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## PROTECTING MARINE ANIMALS: DOMESTIC AND INTERNATIONAL REGULATION ON OCEAN PLASTIC DUMPING

Xiaoduo Liu\*

### I. INTRODUCTION

Plastic plays a critical role in the world's economy because the global manufacturing industry widely uses it to produce goods that have changed the way humans live. Some plastic products may have significant environmental impacts that many people are not aware of. Huge amounts of discarded plastic float in the open sea. Although humans regularly benefit from plastic, it harms and kills marine animals because of their inability to adapt to the environmental changes.

This article explores how the international community created a "legal pathway" for plastic waste to enter the oceans and how nations can help protect marine animals from ocean plastic. Ocean plastic dumping is an international issue, and an international cooperative agreement to address this issue would take time to develop. However, nations can impose domestic regulations and share technologies with each other in order to speed up the progress and ultimately restore the marine environment so that animals can thrive. Part II of this article presents an overview of plastic's advantages over other materials and its possible legal identity as "waste." Part III of this article illustrates how ocean plastic may harm marine animals. Part IV of this article explores plastic's "legal pathway" into the oceans and identifies the parties responsible for the current ocean plastic crisis. Part V of this article addresses how nations can protect marine animals from ocean plastic by imposing domestic regulations and collaborating internationally.

### II. BACKGROUND

#### *A. Plastic's Market Takeover*

Modern manufacturing has been through significant changes since plastic was first introduced approximately 150 years ago.<sup>1</sup> For example,

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industries are no longer confined by limited natural resources such as metal, ivory, stone, and wood.<sup>2</sup> Plastic has several advantages compared to other materials such as metal. For example, between plastic and metal, generally plastic has four advantages that drive manufacturers to switch from metal to plastic.

First, plastic is generally much lighter than metal.<sup>3</sup> Consumers may prefer plastic lunch boxes over stainless steel lunch boxes because plastic is light and microwavable, although the long-term health effects of microwaving plastic are still uncertain.<sup>4</sup> Also, automobile manufacturers are replacing metal parts with plastic parts to improve fuel economy and meet governmental regulations.<sup>5</sup>

In the United States, the Corporate Average Fuel Economy (“CAFE”) standards, first enacted by Congress in 1975, aims to: (1) reduce energy consumption by passenger cars and light trucks, (2) save consumers money on fuel, and (3) reduce greenhouse gas (“GHG”) emissions.<sup>6</sup> CAFE authorizes the United States Department of Transportation’s National Highway Traffic and Safety Administration (“NHTSA”) to cooperate with the United States Environmental Protection Agency (“USEPA”) to establish CAFE and GHG emission standards.<sup>7</sup> NHTSA and USEPA have jointly issued final rules regulating the average “miles per gallon” fuel economy and “grams per mile” GHG emissions for passenger cars and light trucks produced in 2017 and beyond.<sup>8</sup> One way for manufacturers to meet NHTSA and USEPA requirements is to replace metal parts, such as piston rings, with

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<sup>1</sup> PATENT OFFICE, SER. NO. 80, PATENT FOR INVENTIONS: ABRIDGMENTS OF SPECIFICATIONS 255 (1876), <https://books.google.com/books?id=0nCoU-2tAx8C&pg=PA255#v=onepage&q&f=false>.

<sup>2</sup> Susan Freinkel, *A Brief History of Plastic’s Conquest of the World*, SCI. AM.: SCI. (May 29, 2011), <https://www.scientificamerican.com/article/a-brief-history-of-plastic-world-conquest/>.

<sup>3</sup> *Metal vs. Plastic: 5 Key Comparisons*, PRODUCTIVE PLASTICS, INC. (Apr. 13, 2017), <https://www.productiveplastics.com/metal-vs-plastic-5-key-comparisons/>.

<sup>4</sup> See Laura Prevo & Debra Boutin, *How to Choose an Earth-Friendly Lunchbox*, BASTYR U.: NEWS (June 2, 2014), <https://bastyr.edu/news/health-tips-spotlight-1/2014/05/how-choose-earth-friendly-lunchbox>; see also *Microwaving food in plastic: Dangerous or not?*, HARVARD U.: HARVARD HEALTH PUB. (Feb. 2006), <https://www.health.harvard.edu/staying-healthy/microwaving-food-in-plastic-dangerous-or-not> (last updated Sept. 20, 2017).

<sup>5</sup> See Matt Bishop, *3 Steps to Converting Metal Automotive Components to Plastic*, KAYSUN CORP.: KAYSUN BLOG (June 1, 2016, 8:38 AM), <https://www.kaysun.com/blog/steps-to-converting-metal-automotive-components-to-plastic>.

<sup>6</sup> *Corporate Average Fuel Economy (CAFE) Standards*, U.S. DEP’T TRANSP., <https://www.transportation.gov/mission/sustainability/corporate-average-fuel-economy-cafe-standards> (last updated Aug. 27, 2014).

<sup>7</sup> *Id.*

<sup>8</sup> *Id.*

heat-resistant “PEEK thermoplastic” in automatic transmission.<sup>9</sup> Also, vehicles that weigh less require less fuel to travel the same distance, which, in turn, would save consumers money and reduce GHG emissions.<sup>10</sup>

Second, plastic can be stronger than metal.<sup>11</sup> Current technologies can enhance plastic’s strength by applying longer fibers or adding glass or carbon fibers for plastic to outperform metal based on a compared strength-to-weight ratio.<sup>12</sup> This ratio “relates the density of the material to its ability to withstand permanent deformation or fracture under pressure.”<sup>13</sup> Aerospace industries are designing plastic parts to replace metal parts because manufacturers can control fiber orientation to produce stronger plastic composites.<sup>14</sup>

Third, plastic can also outperform metal in strength-to-stiffness ratio.<sup>15</sup> “Stiffness relates to how a component bends under load while still returning to its original shape once the load is removed.”<sup>16</sup> To illustrate, in automobile industries, a vehicle’s body made of low-stiffness materials would wave and flex beyond an acceptable level when the vehicle is in motion.<sup>17</sup> Now, plastic composites can outperform metal in both strength and stiffness without carrying additional weight or thickness.<sup>18</sup>

Lastly, plastic is much easier to shape and manipulate compared to metal. Thus, plastic requires less time, labor, money, and energy during its production.<sup>19</sup> For example, high-end technologies, such as 3D printing that relies on plastic as its “ink” to produce specific products, are developing quickly.<sup>20</sup>

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<sup>9</sup> James D. Sawyer, *Change-up Pitch: From Metal to Plastic*, ADVANCED MANUFACTURING (Oct. 2, 2014), <http://advancedmanufacturing.org/change-pitch-metal-plastic/>.

<sup>10</sup> *Id.*

<sup>11</sup> Jeff Kerns, *Replacing Metal with Plastic*, MACHINE DESIGN (Aug. 23, 2016), <http://www.machinedesign.com/materials/replacing-metal-plastic>.

<sup>12</sup> *Id.*; PRODUCTIVE PLASTICS, INC., *supra* note 3.

