Volume 29 | Issue 1 Article 6

5-21-2018

Move Over Diamonds -- Plastics are Forever: How the Rise of Plastic Pollution in Water Can be Regulated

Stephanie F. Wood

MOVE OVER DIAMONDS – PLASTICS ARE FOREVER: HOW THE RISE OF PLASTIC POLLUTION IN WATER CAN BE REGULATED

> Plastics are now virtually everywhere in our modern society. We drink out of them, eat off of them, sit on them, and even drive in them. They're durable, lightweight, cheap, and can be made into virtually anything. But it is these useful properties of plastics, which make them so harmful when they end up in the environment. Plastics, like diamonds, are forever![1]

I. Introduction

Plastics are everywhere.[2] Everyone uses plastic.[3] As a vital manufacturing ingredient for almost every industry, plastics appear in a high percentage of the products people use every day.[4] For more than half a century, "[g]lobal production and consumption of plastics have continued to rise."[5] Although many cannot imagine a world without plastic, products composed of plastics are "durable and very slow to degrade . . . ultimately, becom[ing] waste with staying power."[6] This increase in disposing of plastic in the environment and plastic's non-biodegradable nature has led to an upsurge in plastic pollution in our waterways and oceans.[7] Although lawmakers passed a variety of regulations and legislation to tackle

1. Captain Charles Moore, *Out in the Pacific Plastics is Getting Drastic: The World's Largest "Landfill" is in the Middle of the Ocean*, Aboard Oceanographic Reseach Vessel, http://marine-litter.gpa.unep.org/documents/World%27s_largest_landfill.pdf (last visited July 23, 2017) (explaining pervasive and ubiquitous nature of plastic in environment).

2. *See* Claire Le Guern, *When the Mermaids Cry: The Great Plastic Tide*, Coastal Care, http://coastalcare.org/2009/11/plastic-pollution/ (last updated Jan. 2017) (discussing prevalence of plastics in today's world).

3. *See Plastic Bag Consumption Facts*, Conserving Now, https://conservingnow.com/plastic-bag-consumption-facts/ (last visited Jan. 20, 2018) (noting prevalence of plastic).

4. *See id.* (explaining how use of plastics has contributed to overconsumption).

5. *Id.* (noting global use of plastics is increasing).

6. *See id.* (discussing properties of plastics).

7. *See* Le Guern, *supra* note 2 (describing how non-biodegradable nature of plastics has contributed to rising amount of plastic pollution found in water).

this upsurge, lawmakers must take more preventive measures to reduce the amount of plastic society produces each year.[8]

"Plastic is versatile, lightweight, flexible, moisture resistant, strong, and relatively inexpensive."[9] These beneficial qualities lead to an over-consumption of plastic goods.[10] Many producers use plastic materials, which "become debris with staying power" because they are both "durable and slow to degrade."[11] The Environmental Protection Agency (EPA) testified to plastic's durability when it reported, "every bit of plastic ever made still exists."[12] Clearly, plastic is durable, and many even consider it resistant to natural biodegradation.[13] However, over time, light fragments and breaks-down plastic into smaller debris.[14]

Many are concerned about the impact that microplastics may have on bodies of water due to their ubiquitous nature.[15] Microplastics are the tiny plastic fragments (less than five millimeters in diameter) that fall off decomposing plastic bottles and bags.[16] Manufacturers often produce consumer products, like cosmetics, that include microplastics.[17] Scientists have discovered microplastics in most marine habitats around the world, particularly in lakes and rivers.[18] These microplastics interact with various marine species, including birds, fish, and turtles, and they are read-

8. *See Statutes and Regulations Affecting Marine Debris*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/trash-free-waters/statutes-and-regulations-affecting-marine-debris (last visited July 23, 2017) (outlining regulatory tools to combat plastic pollution in waterways).

9. *See* Claire Le Guern, *supra* note 2 (describing qualities of plastic).

10. *See id.* (explaining rationale for over consumption).

11. *Id.* (explaining durability of plastic).

12. *Ocean Plastics Pollution: A Global Tragedy for Our Oceans and Sea Life*, CTR. FOR BIOLOGICAL DIVERSITY, http://www.biologicaldiversity.org/campaigns/ocean_plastics/ (last visited July 23, 2017) (discussing longevity of plastic in environment).

13. *See* Le Guern, *supra* note 2 (explaining tendency of plastic to not degrade).

14. *See id.* (describing process of plastics breaking down into microplastics and small plastic debris).

15. *See* Amy Lusher, *Microplastics in the Marine Environment: Distribution, Interactions, and Effects*, MARINE ANTHROPOGENIC LITTER 245, 245 (M. Bergmann et al. eds., 2015), https://link.springer.com/content/pdf/10.1007%2F978-3-319-16510-3_10.pdf (introducing growing concern of microplastics in environment).

16. *See id.* (defining microplastics); *see also* Lisa W. Foderaro, *Study Investigates Proliferation of Plastic in Waterways Around New York*, N.Y. TIMES (Feb. 18, 2016), https://www.nytimes.com/2016/02/19/nyregion/-nyregion-00plastic-beads-water-pollution.html (describing microplastics and their characteristics).

17. *See* Foderaro, *supra* note 16 (discussing common products that can lead to microplastics introduction in environment).

18. *See* Lusher, *supra* note 15, at 245 (explaining increasing prevalence of micro-plastics).

ily ingested and subsequently passed through food chains.[19] The spread of microplastics will inevitably continue to rise as society increases plastic production, consumption, and disposal.[20]

As the world's reliance on plastic increases, as well as its increasing production rate and proximate disposal, the environmental impacts of plastics are a growing concern.[21] "Plastic production increased dramatically worldwide over the last [sixty] years, passing from 0.5 million tons [per year] in 1960 to almost 300 million tons in 2013."[22] Scientists have found that most plastic pollution enters marine environments from land-based sources, including "litter, trash and debris from construction, ports and marinas, commercial and industrial facilities, and trash blown out of garbage containers, trucks, and landfills."[23] Plastics in the aquatic environment exacerbate this concerning situation due to their persistence and effect on the environment, wildlife, and human health.[24] Habitat alteration is one of these devastating effects, and the accumulating trash and debris triggers habitat alteration in aquatic environments, like rivers, oceans, and beaches.[25] The accumulation of debris can detrimentally modify habitat structures, leading to a decline in the populations of species that depend on these habitats for survival.[26] Scientists have widely documented the ingestion of plastic debris by fish, seabirds, and other aquatic wildlife that mistake plastic particles for food.[27] The ingestion of plastics results in a variety of health problems for such animals, including decreased mobility and predatory avoidance, toxicity, and development of internal and

19. *See* Foderaro, *supra* note 16 (describing how microplastics enter food chains).

