



Keeping Plastic out of Puget Sound

Why Washington Should Join the Global
Movement to Reduce Plastic Bag Pollution



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Executive Summary

Puget Sound is threatened by plastic pollution. Plastic trash persists for hundreds of years and can kill or harm whales, turtles, seabirds and other marine animals.

Single use plastic bags are a significant part of the problem. To reduce ocean pollution and protect the environment, **dozens of national and local governments across the planet have taken official action to reduce or eliminate single use plastic bags.**

State and local governments in Washington should follow their lead and ban the use of plastic grocery bags.

Plastic bags contribute to the pollution of Puget Sound.

- Washingtonians use over 2 billion plastic bags per year. Nationwide, less than 6 percent of plastic bags are

recycled. Instead, they end up sitting in landfills, littering streets, clogging streams, fouling beaches, or floating in the Sound.

- Researchers at the University of Washington-Tacoma have found plastic pollution in every water sample they have taken from Puget Sound.
- In April 2010, a dead grey whale washed up on the beach in West Seattle. It had 20 plastic bags in its stomach.
- In the Strait of Juan de Fuca, researchers found that 12.2 percent of gulls consume plastic – half of which was thin-film, like what plastic bags are made of.

- On beaches of Orcas Island, volunteers collected more than 10,000 pieces of micro-plastic in one day of cleanup work, including pieces of plastic bags.

More than 80 national and local governments around the world have taken action to protect the ocean by reducing the use of plastic bags.

- At least 20 nations and 88 local governments have passed bans on distributing thin plastic or other types of disposable plastic bags, including the nations of Italy, Kenya, Mongolia, Macedonia, and Bangladesh; the states of Maharashtra, India and Buenos Aires, Argentina; and the cities of Karachi, Pakistan and Telluride, Colorado.
- Approximately 26 nations and local communities have established fee programs to reduce plastic bag use and/or increase the use of reusable alternatives, including Botswana, China, Hong Kong, Wales, Ireland, Israel, Canada's Northwest Territories, Toronto, Mexico City, and Washington, D.C.

Bans and meaningful fee programs effectively reduce plastic bag pollution.

- Ireland, which in 2002 established a fee roughly equivalent to 28 U.S. cents per bag, saw plastic bag use drop by 90 percent within the first year.
- After Washington, D.C., implemented a much smaller 5-cent tax on plastic bags, the number of plastic bags distributed by food

retailers fell from 22.5 million per month to 3.3 million per month.

- The year after banning plastic bags at pharmacies and supermarkets in 2007, San Francisco businesses distributed 127 million fewer plastic bags, and cut overall bag waste reaching the city landfill by up to 10 percent.

Two Washington cities have already taken action to reduce plastic bag pollution.

- Edmonds was the first city in Washington to ban plastic bags, adopting a ban in 2009.
- More recently, Bellingham adopted a ban on thin-plastic carry-home bags and a 5 cents fee on paper bags in July 2011.
- Other cities, including Seattle, Lake Forest Park, and Mukilteo, are actively considering bag bans.

Much more progress can be made to reduce plastic pollution in Puget Sound and transform our throw-away culture.

- Education and recycling cannot keep pace with the generation of plastic bag pollution. For example, despite a 2006 law in California requiring retailers to place bag recycling bins in front of their stores, less than 5 percent of bags there are recycled.
- To make a real impact, all Washington cities and counties should restrict the use of plastic bags, and advocate for similar action at the state level.

Introduction

Puget Sound is an irreplaceable treasure. It is central to Washington's culture and our livelihood. Harbor seals play within our bays and thousands of salmon make their way through the Sound every year to spawn. Three endangered pods of resident orcas visit the Sound on a regular basis. Seabirds congregate on our beaches and in our harbors, belting out their familiar cries. And beneath the waves, the seafloor is filled with sea grasses and clam beds.

The Sound is also an incredibly valuable part of our economy. The benefits provided by Puget Sound – including food, protection from storms, attractions for tourism, and opportunities for recreation – contribute an estimated \$83 billion directly to the economy.¹

Unfortunately, Puget Sound and our oceans are also in trouble. Destructive

overfishing, global climate change, habitat loss, and toxic run-off are putting important marine ecosystems at risk. Many critical wildlife populations and historic salmon runs are in serious decline.

The problems facing Puget Sound and our oceans are varied and complex, from our overdependence on fossil fuels to our careless use of natural resources. However, many of these problems can be traced back toward an unreasonable expectation that our consumer activities don't impact the Sound despite growing evidence to the contrary.

To protect and preserve Puget Sound for the long haul, we need to recognize the real and increasing threat that plastic pollution poses. The most important way to accomplish this is to generate less trash.



These bags help us move groceries for a few minutes, but they pollute our environment for hundreds of years and threaten our wildlife.