<sup>13</sup> See Pearl Lewis, *How to Calculate a Weight-to-Strength Ratio*, SCIENCING: PHYSICS, <https://sciencing.com/calculate-weight-strength-ratio-8114466.html> (last updated Mar. 13, 2018); see also PRODUCTIVE PLASTICS, INC., *supra* note 3.

<sup>14</sup> See, e.g., Kerns, *supra* note 11.

<sup>15</sup> PRODUCTIVE PLASTICS, INC., *supra* note 3.

<sup>16</sup> Daniel J. Schaeffler, *The differences between stiffness and strength in metal*, FABRICATOR (Dec. 1, 2015), <https://www.thefabricator.com/article/metalsmaterials/the-differences-between-stiffness-and-strength-in-metal>.

<sup>17</sup> *Id.*

<sup>18</sup> See Kerns, *supra* note 11.

<sup>19</sup> PRODUCTIVE PLASTICS, INC., *supra* note 3.

<sup>20</sup> *What Material Should I Use for 3D Printing?*, 3D PRtg. FOR BEGINNERS (Feb. 10, 2013), <https://3dprintingforbeginners.com/filamentprimer/>.

Today, plastic is in offices, schools, kitchens, outdoor recreation areas, and even outer space where it can protect astronauts from radiation.<sup>21</sup> Research found that “an average person living in Western Europe or North America consumes 100 kilograms of plastic each year.”<sup>22</sup> Chinese residents use and discard more than 60 million plastic food containers every day, because of the boom of online food ordering and delivery businesses.<sup>23</sup> An annual report released by the State Post Bureau of the People’s Republic of China shows that, despite a huge decline, the country still used 14.7 billion plastic bags and 3.3 hundred million packing tapes for shipping in 2016.<sup>24</sup> One study estimated that roughly 12,000 metric tons of plastic product will be landfilled or enter the environment by 2050.<sup>25</sup> Therefore, plastic may continue to dominate the global market for decades to follow as an easily accessible and cost-effective material.

### *B. Plastic “Waste” and Recyclability*

A functioning plastic product may not harm the environment; however, once it is out of the consumer’s control, it becomes “waste” and its disposal becomes subject to governmental regulation.

The term “waste” has different definitions internationally; for example, under the United States’ Resource Conservation and Recovery Act (“RCRA”), “solid waste” means “any garbage, refuse [and] other discarded material, including solid, liquid [and] semisolid [material, which results] from industrial, commercial, mining, [agricultural operation, and community activities].”<sup>26</sup> China defines “solid waste” as “abandoned materials in solid, semi-solid state coming from production, construction, everyday life and

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<sup>21</sup> Mike Wall, *Plastic Could Protect Astronauts from Deep-Space Radiation*, SPACE.COM (June 14, 2013, 6:32 AM), <https://www.space.com/21561-space-exploration-radiation-protection-plastic.html>.

<sup>22</sup> Gaelle Gourmelon, *Global Plastic Production Rises, Recycling Lags*, WORLDWATCH INST. (Jan. 28, 2015), <http://www.worldwatch.org/global-plastic-production-rises-recycling-lags-0>.

<sup>23</sup> See Zhang Junfen (张骏芬), Yi Tian 6000 Wan Ge Waimai He! Zhongguo Suliao Laji Xin Tiaozhan (一天 6000 万个外卖盒! 中国塑料垃圾新挑战), SOHU: BUS. (Jan. 12, 2018, 18:34 PM), [http://www.sohu.com/a/216281954\\_335495](http://www.sohu.com/a/216281954_335495); see also *China’s food-delivery business is booming. So is waste*, ECONOMIST (Oct. 19, 2017), <https://www.economist.com/news/china/21730427-wooden-chopsticks-and-plastic-boxes-threaten-environment-chinas-food-delivery-business>.

<sup>24</sup> Kuaidi Baozhuang Zai Biange Zhong Qude Xin Tupo (快递包装在变革中取得新突破), ST. POST BUREAU P.R.C. (Sept. 15, 2017), [http://www.spb.gov.cn/ztgz/gjyzjzt/lskd/dtyw/201709/t20170915\\_1326415.html](http://www.spb.gov.cn/ztgz/gjyzjzt/lskd/dtyw/201709/t20170915_1326415.html).

<sup>25</sup> Roland Geyer et al., *Production, use, and fate of all plastics ever made*, SCI. ADVANCES (July 19, 2017), at 1, <http://advances.sciencemag.org/content/3/7/e1700782/tab-pdf>.

<sup>26</sup> 42 U.S.C. § 6903(27) (2018).

other activities and causing environmental pollution.”<sup>27</sup> According to Merriam-Webster, “pollution” is defined as “the condition of being polluted” or “the action of polluting especially by environmental contamination with man-made waste.”<sup>28</sup> Besides the United States and China, Poland, in its National Waste Management Plan, identifies “households” and “infrastructure sites” as “sources of waste origination” and classifies “plastic waste” as “municipal waste.”<sup>29</sup>

Today, all plastic products are arguably solid and man-made products. A food container is one example of many plastic products that go through industrial, commercial, and household stages and end up as waste. Without regulation identifying industrial, commercial, and household sites as major sources for plastic waste, such waste will significantly affect the environment around the world.

Humans have produced approximately 8,300 million metric tons of plastic product in the past 60 years.<sup>30</sup> Recycling is one of the major approaches used to address plastic-related environmental issues.<sup>31</sup> The term “recyclability” is defined as the “ability of waste materials to be captured and separated from the waste stream for conversion into a new item or reused in the same capacity.”<sup>32</sup>

Each grade or type of plastic waste has its own recyclability, and not all plastic is recyclable.<sup>33</sup> For example, although people may use plastic bags to collect either trash or recyclable materials, some recycling facilities do not accept plastic bags because their technologies cannot efficiently treat or recycle them.<sup>34</sup> Likewise, some facilities do not accept foam cups and

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<sup>27</sup> *Law of the People’s Republic of China on Prevention and Control Environmental Pollution by Solid Waste*, MINISTRY COM. P.R.C. (Mar. 19, 2007), <http://english.mofcom.gov.cn/aarticle/policyrelease/internationalpolicy/200703/20070304471567.html>.

<sup>28</sup> *Pollution*, MERRIAM-WEBSTER, <https://www.merriam-webster.com/dictionary/pollution> (last visited Nov. 6, 2018).

<sup>29</sup> See *POLAND: The 2010 National Waste Management Plan*, MINISTERSTWO ŚRODOWISKA (Dec. 2006), at 9, [https://www.mos.gov.pl/g2/big/2009\\_06/e97e2a07ce29b48c19f462f83a6bf1a9.pdf](https://www.mos.gov.pl/g2/big/2009_06/e97e2a07ce29b48c19f462f83a6bf1a9.pdf); see also *The National Waste Management Plan 2014*, CLIMATE POL’Y OBSERVER (July 30, 2010), at 10, [https://climateobserver.org/wp-content/uploads/2014/09/Poland\\_National-Waste-Management-Plan-2014.pdf](https://climateobserver.org/wp-content/uploads/2014/09/Poland_National-Waste-Management-Plan-2014.pdf).

<sup>30</sup> Geyer et al., *supra* note 25.

<sup>31</sup> *Id.*

<sup>32</sup> *What is RECYCLABILITY?*, L. DICTIONARY, <https://thelawdictionary.org/recyclability/> (last visited Nov. 6, 2018).

