Plastic and Marine Hazards Reduction Bylaw
White Paper

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This document provides background and information supporting the "Plastic and Marine Hazards Bylaw" proposal and explains the reasoning behind the proposed bylaw. It is divided into sections: Plastic Bag Regulations, Polystyrene Regulations, Biodegradable and Compostable Plastics, Balloon Regulations, and Plastics in the Marine Environment. It also provides a bibliography listing many of the sources consulted.

Recent research suggests that 90.5% of plastic waste has never been recycled, with about 12% having been incinerated and the remaining 78% making its way into landfills or becoming litter.

I. Plastic Bag Regulations

Massachusetts residents use two billion plastic bags a year, which is about one bag per person per day. This is nearly 250 bags for every foot of our state's coastline every year. Indeed, single-use plastic checkout bags often end up in the ocean, where they are a hazard to marine life. They look very much like jellyfish, a common food for sea turtles and marine mammals. Once ingested, they can block the esophagus, causing suffocation. Sea turtles in particular have throats meant to help swallow jellyfish, and so are unable to egest plastic bags and balloons once swallowed. In the stomach, plastic bags inhibit the processing of food and the absorption of nutrients and can lead to malnutrition, starvation and death.

As of November 2019, 122 municipalities in Massachusetts have enacted some version of a plastics checkout bag regulation, representing over 50% of the state's population. Every town on Cape Cod, except Eastham, has a bylaw or regulation in place. During the May 2019 Eastham Town Meeting, a petition article was passed requiring the banning of single use plastic bags. A bylaw is required before a ban can be implemented. All of the bag bylaws in the Commonwealth have the same intent: to protect the ocean and its wildlife, as well as humans, from the hazards of plastic waste. Some of the laws affect only bags from grocery stores while others, such as the one from Wellfleet, includes all retail establishments.

Review of Plastic Checkout Bag Regulations

Plastic bag bylaws for Massachusetts can be found at these websites:
http://www.massgreen.org/plastic-bag-legislation.html
http://www.baglaws.com/legislation.php?state=Massachusetts

And Massachusetts plus every city in America, here:
https://www.forbes.com/sites/trevornace/2018/09/20/heres-a-list-of-every-city-in-the-us-to-ban-plastic-bags-will-your-city-be-next/.

Most bag laws fit into one of four categories.

1. Ban the plastic bag and leave replacement options open.

2. Ban the bags and set performance standards for replacements that usually include 100% recyclable paper bags made with a minimum of 40% post-consumer recycled content and sometimes include reusable plastics bags of at least 3.5 or 4.0 mil thick. Almost all of them suggest reusable bags of various sorts. Some require that replacement bags be durable enough for a certain number of reuses.
3. Ban the bags and set performance standards for replacements (as above) and add a nominal fee of five or 10 cents to discourage the use of paper bags, which have environmental issues of their own and can increase the solid waste that municipalities need to handle.
4. Don't ban the bags but set a fee of five or 10 cents for each bag to discourage use. Some laws extend the same fee to paper bags.

Where fees have been authorized, there are a few different schemes for the disposition of the funds: the fees go to the merchants, the fees go to the municipality, or the funds are split between the two. In Washington, D.C., the bag fee is split between the merchant and the city, with the city's portion going to the Anacostia River restoration project.

Why Bag Fees Work

Bag fees help reduce the number of both plastic and paper checkout bags for a variety of reasons. If offered a free bag, most people will take it. It is there and it makes things easy and they don't have to remember to bring bags from home. So, banning plastic bags without adding a fee for a replacement paper bag, ends up encouraging people to create more solid waste, since most bags are not recycled, adding to the municipal cost of handling waste. Also, people don't like paying for something that they used to get for free, so adding in a bag fee makes it more likely that people will bring their own bag or refuse a bag entirely. Further, a study suggests that charging a fee changes the status quo, since it requires people to make an affirmative choice of whether they are willing to pay the fee or not. This gives them time to think about the consequences of using a non-reusable bag. Places that instituted fees with a change in their bag policies, have noticed a marked decrease in the use of both kinds of bags.

Paper or Plastic?

Plastic bags are made from hydrocarbons – oil or natural gas – which are non-renewable resources that generate greenhouse gases. Much of the natural gas in this country comes from hydrofracking, a process that pumps vast amounts of water into shale to fracture the rock and release the gas, with chemical additives used to make the process more economical. It uses 6-8 million gallons of water each time. The fracking liquid returns to the surface with heavy metals and radioactive materials that it picked up below, and potentially releases heavy metals and radioactive materials into rivers, streams, and underground water supplies.