Plastic bags – the single use kind you receive at many grocery stores – are a good place to start. These bags help us move groceries for a few minutes, but they pollute our environment for hundreds of years and threaten our wildlife. These bags represent a wasteful and unnecessary use of limited fossil fuel resources. Switching to reusable bags can cut down on the amount of plastic trash ending up in Puget Sound and begin to raise public consciousness about the need to make our communities more sustainable.

Banning plastic bags is an idea whose time has come. As this report shows, nations from Tanzania to Italy, and communities from Buenos Aires to Bellingham,

have taken action to reduce plastic bag pollution. While the list of policies covered in this report is not necessarily exhaustive, it does show the wide scope of action across the planet to protect our oceans, reduce litter, and use our natural resources more wisely.

By joining these global communities in banning plastic bags, Washington has an opportunity to build on its reputation for environmental leadership and become the first state in the U.S. to ban plastic bags. Each new county, city or town that takes action to reduce plastic bag pollution builds momentum towards a cleaner Puget Sound and ocean for current and future generations.

Plastic Bags Pollute Puget Sound

Plastic trash contaminates Puget Sound and litters its shoreline.

This litter, including plastic bags, poses a serious threat to wildlife in the Sound. Many marine species may mistake plastic for food. When they ingest plastic, they can choke, suffer digestive system blockages, or absorb toxic chemicals.

In April 2010, West Seattle residents found a grey whale, dead on the beach. A necropsy revealed that the whale's stomach was full of trash, including 20 plastic bags.² Further out in the Strait of Juan de Fuca, the Port Townsend Marine Science Center found that about 12.2 percent of the gulls nesting along the shores were consuming plastic. Half of

this plastic was thin film, which includes plastic bags.³

The problem is not limited to Puget Sound. According to the United Nations Environment Programme, every square mile of ocean contains 46,000 pieces of floating plastic, on average.⁴ About one thousand miles off the Washington coast, more than 100 million tons of plastic garbage has concentrated in an area known as the Great Pacific Garbage Patch.⁵ Churned by ocean currents, this toxic, plastic soup spans an area twice the size of Texas.⁶ Within this area, plastic outweighs plankton by up to six times during certain times of the day.⁷

Plastic pollution ends up in ocean animals. In June 2011, researchers at

UC San Diego's Scripps Institute of Oceanography published a study finding that nearly one in ten small fish collected in the middle of the Pacific Ocean had plastic in their bodies. The researchers estimated that world-wide, fish are eating as much as 24,000 tons of plastic each year.⁸ Over 260 marine species have been found with plastic in their stomachs or tangled around their bodies— interfering with feeding, movement and reproduction, and causing injury or death.⁹

Sea turtle, which feed on jellyfish, often mistake plastic bags for jellyfish and eat them.¹⁰ One study found that nearly 30 percent of turtle mortality in the eastern Moreton Bay region was due to plastic debris consumption. Half of the plastic in turtle stomachs was thin plastic, like the kind used to make plastic bags.¹¹

On Midway Island, over one thousand miles from any major city, is one of the largest nesting sites of the Laysan albatross. These birds soar hundreds of miles in search of food to bring back to their chicks, and all too often, they mistakenly bring back plastic. One study revealed that 97.5% of the chicks had plastic in their stomach, and 40% of these chicks died from eating too much plastic trash.¹²

Plastic does not biodegrade in the ocean. Rather, it breaks up into smaller and smaller pieces, which remain hazardous to the ocean ecosystem. While not as visible as large pieces of plastic trash, small plastic bits, or micro-plastics, are a huge problem in Puget Sound. On Orcas Island, cleanup volunteers collected more than 10,000 pieces of small pieces of plastic during one day of work at Fishing Bay.¹³ Scientists estimate that 6 tons of plastic litter Washington's shoreline.¹⁴

Small pieces of plastic are not limited to our beaches; they are floating in our waters. Researchers at the University of Washington - Tacoma found plastic bits in every sample they have taken from

Puget Sound examined the extent of micro-plastic pollution in the water, and they have found plastic in every sample taken.¹⁵

Very small pieces of plastic or microplastics pose threats as well. These specks of plastic absorb other chemicals in the water, including the banned toxicants DDT and PCBs, becoming super-concentrated toxic pellets.¹⁶ Small plastics are easily ingested by filter feeders, like clams and mussels, facilitating the accumulation of toxic chemicals up the food chain. Any other animals (including humans) that eat these contaminated shellfish risk ingesting these same toxins.¹⁷

These chemicals are already found in our wildlife, and it's possible that plastic helped move them there. According to the Washington Department of Fish and Wildlife, PCB levels in Chinook salmon from Puget Sound are 3-5 times higher than any other population on the West Coast. Herrings and Mussels in the Sound were also found to have high levels of PCB.¹⁸ Toxic contamination is also one of the major threats to Puget Sound's endangered orca pods. PCB levels in resident orcas are high enough to make them sick, impacting their reproductive and immune systems. Young orcas are especially impacted by toxic contamination since these chemicals become extremely concentrated in their mother's milk.¹⁹

Plastic Bags Contribute to the Pollution in Puget Sound

Too much of this plastic trash in Puget Sound comes from items that we use for a short time and then discard. Single use plastic bags are a prime – and visible – example. Plastic bags are convenient, but they are also durable and buoyant. For a few minutes of carrying groceries, the bags have the potential to

photo: Environment Washington



Seattle city councilor Mike O'Brien stands with a bag monster in support of Seattle's 2009 bag fee.

contaminate Puget Sound and the ocean environment for hundreds of years.

