used, as many people buy these products only to throw them out after not using them (Everett-Haynes, 2015).
- Shop locally for as many of the products you use as possible. Locally produced food and other goods are typically more environmentally friendly, and those who shop from such places typically put pressure on sellers to make their products as environmentally friendly as possible (Farmers Market Coalition, n.d.). Shopping locally also helps to cut down on the use of naval shipping. Not only does long-distance transport of goods typically burn fossil fuels, but transport by boat can also lead to oil or goods being released into the ocean, and the movement of ships can cause damage to aquatic ecosystems (Endresen et al, 2008). There are also many determined and suspected dangers caused by freighter ships for those who live in coastal trade hubs, mostly due to the pollution they emit (European Federation of Transport and Environment, 2009). Do some quick research (a few Google searches are all it takes) to find out if the companies you frequently buy from have ethical business practices such as using less plastic packaging or manufacturing products in the USA.
- When shopping or dining out, help reduce the demand for overexploited species by choosing seafood that is both healthful and sustainable. Educating yourself on the environmental impact of consuming certain species and seafood sourced from certain locations can make a big difference in your impact on marine life. You can start your research with this link to find your personal seafood guide. Avoid purchasing items such as coral jewelry, tortoiseshell hair accessories (made from hawksbill turtles), and shark products. Certain products contribute to the harming and even decimation of fragile coral reefs and marine populations (Oceana, n.d.).



Diminish your Emissions

Climate change is one of the largest threats to our oceans, as well as to human safety, in the modern world. The practices that contribute to climate change also negatively impact marine ecosystems, further amplifying the overall impact of climate change itself.

WHAT YOU CAN DO:

- **Use sustainable transportation:** If walking and biking won't work for where you're going, try taking a bus or train. Public and group transportation helps to reduce CO2 emissions since transportation makes up a large portion of the emissions produced by average households. In a household with two cars and two driving adults, replacing one car with public transportation can often reduce the total household greenhouse emissions by 30% (Kansas City Area Transportation Authority, n.d.).



- **Reduce waste:** Thankfully, most of the tips we've mentioned for reducing the waste in our oceans will work on reducing emissions as well. Reusing products, cutting out non-biodegradable plastics, and supporting sustainable companies are all great ways to cut down on your carbon footprint (Carbon Offsets Alleviate Poverty, n.d.). In addition to the environmental benefits, consider the financial benefits of saving money on goods and energy.



- **Have a voice.** This issue is the largest and hardest to fix out of any that we've mentioned, and sadly while individual efforts help, it'll take a strong approach to really curb climate change. Reaching out to your federal representatives is very important, but this still comes down to their choices on the matter. Getting involved with your school, town/city, and state to promote sustainability is often very accessible and a huge help. This is a more practical way for the average person to get involved as opposed to putting pressure on the federal government. Try focusing on bans and/or regulations on wasteful products like single-use plastics, promoting public transportation, and funding renewable energy usage. No matter your age, your reputation, or anything else really, starting a petition or forming a group to make your community more sustainable can have a major impact (Oceana, n.d.).



Recycling

Only 9% of plastics consumed are properly recycled. This turns a group of potentially sustainable products into the largest portion of landfills, the primary source of waste in the ocean, and a huge turnover for debris from several resources. From 1992 to January of 2018, 45% of recyclables in the world were exported to China. With China and India recently declaring that they can no longer handle incoming recyclables, new solutions are needed on many levels (Watson, 2018).

WHAT YOU CAN DO:

Start with yourself: Recycle whenever possible: if no recycling bin is nearby, carry your recyclable plastics with you if you can. Bringing a backpack on any long outing will help with this, and using that backpack to carry a reusable water bottle, utensils and other items will substitute the need for any other kind of plastics. Use as many biodegradable alternatives as possible, since there's a chance that even the most environmentally conscious of people can find their waste ending up in landfill (Albeck-Ripka, 2018).

Encourage your home, school, workplace etc. to provide recycling bins. If they are hesitant, offer to help handle the problem yourself, and get others involved. A few people carrying out recyclables to bring home and properly dispose of could handle the whole issue, and will at least help make a difference.



