

Plastic Pollution in the Oceans

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Outline

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- ▶ Ethical Risks
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- ▶ Lessons Learned
- ▶ What to do now

Introduction

- Threat to Marine Life
 - ▶ Ocean Acidification
 - ▶ Overexploitation
 - ▶ Extinction of Species
 - ▶ Sea Water Level Rising
- Current Major Threat
 - ▶ Plastic Pollution

“As plastic manufacture and use increases and subsequent disposal at sea becomes more extensive, the impact of discarded plastic on birds inhabiting the marine environment may also be expected to increase” (Azzarello and Van Vleet, 1987).



Plastics and Their Use

- Derived from petrochemicals.
- Single-Use Plastics
 - ❖ Plastics that are used only once before throwing
 - ▶ Plastic bags
 - ▶ Straws
 - ▶ Coffee stirrers
 - ▶ Soda and water bottles
 - ▶ Most food packaging



Why so much Waste?

- Why so much plastic waste
 - ▶ Low recycling
 - ▶ Half of the produced plastics are disposable
- Long lasting
 - ▶ Exist under sediments
 - ▶ Away from UV



Plastic in the Ocean

- First plastic pollution observed by scientists
 - ▶ During plankton study in 1970s
 - ▶ Considerable studies of impacts of plastic on marine birds (since early 1980's)
- Effects
 - ▶ Ecological
 - ▶ Environmental
 - ▶ Health
 - ▶ Economical



Transport of Plastics to Ocean



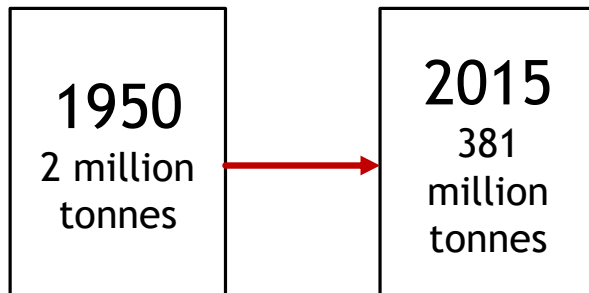
- Littering
- River
- Microbeads
- Fishing and Recreation
 - ▶ 52% ocean plastics
- Accidentally spilled plastic

Plastic Pollution in the Oceans

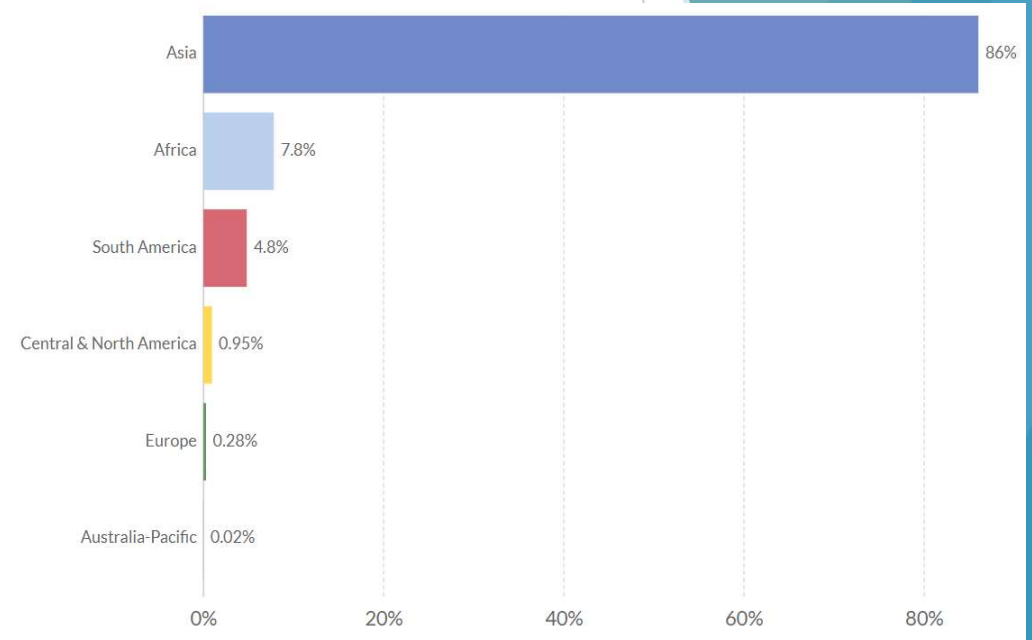
- The National Academy of Sciences (1975) estimated that $\sim 4.5 \times 10^4$ metric tons of plastic were being discarded at sea annually.
- The amount of mismanaged generated plastic waste by a coastal population of a single country ranges from 1.1 to 8.8×10^6 tons per year, with the top 20 countries' mismanaged plastic waste encompassing $\sim 83\%$ of the total plastic discharges into the marine environment (Jambeck *et al.*, 2015).
- Plastic pollution has increased from 0.5 to 260×10^6 tonnes per year since 1950 (Heap, 2009).
- There are more than 5.25 trillion plastic pieces weighing more than 268,940 tons afloat at sea (Eriksen *et al.*, 2014).