Every year, Washingtonians use over 2 billion plastic grocery bags.²⁰ The city of Seattle alone uses about 292 million a year.²¹ Nationwide, less than 6 percent of these plastic bags end up recycled.²² In-

stead, the bags end up sitting in landfills, littering streets, clogging streams, fouling beaches, or floating out to sea. According to beach cleanup volunteers working with the Ocean Conservancy, plastic bags were the sixth-most common item found on beaches worldwide over 25 years of clean up events, accounting for 5 percent of all trash items.²³

Plastic Pollution Costs Our Economy, Too

Plastic pollution costs developing and industrialized nations up to \$1.3 billion annually, primarily by threatening fishing, shipping and tourism industries.²⁴ In the United States, governments spend at least \$11.5 billion annually on litter collection, disposal and enforcement. Businesses bear almost 80 percent of this burden.²⁵

Plastic bags alone exact huge economic costs. Retailers spend hundreds of millions of dollars annually to provide single-use bags to customers. Supermarkets spend up to \$1,500 to \$6,000 a month to provide single-use bags to their customers at check-out.²⁶ Stores typically pay 2 to 5 cents per plastic bag; these costs are embedded in food prices and are then passed onto consumers.²⁷

Communities Across the World Have Taken Action to Reduce Plastic Bag Pollution

More than 80 national and local governments across the world have taken official action to protect the ocean by reducing the use of plastic bags. In their place, retailers are selling reusable bags, or bags made from compostable material.

Nations from Kenya to Mongolia, and local governments from Maharashtra, India to Rio de Janeiro, Brazil, have taken action to ban single use plastic bags. Dozens more, from Hong Kong to Ireland, have established fee programs to reduce plastic bag use or support more sustainable alternatives. Other nations and communities have established taxes on businesses that distribute plastic bags.

Bans on Plastic Bags

At least 20 nations and 46 local governments have implemented bans on distributing specific kinds of single use plastic bags.

Governments have had a variety of reasons to implement bag bans. Some communities enacted bag bans specifically to reduce ocean pollution – a rationale particularly common in communities whose economies depend upon beach activities, whale watching and other forms of ocean tourism. Others chose to enact the policy to reduce litter. For example, the state of Maharashtra in India, where Bombay is located, banned plastic bags to prevent them from clogging storm drains and contributing to floods.²⁸

Policies that ban the distribution of plastic bags are the most effective at reducing plastic bag pollution. For example, the year after banning plastic bags at pharmacies and supermarkets in 2007, San Francisco businesses distributed 127 million fewer plastic bags, and cut overall bag waste reaching the city landfill by up to 10 percent.²⁹ And four months after Huntingdon, Canada, banned plastic bags, the owner of a grocery store reported that 82 percent of his customers brought their own bags, while the remainder chose paper.³⁰

Nations:

At least 20 nations have passed bans to reduce bag pollution, including:³¹

Bangladesh	2002
Bhutan	2005
Botswana	2007 ³²
China	2008
Eritrea	2005
Ethiopia	2008
France	2010
Kenya	2008
Italy	2007
India	2002
Macedonia	2011 ³³
Mongolia	2009 ³⁴
Papua New Guinea	2009 ³⁵
Rwanda	2005
Somaliland	2005
South Africa	2003
Taiwan	2003
Tanzania	2006
Uganda	2007
United Arab Emirates	2011

Local Governments Abroad:

Additionally, more than 20 local governments outside of the United States have passed plastic bag bans, including:³⁶

Dahka, Bangladesh	2002
South Australia	2008
Northern Territory, Australia	2011
Loddon Shire, Victoria, Australia	2005
Corsica, France	1999
Paris, France	2007
Rio de Janeiro, Brazil	2009
Buenos Aires, Argentina	2008
Leaf Rapids, Manitoba, Canada	2007
Eriksdale, Manitoba, Canada	2008 ²⁸
Coldwell, Manitoba, Canada	2008 ²⁹
Huntingdon, Quebec, Canada	2008
Hurghada, Red Sea Province, Egypt	2009 ³⁰
Delhi, India	2009
Maharashtra, India	2005 ³¹
Himachal Pradesh, India	2009 ³²
Chandigarh, India	2008 ³³
Karachi, Sindh, Pakistan	2006 ³⁴
Zanzibar, Tanzania	2006
Llandysilio, Wales	2007

photo: iStockphoto.com, user McIninch



Policies that ban the distribution of plastic bags or establish fees or taxes on such bags are effective at reducing plastic bag pollution, and encouraging the use of reusable bags.