20. *See* Lusher, *supra* note 15, at 246 (noting that it is very likely for microplastics to continue to flood aquatic environments).

21. *See generally* Le Guern, *supra* note 2 (introducing environmental problems created by plastic pollution in water).

22. *See* Carlo Giacomo Avio et al., *Plastics and Microplastics in the Oceans: From Emerging Pollutants to Emerged Threat*, MARINE ENVTL. RESEARCH (2016), http://jpi-oceans.eu/sites/jpi-oceans.eu/files/public/EPHEMARE/Images/News/Avio%20et%20al.%2C%202016.pdf (alteration in original) (explaining dramatic increase in plastic production).

23. *The Problem of Marine Plastic Pollution*, CLEAN WATER ACTION, http://www.cleanwater.org/problem-marine-plastic-pollution (last visited Sept. 23, 2017) (discussing main sources of plastic debris found in water).

24. *See Impacts of Mismanaged Trash*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/trash-free-waters/impacts-mismanaged-trash (last updated May 23, 2017) (high-lighting negative impacts of plastic pollution in water).

25. *See id.* (explaining impact of habitat alteration).

26. *See id.* (describing how habitat alteration can cause declines in species).

27. *See id.* (explaining common occurrence of ingestion of plastic particles by aquatic wildlife).

external wounds.[28] In addition to the habitat degradation and the adverse effect on aquatic wildlife health, plastic pollution in water negatively impacts humans.[29] The prevalence of aquatic debris has been found to "interfere with navigation, impede commercial and recreational fishing, [and] threaten health and safety . . . ."[30]

A number of regulatory tools address and limit the amount of plastic pollution that enters our aquatic ecosystems.[31] The Clean Water Act (CWA) is the primary federal law governing water pollution.[32] The CWA protects the waters of the United States and serves as the primary tool to safeguard the nation's waters.[33] Under the CWA's compliance monitoring, the EPA works with a number of regulatory partners "to monitor and ensure compliance with clean water laws and regulations in order to protect human health and the environment."[34] The CWA also "prohibits the discharge of any pollutant . . . from a point source" into navigable waters of the United States unless a permit is obtained.[35] The EPA regulates plastic as a pollutant, through the CWA.[36]

The Pollution Prevention Act, another regulatory tool, works to reduce the amount of pollution through "cost-effective changes in production, operation, and raw materials use."[37] The Pollution Prevention Act allows for source reduction, which refers to "practices that reduce hazardous substances being released into the envi-

---

28. *See id.* (discussing health problems caused by ingestion of plastics).

29. *See Impacts of Mismanaged Trash*, *supra* note 24 (outlining negative impacts humans face from plastic pollution throughout world's rivers and oceans).

30. *See id.* (alteration in original) (noting various negative impacts humans face from plastic debris in waters).

31. *See generally Statutes and Regulations Affecting Marine Debris*, *supra* note 8 (outlining regulatory tools to combat plastic pollution in waterways).

32. *See generally Summary of the Clean Water Act*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/laws-regulations/summary-clean-water-act (last visited July 23, 2017) (summarizing importance of Clean Water Act).

33. *See generally* The Clean Water Act, 33 U.S.C. § 1251 (1972) (outlining goals of CWA).

34. *Clean Water Act (CWA) Compliance Monitoring*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/compliance/clean-water-act-cwa-compliance-monitoring (last visited Sept. 23, 2017) (discussing role of EPA within CWA).

35. Rachel Doughty & Marcus Eriksen, *The Case for a Ban on Microplastics in Personal Care Products*, 27 TUL. ENVTL. L.J. 277, 281-82 (2014) (discussing regulatory tools of Clean Water Act and how it addresses plastic pollution in waters of United States).

36. *See generally Summary of the Clean Water Act*, *supra* note 32 (summarizing how EPA can regulate plastic pollution through CWA).

37. The Pollution Prevention Act, 42 U.S.C. § 13101(a)(2) (1990) (outlining goals for preventing pollution at its source through various measures).

ronment prior to recycling, treatment[,] or disposal."[38] Source reduction diminishes marine debris, including plastic.[39] It effectively reduces the overall amount of hazardous materials in the environment, which limits the amount of marine debris, making it superior to waste management or pollution control.[40]

These laws and other legislation like them help to address the growing concerns of plastic pollution found in aquatic environments.[41] Since the passage of the CWA, "rivers and bays have grown significantly cleaner as state and local governments have imposed tighter controls on industrial pollution and sewage treatment."[42] The Act, however, has yet to address the growing plastic pollution problem.[43] One step in the right direction is the Microbead-Free Waters Act of 2015, which bans the production and sale of microbeads over the course of 2017 and 2018, and will continue indefinitely.[44] Microbeads are "tiny plastic beads that are used as exfoliants in cosmetics like face and body scrubs, and toothpaste."[45] When microbeads are manufactured, these tiny plastic beads have been known to gather contaminants.[46] They enter wastewater treatment plants where they continue to absorb chemicals, which poses grave risks to any marine animals that might later consume them.[47] Under this new law, plastic microbeads cannot be manufactured after July 1, 2017 and cannot be sold after July 1, 2018.[48]

---

38. *See Summary of the Pollution Prevention Act, Laws & Regulations*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/laws-regulations/summary-pollution-prevention-act (last visited July 23, 2017) (summarizing Pollution Prevention Act and its source reduction practices).

39. *See generally id.* (explaining how source reduction works).

40. *See id.* (discussing why source reduction is most desirable for pollution prevention).

41. *See* Le Guern, *supra* note 2 (outlining existing legislation to control plastic pollution).

42. *See* Foderaro, *supra* note 16 (explaining how passage of CWA contributed to cleaner bodies of water in New York).

43. *See id.* (discussing how CWA failed to specifically address problem of plastic debris).

44. *See* Ally Carr, *More than Face Value? The Environmental Cost of Microbeads*, THE BIODESIGN INST., https://biodesign.asu.edu/news/more-face-value-environmental-cost-microbeads (last visited July 23, 2017) (discussing new Microbead-Free Waters Act signed into law by President Obama).

45. *See id.* (describing common uses of microbeads).

46. *See id.* (noting how plastics' manufacturing process contributes to their detrimental effects).

47. *See id.* (explaining how ingestion of microbeads by aquatic wildlife can be detrimental to such wildlife's health).

48. *See id.* (explaining parameters of new law and effective dates).