Demand better infrastructure: Similar to carbon dioxide emissions, these systematic problems mean that more involvement is needed on every level. Even if all recyclables in the U.S. end up in recycling bins, much of it will still be thrown away due to a lack of resources. Start with your town and work your way up: if there is no recycling facility in your area, advocate for one.. Small amounts of funding by towns and cities around the world could address this problem completely, and it's up to all of us to make sure this happens (Cho, 2020). Resolving the recent recycling crisis is one of the most important and approachable ways to mitigate the harm to our oceans.



Clean Up Your Community

One of the most accessible ways to help is to clean up local beaches, rivers, lakes, ponds, etc. These cleanups keep us and wildlife safer and can lead to a better economy in the surrounding area. Even cleanups in non-coastal areas can lead to a lot of goods being recycled, which will help reduce emissions (Crane, 2018).

WHAT YOU CAN DO:

Find organized cleanups happening near you. Many schools, activist groups, and communities frequently hold events to get people involved in the effort. You can go it alone too: most bodies of water are at least partially public, meaning there's an opportunity for you to dedicate some extra time to do some individual cleaning. Be sure to check first whether the body of water and the surrounding area is public or private property to avoid accidental trespassing. Be the one to organize a group. Talk to your friends, classmates, family, and anyone else you may be able to get on board to organize a clean-up as a group. You don't have to be a part of a charity or an environmental club, all you need is a group of people who want to help keep local water clean.

Stay safe: biodegradable rubber gloves will be enough for most trash items you find but be sure to take necessary safety precautions when dealing with metal and other hazardous materials. . Safety aside, you'll still want to prioritize the small stuff. Plastics like bags, wrappers, bottles, straws, packaging, and styrofoam are the most likely to end up harming wildlife. All of these are toxic to them and are likely to drift through the water until they're eaten due to their lightweight and low density, coupled with the fact that they never biodegrade. These are also the easiest and safest for you to remove (Weller, 2017).

Keep an eye out for larger efforts: Since 2012, The Center for Coastal Studies has partnered with various organizations and Cape Cod fishermen to remove abandoned fishing gear from the Cape Cod bay floor. So far, the program has removed over 38 tons of gear. The Center for Coastal Studies is a non-profit that utilizes volunteers for projects such as this one (Center for Coastal Studies, 2020). Other foundations and organizations commonly have similar initiatives, such as the six Trash-Free Water projects currently funded and assisted by the EPA (the United States Environmental Protection Agency, 2021).



Try a 30 Day Challenge!

There are several different eco-friendly challenges, with each typically lasting about a month. Try one out and see how you can change your lifestyle.

HOW YOU DO IT:



- Look around online for a challenge that sounds interesting and practical to you. Alternatively, make your own challenge by gathering inspiration from the environmental issues that are most important to you, and set goals for yourself that reduce your impact in that area. Common tasks include replacing disposable items with reusable ones, using creativity to reuse items in unique ways, fixing broken things instead of throwing them away, and opting for transportation methods that don't rely on fossil fuels, such as biking or walking. . Try to have some variety. It's worth considering lowering the number of tasks and doing them for longer so you can build stronger habits from your challenge, but try to explore different tasks to see how easily you could incorporate some of them into your life (Kong, 2020).
- **Build and practice new habits:** Finishing your challenge is a great accomplishment, but the idea is for it to help you change your habits and lead a more sustainable life. Think back on what parts of your challenge you found easy, as they're the ones you're most likely to build long-term habits from. You can also focus on the ones that you felt the best about accomplishing, and work towards shifting your everyday behaviors gradually towards completing those tasks on a regular basis (Kellog, 2020).
- **Get other people involved:** Challenge your friends, family, coworkers, and whoever else you want to take part in the challenge alongside you. You'll not only get more people living sustainably, but you'll also have a friendly competition and some cooperation between the participants (GME Marketing, 2015).



Help to Run a Waste Audit

Most people don't realize how fast their waste adds up. Tracking this information can make your school, home, or workplace more aware of their waste, and more involved in reducing it.