Local Governments in the United States:

Well over 50 American communities have acted against plastic bags, including:⁴⁴

American Samoa	(2011)
Maui County, Hawaii	(2008)
Kauai County, Hawaii	(2009)
At least 30 coastal communities in Alaska, including Bethel	(2009) ⁴⁵
Telluride, Colorado	(2011) ⁴⁶
Westport, Connecticut	(2008) ⁴⁷
Unincorporated Marshall County, Iowa	(2008) ⁴⁸
Outer Banks, North Carolina	(2009) ⁴⁹
Southampton Village, New York	(2011) ⁵⁰
Suffolk County, New York	(1998) ⁵¹
Brownsville, Texas	(2011)
South Padre Island, Texas	(2011) ⁵²
Unincorporated Marin County, California	(2011)
Fairfax, California	(2008)
Unincorporated L.A. County, California	(2010)
Calabasas, California	(2011)
Malibu, California	(2008)
Long Beach, California	(2011)
Santa Monica, California	(2011)
San Francisco, California	(2007)
Unincorporated Santa Clara County, California	(2011)
Palo Alto, California	(2011)
San Jose, California	(2010)
San Luis Obispo, California	(2011) ⁵³
Laguna Beach, California	(2011) ⁵⁴
West Hollywood, California	(2011) ⁵⁵
Unincorporated Santa Cruz County, California	(2011) ⁵⁶
Aspen, Colorado	(2011) ⁵⁷

Local Governments in Washington

Two cities in Washington have acted against plastic bag pollution: Edmonds and Bellingham.

Edmonds became the first city in the state of Washington to ban disposable plastic bags. After growing concern about the impact these bags have on the environment, the city council approved a ban in 2009.⁵⁸

The next city to approve a ban came in July 2011, when the Bellingham City Council unanimously approved banning disposable plastic bags and a 5 cents fee on paper bags. The community rallied together behind the ordinance with thousands of signatures, neighborhood endorsements, and the support of major grocery stores in the city.⁵⁹ These two cities have set the standard for the rest of Washington to follow.

Fee Programs and Taxes

Approximately 25 nations and local communities have established fee programs to reduce plastic bag use or encourage reusable alternatives.

Fee programs and taxes can have multiple purposes. First, by establishing a price on disposable bags, governments can send a price signal to citizens to motivate different behaviors. For example, in 2002 the Republic of Ireland established a 15 Euro cent tax on plastic bags (roughly equivalent to about 28 U.S. cents per bag today), applied to consumers at the point of sale. In the first year of this policy, consumers used 90 percent fewer plastic bags. The tax grew relatively less effective over time, so the nation increased the tax in 2007. Overall, plastic bags have gone from 5 percent to less than 0.25 percent of the waste stream.⁶⁰

Washington, D.C. provides another example. After the district implemented a much smaller 5 cent tax on plastic

bags, the number of bags distributed by food retailers fell from 22.5 million per month to 3.3 million per month.⁶¹ That is a decrease of more than 85 percent. This action translated into an observed decrease in plastic pollution in rivers and streams. According to the Alice Ferguson Foundation, since implementation of the bag fee, river cleanup efforts have turned up 66 percent fewer plastic bags.⁶²

Fee policies can also reimburse shop owners for any added expense of policy compliance. For example, stores in unincorporated Los Angeles County must charge customers 10 cents for every paper bag provided. The store retains the revenue and can use it to cover the cost of providing paper bags or the cost of educating customers about reusable bags.

Fee programs and taxes can also provide funding for government programs. For example, Ireland uses the money from its bag tax for recycling programs, enforcement of solid waste laws, and other environmental priorities.⁶³

Some countries have both a ban on certain types of plastic bags, and fees on others. For example, China has banned disposable bags that fail to meet the durability standards necessary to be considered reusable. China then requires retailers to charge customers a fee to obtain one of the more durable plastic bags, encouraging reuse.⁶⁴

Governments that have created fee programs or taxes applied to single use bags include:⁶⁵

Nations:

Belgium	(2007)
Botswana	(2007) ⁶⁶
Bulgaria	(2011)
China	(2008) ⁶⁷
Denmark	(1994) ⁶⁸
Hong Kong	(2009) ⁶⁹

Germany	(earlier than 2005) ⁷⁰
Ireland	(2002)
Israel	(2008)
The Netherlands	(2008) ⁷¹
South Africa	(2003) ⁷²
Wales	(2011)

Local Governments Abroad:

Northwest Territories, Canada	(2010)
Toronto, Ontario, Canada	(2009)
Amqui, Quebec, Canada	(2008) ⁷³
Mexico City, Mexico	(2009)
Andalucia, Spain	(2011) ⁷⁴

Local Governments in the United States:

Washington, D.C.	(2009)
Montgomery County, Maryland	(2011)

Local Governments in Washington:

In 2009, the Seattle City Council passed a law placing a 20-cent fee on plastic bags, hoping to encourage consumers to use their reusable bags instead. While this policy might have reduced plastic bag consumption, it was over-turned by a ballot initiative funded almost entirely by the American Chemistry Council (ACC), an industry group with members like Exxon Mobil and Dow Chemical. Pouring over \$1.4 million into defeating the bag fee, the ACC outspent environmental groups 18 to 1, largely using false claims to defeat the measure.⁷⁵

Policy Recommendations

Nothing we use for a few minutes should end up polluting Puget Sound for hundreds of years. Items meant only for a single use provide dubious convenience, and a great deal of hidden cost. When we throw away something like a plastic bag, “away” may actually mean our beaches, Puget Sound, or the belly of a whale.