It is important to address the dangers of plastic pollution through regulatory tools and preventative measures.[49] States are taking steps to combat the plastic pollution problem through plastic bag bans.[50] One such state is California, which passed "Proposition 67, ratifying the 2014 state law banning retailers from handing out single-use plastic bags at the checkout."[51] The California ban is the first of its kind in the United States, and other states can follow California's lead by enacting similar bans.[52]

Almost everywhere across the United States, plastic bags remain the norm for how people carry their items home from stores, most of which are never recycled.[53] Further, even when not recycled, those bags that are meant to degrade may not breakdown successfully.[54] Recycling will not solve plastic pollution because it does not stop the growing production of plastics.[55] Plastic pollution should be stopped "at the source by phasing out single-use plastics and plastic packaging."[56]

This Comment analyzes the current plastic regulations in place and their ability to handle the rising use and presence of plastics in aquatic environments.[57] Part II discusses the properties of plastic and how these properties contribute to its omnipresence and dan-

---

49. *See generally A Global Tragedy for Our Oceans and Sea Life*, CTR. FOR BIOLOGICAL DIVERSITY, http://www.biologicaldiversity.org/campaigns/ocean_plastics/ (last visited July 23, 2017) (discussing how steps need to be taken to combat plastic pollution problem).

50. *See State Plastic and Paper Bag Legislation*, NAT'L CONFERENCE OF STATE LEGISLATURES (July 5, 2017), http://www.ncsl.org/research/environment-and-natural-resources/plastic-bag-legislation.aspx (explaining how some states are working to reduce use of plastic bags).

51. *See* Times Editorial Bd., *California Banned Plastic Bags. Now It's Up to Consumers to Stop Being Wasteful*, L.A. TIMES (Nov. 23, 2016), http://www.latimes.com/opinion/editorials/la-ed-beyond-bag-ban-20161121-story.html (discussing California's recent ban of single-use plastic bags).

52. *See id.* (noting California is first state to go through with such ban on plastic bags).

53. Daniel Goleman, *Facing the Dirty Truth About Recyclable Plastics*, YALE ENV'T 360 (May 5, 2011), http://e360.yale.edu/feature/facing_the_dirty_truth_about_recyclable_plastics/2400/ (noting prevalence of plastic bag use in United States).

54. *See id.* (explaining predicament of non-recycling and plastics, which claimed to be degradable, are not actually breaking down).

55. Lisa Kaas Boyle, *The Myth of the Recycling Solution*, PLASTIC POLLUTION COAL. (Oct. 5, 2015), http://www.plasticpollutioncoalition.org/pft/2015/8/23/the-myth-of-the-recycling-solution (explaining temporary benefits of recycling plastic).

56. *See id.* (expressing need for plastic pollution to be stopped at source to best address problem).

57. For a discussion of the current laws in place addressing plastic pollution in our nation's waters, see *infra* notes 136-165 and accompanying text.

gerous impacts for both wildlife and humans.[58] Part III analyzes the current regulations in place and how they work to combat plastic pollution.[59] Part IV discusses possible suggestions and solutions to the increasingly prevalent threat of plastics found in our aquatic environments.[60]

II. THE DANGERS OF PLASTICS AND THE NECESSITY OF FURTHER REGULATION

Since the inception of plastics in the 1930s and 1940s, the prevalence of plastic in the commercial marketplace has continued to grow.[61] The term "plastics" describes a diverse group of materials, making up approximately twenty different types of plastics, each possessing incredibly versatile properties that have contributed to their increased use.[62] Plastic has become "an optimal medium" for a plethora of consumer products because of its durability, inexpensiveness, and weight.[63] In the United States, approximately forty-eight million tons of plastic are produced each year.[64] Due to the diversity and versatility of plastics, practically every aspect of our daily lives involves some form of plastic use.[65] Plastics can be found in the packaging we use, the cars we drive, and even the clothing we wear.[66] Despite the societal benefits plastic has brought into our lives, there is a dark side to the ever-increasing production of plastics.[67]

---

58. For a discussion of negative impacts of plastic pollution on wildlife and humans, see *infra* notes 61-142 and accompanying text.

59. For a discussion and analysis of the current state of the law and regulations in place, see *infra* notes 143-172 and accompanying text.

60. For a discussion of possible solutions and suggestions to the plastic pollution problem, see *infra* notes 173-191 and accompanying text.

61. *See* Jenna R. Jambeck et al., *Plastic Waste Inputs from Land into the Ocean*, SCIENCE 696, 768 (Feb. 23, 2015), http://science.sciencemag.org/content/347/6223/768 (discussing origination of plastics and its increasing prevalence since).

62. Richard C. Thompson et al., *Our Plastic Age*, 364 PHIL. TRANSACTIONS ROYAL SOC'Y B 1973 (2009), http://rstb.royalsocietypublishing.org/content/royptb/364/1526/1973.full.pdf (discussing properties of plastics that make them desirable to produce).

63. Michelle Sigler, *The Effects of Plastic Pollution on Aquatic Wildlife: Current Situations and Future Solutions*, WATER AIR SOIL POLLUTION 1 (Oct. 18, 2014), https://www.earthexpeditions.org/system/files/Sigler_Michelle_Water%20Air%20Soil%20Pollut_2014.pdf (describing why use of plastics has continued to increase).

64. *See id.* (discussing production of plastics in United States).

65. Grant A. Harse, *Plastic, the Great Pacific Garbage Patch, and International Misfires at a Cure*, 29 UCLA J. ENVTL. L. & POL'Y 331, 334-35 (2011) (explaining how plastics have become part of our daily lives).

66. *See id.* at 335 (listing various uses of plastics).

67. *See* Sigler, *supra* note 63 (describing negative aspects of plastic's useful properties).

Within the last thirty years, it has become more apparent that the useful qualities of plastics are also what makes them harmful to the environment.[68] The durability of plastics and constant growth in use contributes to the increase in pollution generally, thus contributing to an increase of pollution found in aquatic environments as well.[69] In fact, plastic accounts for approximately ten percent of the waste humans generate.[70] This is an extreme cause for concern, as plastics break down very slowly.[71] Most plastics "break into smaller and smaller pieces, eventually becoming individual polymer molecules, which must undergo further degradation before becoming bioavailable."[72] Though the exact time it takes for plastics to completely degrade in the marine environment is unknown, it is estimated that this degradation process takes approximately several centuries.[73]

As lightweight and durable plastics persist in the environment, it is inevitable that they will travel long distances, eventually settling in bodies of water like lakes, rivers, and oceans.[74] An estimated eighty percent of marine debris comes from land-based sources, including runoff from wastewater systems, wind-blown litter, and litter left on beaches, among others.[75] A 2014 study found that an estimated "5.25 trillion plastic particles weighing 268,940 tons are currently floating at sea."[76]

---

68. *See id.* (addressing plastic's properties as pernicious to environment).