Most municipalities do not collect thin-film plastics, such as grocery bags, for recycling, including Eastham. So, the bags end up in landfills, being incinerated (where they can release toxic gases and particulates), or as litter, at which point they can make their way into our waterways and onto our beaches.

Paper bags have their own issues. Chemical fertilizers are often used on the trees grown for wood pulp. The pulping process uses between 4,500 and 17,000 gallons per ton of paper. Paper bags are heavy, and transport requires the use of petroleum. Paper bags, like most other things, are seldom recycled, and end up as solid waste.

The draft Bylaw recognizes that both paper and plastic bags have issues and seeks to reduce the use of both through the implementation of a ban on plastic bags and a fee for paper bags. It proposes a minimum fee of 10 cents for each bag, with half going to the merchant and half going to the Town of Eastham for conservation projects.

II. Polystyrene

As of November 2019, 39 municipalities in Massachusetts have laws or regulations pertaining to polystyrene use, including Wellfleet, Provincetown, Orleans, and Dennis. At the May 2019 Eastham Town Meeting a petition article was passed requiring the regulation of polystyrene food service ware. A bylaw is required before such a ban can be implemented. Links to polystyrene laws in Massachusetts and other places can be found on this website:

http://www.massgreen.org/polystyrene-legislation.html

Polystyrene is in wide-spread use because it has been fairly cheap to produce, and the foam form provides good insulation. But the environmental cost may outweigh the benefits to restaurants and grocery stores, especially now that many affordable and sustainable alternatives are available. Alternatives to polystyrene include but are not limited to biodegradable paper, woodenware, bamboo fiber, PET plastics, reusable polypropylene, biodegradable plastics, PLA compostable plastics and sugarcane-based plastics. Restaurants with dishwashing facilities also have the option of transitioning to durable reusable ware.

Polystyrene is made from petrochemicals, such as natural gas, and is based on styrene and benzene, which is a neurotoxin and probable carcinogen. It releases greenhouse gases as it degrades. Natural gas in this country is largely retrieved through hydrofracking, which poses a threat to local water resources, and can release heavy metals and radioactive elements which can spill or be dumped into rivers and streams. Underground water supplies can also be contaminated by fracking, through the migration of gas and frack fluid underground.

Polystyrene comes in two forms, rigid (extruded polystyrene, XPS) and foam (expanded polystyrene, EPS), which might be better known under the trade name Styrofoam. The foam form is used for plates, insulated beverage cups and bowls, clamshell food containers, and trays. It is used for packing peanuts and other packaging material, buoys, and coolers. Rigid polystyrene is used for clear food containers, plates, bowls, beverage cups and bowls, utensils, and straws.

To make EPS, small beads of the polymer polystyrene are steamed with chemicals until they expand to 50 times their original volume. After cooling, the pre-expanded beads are blown into a mold, such as that of a drink cup, bowl or cooler, then steamed again, expanding further until the mold is completely filled and all of the beads have fused together. The finished product is lightweight, inexpensive and about 95% air, with good insulating properties and cheap manufacturing costs.

The EPA estimates that Americans throw away about 25 billion foam coffee cups a year. These are not readily recycled. The bulky form of foam polystyrene is not accepted in Massachusetts (and many other places) for recycling. Because the foam is 95% air and is often contaminated with food residue recycling is impractical. Due to the chemical process that turns polystyrene beads into EPS, you can't take recycled Styrofoam cups and make molds again because the foam had already been expanded, and it can't be used a

second time. You need to start again with virgin polystyrene beads. The rigid form is also seldom recycled. It does not biodegrade, so it will persist in the environment forever.

Polystyrene foams easily break down into little foam beads (microplastics) that appear to fish and other marine life as food. This is dangerous for a number of reasons. EPS acts like a pollutant sponge, picking up and concentrating toxic chemicals in the ocean. Marine animals ingest these, and the chemicals can then leach out and cause harm. Even without the chemical absorption, the microbeads appear to marine life as food, and the tiny bits of foam replace the foods that they would normally eat, meaning they are not getting the nutrients they need to survive. Further, and most troubling, these EPS beads and toxins work their way up the food chain and into humans.

Extruded polystyrene is also not recycled and often ends up in landfills, incinerated or as litter, making its way into our oceans and on to our beaches. Once in the ocean, it creates a hazard for marine life. The hard plastics, like cutlery, breaks into sharp and jagged pieces of plastic that can cause damage to the digestive tracts of marine animals when ingested. The plastics continue to fragment into smaller and smaller pieces, becoming microplastics, as discussed above.