To protect Puget Sound and conserve precious natural resources, our culture needs to shift away from its “throw-away” mentality.

Washingtonians will have to reduce the amount of trash and pollution making its way to the water. An obvious first place to start is to reduce the amount of unnecessary plastics, like plastic bags.

Education and recycling efforts simply

cannot keep pace with the generation of plastic bag pollution. Accordingly, Washington should adopt a state-wide policy to ban the use of single use plastic bags. Until that happens, cities and counties in Washington should enact policies to ban or limit the use of single use plastic bags. Not only can these individual policies have a meaningful impact, they can build momentum for the state to take similar action. With Puget Sound in our own backyard, Washington should be a leader on this issue and serve as an example for the rest of the West Coast and the country.

Ultimately, Washington’s actions can lead to a cleaner Puget Sound and ocean for current and future generations.

Notes

1. David Batker, Paula Swedeen, Robert Costanza, Isabel de la Torre, Roelof Boumans, and Kenneth Bagstad, Earth Economics, *A New View of the Puget Sound Economy: The Economic Value of Nature's Services in the Puget Sound Basin*, 2008.
2. Lynda V. Mapes "Beached Whales' Stomach Found to Be Full of Fresh Trash," *The Seattle Times*, 20 April 2010, available at seattletimes.nwsource.com/html/localnews/2011657607_graywhale21m.html.
3. Jen Kingfisher, Port Townsend Marine Science Center, *Micro-Plastic Debris Accumulation on Puget Sound Beaches*, 2010.
4. United Nations Environment Programme, *Ecosystems and Biodiversity in Deep Waters and High Seas*, UNEP Regional Seas Reports and Studies No. 178, June 2006.
5. Kathy Marks and Daniel Howden, "The World's Rubbish Dump: A Tip that Stretches from Hawaii to Japan," *The Independent UK*, 5 February 2008.
6. Lindsey Hoshaw, "Afloat in the Ocean, Expanding Islands of Trash," *New York Times*, 9 November 2009. The U.S. National Oceanic and Atmospheric Administration notes that there is uncertainty about the definition and size of the Garbage Patch, but the bottom line is that "man-made debris does not belong in our oceans and waterways." National Atmospheric and Oceanic Administration, *De-Mystifying the "Great Pacific Garbage Patch"*, 13 June 2011, available at marinedebris.noaa.gov/info/patch.html#5.
7. Algalita Marine Research Foundation, *Research - North Pacific Gyre Plankton Sample Analysis '07-'08*, undated, downloaded from www.algalita.org/research/np_gyre_sample07-08.html on 7 June 2011.
8. Tony Barboza, "Researchers Find Plastic in More Than 9% of Fish in Northern Pacific Ocean," *Los Angeles Times*, 1 July 2011.
9. JGB Derraik, "The Pollution of the Marine Environment by Plastic Debris: A Review," *Marine Pollution Bulletin* 44: 842-852, 2002; D.W. Laist, "Impacts of Marine Debris: Entanglement of Marine Life in Marine Debris Including a Comprehensive List of Species with Entanglement and Ingestion Records," In: J.M. Coe & D.B. Rogers (Eds.), *Marine Debris: Sources, Impacts, and Solutions*, (Springer-Verlag, New York) 1997, pp. 99-140.
10. Colette Wabnitz & Wallace Nichols, "Editorial: Plastic Pollution: An Ocean Emergency," *Marine Turtle Newsletter* 129, March 2010.
11. Lexi Metherell, "Third of Turtles Killed by Marine Rubbish," *ABC News Australia*, 7 June 2011, available at www.abc.net.au/news/stories/2011/06/07/3237485.htm.
12. Monterey Bay Aquarium, *Laysan Albatross & Plastics*, accessed 7 October, 2011, available at http://www.montereybayaquarium.org/cr/oceanissues/plastics_albatross/
13. Margie Doyle, "Micro-Plastic Pollution in San Juans' Water," *Orcas Issues*, 12 May 2010, available at orcassisues.com/micro-plastic-pollution-in-san-juans-waters.
14. Jen Kingfisher, Port Townsend Marine Science Center, *Micro-Plastic Debris Accumulation on Puget Sound Beaches*, 2010.
15. Gary Chittam, "A Little Plastic in Every Scoop of Puget Sound," *KING 5 News*, 9 November 2010, available at www.king5.com/news/environment/A-Little-Plastic-In-Every-Scoop-of-Puget-Sound-106994203.html.
16. Jessica Marshal, "Microplastics Eyed as Marine Pollutants: Experts Start to Ask if Tiny Particles Might Be Clogging Ocean Food Chain," *Discovery News*, 2 October 2008, available at www.msnbc.msn.com/id/26994478/ns/us_news-environment/#.To8hIHE7htQ.