HOW YOU DO IT:

Keep track of how much certain products/objects are used over a certain time span. You could track only the usage of disposable spoons or the total waste produced by your kitchen, cafeteria, or break room. You could also do this for just one meal of one day, or across several weeks. The setup for these can be anywhere from just one student with a clipboard to a city-wide initiative with dozens of volunteers involved.



Get others involved: not only does forming some kind of group make this easier, but it'll also get more people thinking about finding solutions to the amount of waste they produce.

Figure out your method: If you're looking at just one item, keeping count of the amount people take to use is your best bet. If you're measuring total waste, weighing the trash and recyclables produced will save lots of time and provide a more accurate measurement.

Communicate and apply. Once you've measured the waste produced, make sure others know about the problem and what they can do to help. If your school uses a lot of plastic utensils, encourage people to bring reusable ones from home. If your family throws out a lot of uneaten food, encourage them to buy and cook less food. Many remaining food scraps can also be composted, so you can either start your own compost bin, or take food scraps to a local compost facility. And if you notice any issues with the waste you produce, fix them!



Join the Cafeteria Rangers!

This program empowers students and teachers to get involved in cutting levels of waste in school cafeterias. With a fairly easy and very well organized set-up and system, this is a very approachable way to help cut down waste in your community, and learn how to handle waste in the future.

HOW TO DO IT:

The step-by-step procedure for implementing this program in your school can be found along with additional information at <http://www.cafeteriaculture.org/sort2save-kit.html>.



Some of the major steps are as follows:

- Figure out if the program is right for you and your school by reading further information online, and determine who will lead the program in your school.
- Run a waste audit in your cafeteria to figure out exactly how bad your waste problem is, as well as which items are wasted the most. This will let you better address the problem, and provide you with before and after data which will assist in raising interest and enthusiasm for the program.
- Schedule your launch day and make everyone aware of it. Waste audits tend to be a surprise, but this program is more about getting people involved in reducing waste through interaction rather than awareness. Form a rotating schedule of classes or other groups who will take on the role of Rangers. These Rangers oversee the sorting of all food scraps and packaging at the end of every lunch period. Rangers typically rotate at the start of each month, but this can be adjusted as needed.
- Spread the word to other schools in your area, and provide information such as the measured weight of waste, and images of bags of waste before and after implementing the program. This will help people quantify how significant your improvements were, and will make them more likely to try the program for themselves. Share your progress in any way you can. Try getting local news or school social media accounts to spread the word.



Lead The Way

Environmental aid gets stronger and more widespread every day, but there's still a long way to go for all of our problems to be solved. Individual efforts are a fantastic contribution, but it's strong organizational efforts which are needed most. What better way to help than to take initiative in forming and improving organizations which help the environment?

HOW TO DO IT:

Start small! If your local school doesn't have a club or other organization devoted to helping the environment, start petitioning and gathering future members right away. A school club might not save the world, but building a passion and understanding towards solving the marine debris crisis will. Clubs like this are surprisingly fun and a great way to start helping out. Taking on a leadership position is daunting to a lot of people, but you'd be surprised how easy it is to get something started when you're passionate about it. Interning or volunteering with local nonprofit organizations is also a great way to get involved in the fight against the debris problem.

Organize your friends, your neighborhood, local businesses, your town, and whoever else you can reach to begin cooperative efforts. Princeton University has a program which gives students free samples of low carbon-footprint and low waste products which can be bought in the area. Efforts like this help to change people's consumption habits one item at a time, and events such as school fundraisers, farmers markets, holiday celebrations, and anything else which brings people together in large numbers can be fantastic ways to begin implementing cooperative initiatives like this one. Organizations like the EPA will often use their resources to help form and support initiatives like this, so you may be surprised by the resources available to you.



Clean Up Your Act

Water—and anything else—that goes down your drain can eventually end up in the ocean, so you have to be careful about the products you use in your home. Many compounds found in soaps and detergents can be toxic to wildlife or affect growth and reproduction.

HOW TO DO IT:

You can help keep the ocean and other waterways healthy by picking your cleaning products carefully. Many household chores can be done with simple, non-toxic ingredients like vinegar, baking soda, or lemon juice.



Visit Consumer Reports' Greener Choices page for suggestions or the U.S.