69. *See* Thompson, *supra* note 62, at 1974 (explaining rise in plastic production results in rise of pollution).

70. *See id.* (describing percentage of plastic waste generated).

71. *See* Charles James Moore, *Synthetic Polymers in the Marine Environment: A Rapidly Increasing, Long-Term Threat*, 108 ENVTL. RESEARCH 131, 132 (Oct. 2008), http://www.caseinlet.org/uploads/Moore—_Env_Res_Plastic_Oceans_2008_1_.pdf (discussing length of time for plastic decomposition).

72. *See id.* (discussing plastic's degradation process).

73. *See id.* (discussing lack of clarity on length of time for plastic degradation process).

74. *See* Peter G. Ryan et al., *Monitoring the Abundance of Plastic Debris in the Marine Environment*, 364 PHIL. TRANSACTIONS ROYAL SOC'Y B 1999 (July 27, 2009), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2873010/ (describing how plastics enter aquatic environments).

75. *See* Michelle Allsopp et al., *Plastic Debris in the World's Oceans*, GREENPEACE 6, http://www.greenpeace.org/international/Global/international/planet-2/report/2007/8/plastic_ocean_report.pdf (last visited Jan. 20, 2017) (explaining sources of marine debris).

76. Marcus Eriksen et al., *Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing Over 250,000 Tons Afloat at Sea*, PLOS ONE, 7 (Dec. 10, 2014), http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0111913&type=printable (outlining research findings showing amount of plastic particles in ocean).

Unfortunately, the ubiquitous nature of plastics has significant negative impacts on aquatic environments and wildlife.[77] As Achim Steiner, United Nations Under-Secretary-General and UNEP Executive Director, said, "Plastics have come to play a crucial role in modern life, but the environmental impacts of the way we use them cannot be ignored."[78] The negative impacts of plastic pollution is evidenced through the surfacing of plastic pollution found on beaches, shorelines, and coastal communities.[79] The EPA reports that about one-third to two-thirds of the pollution found on beaches is the result of "single-use, disposable plastic packaging from food and beverage-related goods and services," with the typical culprits being plastic cups, bottles, straws, and the like.[80]

The prevalence of discarded, recreational plastic found stranded along shorelines and beaches also has negative economic impacts, as the presence of this litter may affect the tourist industries.[81] Aquatic plastic pollution reduces the "aesthetic and recreational value[ ]" of shorelines and beaches on which they end up.[82] As a result, communities incur large economic costs from cleaning plastic pollution from beaches.[83] Communities on the West Coast of the United States spend more than $520 million each year to prevent unsightly plastic pollution from accumulating on their beaches.[84] Even more alarming, according to reports released by the United Nations Environment Programme, the financial damage

77. *See generally* Murray R. Gregory, *Environmental Implications of Plastic Debris in Marine Settings—Entanglement, Ingestion, Smothering, Hangers-on, Hitch-hiking and Alien Invasions*, 364 PHIL. TRANSACTIONS ROYAL SOC'Y B 2013 (July 27, 2009), http://rstb.royalsocietypublishing.org/content/royptb/364/1526/2013.full.pdf (outlining negative impacts of plastic in aquatic environments).

78. *See Plastic Waste Causes Financial Damage of US$13 Billion to Marine Ecosystems Each Year as Concern Grows over Microplastics*, U.N. ENV'T PROGRAMME (June 23, 2014), http://web.unep.org/newscentre/plastic-waste-causes-financial-damage-us13-billion-marine-ecosystems-each-year-concern-grows-over (quoting Achim Steiner regarding impact of overuse of plastics).

79. *See id.* (discussing negative impact of plastic pollution on shorelines and beaches).

80. *See Sources of Aquatic Trash*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/trash-free-waters/sources-aquatic-trash (last visited July 23, 2017) (describing findings of trash on beaches).

81. *See Impacts of Mismanaged Trash*, *supra* note 24 (explaining negative impacts of plastic pollution).

82. *See id.* (explaining pollution's negative impacts on value).

83. *See id.* (addressing economic costs incurred from cleaning up pollution).

84. *See id.* (stating costs associated with combatting pollution on beaches).

of plastics to marine environments costs the United States approximately $13 billion each year.[85]

The prevalence of plastics in the environment has resulted in emerging evidence of the threats plastics pose to wildlife.[86] The Convention on Biological Diversity estimates that plastic pollution has impacted approximately 663 species of marine life.[87] Specifically, plastic pollution affects wildlife through ingestion, entanglement, and smothering.[88] Scientists have found that more than 250 species ingest plastic materials or become entangled in plastic materials.[89] These species include turtles, sea birds, fish, crustaceans, among others.[90] For example, such marine animals "are known to ingest plastic pellets, bottle caps, pieces of toys, and cigarette lighters, among other plastic products."[91] Plastic bags in particular have also been mistaken for food by a wide range of marine species, especially those that consume jellyfish.[92] Tragically, ingestion of these materials often leads to health concerns such as wound development, blockage of the digestive tract, which can lead to starvation, and impairment of feeding abilities.[93] Many marine animals are attracted to or become accidentally entangled in netting, ropes, and cords, leading to death or injury.[94] Marine debris can also introduce aggressive invasive species to new areas, as floating plastic debris may facilitate the dispersal of organisms like tubeworms and barnacles due to colonization of these organisms on the marine debris.[95]

---

85. *See Plastic Waste Causes Financial Damage of US$13 Billion to Marine Ecosystems Each Year as Concern Grows over Microplastics*, *supra* note 78 (outlining costs of plastic waste in marine ecosystems).

86. *See generally* Gregory, *supra* note 77 (introducing impacts of plastics on marine life).

87. *See* Secretariat of the Convention on Biological Diversity and Technical Advisory Panel, *Impacts of Marine Debris on Biodiversity: Current Status and Potential Solutions*, CBD TECH. SERIES NO. 67, 2012, at 9, http://www.cbd.int/doc/publications/cbd-ts-67-en.pdf (summarizing results of research).

88. *See id.* (stating harmful ways plastics in bodies of water have been known to affect wildlife).

89. *See* Gregory *supra* note 77, at 2014 (discussing species impacted by entanglement and ingestion).

90. *See id.* (listing species impacted).

91. *See* Harse, *supra* note 65, at 336-37 (discussing examples of commonly ingested plastic materials).

92. *See* Le Guern, *supra* note 2 (discussing ingestion of plastics by various marine species).

93. *See* Gregory *supra* note 77, at 2015-16 (explaining health effects wildlife face from ingestion of plastics).