17. Ashley Ahearn, "Microplastics Making their Way Through the Food Chain, Right Up to You," *OPB News*, 23 May 2011, available at news.opb.org/article/microplastics-making-their-way-through-food-chain-right-you/.
18. Sandra M. O'Neil and James E. West, Washington Department of Fish and Wildlife, "Marine Distribution, Life History Traits, and the Accumulation of Polychlorinated Biphenyls in Chinook Salmon from Puget Sound, Washington," *Transactions of the American Fisheries Society*, 138:616-632, 7 May 2009, available at: <http://wdfw.wa.gov/publications/pub.php?id=01030>
19. Lisa Stiffler, "Orcas So Full of Pollutants, It's Enough to Sicken Them: One Chemical Lingers Despite 30-Year-Old Ban," *Seattle Post-Intelligencer*, 10 October 2007, available at www.seattlepi.com/local/article/Orcas-so-full-of-pollutants-it-s-enough-to-1252155.php.
20. Estimate based on 360 bags used per person per year, per: Elizabeth Royte, *Garbage Land: On the Secret Trail of Trash*, (Little, Brown and Company, New York, NY) 13 July 2005, multiplied by the population of the state of Washington, per U.S. Census Bureau, *2010 Census*, May 2011.
21. Seattle Public Utilities, *City of Seattle Disposable Shopping Bags Green Fee and Expanded Polystyrene (EPS) Foam Food Container Ban*, 18 June 2008.
22. HDPE plastic film was recycled at a rate of 6.1% in 2009. This number is most likely artificially inflated for plastic bags since the study did not separate plastic bags from other HDPE plastic film. United States Environmental Protection Agency, *Municipal Solid Waste in the United States*, 2009, available at <http://www.epa.gov/osw/nonhaz/municipal/pubs/msw2009rpt.pdf>
23. Ocean Conservancy, *Tracking Trash: 25 Years of Action for the Ocean*, 2011.
24. A. McIlgorm, HF Campbell, and MJ Rule, *Understanding the Economic Benefits and Costs of Controlling Marine Debris in the APEC Region, A Report to the Asia-Pacific Economic Cooperation Marine Resource Conservation Working Group by the National Marine Science Centre (University of New England & Southern Cross University), Coffs Harbour, NSW, Australia*, December 2008.
25. Mid-Atlantic Solid Waste Consultants for Keep America Beautiful, Inc., *National Visible Litter Survey and Litter Cost Study*, 18 September 2009.
26. Estimates from bag manufacturers and the Food Marketing Institute: J. Downing, "Free Grocery Bags Targeted for Extinction in California," *Sacramento Bee*, 25 August 2008.
27. Los Angeles County Department of Public Works, Environmental Programs Division, *An Overview of Carryout Bags in Los Angeles County: Staff Report to the Board of Supervisors*, August 2007.
28. Ramola Talwar Badam, "Maharashtra Bans Plastic Bags," *Rediff.com*, 24 August 2005.
29. Joe Eskenazi, "Baggage: The City's Politicos Made the Enviro Happy by Banning Plastic Bags, but Left Us with More Pollution and Cost," *SF Weekly*, 7 January 2009.
30. The Canadian Press, "Anti-Plastic Bag Movement Growing as Residents Adapt to New Laws," *CBC News Canada*, 21 April 2008.
31. These policies are not uniform. Some affect bags of certain thicknesses, or from certain types and sizes of retail outlets. The purpose of this report is to note the existence of bag ban policies in a variety of locations across the world, and not to compare the relative strengths and weaknesses of these policies. Unless otherwise noted, the sources for all bag ban policies and adoption dates are: State of Florida, Department of Environmental Protection, *The Retail Bags Report: List of Retail Bag Policies*, updated 28 January 2011, available at www.dep.state.fl.us/waste/retailbags/pages/mapsandlists.htm; and Jennie R. Romer, Esq., *PlasticBagLaws.org, Legislation*, downloaded from plasticbaglaws.org/legislation/ on 7 June 2011.
32. Johane Dikgang and Martine Visser, Resources for the Future, "Behavioral Response to Plastic