Environmental Protection Agency's Safer Product Labeling Program to learn about store-bought products that pose less of a risk to the environment. Small details about the cleaning products you use can make a big difference in the environmental impact you have, and figuring out the difference between harmful and non-harmful products can ensure that your hygiene doesn't hurt the environment.



Look for phosphate-free laundry detergent and try to avoid using antibacterial gels and soaps. Read labels carefully and follow all instructions when using and disposing of cleaning products. Even safe chemical alternatives could potentially harm you and the environment if they are used or disposed of incorrectly. For example, some products are sold at high concentrations and are meant to be diluted before use, so that more of the product can be sold with less packaging. If a product like this isn't properly prepared, it could be dangerous if inhaled, burn your skin or eyes, and harm wildlife that may come into contact with it during its use or after its disposal. A product may be completely safe to use on surfaces around your house, but may bring toxicity to marine wildlife if used in a sink or bathtub. The more you know about the products you use, the more you can avoid any potential harm from being caused.



Magnificent Miscellaneous Activities

There are a lot of other ways to reduce plastic waste in the ocean, such as:

Cook more meals at home as it doesn't involve takeout containers or doggy bags. For those times when you do order in or eat out, tell the restaurant owners you don't need any plastic cutlery. Consider patronizing restaurants and grocery stores that offer only sustainable seafood, and speak up about your concerns if you spot a threatened species on the menu or at the seafood counter.

Many institutes and organizations are fighting to protect ocean habitats and marine wildlife. Find a national organization and consider giving financial support or volunteering for hands-on work or advocacy. If you live near the coast, join up with a local branch or group and get involved in projects close to home. If you live inland, you can also get involved with cleaning up lakes, rivers, or other bodies of water. This not only helps your community, but can also help ocean habitats that are downstream from these bodies of water. Research the water habitat policies of public officials before you vote or contact your local representatives to let them know you support marine conservation projects.

Practice responsible boating, kayaking, and other recreational activities on the water. Never throw anything overboard, and be aware of marine life in the waters around you. If you're set on taking a cruise for your next vacation, do some research to find the most eco-friendly option.

Avoid using plastic cutlery, and use wire hangers instead of plastic hangers.



Instead of a plastic hamper, try to use alternates. Bamboo products are typically sturdy and pose no serious threat to the environment if they're sourced ethically (Plastic Pollution Coalition, n.d.). You can place a cloth burlap bag inside the bamboo hamper and easily take the bag out to do laundry.

Switch to e-billing. While there may not be a whole lot of plastic involved with receiving bills in the mail, there are many ecological benefits for signing up for e-billing. The average American household can save 6.6 pounds of paper each year and avoid producing 171 pounds of greenhouse emissions (Reuters, 2008).



Keep Learning, Keep Helping!

There are always ways to learn more about the issues beguiling our oceans and our environment. The more you know, the more you can help to end these issues.

HOW TO DO IT:

Research On Your Own!



You don't need to be a scientist, an activist, or anything else besides a dedicated individual, to learn more about how you can help. Your library and the internet are great places to start. Try looking through epa.gov, sites of local activist organizations, Wikipedia (just double-check the sources), and anything else you find from googling a topic you're concerned about.

Join or start local clubs, organizations, or more loosely organized groups in your area. Even if none of the members are environmental experts, you'll have a group of people to exchange questions and ideas with. Learning together will make things easier for you, and you'll help others to learn along the way.

See if classes on environmentalism are an option for you: courses on environmentalism at all education levels are becoming more common, and websites like Class Central and Academic Earth offer courses on environmental science for free. Khan Academy and various YouTube channels also offer free lectures in various forms. None of these besides a college degree will qualify you as an environmental scientist or anything similar, but they're a great way to get an in-depth understanding of environmental issues.



Keep Learning, Keep Helping! Cont.

There are always ways to learn more about the issues beguiling our oceans and our environment. The more you know, the more you can help to end these issues.