<sup>33</sup> *Now Accepting # 1 - 7 Plastic Bottles, Tubs and Jars in your Curbside Recycling Bin!*, ECO-CYCLE, <http://www.ecocycle.org/plastics-recycling> (last visited Nov. 6, 2018).

<sup>34</sup> *Id.*

containers for recycling.<sup>35</sup> Products made from a single type of plastic, such as water bottles, generally have the highest recycling value.<sup>36</sup> However, the material must be thermoplastic, which means it can be “re-melted and remolded into new products.”<sup>37</sup> Plastic recycling is complicated and challenging because it is hard for people and machines to differentiate “thousands of variations.”<sup>38</sup> Despite current efforts around the world, only about 9% of plastic waste had been properly recycled as of 2015.<sup>39</sup>

### III. PLASTIC’S IMPACTS ON MARINE ANIMALS

In addition to the plastic being recycled, landfilled, and littered, approximately 10 to 20 million tons of plastic waste end up in the oceans each year, and roughly 270,000 tons of plastic float on the ocean surface.<sup>40</sup> A recent study identified a “major ocean plastic accumulation zone,” known as the “Great Pacific Garbage Patch” (“Pacific Patch”).<sup>41</sup> The Pacific Patch is between California and Hawaii and consists of at least 79,000 metric tons of plastic waste, covering 1.6 million square kilometers.<sup>42</sup> Such waste accumulation zones inevitably harm marine animals.

The time it takes for plastic waste to decompose in the oceans varies depending on factors such as the type of plastic and water temperature.<sup>43</sup> Some types of plastic take decades to decompose while others take more than 100 years.<sup>44</sup> Even if some waste could decompose in a year or two, it

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<sup>35</sup> *Id.*

<sup>36</sup> Lilly Sedaghat, *7 Things You Didn’t Know About Plastic (and Recycling)*, NAT’L GEOGRAPHIC: CHANGING PLANET (Apr. 8, 2018), <https://blog.nationalgeographic.org/2018/04/04/7-things-you-didnt-know-about-plastic-and-recycling/>.

<sup>37</sup> *Id.*

<sup>38</sup> *Recycling Plastic: Complications & Limitations*, EUREKA RECYCLING, [http://sites.fitnyc.edu/depts/sustainabilityatfit/Recycling\\_Plastic\\_Co.pdf](http://sites.fitnyc.edu/depts/sustainabilityatfit/Recycling_Plastic_Co.pdf) (last visited Nov. 6, 2018).

<sup>39</sup> Geyer et al., *supra* note 25.

<sup>40</sup> Gourmelon, *supra* note 22.

<sup>41</sup> L. Lebreton et al., *Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic*, SCI. REP. (Mar. 22, 2018), at 1, <https://www.nature.com/articles/s41598-018-22939-w.pdf>.

<sup>42</sup> *Id.*

<sup>43</sup> *How Long Does It Take for Trash to Decompose?*, BE GREEN PACKAGING: NEWS (May 14, 2013), <https://begreenpackagingstore.com/blogs/news/7873165-how-long-does-it-take-for-trash-to-decompose>; William Harris, *How long does it take for plastics to biodegrade?*, HOWSTUFFWORKS, <https://science.howstuffworks.com/science-vs-myth/everyday-myths/how-long-does-it-take-for-plastics-to-biodegrade.htm> (last visited Nov. 6, 2018); Carolyn Barry, *Plastic Breaks Down in Ocean, After All—And Fast*, NAT’L GEOGRAPHIC: ARTICLE (Aug. 20, 2009), <https://news.nationalgeographic.com/news/2009/08/plastic-breaks-down-in-ocean-after-all-and-fast/>.

<sup>44</sup> BE GREEN PACKAGING, *supra* note 43.

may release toxic chemicals such as bisphenol A (“BPA”) which can poison marine animals.<sup>45</sup>

Abandoned plastic fishing nets are common, and visible plastic waste can cause injury and death to marine animals.<sup>46</sup> At least 75% of the Pacific Patch consists of plastic debris larger than five centimeters, and at least 46% of the debris are fishing nets.<sup>47</sup> Although monitoring the effects of plastic waste on marine animals is difficult, researchers concluded in 2005 that fishing nets killed approximately 1,000 marine animals and seabirds each day.<sup>48</sup> Fishing nets are dangerous because they can capture animals and limit their mobility.<sup>49</sup> For example, the nets may strangle and suffocate the animals, and some animals may starve to death because they cannot move to find food as they normally would. Even if an animal can still move while dragging a fishing net, the chances of the animal’s survival could be much lower because the animal may not move fast enough to avoid predators, or the hindrance may distress the animal thereby jeopardizing its survival.

Plastic waste may get stuck around an animal’s neck or body when it is young and can lead to deformities or underdeveloped organs as the animal grows, even without causing exterior injury or death.<sup>50</sup> For example, if a baby sea turtle swims into a six-pack ring and is unable to escape the ring, the ring may later deform the turtle’s shell and lead to compressed lungs.<sup>51</sup>

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<sup>45</sup> Tom Laskawy, *Scientists: BPA has widely contaminated the oceans*, GRIST: BUS. & TECH. (Mar. 25, 2010), <https://grist.org/article/new-evidence-that-bpa-has-widely-contaminated-the-oceans/>.

<sup>46</sup> Jacob Shea, *Ghost Fishing Nets: Invisible Killers in the Oceans*, EARTH ISLAND J.: LATEST (Jan. 7, 2014), [http://www.earthisland.org/journal/index.php/elist/eListRead/ghost\\_fishing\\_nets\\_invisible\\_killers\\_in\\_the\\_oceans/](http://www.earthisland.org/journal/index.php/elist/eListRead/ghost_fishing_nets_invisible_killers_in_the_oceans/).

<sup>47</sup> L. Lebreton et al., *supra* note 41.

<sup>48</sup> See James Owen, *Nets Kill Nearly 1,000 Marine Mammals a Day, Groups Say*, NAT’L GEOGRAPHIC (June 10, 2005), [https://news.nationalgeographic.com/news/2005/06/0610\\_050610\\_dolphins.html](https://news.nationalgeographic.com/news/2005/06/0610_050610_dolphins.html) (last visited Apr. 22, 2018); see also *NETS KILL NEARLY 1,000 MARINE MAMMALS A DAY, GROUP SAYS*, SR<sup>3</sup>: BLOG (Nov. 11, 2016), <https://www.sealifer3.org/news/2016/11/11/nets-kill-nearly-1000-marine-mammals-a-day-group-says>.

<sup>49</sup> Shea, *supra* note 46.

<sup>50</sup> Liz Dwyer, *Indestructible Plastic Six-Pack Rings Kill Countless Wildlife—but Not This New Edible Variety That Turtles Love to Munch On (Video)*, ALTERNET: ENV’T (Sept. 28, 2016), <https://www.alternet.org/environment/indestructible-plastic-six-pack-rings-kill-countless-wildlife-not-new-edible-variety>.