- Bag Legislation in Botswana," *Environment for Development Discussion Paper Series*, EfDDP 10-13, May 2010.
33. Free bags have been outlawed since 2009. Now all plastic bags will be banned by 2013. See Richard Higgs, "Balkan Republic of Macedonia Bans Plastic Bags," *Plastics and Rubber Weekly*, 4 February 2011.
34. United Nations, *Mongolia National Report on Sustainable Development for the 18th Session of the Commission on SD*, February 2010, available at www.un.org/esa/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/mongolia/Full_text.pdf.
35. "PNG Government Bans Plastic Bags," *Pacific Business Online*, 3 October 2009.
36. These policies are not uniform. Some affect bags of certain thicknesses, or from certain types and sizes of retail outlets. The purpose of this report is to note the existence of bag ban policies in a variety of locations across the world, and not to compare the relative strengths and weaknesses of these policies. Unless otherwise noted, the sources for all bag ban policies and adoption dates are: State of Florida, Department of Environmental Protection, *The Retail Bags Report: List of Retail Bag Policies*, updated 28 January 2011, available at www.dep.state.fl.us/waste/retailbags/pages/mapsandlists.htm; and Jennie R. Romer, Esq., PlasticBagLaws.org, *Legislation*, downloaded from plasticbaglaws.org/legislation/ on 7 June 2011.
37. Rural Municipality of Eriksdale, *By-Law 07-2008*, 9 December 2008, available at www.eriksdale.com/data/policies/MicrosoftWord-BL_07_2008_PLASTIC_SHOPPING_BAGS1.pdf
38. Rural Municipality of Coldwell, *Notices: Elimination of Single Use Plastic Shopping Bags in the RM of Coldwell and Lud of Lundar*, 1 October 2008, available at www.lundar.ca/notices_detail.asp?ID=67.
39. Ramola Talwar Badam, "Maharashtra Bans Plastic Bags," *Rediff.com*, 24 August 2005.
40. Government of Himachal Pradesh, *Himachal Poised to Become Polythene Free from 15th August* (press release), 27 July 2009.
41. "Chandigarh (India) Bag Ban," *Plastic Free Times*, undated, downloaded from plasticfreetimes.com/~plasticf/chandigarh-india-bag-ban on 8 June 2011.
42. Sindh Governor House, Islamic Republic of Pakistan, *Manufacture, Sale and Use of Plastic Polyethylene Bags Banned*, 3 February 2006, available at www.governorsindh.gov.pk/pressrelease/news.asp?id=1325.
43. United News of India, "Only 40 Micros Plastic Bags in Meghalaya from October 2," *Waste Management World*, 30 August 2011, available at www.waste-management-world.com/index/from-the-wires/wire-news-display/1489999151.html.
44. These policies are not uniform. Some affect bags of certain thicknesses, or from certain types and sizes of retail outlets. The purpose of this report is to note the existence of bag ban policies in a variety of locations across the world, and not to compare the relative strengths and weaknesses of these policies. Unless otherwise noted, the sources for all bag ban policies and adoption dates are: State of Florida, Department of Environmental Protection, *The Retail Bags Report: List of Retail Bag Policies*, updated 28 January 2011, available at www.dep.state.fl.us/waste/retailbags/pages/mapsandlists.htm; and Jennie R. Romer, Esq., PlasticBagLaws.org, *Legislation*, downloaded from plasticbaglaws.org/legislation/ on 7 June 2011.
45. According to the Florida DEP, at least 30 coastal communities in Alaska have banned bags to reduce litter and protect wildlife, including seals and salmon. See note 37. Bethel: City of Bethel, Alaska, *Ordinance #09-12*, Passed 23 June 2009.
46. Karen James, "Telluride Is the First Community in Colorado to Ban Plastic Bags," *The Watch*, 7 October 2010.
47. Wendy Carlson, "Westport First in State to Ban Plastic Bags," *New York Times*, 26 September 2008.
48. Associated Press, "Iowa County Joins San Francisco in Bag Ban," *The Street.com*, 8 April 2009.