94. *See id.* at 2014 (explaining consequences of entanglement).

95. *See id.* at 2018 (discussing how invasive species are aided by floating plastics in waters).

Ingested particles pose a major threat not only to aquatic wildlife, but also to humans who unknowingly consume plastics embedded in seafood.[96] Studies show that plastics are prone to

> sorb (take up) persistent, bioaccumulative, and toxic substances, which are present in trace quantities in almost all water bodies. The constituents of plastics, as well as the chemicals and metals they sorb, can travel into the bodies of marine organisms upon consumption, where they may concentrate and climb the food chain, ultimately into humans.[97]

Many of the chemicals found in plastics are known to have adverse effects on human health.[98] One class of chemicals used in plastic manufacturing, endocrine-disrupting compounds (EDCs), has been the subject of research due to its potential impacts on humans.[99] Some studies suggest that "EDCs . . . [contribute to] the development of cancer, . . . [reduce] human sperm [amounts], [cause] temporal increases in the frequency of developmental abnormalities of the male reproductive tract, and . . . [cause premature onset of] puberty in human females."[100] Phthalates and bisphenol A (BPA) are two EDCs that are used in plastic manufacturing.[101] Phthalates are found in soft plastic products, gel capsules, and other personal care products.[102] They have been found to seep out of products, and studies have identified "high levels of monoester metabolites of phthalates in the urine of the general population."[103] BPAs are also widely used in the production of

96. *See id.* at 2015-16 (noting negative effects of floating plastic debris on wildlife); *see generally* Harse *supra* note 65, at 341 (explaining how chemicals travel up food chain to humans).

97. Nate Seltenrich, *New Link in the Food Chain? Marine Plastic Pollution and Seafood Safety*, 123 ENVTL. HEALTH PERSPECTIVES, A34, A35 (Feb. 2015), https://ehp.niehs.nih.gov/123-A34/ (discussing "emerging" third field of plastic pollution).

98. *See* Chris E. Talsness et al., *Components of Plastic: Experimental Studies in Animals and Relevance for Human Health*, 364 PHIL. TRANSACTIONS ROYAL SOC'Y B 2079 (2009), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2873015/pdf/rstb20080281.pdf (explaining adverse effects of chemicals found in plastics on humans).

99. *See id.* (defining EDCs and how these chemicals have been subject of much research).

100. *Id.* at 2079-80 (discussing potential health threats to human health from EDCs).

101. *See id.* at 2080 (explaining two kinds of EDCs found in plastics).

102. *See id.* (stating products phthalates are used in).

103. *See* Talsness et al., *supra* note 98, at 2080 (explaining presence of phthalates in humans).

plastic items, such as beverage bottles and food storage containers.[104] This includes containers intended to be microwaved, although BPA is known to seep out more rapidly in higher temperatures.[105]

Through digestion, humans and animals alike are inadvertently exposed to chemicals when they consume other animals that ingested plastic particles.[106] As the amount of plastics in marine environments increases and marine animals ingest more chemicals, the exposure of those chemicals to humans also increases.[107] Human exposure to BPA has been linked to an increased risk for type 2 diabetes, cardiovascular disease, and heart attacks.[108]

Chemicals that are released into the environment, like BPAs, pose a threat to human health when combined with plastics.[109] The effects of chemicals such as hydrophobic anthropogenic contaminants (HACs), like polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloro-ethane (DDT), are well-documented.[110] These contaminants can be found in "sediments, seawater, and marine biota" around the globe, with high concentrations of PCBs reported in the seawater and sediment of the United States, among other countries.[111] HACs float on the ocean's surface, where they are absorbed by plastics due to the chemical's "lipophilic properties."[112] Plastics act like sponges, soaking up these ocean contaminants, "accumulating . . . [PCBs and other toxins] at concentrations up to [one] million times higher than in ocean water."[113] PCBs

104. *See id.* (discussing BPA presence in plastics).

105. *See id.* at 2082 (describing how high temperatures contribute to increase in BPA seepage from plastic packaging).

106. *See* Harse, *supra* note 65, at 341 (explaining how chemicals can pass through marine animals to humans).

107. *See* Seltenrich, *supra* note 97 (describing plastics in marine environments pose threat to humans).

108. *See* Talsness et al., *supra* note 98, at 2084 (noting potential health risks BPA creates for humans).

109. *See* Harse, *supra* note 65, at 340-41 (introducing danger of certain contaminants on human health).

110. *See id.* (discussing PCBs as hazardous substances).

111. *See id.* (providing where such contaminants can be found); *see also* Emma L. Teuten et. al, *Transport and Release of Chemicals from Plastics to the Environment and to Wildlife*, 364 PHIL. TRANSACTIONS ROYAL SOC'Y. B 2027, 2035 (2009), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2873017/pdf/rstb20080284.pdf (explaining where contaminants have been found in environment).

112. Harse, *supra* note 61 (describing how properties of plastics cause absorption of contaminants).

113. *See* Le Guern, *supra* note 2 (discussing rate at which contaminants are absorbed).

have been linked to reproductive disorders, an increased risk of disease, and even death.[114]

Even more disturbing, DDTs, a chemical widely documented as a "probable human carcinogen," has been found in plastic particles ingested by marine animals.[115] Marine animals have been known to ingest the plastic particles that end up in aquatic environments.[116] As Captain Charles Moore explained, "You can buy certified organic produce[, b]ut no fishmonger on Earth can sell you a certified wild-caught fish."[117] When marine animals directly ingest plastic particles, or indirectly ingest plastic particles through consuming smaller animals that have ingested plastic particles, marine animals are also ingesting contaminants such as HACs.[118] The ultimate consequence of marine animals consuming plastic particles is that humans are also "ingesting and concentrating these chemicals, to potentially disastrous effect."[119]

Although invisible to the naked eye, microplastics have emerged as a rising threat to our oceans and aquatic wildlife.[120] The term "microplastics" refers to plastic particles that range between one and five millimeters in size.[121] "[I]n 2014, the United States alone introduced over 260 tons of these microplastics into the world's oceans . . . ."[122] The sources of microplastics vary.[123] One main source is direct introduction into the environment through runoff and weathering degradation of plastic debris, which

---

114. *See id.* (noting health concerns PCBs pose).

115. *See id.* (detailing known health risks of DDTs).

116. *See* Harse, *supra* note 65, at 336-37 (reiterating documentation of ingestion of plastic particles by marine wildlife).

117. *See id.* at 341 (quoting Captain Charles Moore, *Seas of Plastic*, TED TALK (Feb. 2009), http://www.ted.com/talks/lang/eng/capt_charles_moore_on_the_seas_of_plastic.html) (analyzing how contaminants found in plastics are virtually everywhere).