<sup>51</sup> See Latrice Harrison, *Poor Turtle Permanently Injured by Plastic 6 Pack Ring is Now an ambassador to Help Others!*, ONEGREENPLANET: BUZZ (Oct. 20, 2015), <http://www.onegreenplanet.org/news/poor-turtle-permanently-injured-by-plastic-makes-a-recovery/>.

Marine animals that eat plastic waste could die because they cannot digest the plastic they thought was food. For example, a hungry sea turtle may swallow a plastic bag thinking it is a jellyfish because the two look similar while floating in the oceans.<sup>52</sup> Also, seabirds may eat plastics because they might smell like food given sometimes plastic “emits the scent of a sulfurous compound that some seabirds have long relied upon to tell them where to find food.”<sup>53</sup> The compound is released by algae that coats floating plastic.<sup>54</sup> Specifically, the compound “is released when algae is eaten by animals like krill, one of the birds’ favorite meals.”<sup>55</sup> Although “the algae does not smell like food itself, it [smells] like food being eaten, which is the birds’ version of a dinner bell.”<sup>56</sup> Scientists have been tracking plastic ingestion by seabirds since 1960.<sup>57</sup> Nearly 90% of seabirds contain plastic in their stomachs, and virtually all of them will have consumed plastic by 2050.<sup>58</sup> “Plastic found [in the birds’ stomachs] includes bags, bottle caps, synthetic fibers from clothing, and tiny rice-sized bits that have been broken down by the sun and waves.”<sup>59</sup>

“Microplastics” and toxic chemicals released by ocean plastic can also harm marine animals. Microplastics are plastic pieces less than five millimeters long.<sup>60</sup> They result from the degradation of ocean plastic debris or other human activities.<sup>61</sup> For example, manufacturers may add microplastics to products such as cleansers and toothpastes.<sup>62</sup> These microplastic pieces may “easily pass through water filtration systems” and enter the oceans.<sup>63</sup> Microplastics are hardly visible and therefore some animals may swallow microplastics while feeding. Swallowing and

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<sup>52</sup> See Kat Smith, *This Image Shows Why Sea Turtles Are Confusing Plastic Bags for Jellyfish*, ONEGREENPLANET: BUZZ (Oct. 25, 2016), <http://www.onegreenplanet.org/news/what-a-plastic-bag-looks-like-to-a-sea-turtle/>; see also Kate Wilson, *A sad story about turtles and plastic bags*, MARINE CONSERVATION SOCIETY: NEWS (Dec. 11, 2017), <https://www.mcsuk.org/news/turtle-eats-plastic-bag/>.

<sup>53</sup> Kat Kerlin, *Why Do Seabirds Eat Plastic? The Answer Stinks*, U. CAL., DAVIS: NEWS (Nov. 9, 2016), <https://www.ucdavis.edu/news/why-do-seabirds-eat-plastic-answer-stinks/>.

<sup>54</sup> *Id.*

<sup>55</sup> *Id.*

<sup>56</sup> *Id.*

<sup>57</sup> Chris Wilcox et al., *Threat of plastic pollution to seabirds is global, pervasive, and increasing*, PNAS (July 2, 2015), at 5, <http://www.pnas.org/content/pnas/early/2015/08/27/1502108112.full.pdf>.

<sup>58</sup> *Id.* at 1.

<sup>59</sup> Laura Parker, *Nearly Every Seabird on Earth Is Eating Plastic*, NAT’L GEOGRAPHIC (Sept. 2, 2015), <https://news.nationalgeographic.com/2015/09/15092-plastic-seabirds-albatross-australia/>.

<sup>60</sup> *What are microplastics?*, NAT’L OCEANIC AND ATMOSPHERIC ADMIN.: OCEAN FACTS, <https://oceanservice.noaa.gov/facts/microplastics.html> (last visited Nov. 6, 2018).

<sup>61</sup> *Id.*

<sup>62</sup> *Id.*

<sup>63</sup> *Id.*

accumulating small pieces could harm the animals just as badly as swallowing visible plastic debris.

Toxic chemicals released by ocean plastic, such as BPA, is an invisible source of harm that may endanger a species by interfering with the animals' reproductive system.<sup>64</sup> One study, which applied an above-existing level of BPA in the oceans to zebrafish to test the impacts of excessive BPA, found that the excessive BPA may cause an abnormal sex ratio.<sup>65</sup> In a recent controversial documentary episode of *Blue Planet II* produced by the British Broadcasting Corporation, a mother whale was shown carrying her dead whale calf in her mouth.<sup>66</sup> The narrator addressed the current ocean plastic issue and stated, "it is possible [that] her calf may have been poisoned by her own contaminated milk."<sup>67</sup> This episode received criticism for not providing scientific evidence to show whether the mother whale's milk was in fact contaminated and the reason for contamination.<sup>68</sup> Although more research is needed to prove how toxic chemicals released by ocean plastic can harm marine animals, graphic messages, including the *Blue Planet II* episode, have raised awareness of the potential adverse impacts of plastic waste.<sup>69</sup>

#### IV. PLASTIC'S "LEGAL PATHWAY" INTO THE OCEANS

Plastic can enter oceans in many ways. Again, some plastic waste gets into the oceans through sewage systems.<sup>70</sup> Also, regardless of a person's location and the local law regulating plastic waste dumping, the person may drop a bottle cup in the water while vacationing at the beach without being caught by law enforcement officers. However, such incremental contributions are not enough to constitute up to the worldwide dumping of 20 million tons of ocean plastic per year.<sup>71</sup>

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<sup>64</sup> Barry, *supra* note 43; see Laura Canesi & Elena Fabbri, *Environmental Effects of BPA: Focus on Aquatic Species*, DOSE-RESPONSE (July-Sept. 2015), [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4674185/pdf/10.1177\\_1559325815598304.pdf](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4674185/pdf/10.1177_1559325815598304.pdf).

<sup>65</sup> Canesi & Fabbri, *supra* note 64, at 2.

<sup>66</sup> Richard Wheatstone, *WHALE OF A LIE?*, SUN: UK NEWS, <https://www.thesun.co.uk/news/4963045/bbc-blue-planet-baby-whale-death-scene-faked-claims-professor/> (last updated Nov. 21, 2017).

<sup>67</sup> *Id.*

<sup>68</sup> *Id.*

<sup>69</sup> *Id.*

<sup>70</sup> NAT'L OCEANIC AND ATMOSPHERIC ADMIN., *supra* note 60.

<sup>71</sup> Gourmelon, *supra* note 22.