HOW TO DO IT:



Try to get further curriculum and other materials on the environment available in your school. In addition to what Seaside provides, there's a large and ever-growing selection of curriculum materials which can be used by your school to form new courses, organize the objectives of a club, or help run events dealing with your local environment. Some of these are simple and specific outlines for clean-up events, while others are extremely long, broad, and detailed descriptions of the environmental crisis in general. Any of these can be great to further your own understanding of the topic and to organize motivated people to help the cause. Many are available online for free, making them accessible for anyone who wants to learn and/or work with their environment. Some of these materials include:

- The Program on Marine Debris created by Duke University's Marine Lab, which lays out in detail how to complete multiple experiments, field research activities, and other methods of engagement to help students gain hands-on experience and a better understanding of both local and global issues involving marine debris, coupled with some other perspective building on environmental issues in general. This is intended for 4th and 5th graders, and official training is only provided to teachers within Carteret County, North Carolina. However, aspects could be implemented into many environmental, science, or even literature classes at a wide variety of educational levels due to the wide variety of activities, topics, and concepts covered in these materials.
- The National Oceanic and Atmospheric Administration's "Activities and Curricula" section on their website, which contains materials ranging from coloring books and craft activities to highly detailed University level curricula, can be downloaded for free.



Keep Learning, Keep Helping! Cont.

There are always ways to learn more about the issues beguiling our oceans and our environment. The more you know, the more you can help to end these issues.

HOW TO DO IT:



- The "Marine Debris & Plastic Source Reduction Toolkit" produced by the Product Stewardship Institute and multiple University of California Campuses, was funded and distributed by the Environmental Protection Agency. This is primarily focused on creating behavioral and policy changes regarding plastic consumption on college campuses, but the majority of content within it is worded in a way for students of all ages to understand easily, or will take only light paraphrasing and explanation to be understood. Similarly, almost all of this content can be directly used outside of a University setting or would only need to be slightly adapted. It highlights every crucial step and many smaller details in analyzing issues with waste such as forming a plan to reduce waste, and implementing policies and/or motivating factors which will reduce or eliminate issues with waste production on a campus, or if adapted, within an office, a community, a town, etc.
- O'Neill Sea Odyssey's "Investigations in a National Marine Sanctuary" is intended to be a guide to a hands-on field trip completed by students in grades 4-6, but many sections (which are easy to find quickly due to the layout) are full of in-depth yet simple information on ecology and the threats posed to them, and in turn to humans, by plastics, pollution, and climate change. Even if only these sections are used and no field trip is performed, this is an excellent source to give an overview of these topics to students of all ages.
- Tangaroa Blue's Marine Debris Education Kit provides simple but detailed PDF and Powerpoint files for all grades up to early high school. This program is based on Australian Curriculum, but is completely understandable and relevant in any classroom setting. It covers the harm caused by marine debris, how marine debris has become an issue, and solutions to the problem. It encourages and formats discussions and activities on the subject as well.



Keep Learning, Keep Helping! Cont.

There are always ways to learn more about the issues beguiling our oceans and our environment. The more you know, the more you can help to end these issues.

HOW TO DO IT:



- The California Coastal Commission's "Waves, Wetlands and Watersheds" includes information and activities specifically made for grades 3-8, as well as a section meant for all education levels. This focuses on species in wetlands and coastal areas, and how human actions are a threat to them.
- The Inland Ocean Coalition's website is full of professional level material on issues impacting the environment and ecology, and focuses on how everyone, even those who are nowhere near the coast, can make an impact on the situation. This includes many consumer habits which directly harm the environment, such as using sunscreens with chemicals that can harm wildlife.
- The University of Hartford's Marine Debris Project provides an extremely adaptable guide to running a course on environmentalism based on materials by the NOAA. The course can be adapted for any location, level of education, and specific focus.
- UN Environment's "Back to School Plastic Challenge" gives a simple but comprehensive outline of information and structured activities to reduce your own plastic consumption, make your school or community more sustainable, and support sustainable businesses. The included materials apply to all levels of education, community efforts, business policy, and personal behaviors.
- The Plastic Pollution Coalition's webpage on Curriculum, which serves as a directory to find activities and educational materials for all levels of education and involvement, including most of those listed above. All materials listed on this webpage come with a provided summary and a link to view and/or download them, making it incredibly easy to find and access the materials you need.



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