III. Biodegradable and Compostable Plastics

Biodegradable or compostable plastics, such as those made of PLA (polylactic acid) are gaining popularity as a replacement for polystyrene food service products. In theory, they break down naturally in the environment or may be composted. This may sound great, as the majority of plastics in use today never break down. The problem is that in most cases biodegradable and compostable bioplastics will only break down in a high-temperature industrial composting facility that reaches temperatures of at least 140°F, and not in your average household compost bin. This is generally not made clear to consumers and thus is misleading. Nor is it made clear that these alternative plastics cannot or should not be added to the regular plastic recycling stream (for resins 1-6) because they will degrade the quality of the final recycled product. Not all industrial composting facilities accept PLA and other biodegradable plastics as they are seen as a contamination risk. These alternative plastics will not break down in the ocean and other waterways because the water is too cold.

Though these biodegradable plastics don't work well for a home user, we might think that they will work well for a food establishment, because they might be better able to arrange for proper composting. But many of these compostable plastics will be used for take-out orders and will be out in the general community, where there is no access to commercial composting. This means they are likely to end up being equivalent to traditional plastics with most ending up in the solid waste stream or as litter, and some of these will end up in the ocean, and become microplastics, supplanting some of the normal diet of marine life.

IV. Balloons

Balloons filled with lighter-than-air gases (such as helium) invariably escape custody and are often deliberately released. And what goes up, must come down. Balloons travel long distances before they burst or the helium escapes. When they land, it is often in the oceans, or they get tangled in trees or on power lines, creating a public nuisance and a hazard to wildlife. Their strings can entangle birds and small

mammals, causing injury or death. Mylar balloons are made of a conductive material and when they get tangled on power lines can cause outages.

In marine environments, balloons look very much like jellyfish, a common food source for sea turtles and marine mammals. Once ingested, the balloons can block the throat, causing suffocation. On entering the stomach and digestive tract, balloons can make it hard for the animal to absorb and process nutrients. It can make the animal feel full, causing it to take in less food. All of this leads to possible malnutrition or death by starvation.

Balloon strings can cause serious damage to sea turtles if ingested, twisting the intestines and causing them to fold in on themselves. This is very painful, and lethal as it makes it impossible for the animal to process food and waste. Balloon strings can also entangle sea birds, causing injury and death.

It is also important to note that helium itself is a dwindling, non-renewable resource. It used as a coolant for particle accelerators, MRI machines and superconductors, and has other important scientific uses.

V. Plastics in the Marine Environment

Approximately 8 million metric tons of plastic enters the oceans from land each year and that number is increasing. This doesn't include plastic debris dumped by ships or swept into the sea from natural disasters such as hurricanes. It is enough plastic to fill every foot of coastline around the world with five plastic grocery bags filled with plastic. Plastic found in the oceans is of every kind imaginable, including plastic grocery bags, bottles, food wrappers, toys, cigarette filters, fishing gear, and coffee stirrers.

Once plastic makes it into the oceans and other waterways, it is there to stay. It doesn't biodegrade and there is no practical way to remove it. Earlier sections touched on some of the hazards of this plastic, but perhaps the most dangerous thing that plastic does is fragment and keep fragmenting into smaller and smaller pieces over time into what are known as microplastics.

Five trillion. That is the accepted estimate for how many pieces of microplastic there are in the ocean, though recent research suggests that this might be vastly underestimated. Microplastic now makes up as much as 85 percent of plastic pollution around the world. In addition, some microplastics in the ocean are from microfibers. Microfibers are created when synthetic clothing, such as acrylic, polyester, fleece, and spandex is laundered in a washing machine. One fleece jacket can produce about 100,000 fibers in one wash alone. These fibers drain from the washing machine and eventually make it into the ocean.

Why are microplastics and microfibers so dangerous? Because they replace the lower orders of food in the oceans and are ingested by everything from zooplankton and oysters to fish and whales. Not only does this deny adequate nutrients to these animals, but plastics often absorb other toxic chemicals as they float around the ocean, which can leach into the creatures that ingest them. And since these microplastics work their way up the food chain, they end up on our dinner plates. Microfibers in particular, being so small, are even working their way into our bloodstreams, though the science is not yet clear on any hazards that represents to our health.

Microplastics have recently been found in beer and in arctic ice. Plastics have been found in the Mariana Trench, 35,849 feet down in the deepest caverns of our oceans.

VI. Summary

Humans have become reliant on plastics because they are inexpensive and durable, but there is ample reason to be concerned about the hazards they present to ourselves, our oceans and wildlife, and our planet. The best way to reduce plastic waste is to simply use something else. While this is not always practical, there are a variety of sustainable and affordable options to replace plastic checkout bags, plastic straws and polystyrene items.

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