It is likely that every nation generating plastic waste is responsible for the Pacific Patch plastic crisis. Nations' domestic laws and international waste trading agreements have shaped a "legal pathway" for plastic to enter the oceans. Although nations recognized that it is important to prevent ocean plastic dumping, domestic laws still allow government entities to exercise their discretion on whether to permit systematic and institutional dumping. Besides, some nations are exporting plastic waste to other nations, and there is no guarantee that those waste will be properly treated without being dumped in the oceans. The Pacific Patch between California and Hawaii may not result solely from the United States' dumping of plastic waste because "huge spirals of seawater formed by colliding currents" collect and carry waste from one side of the ocean to another (Figure 1).<sup>72</sup>

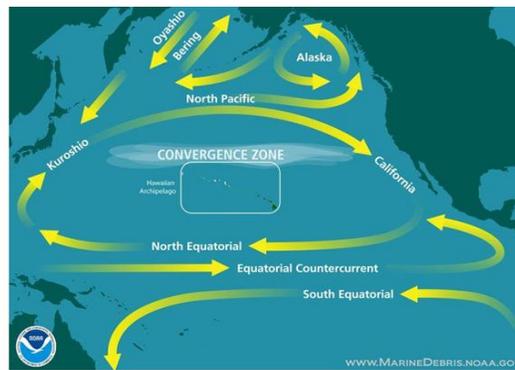


Figure 1 – "Illustration of oceanographic features in the N. Pacific"  
(National Oceanic and Atmospheric Administration)

#### A. 1972: *The London Convention*

The international community recognized back in 1972 that ocean dumping is a global issue requiring all nations' contributions to protect the marine environment. Participating nations met at the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, known as the London Convention.

<sup>72</sup> See Russell McLendon, *What is the Great Pacific Ocean Garbage Patch?*, MOTHER NATURE NETWORK (Mar. 22, 2018), <https://www.mnn.com/earth-matters/translating-uncle-sam/stories/what-is-the-great-pacific-ocean-garbage-patch>; see also *How Debris Accumulates*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN.: MARINE DEBRIS PROGRAM, <https://marinedebris.noaa.gov/movement/how-debris-accumulates> (last visited Nov. 6, 2018); Jeannie Evers, *Great Pacific Garbage Patch*, NAT'L GEOGRAPHIC: SOC'Y, <https://www.nationalgeographic.org/encyclopedia/great-pacific-garbage-patch/> (last updated Sept. 19, 2014).

Participants at the London Convention entered into an international treaty by the same name. The treaty recognizes that “the marine environment and the living organisms which it supports are of vital importance to humanity, and all people have an interest in assuring that it is so managed that its quality and resources are not impaired.”<sup>73</sup> The parties of the London Convention agreed they must individually and collectively impose their own control measures to regulate “all sources of pollution of the marine environment” and “prevent the pollution of the sea” by dumping waste that threatens human health, living resources and marine life.<sup>74</sup> The treaty defines “waste” as “material and substance of any kind, form or description,” which clearly covers plastic waste.<sup>75</sup> The Convention currently has 87 parties.<sup>76</sup>

### *B. United States’ Waste Management Scheme for Waterway Protection*

In October 1972, before ratifying the London Convention in 1974, the United States enacted the Marine Protection, Research, and Sanctuaries Act, also known as the Ocean Dumping Act, to implement the Convention’s requirements.<sup>77</sup>

The Ocean Dumping Act prohibits dumping of materials that would “unreasonably degrade or endanger” human health or the marine environment.<sup>78</sup> Specifically, the Act prohibits: “(1) transportation of material from the United States for the purpose of ocean dumping, (2) transportation of material from anywhere for the purpose of ocean dumping by U.S. agencies or U.S.-flagged vessels, and (3) dumping of material transported from outside the United States into the U.S. territorial sea.”<sup>79</sup> However, the United States Environmental Protection Agency may permit the dumping of

<sup>73</sup> Convention of the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Dec. 29, 1972, 1972 U.S.T. LEXIS 106, T.I.A.S. 8165, <http://www.imo.org/en/OurWork/Environment/LCLP/Documents/LC1972.pdf>.

<sup>74</sup> *Id.* at art. I.

<sup>75</sup> *Id.* at art. III, § 4.

<sup>76</sup> See *Parties to the London Convention and Protocol*, INT’L MARITIME ORG., <http://www.imo.org/en/OurWork/Environment/LCLP/Documents/Parties%20LC%20and%20LP%20Oct%202017.pdf> (last visited Nov. 6, 2018); see also *Ocean Dumping: International Treaties*, U.S. ENVTL. PROTECTION AGENCY: OCEAN DUMPING, <https://www.epa.gov/ocean-dumping/ocean-dumping-international-treaties#US%20LC%20Contracting%20Party> (last visited Nov. 6, 2018).

<sup>77</sup> See *Learn about Ocean Dumping*, U.S. ENVTL. PROTECTION AGENCY: OCEAN DUMPING, <https://www.epa.gov/ocean-dumping/learn-about-ocean-dumping#prohibited> (last visited Nov. 6, 2018); see also U.S. ENVTL. PROTECTION AGENCY, *supra* note 76.

<sup>78</sup> 33 U.S.C. § 1412(a) (2018).

<sup>79</sup> See *Summary of the Marine Protection, Research, and Sanctuaries Act*, U.S. ENVTL. PROTECTION AGENCY: LAWS & REGULATIONS, <https://www.epa.gov/laws-regulations/summary-marine-protection-research-and-sanctuaries-act> (last visited Nov. 6, 2018); see also 33 U.S.C. § 1401(c) (2018).

materials which do not “unreasonably degrade or endanger” human health or the marine environment.<sup>80</sup>

The United States also enacted the Clean Water Act (“CWA”) to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.”<sup>81</sup> CWA prohibits discharge of any pollutant without a government-issued permit.<sup>82</sup> It also governs “discharge of any pollutant into marine waters,” including the “deep waters of the territorial sea or the waters of the contiguous zone, or into saline estuarine waters where there is strong tidal movement.”<sup>83</sup> Furthermore, the United States enacted RCRA in 1976 to prohibit all open dumping of solid waste in order to protect the land and waterways.<sup>84</sup> RCRA’s Subtitle D authorizes individual U.S. states to develop comprehensive plans to encourage recycling and permit landfilling of non-hazardous industrial solid waste and municipal solid waste.<sup>85</sup> Although CWA and RCRA focus more on inland dumping, these statutes along with the Ocean Dumping Act can benefit marine animals because an unregulated dumping near any inland waterway can result in waste entering the oceans.

The United States is concerned with the marine environment, and certain results positively reflect that concern. According to a study analyzing ocean plastic dumping in 2010, the United States ranked twentieth of 192 nations for contributing up to 0.11 million metric tons of ocean plastic in 2010.<sup>86</sup> The result is positive because the United States is the only “high income” nation on the study’s top-20 list for ocean dumping and is currently the world’s largest economy, which means it is expected to have the ability to consume more plastic products than many other nations.<sup>87</sup> Nations, even

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<sup>80</sup> 33 U.S.C. § 1412(a) (2018).

<sup>81</sup> 33 U.S.C. § 1251 (2018).

<sup>82</sup> *Clean Water Act and Federal Facilities*, U.S. ENVTL. PROTECTION AGENCY: ENFORCEMENT, <https://www.epa.gov/enforcement/clean-water-act-cwa-and-federal-facilities> (last visited Nov. 6, 2018).

<sup>83</sup> 33 U.S.C. § 1311 (2018).

<sup>84</sup> *Protecting Communities, Restoring Land, Conserving Resources: RCRA’s Critical Mission & the Path Forward*, U.S. ENVTL. PROTECTION AGENCY (June 2014), at 5, [https://www.epa.gov/sites/production/files/2015-09/documents/rcras\\_critical\\_mission\\_and\\_the\\_path\\_forward.pdf](https://www.epa.gov/sites/production/files/2015-09/documents/rcras_critical_mission_and_the_path_forward.pdf).