118. *See* Harse, *supra* note 65, at 341 (explaining how chemicals can pass through food chain from marine animals that ingest plastics).

119. *See id.* (discussing how harmful effects of fish ingesting plastic particles can be felt up food chain to humans).

120. *See* Anthony L. Andrady, *Microplastics in the Marine Environment*, 62 MARINE POLLUTION BULL., 1596 (Aug. 2011), https://ac.els-cdn.com/S0025326X11003055/1-s2.0-S0025326X11003055-main.pdf?_tid=99ddd13c-a24e-11e7-b4d4-00000aacb361&acdnat=1506384593_fc9d92a987e5b99320b5e3fb176507fe (discussing omnipresent quality of microplastics).

121. *See* Guy Graney, *Slipping Through the Cracks: How Tiny Plastic Microbeads Are Currently Escaping Water Treatment Plants and International Pollution Regulation*, 39 FORDHAM INT'L L.J. 1023, 1025 (2016) (describing typical size of microplastics).

122. *See id.* (outlining amount of microplastics released into environment).

123. *See id.* at 1025-26 (discussing numerous sources for microplastics in aquatic environments).

causes fragmentation into smaller particles.[124] Another source of microplastics is the purposeful manufacture for cosmetic products, like facial cleansers, which are introduced into the oceans through runoff.[125] These types of microplastics are more commonly known as microbeads.[126] "[M]icrobeads have begun to steadily accumulate in larger bodies of water since their introduction, due in part to the inability of most modern water filtration systems to filter out the small-sized plastics."[127] Microplastics have been accumulating worldwide for the last four decades, and in that time scientists have documented their presence on beaches, in surface waters, and even in the most remote marine environments.[128] Microplastics have even been found in the Arctic and Antarctic Oceans.[129]

Due to the seemingly innocuous nature of microplastics, marine animals, from sea turtles and fish to the smallest of organisms like plankton and mollusks, easily ingest microplastics.[130] The small size of microplastics allows for exposure to marine animals at different levels of the food chain.[131] In fact, of all the reports of interaction between marine animals and litter, ten percent of those encounters involve microplastics.[132] Much like larger plastic particles, ingestion of microplastics poses significant health risks to marine wildlife.[133] For example, a recent study found that exposure of fish embryos to microplastics reduced hatching success

---

124. *See* Andrady, *supra* note 120 (outlining common sources of microplastics).

125. *See id.* (discussing microplastics directly created via manufacturing).

126. *See* Graney, *supra* note 121 (defining microbeads and their characteristics).

127. *Id.* at 1026 (describing wide accumulation of microplastics in world's large bodies of water).

128. *See* Stephanie L. Wright, Richard C. Thompson & Tamara S. Galloway, *The Physical Impacts of Microplastics on Marine Organisms: A Review*, 178 ENVTL. POLLUTION 483 (2013), https://www.ncbi.nlm.nih.gov/pubmed/23545014 (explaining microplastics presence is widespread).

129. *See* Won Joon Shim & Richard C. Thomposon, *Microplastics in the Ocean*, 69 ARCHIVES ENVTL. CONTAMINATION & TOXICOLOGY 265, 266 (Sept. 2, 2015), https://link.springer.com/content/pdf/10.1007%2Fs00244-015-0216-x.pdf (noting microplastics have been found in remote locations).

130. *See* Andrady, *supra* note 120 (discussing marine animals that typically ingest microplastics).

131. *See id.* (explaining how size of microplastics contributes to danger they pose to animals).

132. *See* Shim & Thomposon, *supra* note 129 (explaining percentage of encounters between marine wildlife and microplastics).

133. *See* Lusher, *supra* note 15 (introducing risks of microplastics on marine wildlife).

and survival.[134] Widespread ingestion and absorption of microbeads by marine animals also poses a grave risk of starvation, suffocation, and even food-chain poisoning.[135] More specifically, "[t]oxin-imbued microbeads run the risk of infiltrating an ecosystem's food web, passing from prey to predator until humans and other higher-level consumers are exposed to highly concentrated levels of harmful chemicals."[136] The presence of microplastics, including microbeads, poses grave health concerns not only for marine life, but also for the health and safety of humans.[137]

In recent years, "researchers . . . have found a stunning amount of plastic in the largest freshwater ecosystem on earth, the Great Lakes."[138] Furthermore, microplastics are prevalent in many rivers and tributaries that flow into the Great Lakes.[139] In 2012, samples taken from Lake Erie revealed that the quantity of microplastics in the lake was three times greater than any samples taken from the oceans.[140] Additionally, there are an estimated 112,000 particles of microplastics per square mile of Great Lakes water.[141] The presence of microplastics of any kind in the Great Lakes, and other freshwater ecosystems, poses the same health risks and concerns for

134. *See* Chelsea M. Rochman, *Ecologically Relevant Data are Policy-Relevant Data: Microplastics Reduce Fish Hatching Success and Survival*, SCIENCE (June 3, 2016), https://static1.squarespace.com/static/55b29de4e4b088f33db802c6/t/575897eac6fc08df251b2c54/1465423853163/Rochman+Science+2016.pdf (describing results of research on European perch exposed to microplastics).

135. *See* Graney, *supra* note 121, at 1026 (examining risks of ingestion and absorption of microbeads to marine animals).

136. *Id.* (discussing impacts of microplastics passing through food chain).

137. *See id.* at 1026-27 (addressing health concerns of both marine animals and humans). "[Microplastic] absorption by marine life risks starvation, suffocation, and, as the plastics absorb trace chemicals from their environment, food-chain poisoning." *Id.* at 1026.

138. *See* Editorial Board, *Microbeads, the Tiny Orbs Threatening Our Water*, N.Y. TIMES (Aug. 21, 2015), https://www.nytimes.com/2015/08/22/opinion/microbeads-the-tiny-orbs-threatening-our-water.html (discussing newly discovered large quantities of microplastics in Great Lakes and their origin).

139. *See Widespread Plastic Pollution Found in Great Lakes Tributaries*, DEP'T OF THE INTERIOR, U.S. GEOLOGICAL SURVEY (released Sept. 14, 2016), https://www.usgs.gov/news/widespread-plastic-pollution-found-great-lakes-tributaries (revealing evidence of plastic pollution found in tributaries of Great Lakes).

140. *See* Sigler, *supra* note 63 (explaining open-water study on Great Lakes and results of sample taken).

