Outline

Sections 1-4 with 3-5 paragraphs per section

Section 1

1. **Opportunities & Challenges**
    - Amount of plastic pollution
    - Why is plastic pollution an issue….(killing animals affecting us as well
2. **Naked "pros"**
    - Only cost more because factories and an extra amount of money
    - How much plastic do Avg people use?
    - Convience/economics
3. **Naked "cons"**
    - Food chain
    - Economics (oil companies work with plastic companies)
    - Energy and environmental impact of plastic
4. **Why is this a pressing problem now?**
    - 50 years we couldn't do anything…why?
    - What we used to store food 100 years ago

Section 2 (technological background of plastics)

1. **History of plastics**
    - 1840s American Charles Goodyear and the British Thomas Hancock took out patents on rubber treated sulfur
    - Big breakthrough is in 1907 invention of Bakelite by Leo Baekeland
2. **Types of plastics**
    - Most common plastics are: PET, PE-HD, PVC, PE-LD, PP, PS, and O
3. **How does plastic breakdown**
    - Photochemical dissolution of buoyant microplastics
4. **Microplastics & ocean pollution**
    - 5.25 trillion pieces of plastic waste in our oceans
    - Its estimated over 1 million seabirds and 100,000 sea mammals die from ocean pollution

Section 3 (application of plastics)

1. **Use of plastics**
    - Early 1900's electrical insulation materials for circuit breakers and switches
2. **Plastic recycling**

- Phase boundaries
- Mechanical recycling where plastic is washed, ground into powders and melted
- Chemical recycling where plastic is broken down into basic components
- Heat compression
- Thermal depolymerization

3. **Alternatives (two paragraphs)**
    - Plant based plastics
    - Biodegradable plastics

Section 4 (future questions)

1. **Biodegradable plastic**
    - Materials derived from biological sources like starch, cellulose, fatty acids, sugar, proteins
    - Materials consumed by microorganisms
2. **Comparison to recall system**
    - National beverage container deposit legislation
    - Impact of employment, natural resource consumption, capital requirements, litter, solid waste, environmental quality, consumer convenience, and prices
3. **3D printing**
    - Easier to make
    - Does not require a huge work load OR workers
    - Quick
    - Can be made from biodegradable material
    - "3D printers produce objects using wheels of filaments made of biodegradable plastic PLA (Polylactic acid), an environmentally friendly material derived from corn starch, or ABS (Acrylonitrile butadiene styrene) polymer derived from fossil fuels."

4. **What now? Where do we stand?**
    - Need to find a safer way of storing
    - Biodegradable plastics are our safest bet
    - Need to make alternatives the top priority

Text boxes:

1. Plastic definition: *specifically*: any of numerous organic synthetic or processed materials that are mostly thermoplastic or thermosetting polymers of high molecular weight and that can be made into objects, films, or filaments ("Plastic." *Merriam-Webster.com*. Merriam-Webster, 2011.Web. 8 May 2011.)

2. Microplastic: small pieces of plastic, less than 5mm in length, that occur in the environment as a consequence of plastic pollution. Microplastics are present in a variety of products: cosmetics, synthetic clothing, plastic bags, and bottles. (Rogers K. 2019 Apr 22. Microplastics. Encyclopædia Britannica. [accessed 2020 Feb 25]. https://www.britannica.com/technology/microplastic)

Estimated page count (without pictures): 4-6

Literature

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Reisser J, Shaw J, Wilcox C, Hardesty BD, Proietti M, et al. (2013) Marine plastic pollution in waters around Australia: characteristics, concentrations, and pathways. *PLoS ONE* 8(11):1-11. Retrieved from: doi:10.1371/journal.pone.0080466 https://journals.plos.org/plosone/article/file?type=printable&id=10.1371/journal.pone.0080466

Prata JC. 2017 Dec 21. Airborne microplastics: Consequences to human health? Environmental Pollution. [accessed 2020 Feb 25]. https://www.sciencedirect.com/science/article/pii/S0269749117307686

Plastic production alone provides ~600k jobs
https://www.bls.gov/oes/2018/may/naics4_326100.htm

Plastic waste can be used to produce energy which provides a way to dispose of the plastic while decreasing need for burning fossil fuels
https://www.sciencedirect.com/science/article/pii/S0360544217307818#fig1

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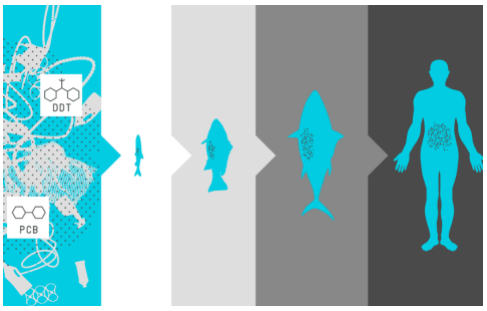
https://www.researchgate.net/profile/Rajmund_Kuti/publication/329970322_The_Environmental_Impact_of_Plastic_Waste_Incineration/links/5c26474292851c22a34b5dde/The-Environmental-Impact-of-Plastic-Waste-Incineration.pdf

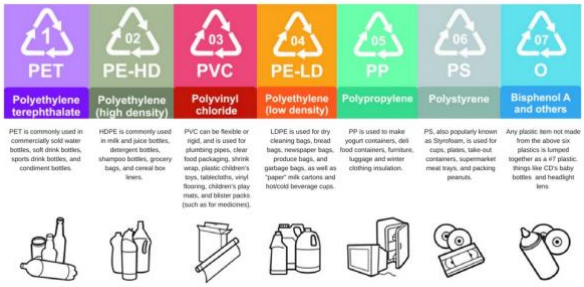
https://www.sciencedirect.com/science/article/abs/pii/S0025326X14008571

https://pubs.acs.org/doi/abs/10.1021/acs.est.5b04026

Pictures in Section 1:



Pictures in Section 2:



Pictures in Section 3:

Pictures in Section 4:

PLASTICS
BREAKDOWN

WE USE TONS OF PLASTIC. IT'S IN **EVERYTHING** FROM PACKAGING TO TOYS, TO THE DASHBOARD IN YOUR CAR. MASSIVE AMOUNTS OF IT END UP IN THE OCEAN. IT CONTAINS TOXINS, AND ABSORBS MORE TOXINS. IT ENTANGLES AND KILLS SEA LIFE. IT CERTAINLY DOESN'T BIODEGRADE. BUT THERE ARE WAYS WE CAN HELP.

ONEWORLD ONEOCEAN

BAD FOR THE OCEAN, BAD FOR US

92.5% OF DEAD SEABIRDS (NORTHERN FULMARS) IN A STUDY HAD INGESTED PLASTIC IN AMOUNTS EQUAL TO **5%** OF THEIR BODY WEIGHT.

54% OF THE **120** MARINE MAMMAL SPECIES ON THE THREATENED LIST HAVE BEEN OBSERVED **ENTANGLED** IN OR **INGESTING** PLASTIC.

AMERICANS USE ROUGHLY **100 BILLION** PLASTIC BAGS PER YEAR. **PLASTIC BAGS CAN TAKE 400 TO 1,000 YEARS TO DECOMPOSE**, BUT THEIR CHEMICAL RESIDUES REMAIN FOR YEARS AFTER.

HOW **BIG** IS THE PROBLEM?

73.9 MILLION POUNDS OF PLASTIC ARE SPREAD THROUGHOUT THE WORLD'S GYRES.

IT'S EXPENSIVE TOO...
AS OF 2009, SOUTHERN CALIFORNIA CITIES HAD SPENT OVER **$1.7 BILLION** TO KEEP WATER-WAYS FROM BEING OVER LEGAL TRASH LIMITS.

CHEMICALS USED IN PLASTICS LIKE PHTHALATES AND FLAME RETARDANTS HAVE BEEN FOUND IN FISH, MOLLUSKS, SEA MAMMALS, AND OTHER SEA LIFE

HOW MUCH PLASTIC ENDS UP IN THE OCEAN?

CIRCULAR CURRENTS **(GYRES)** THOUSANDS OF MILES ACROSS COLLECT IMMENSE AMOUNTS OF PLASTIC IN ALL OF THE WORLD'S OCEANS.
MICROPLASTIC CONCENTRATIONS IN THE NORTH PACIFIC GYRE **INCREASED 100X IN THE PAST 40 YEARS.**

CURRENTS CARRY THE PLASTIC EVERYWHERE.
RUBBER DUCKS LOST FROM A SHIPPING CONTAINER IN THE **NORTH PACIFIC** WERE FOUND NEAR **SCOTLAND**, IN THE NORTH ATLANTIC. TSUNAMI DEBRIS FROM JAPAN ARRIVED IN **NORTH AMERICA**, AFTER CROSSING THE LARGEST OCEAN ON EARTH **IN JUST 10 MONTHS.**

PLASTIC IS MADE OF TOXINS

331 MILLION BARRELS OF PETROLEUM & NATURAL GAS LIQUIDS

WERE USED TO MAKE U.S. PLASTIC PRODUCTS, EQUAL TO ABOUT **5%** OF THE NATIONAL PETROLEUM CONSUMPTION.

PLASTICS CONTAIN **TOXIC** CHEMICALS

FACT:

MORE TOXINS ADHERE AS PLASTIC BREAKS DOWN

IN PLASTIC FROM **THE NORTH PACIFIC GYRE:**

40% CONTAINED PESTICIDES LIKE DDT.
50% CONTAINED PCBs (**BANNED** BY U.S. CONGRESS IN 1979, FOR HAVING VARIOUS **NEUROTOXIC** EFFECTS). **80%** CONTAINED PAHs (MAY BE **HIGHLY CARCINOGENIC**).

FLOATING TOXIC MICROPLASTICS ARE OFTEN INGESTED BY MARINE LIFE, WHICH IN TURN IS CONSUMED BY US.

RESEARCH PROVIDED BY OCEAN CONSERVANCY, 5 GYRES, AND OTHERS INFOGRAPHIC BY WWW.ABRAHAMTHINKIN.COM FOR ONE WORLD ONE OCEAN | 2012

WHAT CAN WE DO TO HELP?

USE LESS PLASTIC

8 OF THE TOP 10 ITEMS FOUND ON BEACHES DURING LAST YEAR'S INTERNATIONAL COASTAL CLEAN-UP DAY WERE PLASTICS RELATED TO EATING & DRINKING.

PLASTIC BAGS > REUSABLE BAGS, NO BAG **STRAWS >** NO NEED **UTENSILS >** USE NON-PLASTIC
TO GO CUPS > REUSABLE MUGS & CUPS **ELECTRONICS >** REPAIR OR UPGRADE. RECYCLE THE OLD ITEM WHEN YOU NEED SOMETHING NEW.
BOTTLED WATER > REUSABLE WATER BOTTLE **PACKAGING >** BUY ITEMS WITH MINIMAL PACKAGING
CLOTHING > BUY NATURAL MATERIALS. SYNTHETIC FIBERS END UP IN THE OCEAN