Statistics

- Production in large quantity after world war II.
- Increase in plastic production



- Majority of the top 20 polluting rivers are from Asia
 - ▶ Contributing to 67 % of river input



Contribution to plastic pollution by region

Lebreton *et al.* (2017)

Recent News



- Pregnant whale found in Italy
 - ▶ Was dead with 50 pounds of plastic
- Young whale in Davao Gulf of the Philippines on March 16
 - ▶ Was dead with 90 pounds of plastic.

Ecological Effects

- Severe challenges to find places for dumping plastic
- Taking up animal habitat
- Affecting ground water
- Pollutants attached with plastic are ingested by animals and marine life
- Around 135,000 whales are affected annually by plastic waste

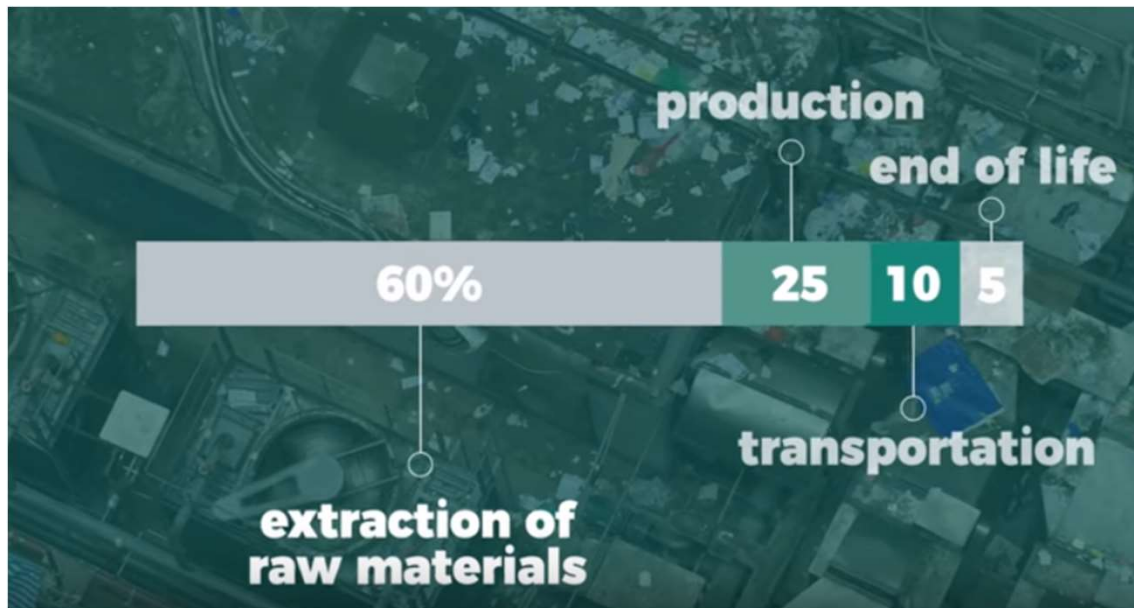


Animal dying due to malnutrition and starvation



Sea Albatross dead after ingesting plastic

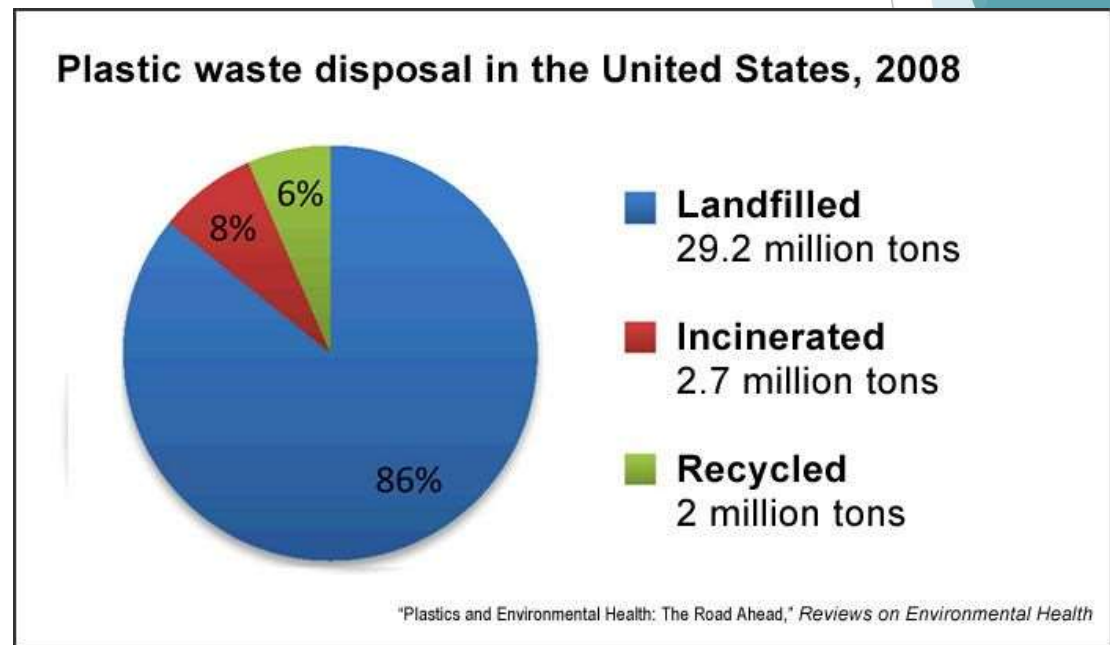
Environmental Effects



Source: English Environment Agency

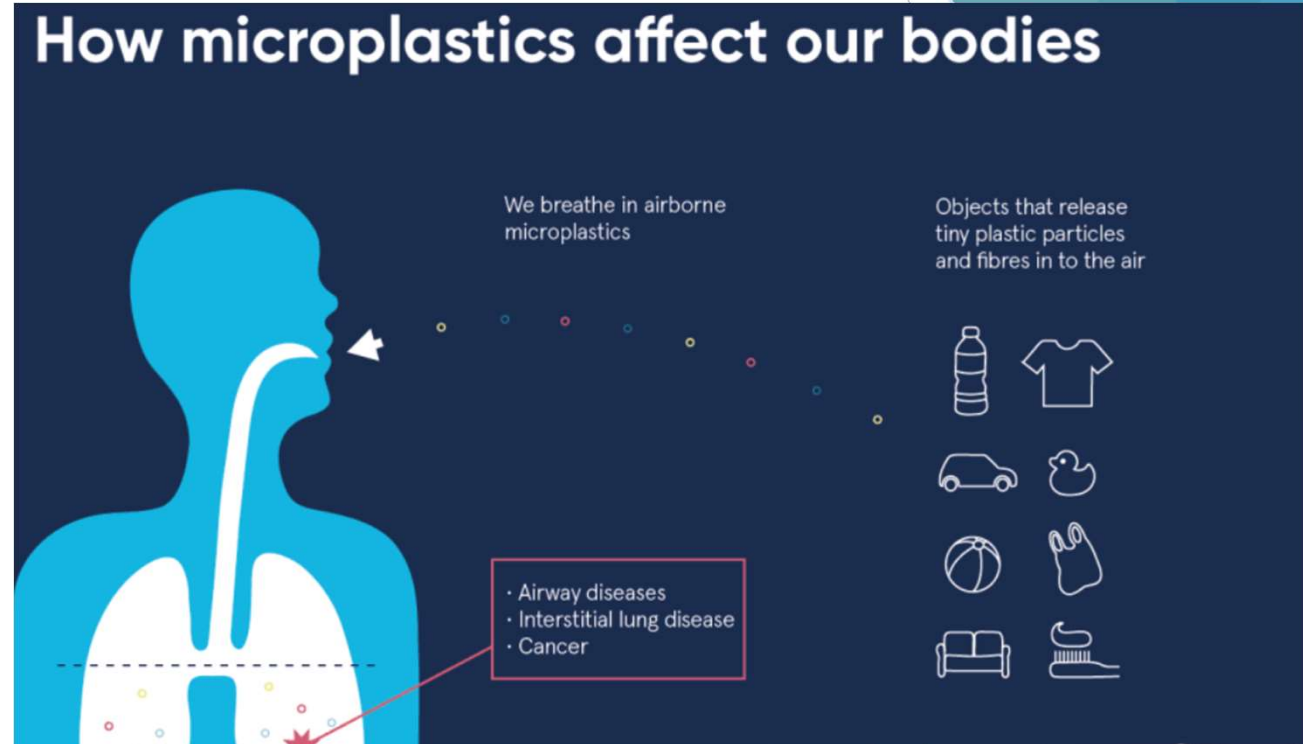
Major Environmental Impacts:

- ✓ Serious threat to animal life
- ✓ Plastic trash vortex
- ✓ Littering problem
- ✓ Loss of resources
- ✓ Green house gases



Health Effects of Plastics

- ✓ Carcinogenic effect
- ✓ Asthma
- ✓ Infertility
- ✓ Defects in birth
- ✓ Lose of immunity



Microplastics Getting Inside our Body

- ✓ Breathing near places where plastic are burnt
- ✓ Intense odor coming after opening new plastic items
- ✓ Using cosmetics from plastic containers
- ✓ Having hot coffee or drinks in a plastic container
- ✓ Using same plastic bottle for drinking water
- ✓ Using plastic container in microwave



The Choice is Yours



paper

cloth

Ethical Risks and Issues

There are terrestrial aspects to plastic pollution:

- Drainage systems become clogged with plastic bags, films, and other items, causing flooding.
- Land birds, such as the reintroduced California condor, have been found with plastic in their stomachs, and animals that normally feed in waste dumps for instance, the sacred cows of India – have had intestinal blockages from plastic packaging.
- The mass of plastic is not greater than that of other major components of waste, but it takes up a disproportionately large volume.

Ethical Risks and Issues

- As waste dumps expand in residential areas, the scavenging poor are often found living near or even on piles of residual plastics.
- Governments have done little and claim they need to focus on more important issues.
- Underdeveloped countries don't have the necessary funds to enforce stricter anti-pollution laws.

Economic Implications

- **Less Recreational Income**
 - ▶ The ocean pollution causes the sea water to become toxic. The coastal area could become dangerous and less people will come.
- **Coral Reefs Loss**
 - ▶ It cost trillions of dollars for the world to take care of coral reefs. That also includes all the cost for trying to recover them from bleaching. Coral reefs are very vulnerable to the condition of the ocean.
- **Money Loss from Cleaning Litter**
 - ▶ Due to products that are thrown away every day, many end up floating in the ocean especially plastic waste. The cost spent for these clean ups is very high.

Economic Implications (cont'd)

- **Money Loss in Shipping**
 - ▶ Industries that rely on renting ships or yachts feel the negative effect from ocean pollution.
- **Money Loss in Aquaculture**
 - ▶ Aquaculture depends on the sea water but the pollution is affecting their income growth too. People who specialize in aquaculture must spend more money to clear out all their equipments.
- **Loss of Income in Agriculture**
 - ▶ Some agriculture areas receive negative impacts from pollution, such as strong wind bringing waste to their farm.