141. *Microplastics in Our Nation's Waterways*, DEPT. OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, https://owi.usgs.gov/vizlab/microplastics/#ref3 (last updated Mar. 16, 2016) (providing statistics on amount of microplastics found in Great Lakes).

both aquatic wildlife and animals as microplastics found in the oceans.[142]

III. CURRENT FEDERAL REGULATIONS

The Clean Water Act (CWA), as amended in 1972, is the most important federal law for regulating discharges of pollutants into the waters of the United States.[143] The general aim of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[144] The Supreme Court addressed the objective of the CWA and stressed that the CWA does not simply control the "addition of pollutants," but deals with pollution as a whole.[145] The Court noted that Congress defined pollution as "'the manmade or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.'"[146]

Regarding the goals of combatting water pollution and maintaining the quality of the nation's waters, the CWA provides a number of tools to control water pollution from various sources.[147] The CWA made it illegal to discharge any pollutant from a point source into navigable waters without a permit.[148] Pollutant, as defined by the CWA, includes solid waste and garbage.[149] The EPA's National Pollutant Discharge Elimination System (NPDES) permit program controls discharges.[150]

Further, the CWA requires all states to adopt water quality standards.[151] Such water quality standards include designated uses and water quality criteria sufficient to protect the designated uses.[152]

142. *See generally id.* (discussing how microplastics in freshwater can be harmful to humans and wildlife); *see also* Graney, *supra* note 121, at 1026 (stating risks microbeads pose to health of marine animals).

143. *See Summary of the Clean Water Act*, *supra* note 32 (summarizing CWA and its objective).

144. *See* 33 U.S.C. § 1251(a) (outlining aim of CWA).

145. *See* S.D. Warren Co. v. Me. Bd. of Envtl. Prot., 547 U.S. 370, 385 (2006) (discussing purpose of CWA regarding pollution).

146. *See id.* (quoting 33 U.S.C. § 1362(19)).

147. *See generally Summary of the Clean Water Act*, *supra* note 32 (introducing regulatory programs, standards, and tools of CWA).

148. *See* 33 U.S.C. §§ 1311, 1342 (outlining requirement of permit to discharge pollutants into water). A point source is defined as "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharge." 40 C.F.R. § 401.11(d) (defining point source).

149. *See* 33 U.S.C. § 1362(6) (2014) (defining pollutant).

150. *See* 33 U.S.C. § 1342 (2014) (explaining role of NPDES).

151. *See* 33 U.S.C. § 1313 (2000) (outlining requirements of Act).

152. *See* 40 C.F.R. § 131.6 (explaining water quality standards).

States are required to identify impaired waters, those bodies of water failing to meet water quality standards, and establish limits on pollutants causing the impairment.[153] To address the impairment, states must formulate Total Maximum Daily Loads (TMDLs), which outline the maximum amount of a pollutant the impaired body of water can receive without violating water quality standards.[154]

If a state develops a TMDL, it must submit updates about impaired waters and load levels to the EPA Administrator "from time to time" for EPA approval.[155] The EPA must also recommend "pollutants suitable for maximum daily load measurement[s]."[156] The EPA has identified and recommended approximately 150 pollutants that are suitable for TMDL measurement, albeit failing to include plastic.[157]

Under the CWA, the EPA has the authority to establish national water quality criteria and publish information on methods to protect water quality.[158] The Administrator has general authority to impose water quality standards if any state fails to establish water quality standards within a certain time frame, or if the Administrator determines a state's water quality standards are inconsistent with the CWA's requirements.[159] Under CWA, Section 1314(a)(1) required the EPA to develop and publish water quality criteria "accurately reflecting the latest scientific knowledge" on a variety of topics, including water pollutants' effects on the health and welfare of aquatic wildlife.[160] The EPA has yet to issue water quality criteria specifically for plastic pollution.[161]

The Pollution Prevention Act (PPA) of 1990 focuses on ways for businesses, the government, and the public to reduce sources of

153. *See* 33 U.S.C. § 1313(d) (addressing State requirements under Act).

154. *See id.* (defining TMDLs and explaining how they work).

155. *See id.* at (d)(2) (explaining process that follows after state development of TMDL).

156. *See* 33 U.S.C. § 1314(a)(2) (2000) (discussing responsibilities of EPA under Act).

157. *See National Recommended Water Quality Criteria–Aquatic Life Criteria Table*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table#table (last visited July 23, 2017) (listing pollutants EPA identifies and recommends).

158. *See* 33 U.S.C. § 1314(a)(1)-(2) (explaining authority given to EPA under Act).

159. *See* 33 U.S.C. § 1313(b)(1) (giving EPA regulatory role if states do not adequately address CWA requirements).

160. *See* 33 U.S.C. § 1314(a)(1) (describing role EPA plays in publishing information regarding health and safety concerns of wildlife).

161. *See Water Quality Criteria*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/wqc (last visited July 23, 2017) (illustrating lack of water quality criteria for plastic pollution).

pollution, rather than strategies for reduction or clean up.[162] The PPA "calls for source reduction practices to prevent hazardous substances, pollutants, or contaminants from being released into the environment."[163] Although the Act does not address plastics specifically, source reduction is especially important for plastic elimination in the aquatic environments because it is the most efficient means to ensure plastic will not enter these environments.[164]

In 2006, the Marine Debris Research, Prevention, and Reduction Act (MDRPRA) was enacted to help "identify, determine sources of, assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, the marine environment, and navigation safety."[165] The Act also established the Marine Debris Prevention and Removal Program, within the National Oceanic and Atmospheric Administration (NOAA), to "reduce, and remove marine debris, with a focus on marine debris posing a threat to living marine resources and navigation safety."[166] The Marine Debris Prevention and Removal Program provided funding for the University of Washington's Center for Urban Waters' study of microplastics.[167]

Finally, in 2015, Congress enacted a federal microbead ban by passing the Microbead-Free Waters Act (MFWA), which prohibits the sale or distribution of rinse-off cosmetics containing plastic microbeads.[168] The MFWA amended the Federal Food, Drug, and Cosmetic Act to prohibit "the manufacture and introduction or delivery for introduction into interstate commerce of a rinse-off cos-

---

162. *See* 42 U.S.C. § 13101 (1990) (iterating formally governmental strategy and direction); *see generally Summary of the Pollution Prevention Act*, *supra* note 38 (summarizing focus of PPA).

163. *See Preventing Trash at the Source*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/trash-free-waters/preventing-trash-source-0 (last updated Dec. 11, 2017) (outlining basis of source reduction practices of Act).

164. *See* 42 U.S.C. § 13101 (1990) (highlighting importance of source reduction); *see generally Summary of the Pollution Prevention Act*, *supra* note 38 (explaining effectiveness of source reduction under PPA).