<sup>85</sup> *Id.* at 6; *Non-Hazardous Waste/Solid Waste*, U.S. ENVTL. PROTECTION AGENCY: REG. INFO. BY TOPIC, <https://www.epa.gov/regulatory-information-topic/regulatory-information-topic-waste> (last visited Nov. 6, 2018).

<sup>86</sup> Jenna R. Jambeck et al., *Plastic waste inputs from land into the ocean*, 347 SCI: MARINE POLLUTION 768, 769 (Feb. 12, 2015), [https://wedocs.unep.org/bitstream/handle/20.500.11822/17969/Plastic\\_waste\\_inputs\\_from\\_land\\_into\\_the\\_ocean.pdf?sequence=1](https://wedocs.unep.org/bitstream/handle/20.500.11822/17969/Plastic_waste_inputs_from_land_into_the_ocean.pdf?sequence=1).

<sup>87</sup> *Id.*; Prableen Bajpai, *The World’s Top 20 Economies*, INVESTOPEDIA (Aug. 16, 2018, 11:06 AM), <https://www.investopedia.com/insights/worlds-top-economies/>.

if not on the study's top-20 list but still contribute to ocean plastic dumping, should nonetheless consider imposing more stringent laws to regulate such activity because plastic has harmful environmental effects and the situation may not be as positive as it seems to be. Even if a nation does not dump as much plastic as others do, it does not necessarily mean that nation generates less waste. A nation can shift its environmental burden to top-tier dumping nations through international waste trading agreements, and the environmental consequences of ocean dumping can be shifted back as water carries waste from the dumper to the generator.

### *C. International Waste Trading and Burden Shifting*

Not all nations treat or recycle their own plastic waste. According to statistics by a non-profit trade association in Washington, D.C., the United States was the largest exporter of plastic waste with more than two million metric tons exported in 2015.<sup>88</sup> China, which ranked first for contributing the most to ocean plastic dumping in 2010, was the largest importer of plastic waste; in fact, China bought more than half of the global supply of plastic waste.<sup>89</sup>

In 2016, the United States exported more than 1.4 million metric tons of plastic waste to China.<sup>90</sup> Before December 31, 2017, China's primary economic practice was to import certain types of solid waste, including plastic waste, which it could recycle and reuse as raw materials for manufacturing.<sup>91</sup> To complete the transaction, each shipment must receive a

<sup>88</sup> *About ISRI*, INST. SCRAP RECYCLING INDUSTRIES, INC., <http://www.isri.org/about-isri> (last visited Nov. 6, 2018); *Global Exports of Plastic Scrap by Country and Year*, INST. SCRAP RECYCLING INDUSTRIES, INC., <http://www.isri.org/docs/default-source/commodities/international-scrap-trade-database/comtrade-plastic-ex.pdf?sfvrsn=4> (last visited Nov. 6, 2018).

<sup>89</sup> Jambeck et al., *supra* note 86; see Peter Buxbaum, *China Scraps Waste and Scrap Imports*, GLOBAL TRADE: NEWS (Oct. 9, 2017), <http://www.globaltrademag.com/global-trade-daily/china-scraps-waste-scrap-imports>; *Global Imports of Plastic Scrap by Country and Year*, INST. SCRAP RECYCLING INDUSTRIES, INC., <http://www.isri.org/docs/default-source/commodities/international-scrap-trade-database/comtrade-plastic-im.pdf?sfvrsn=4> (last visited Nov. 6, 2018).

<sup>90</sup> *United States Scrap Trade with China*, INST. SCRAP RECYCLING INDUSTRIES, INC., <http://www.isri.org/docs/default-source/int%271-trade/2017isrichinatradesheet.pdf> (last visited Nov. 6, 2018); Cody Boteler, *ISRI: Overall scrap exports up in 2017, despite China disrupting paper, plastic*, WASTE DIVE (Feb. 16, 2018), <https://www.wastedive.com/news/isri-scrap-exports-2017-china-disruption-paper-plastic/517202/>.

<sup>91</sup> Guanyu Fabu "Jinkou Feiwu Guanli Mulu" (2017 Nian) de Gonggao (关于发布《进口废物管理目录》(2017年)的公告) (promulgated by the Ministry of Ecology and Environment of the People's Republic of China, Ministry of Commerce of the People's Republic of China, National Development and Reform Commission, General Administration of Customs of the People's Republic of China, General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, Aug. 10, 2017, effective Dec. 31, 2017), [http://www.mep.gov.cn/gkml/hbb/bgg/201708/t20170817\\_419811.htm?COLLCC=304399588&](http://www.mep.gov.cn/gkml/hbb/bgg/201708/t20170817_419811.htm?COLLCC=304399588&).

Relevant License for Import of Solid Waste from the Ministry of Ecology and Environment of the People's Republic of China.<sup>92</sup>

China, like the United States, is concerned about the impacts of ocean dumping. According to the Measures on the Administration of Import of Solid Waste, “[d]umping, storage, and disposal of any imported solid waste shall be banned within the territory of the People's Republic of China.”<sup>93</sup> Also, China's Marine Environment Protection Law prohibits waste dumping in China's territorial sea unless the national oceanic administrative department permits it.<sup>94</sup> Both the United States' Ocean Dumping Act and China's Marine Environmental Protection Law grant their respective government agencies authority to permit the dumping of certain waste into the oceans.<sup>95</sup>

China has not been able to efficiently treat and recycle all plastic waste because of the amount of plastic product China produces, plus the amount of waste it imports from other nations. According to an annual report released by China Oceanic Information Network, in 2016, roughly 65 kilograms per square kilometer of waste floated on China's ocean surface and 84% of the waste consisted of plastic.<sup>96</sup> On-shore activities contributed 67% of the floating waste and the rest resulted from off-shore activities.<sup>97</sup> Also, two tons per square kilometer of waste lay on the beaches along China's shoreline, and 68% of the waste consisted of plastic.<sup>98</sup> Moreover, 671 kilograms per square kilometer of waste were under the ocean surface

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<sup>92</sup> Measures on the Administration of Import of Solid Waste (promulgated by the Ministry of Ecology and Environment of the People's Republic of China, Ministry of Commerce of the People's Republic of China, National Development and Reform Commission, General Administration of Customs of the People's Republic of China, General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, Apr. 8, 2011, effective Aug. 1, 2011), ch. 1, art. 5, [http://english.mep.gov.cn/Resources/laws/regulations/Solid\\_Waste/201111/P020111114599168815496.pdf](http://english.mep.gov.cn/Resources/laws/regulations/Solid_Waste/201111/P020111114599168815496.pdf).

<sup>93</sup> *Id.*

<sup>94</sup> Marine Environmental Protection Law of the People's Republic of China (promulgated by Order No. 26 of the President of the People's Republic of China, Dec. 25, 1999, effective Apr. 1, 2000), ch. VI, art. 55, [http://www.npc.gov.cn/englishnpc/Law/2007-12/13/content\\_1384046.htm](http://www.npc.gov.cn/englishnpc/Law/2007-12/13/content_1384046.htm).

<sup>95</sup> *Id.*; 33 U.S.C. § 1412(a) (2018).