49. This policy is the only bag ban in the United States to date that was created by a state legislature. It only applies to the Outer Banks of North Carolina, so we grouped it with local government policies.
50. "Southampton Village Bans Plastic Bags," *CBS New York / Associated Press*, 28 April 2011.
51. Suffolk County, New York, *Suffolk County Code, Chapter 301, Food Labeling and Packaging Article II, Uniform Packaging Practices for Retail Food Establishments*, Adopted 29 March 1998, available at www.mindfully.org/Plastic/Suffolk-Co-NY-Ban.htm.
52. Lynn Brezosky, "South Padre Bans Single-Use Plastic Bags," *San Antonio Express-News*, 19 January 2011.
53. Robert A. McDonald, "SLO Council Mulls Disposable Bags," *New Times* 26(6), 7 September 2011, available at www.newtimesslo.com/news/6588/slo-council-mulls-disposable-bags/
54. Barbara Diamond, "Plastic Bag Ban to Be Developed; City Council Votes for City Staff to Begin Work on Ordinance that Would Ban the Bags Throughout Laguna," *Laguna Beach Coastline Pilot*, 8 September 2011, available at www.coastlinepilot.com/news/tn-cpt-0909-plasticbag-20110908,0,2212134.story.
55. WeHo News Staff, "WeHo Bans Plastic Bags; LA Goes Further," *WeHo News* 7(2), 8 September 2011, available at wehonews.com/z/wehonews/archive/page.php?articleID=6465.
56. Danny Wool, "Santa Cruz County Bans on Bags," *Santa Cruz News*, 14 September 2011, available at http://news.santacruz.com/2011/09/14/santa_cruz_county_bags_on_bags
57. Carolyn Sackariason, "Plastic bag to be banned at Aspen grocery stores," *Aspen Daily News*, 12 October 2011, available at <http://www.aspendailynews.com/section/home/149561>
58. Lynn Thompson, "Edmonds is First City in State to Ban Plastic Grocery Bags," *The Seattle Times*, 28 July 2009, available at seattletimes.nwsource.com/html/politics/2009555416_bagban29m.html.
59. John Stark, "City Council Approves Plastic Shopping Bag Ban," *The Bellingham Herald*, 13 July 2011, available at www.bellinghamherald.com/2011/07/11/2098162/city-council-approves-plastic.html.
60. State of Florida, Department of Environmental Protection, *Retail Bags Report for the Legislature*, 1 February 2010; S. McDonnell, F. Convery & S. Ferreira, *The Irish Plastic Bag Levy - A Review of Its Performance Five Years On*, undated, available at www.webmeets.com/files/papers/EAERE/2008/294/Plastic%20Bags%20-Irish%20Levy%20-%20EAERE%20PAPER%202008.pdf.
61. Lauren Markoe, NRDC, "How D.C. Beat the Plastic Bag Lobby," *On Earth*, 11 November 2010.
62. As cited by: Surfrider Foundation, *Ban the Bag: Washington D.C., A Success Story*, downloaded from www.surfrider.org/dc/plastics.html, 27 June 2011.
63. State of Florida, Department of Environmental Protection, *Retail Bags Report for the Legislature*, 1 February 2010; S. McDonnell, F. Convery & S. Ferreira, *The Irish Plastic Bag Levy - A Review of Its Performance Five Years On*, undated, available at www.webmeets.com/files/papers/EAERE/2008/294/Plastic%20Bags%20-Irish%20Levy%20-%20EAERE%20PAPER%202008.pdf.
64. Mary O'Loughlin, Fulbright Research Fellow, *B.Y.O.B. (Bring Your Own Bag): A Comprehensive Assessment of China's Plastic Bag Policy*, 17 February 2011, available at digitalcommons.law.umaryland.edu/cgi/viewcontent.cgi?article=1019&context=student_pubs.
65. These policies are not uniform. Some fees and taxes apply to plastic bags. Others apply to paper bags as an added price signal complementing a ban on plastic bags. Some apply to consumers at the point of sale. Others apply to retailers upstream in the supply chain. The purpose of this report is to note the existence of these policies in a variety of

- locations across the world, and not to compare the relative strengths and weaknesses of these policies. Unless otherwise noted, the sources for all policies and adoption dates are: State of Florida, Department of Environmental Protection, *The Retail Bag Report: List of Retail Bag Policies*, updated 28 January 2011, available at www.dep.state.fl.us/waste/retailbags/pages/mapsandlists.htm; and Jennie R. Romer, Esq., PlasticBagLaws.org, *Legislation*, downloaded from plasticbaglaws.org/legislation/ on 7 June 2011.
66. Johane Dikgang and Martine Visser, Resources for the Future, “Behavioral Response to Plastic Bag Legislation in Botswana,” *Environment for Development Discussion Paper Series*, EfDDP 10-13, May 2010.
67. Mary O’Loughlin, Fulbright Research Fellow, *B.Y.O.B. (Bring Your Own Bag): A Comprehensive Assessment of China’s Plastic Bag Policy*, 17 February 2011, available at digitalcommons.law.umaryland.edu/cgi/viewcontent.cgi?article=1019&context=student_pubs.
68. Denmark also taxes wasteful packaging and waste delivered to landfills to encourage more sustainable use of resources by product manufacturers and retailers.
69. City of Hong Kong, *Product Eco- Responsibility Ordinance*, Ordinance Number 32 of 2008, July 2008, available at www.epd.gov.hk/epd/psb/files/PER_Ordinance_Eng.pdf.
70. Dan Magestro, “Plastic Bag Obsession,” *The Lantern: Ohio State Student Newspaper*, 31 October 2005.
71. Heal the Bay, *List of Countries with Plastic Bag Fees and Bans*, 20 November 2009.
72. Johane Dikgang, Anthony Leiman and Martine Visser, University of Cape Town, *Analysis of the Plastic Bag Levy in South Africa*, Policy Paper 18, July 2010.
73. The Canadian Press, “Anti-Plastic Bag Movement Growing as Residents Adapt to New Laws,” *CBC News Canada*, 21 April 2008.
74. “Andalucia Announced 10 Cent Tax on Plastic Bags from Jan 1st,” *TheReader.es*, 30 October 2010.
75. Kitt Doucette, “The Plastic Bag Wars: The World Consumes 1 Million Plastic Shopping Bags Every Minute – and the Industry Is Fighting Hard to Keep It that Way,” *Rolling Stone*, 4 August 2011.