165. *See* 33 U.S.C. § 1952 (2006) (explaining aim of MDRPRA).

166. *Id.* (addressing establishment of Marine Debris Prevention and Removal Program under MDRPRA).

167. *See* Julie Masura, Joel Baker, Gregory Foster & Courtney Arthur, *Laboratory Methods for the Analysis of Microplastics in the Marine Environment: Recommendations for Quantifying Synthetic Particles in Waters and Sediments*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN. MARINE DEBRIS PROGRAM (July 2015), https://marinedebris.noaa.gov/sites/default/files/publications-files/noaa_microplastics_methods_manual.pdf (analyzing microplastics in aquatic environments).

168. *See* Microbead-Free Waters Act of 2015, PUB. L. NO. 114-114, 129 Stat. 3129 (amending 21 U.S.C. § 331).

metic that contains intentionally-added plastic microbeads."[169] The Act defines plastic microbead as "any solid plastic particle that is less than five millimeters in size and is intended to be used to exfoliate or cleanse the human body or any part thereof."[170] Beginning July 2018, the MFWA will ban sales of cosmetics containing microbeads, and, by July 2019, the Act will ban over-the-counter drugs that contain microbeads.[171] This ban targets one of the leading ocean contaminants and is especially important because microbead cleanup is no small feat.[172]

IV. SUGGESTIONS AND SOLUTIONS

As the amount of plastic that is introduced, or is currently present in aquatic environments, accelerates and accumulates, there must be measures taken to mitigate the harm that has already been done to these environments and to prevent any further harm.[173] The most favorable option to assist the EPA in reducing the plastic pollution in our nation's water would be to develop a rule or regulation that specifically addresses plastic pollution under the CWA.[174] The EPA should consider enacting a rule that contains national water quality criteria for plastic pollution, including microplastics.[175] To date, the EPA has not done so.[176] If the EPA adopts a water quality criteria for plastic pollution, it is likely that many more bodies of water around the country would be found to be "impaired" due to the amounts of plastic pollution that are cur-

169. *Id.* (outlining MFWA amendment to the Federal Food, Drug, and Cosmetic Act).

170. *Id.* (defining plastic microbead); *see also* Sarah Kettenmann, *Nationwide Ban on Plastic Microbeads in Cosmetics*, 31 NAT. RES. & ENV'T 1 (Summer 2016), http://www.bdlaw.com/assets/attachments/466.pdf (defining plastic microbead under Act).

171. *See* Kettenmann, *supra* note 170, at 1 (explaining time frame of related bans on products that contain plastic microbeads).

172. *See id.* (addressing microbeads as leading plastic pollutant in oceans today).

173. *See* Jessica R. Coulter, *A Sea Change to Change the Sea: Stopping the Spread of the Pacific Garbage Patch with Small-Scale Environmental Legislation*, 51 WM. & MARY L. REV. 1959, 1960-62 (Apr. 2010) (addressing importance of acting to prevent ever-increasing plastic presence in oceans).

174. *See* Doughty, *supra* note 35, at 284 (explaining need for CWA to address plastics in water quality criteria formulation).

175. *See id.* (discussing need for EPA to issue new rule containing water quality criteria for plastic pollution).

176. *Id.* (noting EPA has failed to address plastic pollution in its water quality criteria).

rently in such waters.[177] Lawmakers should make adjustments to the TMDLs for bodies of water.[178] As noted above, the EPA is required to recommend pollutants that are suitable for TMDL measurement.[179] The EPA should identify and recommend plastic as a pollutant to ensure that states take plastic pollution into account when they calculate their TMDL amounts.[180]

Another necessary step for the reduction of plastics found in aquatic environments is a uniform nationwide ban on plastic bags.[181] On September 30, 2014, California became the first state to ban single-use bags, including plastic bags.[182] The ban "prohibit[s] stores that exceed a designated amount of revenue or retail floor space from providing free single-use bags to customers at the point of sale."[183] This ban and others like it will positively impact the environment because single-use plastic bags make up a large portion of the plastic that ends up in the ocean.[184] Plastic bags are also harmful to marine wildlife, as they have been known to suffocate certain species, and are often mistaken as food.[185] Other states should follow California's model if they want to reduce the production of plastic pollution.[186]

Finally, Americans need to be more aware of the prevalence of plastic debris in our oceans and participate in preventative programs.[187] If consumers are aware of the dangers plastics in aquatic environments pose, it is likely that they will make better choices in terms of consumption and disposal of plastic.[188] As Hideshige

177. *See id.* (explaining current TMDLs are not effective to address plastic pollution because of EPA's failure to address plastic as pollutant to be measured under TMDLs).

178. *See* Harse, *supra* note 65, at 355 (noting need for adjustments to TMDLs for bodies of water).

179. *See id.* (quoting 33 U.S.C. § 1314(a)(2)).

180. *See id.* at 355-56 (noting EPA does not list nor identify plastic as pollutant and emphasizing need for EPA to expand list to include plastic).

181. *See* Qiying Zhu, *The California Plastic Bag Ban: Where Do We Go From Here?*, 5 ARIZ. J. ENVTL. L. & POL'Y 1053, 1054 (2015) (addressing necessity for ban on single-use plastic bags).

182. *Id.* at 1053 (highlighting California as first state to ban single-use bags).

183. *See id.* (outlining prohibition under new California single-use bag ban).

184. *See id.* at 1055-56 (explaining positive impacts of plastic bag bans).

185. *See id.* at 1054 (noting dangers plastic bags pose to wildlife when they enter aquatic environments).

186. *See* Zhu, *supra* note 181, at 1057 (explaining potential success of California plastic bag ban if adopted by other states).

187. *See* Le Guern, *supra* note 2 (discussing importance of consumer education and accountability when purchasing plastic products).

188. *See id.* (addressing importance of consumer awareness when making decision to purchase plastic products).

Takada, Yukie Mato professor of organic geochemistry at Tokyo University, said, "We can't avoid using plastic, but we use too much."[189] While eradicating both plastic production and use are not realistically feasible today, consumers can make a difference by choosing reusable plastic products, or plastic-free products.[190] These measures will lead to a reduction in the amount of plastic pollution found in our nation's waters and the surrounding oceans.[191]

*Stephanie F. Wood**

---

189. *Id.* (quoting professor from Tokyo University).

190. *See id.* (noting importance of promoting and encouraging people to use reusable plastic products or plastic-free products).

191. For a discussion of suggestions and solutions for reducing the amount of plastic pollution in aquatic environments, see *supra* notes 173-191 and accompanying text.

* J.D. Candidate, 2018, Villanova University Charles Widger School of Law; B.A., 2015, SUNY Binghamton.