<sup>96</sup> Zhuyao Ruhai Wuran Yuan Zhuangkuang (主要入海污染源状况), CHINA OCEANIC INFO. NETWORK, at 35/36, [http://www.nmdis.org.cn/gongbao/nrhuanjing/nr2016/201704/t20170413\\_35530.html](http://www.nmdis.org.cn/gongbao/nrhuanjing/nr2016/201704/t20170413_35530.html) (last updated Apr. 13, 2017).

<sup>97</sup> *Id.*

<sup>98</sup> *Id.*

with 64% of them consisting of plastic.<sup>99</sup> The report also recognized the potential threat of microplastics that could absorb toxic matters from the surrounding environment.<sup>100</sup> Microplastics were found on seashores, in the oceans, and in marine animals' bodies.<sup>101</sup>

A non-profit organization based in the United States released a report in 2015 acknowledging that, among the plastic waste China imported, up to 20% of the waste ended up in China's waste stream, "accounting for roughly 4% of total plastic waste in China."<sup>102</sup> Although "China has the largest waste-recycling industry in the world," some collected waste still goes to open dumping, and some imported plastic waste will likely end up in the oceans if it cannot be efficiently treated and recycled.<sup>103</sup>

The 2015 report estimated that five Asian nations (China, Indonesia, Philippines, Vietnam, and Thailand) together contributed up to 60% of ocean plastic.<sup>104</sup> Among these five nations, while China was the largest plastic waste importer in 2015, Indonesia was also a top-20 importer, which suggests that Indonesia imported some plastic waste before dumping it.<sup>105</sup> Under Indonesian law, a party "assuming responsibility for [the activity of] dumping into the sea shall be obligated to obtain a license from the Minister."<sup>106</sup>

Every nation mentioned above that is a major importer and exporter of plastic waste has domestic laws mandating individuals to obtain a permit before open dumping.<sup>107</sup> Nonetheless, those laws imply a possibility that a certain amount of the nations' plastic waste can be dumped in the oceans even though there are requirements in place. Therefore, a "legal pathway" allows plastic waste to travel either domestically or internationally and end

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<sup>99</sup> *Id.*

<sup>100</sup> *Id.* at 37-38.

<sup>101</sup> *Id.*

<sup>102</sup> *Stemming the Tide: Land-based strategies for a plastic-free ocean*, OCEAN CONSERVANCY (Sept. 2015), at 20-21, <https://oceanconservancy.org/wp-content/uploads/2017/04/full-report-stemming-the.pdf>.

<sup>103</sup> *Id.* at 21.

<sup>104</sup> *Id.* at 25.

<sup>105</sup> INST. SCRAP RECYCLING INDUSTRIES, INC., *supra* note 89.

<sup>106</sup> Control Over Marine Contamination and/or Damage (promulgated by the President of the Republic of Indonesia, Feb. 27, 1999, effective Feb. 27, 1999), ch. VIII, art. 18,

<http://extwprlegs1.fao.org/docs/pdf/ins36551.pdf>.

<sup>107</sup> 33 U.S.C. § 1412(a) (2018); U.S. ENVTL. PROTECTION AGENCY, *supra* note 82; U.S. ENVTL. PROTECTION AGENCY, *supra* note 84; *Global Exports of Plastic Scrap by Country and Year*, *supra* note 88; INST. SCRAP RECYCLING INDUSTRIES, INC., *supra* note 89; Marine Environmental Protection Law of the People's Republic of China, *supra* note 94; *id.*

up in the open sea. As long as a nation participates in plastic waste generating and international waste trading, it should be responsible for the world's ocean plastic crisis even if it prohibits domestic ocean dumping, because it is possible that the amount of plastic that is supposed to be dumped by a waste exporter will be traded to and dumped by an importer under a permit.

*D. 2017: The Burden Shifted Back from Importers to Exporters*

Although an exporter may shift its burden of treating plastic waste and the environmental consequences of domestic dumping to importers, the burden may later be shifted back to the exporter for two reasons. First, as Figure 1 shows, no matter where plastic waste is dumped, sea currents may collect the waste and bring it back from an importer to an exporter.<sup>108</sup> For example, the Pacific Patch can be a result of a certain amount of plastic waste being generated in the United States, sold to and dumped by an East Asian importer, and carried back to the United States by the Kuroshio current or the Equatorial countercurrent.<sup>109</sup> If the United States dumps the same amount of plastic waste without exportation, sea currents will likely carry the waste around the Pacific Ocean and eventually back to the same Pacific Patch.<sup>110</sup>

Second, given parties voluntarily enter into a waste trading agreement, an exporter should not expect that such business relationship would last indefinitely because an importer can decide not to import waste for different reasons. For example, a nation may stop importing plastic waste because it decided to develop other manufacturing industries that do not need much recycled plastic, or the imported plastic waste has posed a significant threat to that nation's environmental quality. On July 18, 2017, China notified the World Trade Organization that it "would be imposing a ban on imports of certain kinds of solid waste by the end of 2017," including plastic waste.<sup>111</sup> As a result, in the United States scrap is "piling up in storage facilities on the West Coast, waiting to be redirected to domestic or foreign facilities, or waiting indefinitely for the [ban] to relax."<sup>112</sup> Some

<sup>108</sup> NAT'L OCEANIC AND ATMOSPHERIC ADMIN., *supra* note 72; *see* NAT'L GEOGRAPHIC, *supra* note 72.

<sup>109</sup> *Id.*

<sup>110</sup> *Id.*

<sup>111</sup> *China's import ban on solid waste queried at import licensing meeting*, WTO: IMPORT LICENSING (Oct. 3, 2017), [https://www.wto.org/english/news\\_e/news17\\_e/impl\\_03oct17\\_e.htm](https://www.wto.org/english/news_e/news17_e/impl_03oct17_e.htm); Guanyu Fabu "Jinkou Feiwu Guanli Mulu" (2017 Nian) de Gonggao, *supra* note 91.

<sup>112</sup> Katherine Wei, *Plastic Waste Piles Up as China's Ban Goes Into Effect*, SIERRA CLUB (Feb. 3, 2018), <https://www.sierraclub.org/sierra/plastic-waste-piles-china-s-ban-goes-effect>; *see Recycling Chaos In U.S. As China Bans 'Foreign Waste'*, NAT'L PUB. RADIO: ENV'T (Dec. 9, 2017, 8:00 AM), <https://www.npr.org/2017/12/09/568797388/recycling-chaos-in-u-s-as-china-bans-foreign-waste>.

facilities have informed residents that they would no longer take plastic waste and such waste would have to be landfilled.<sup>113</sup> As a result of this dilemma, the United States may grant permits to allow certain ocean dumping if it cannot adjust to the market change by securing new waste importers or improving its domestic waste recycling scheme.

For these reasons, although a waste exporter may not engage in ocean dumping, it can still contribute to the ocean plastic crisis by generating and selling plastic waste to nations where a certain amount of the waste will be dumped under permits. Besides, even if a nation has a stringent permitting process, certain amount of waste may still be imported or dumped illegally without government approval.<sup>114</sup>

Therefore, ocean plastic dumping is a global concern and nations that generate plastic waste or participate in international waste trading should work together to restore the marine environment. Although protecting animals may not be a nation's primary interest to pursue, an ocean free of plastic waste would certainly be a long-term benefit to humanity.