Economic Implications (cont'd)

- Disrupted Shipping
 - ▶ They cannot operate properly due to trash.
- Increased Cost for Marine Debris Injuries
 - ▶ People can get hurt from debris and plastic pollution.
- Dredging Sea Bed
 - ▶ Cleaning up the waste costs money and time.
- Destroyed Important Equipment
 - ▶ Cables and other equipment can get destroyed on the sea floor from pollution.
- Less Sponges Production
 - ▶ Sponges die out from the pollution.
- Decrease in Medicine Sources
 - ▶ Medicine that is found in the ocean will become more expensive as it becomes more rare.

Lessons Learned

- Plastic was intended to make our lives easier, but now it is a product that we have become dependent on.
- The value of our ocean is indispensable and must be protected.
- The true nature and severity of plastic in our oceans was not discovered until the 21st century.
- People and organizations have become active in cleaning our oceans, but our dependency on plastic is still too large.

Lessons Learned (cont'd)

We must look at the origins of this disaster in order to understand potential solutions better

- What are the main uses of plastic?
 - ▶ Food wrapping, beverage bottles, grocery bags, and straws
- Which countries produce the most plastic?
 - ▶ China, Indonesia, Philippines, Vietnam, and Sri Lanka

What is being done?

- In 2019, Peru banned visitors to their national parks and museums from bringing single-use plastics.
- Supermarkets in Thailand and Vietnam have swapped plastic packaging for banana leaves.
- Recently, New York became the second state to ban plastic bags.
- San Francisco International Airport is banning the sale of single-use plastic water bottles.
- The Aquarium Conservation Partnership has started campaigns to limit plastic use, such as “No Straw November” where they eliminated the need for 5 million straws.
- The New Plastics Economy Global Commitment is striving to create a more circular economy for plastics and prevent landfills from growing.
 - ▶ Companies include: Nestle, Coca-Cola, L’Oreal, and H&M

Sustainable Development Goal #14

Life Below Water:

“Conserve and sustainably use the oceans, seas, and marine resources for sustainable development”

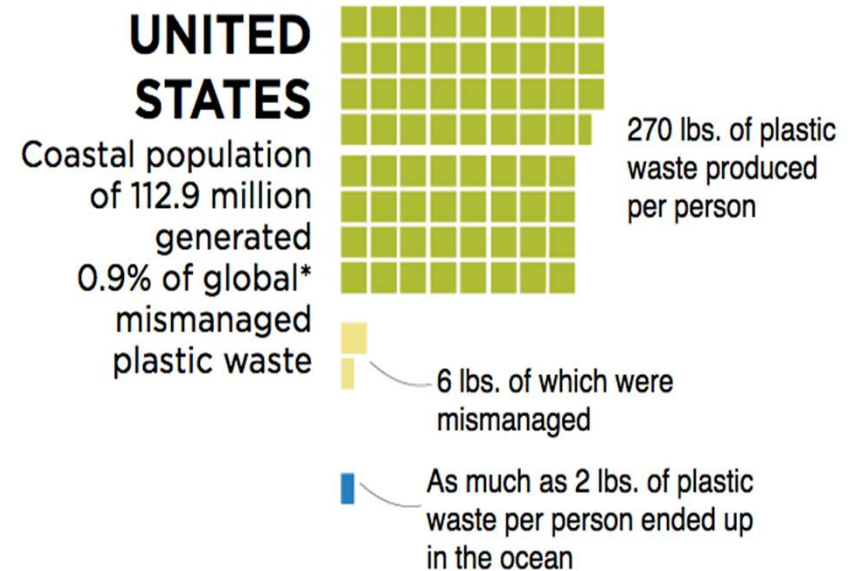


What Needs to be Done?

- Waste management and recycling reform
- Decrease and phase out single-use plastics
- Consumer awareness of current consumption and dumping practices
- Current work of non-profits and companies should be amplified to utilize normal lifestyle practices for everyone

What we can do?

- Realize your own plastic consumption and dependency
- Try to reduce this dependency and encourage others to do so as well
- Support groups that are protecting and cleaning the oceans

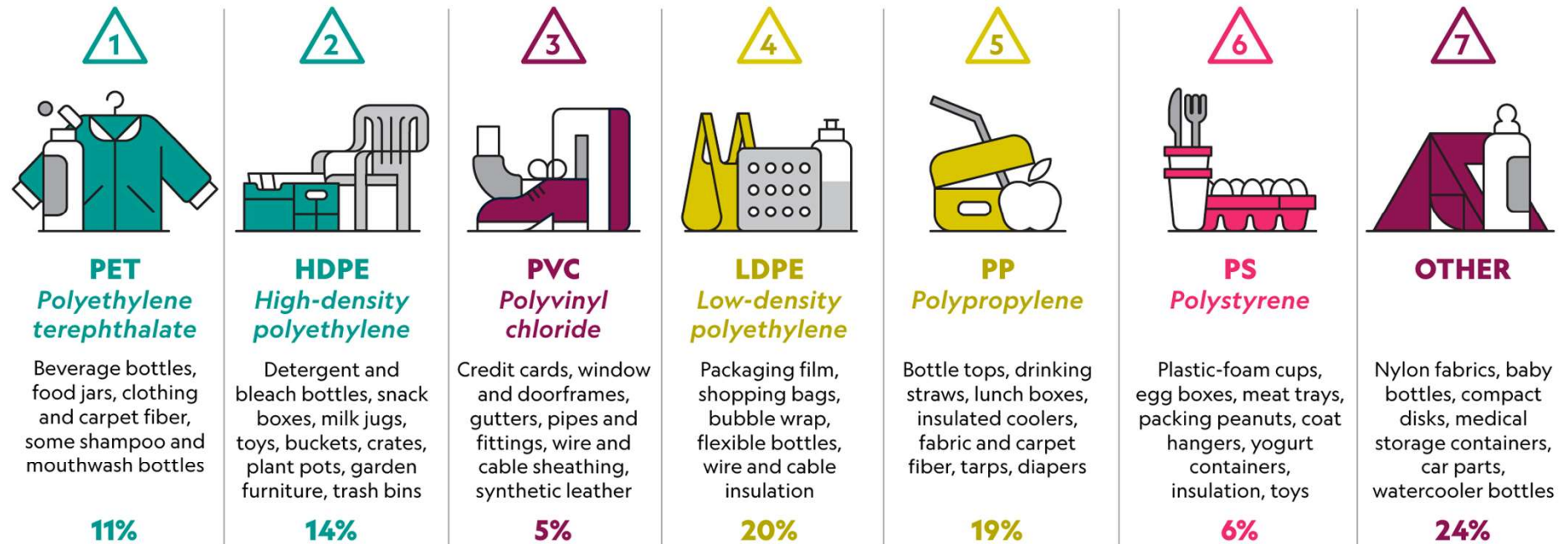


THE CHALLENGE OF RECYCLING

Globally, 18 percent of plastic is recycled, up from nearly zero in 1980. Plastic bottles are one of the most widely recycled products. But other items, such as drinking straws, are harder to recycle and often discarded.

Ease of recycling by type*

- △ Easy
- △ Manageable
- △ Difficult
- △ Very difficult



↑
Percentage of global plastic waste, 2015

Conclusions

- The threat of plastic pollution is global, pervasive, and increasing, representing an ocean emergency.
- Plastic pollution has been observed in subtropical gyres, closed bays, gulfs, and seas surrounded by densely populated coastlines and watersheds.
- Plastic pollution in the world's oceans is a serious problem; there are more than 5.25 trillion plastic pieces weighing more than 268,940 tons afloat at sea (Eriksen *et al.*, 2014).
- Sixteen of the top 20 plastic producing countries are “middle-income” countries, where fast economic growth occurs, but waste management infrastructure is lacking (Jambeck *et al.*, 2015).
- It has been projected that mismanaged plastic in the U.S. will increase by 22% by 2025 (Jambeck *et al.*, 2015).
- Plastic pollution pose significant threats to wildlife (Wilcox *et al.*, 2015; Azzarello and Van Vleet, 1987).
- Long-term solutions will likely include waste reduction (reduce, reuse, and recycle) and “downstream” waste management strategies (e.g., expanded recovery systems, expanded plastic producer responsibilities, etc.)



Questions?