Ideally, the international community must develop a long-term solution because ocean preservation is not just for people who love sightseeing or wildlife; it also represents humans' willingness to work together to preserve a habitable environment for future generations.

## V. PROTECTING MARINE ANIMALS: PRESENT AND FUTURE

### A. Domestic Regulations

In December 2017, roughly 200 nations signed a non-binding United Nations ("UN") resolution ("Resolution") at the U.N. Environmental Assembly in Nairobi, Kenya to eliminate ocean plastic.<sup>115</sup> The Resolution encourages nations to take action to "by 2025, prevent and significantly reduce marine pollution of any kinds, in particular from land-based activities,

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<sup>113</sup> Wei, *supra* note 112.

<sup>114</sup> *Thailand to ban e-waste, plastic imports*, BASEL ACTION NETWORK: NEWS (Aug. 17, 2018), <http://www.ban.org/news/2018/8/17/thailand-to-ban-e-waste-plastic-imports>; Kuala Langat, *Illicit recycling factories exposed in Malaysia*, STRAITS TIMES: SE ASIA (Sept. 26, 2018, 10:20 AM), <https://www.straitstimes.com/asia/se-asia/illicit-recycling-factories-exposed-in-malaysia>.

<sup>115</sup> *World commits to pollution-free planet at environment summit*, U.N. ENV'T PROGRAMME (Dec. 6, 2017), <https://www.unenvironment.org/news-and-stories/press-release/world-commits-pollution-free-planet-environment-summit>.

including marine debris and nutrient pollution.”<sup>116</sup> Specifically, the Resolution calls on nations “based on best available knowledge of sources and levels of marine litter and microplastics in the environment, to prioritize policies and measures at the appropriate scale to avoid marine litter and microplastics from entering the marine environment.”<sup>117</sup>

Besides the Resolution, nations and their citizens have already discussed domestic solutions to combat ocean plastic crisis. The Environmental Law Centre at the University of Victoria prepared a clinic report recommending a seven-part framework to mitigate marine plastic pollution. This framework included: (1) reducing consumer and industrial use of single-use plastics, (2) reducing plastic debris discharge from stormwater outfalls, (3) reducing microplastic pollution, (4) cleaning up derelict fishing and aquaculture gear, (5) extending producer responsibility, (6) redesigning the plastics economy, and (7) increasing education and outreach.<sup>118</sup>

One of the most forthright measures nations have taken to reduce ocean plastic is the banning of certain types of plastic. For example, more than ten nations have completely banned the use of plastic bags, and most others have imposed partial bans.<sup>119</sup> In 2008, China banned “shops, supermarkets, and sales outlets from providing free plastic bags that are less than 0.025 millimeters thick.”<sup>120</sup> China’s regulation prevented more than 1.4 million tons of plastic bags from being used and discarded.<sup>121</sup> Also, the United States banned the “manufacture or the introduction or delivery for

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<sup>116</sup> E.A. Res. 3/7, ¶ 2 (Dec. 6, 2017),

<https://papersmart.unon.org/resolution/uploads/k1800210.english.pdf>.

<sup>117</sup> *Id.* at ¶ 3.

<sup>118</sup> Meaghan Patridge et al., *A National Strategy to Combat Marine Plastic Pollution: A Blueprint for Federal Action*, T. BUCK SUZUKI ENVTL. FOUND. (Apr. 2018), at 4-6, [http://www.elc.uvic.ca/wordpress/wp-content/uploads/2018/04/2017-01-11\\_National-Marine-Plastics-Strategy-FINAL.pdf](http://www.elc.uvic.ca/wordpress/wp-content/uploads/2018/04/2017-01-11_National-Marine-Plastics-Strategy-FINAL.pdf).

<sup>119</sup> G. Cabrera, *Countries with plastic bag bans*, THOMSON REUTERS (June 5, 2018), <http://fingfx.thomsonreuters.com/gfx/rngs/GLOBAL-PLASTIC/010050KC19P/PLASTIC-BAN-01.jpg>.

<sup>120</sup> Ben Block, *China Reports 66-Percent Drop in Plastic Bag Use*, WORLDWATCH INST., <http://www.worldwatch.org/node/6167> (last visited Nov. 6, 2018); Guowuyuan Bangongting Guanyu Xianzhi Shengchan Xiaoshou Shiyong Suliaodai de Tongzhi (国务院办公厅关于限制生产销售使用塑料袋的通知) (promulgated by General Office of the State Council of the People’s Republic of China, Dec. 31, 2007, effective June 1, 2008), ¶ 1, [http://www.gov.cn/zwzqk/2008-01/08/content\\_852879.htm](http://www.gov.cn/zwzqk/2008-01/08/content_852879.htm).

<sup>121</sup> Zhu Jianhong (朱剑红) & Zhao Zhanhui (赵展慧), “Xian Su Ling” 2008 Nian Qi Shishi Zhijin Shao Yong Suliaodai 140 Wan Dun (“限塑令”2008年起实施至少用塑料袋 140 万吨), XINHUANET (Feb. 17, 2016, 7:52 AM), [http://www.xinhuanet.com/finance/2016-02/17/c\\_128725736.htm](http://www.xinhuanet.com/finance/2016-02/17/c_128725736.htm) (the original article was published on [paper.people.com.cn](http://paper.people.com.cn), which may have been archived and is unavailable).

introduction into interstate commerce of a rinse-off cosmetic that contains intentionally-added plastic microbeads.”<sup>122</sup> Furthermore, the United Kingdom announced its intention to ban the nationwide sale of plastic straws, while several cities in the United States, such as Seattle, Washington and Malibu, California, have implemented similar bans.<sup>123</sup> It is not clear how long it will take to completely replace plastic straws with alternatives such as paper straws because the cost of paper straws is “four times that of plastic straws,” and “large volume users such as fast-food chains” may not be able to afford that.<sup>124</sup>

Although proactive bans are being imposed which may reduce plastic waste in the long run, a large amount of ocean plastic remains that could harm marine animals. While reactive measures may directly and immediately mitigate ocean plastic’s impacts on animals, they also come with a cost.

For example, nations may not be ready for plastic waste removal until they have developed the technologies to efficiently treat the removed waste or until they have designated areas to landfill the waste. Still, without a well-established domestic reactive framework, a nation may temporarily improve its own marine environment by putting some of the removed waste in the international waste trading market without dumping it somewhere within the border. However, as discussed before, at least some of those waste would again end up in the oceans and be carried back through sea currents to where it was shipped out. Also, although volunteers around the world are trying to remove as much waste as possible, their incremental contributions would not be able to offset the impacts of the current waste dumping and trading scheme.<sup>125</sup> To encourage removal, governments may need to create incentives for entities and private citizens to participate in

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<sup>122</sup> 21 U.S.C. § 331(ddd)(1) (2018).

<sup>123</sup> *UK Government rallies Commonwealth to unite on marine waste*, GOV.UK: PRESS RELEASE, <https://www.gov.uk/government/news/uk-government-rallies-commonwealth-to-unite-on-marine-waste> (last updated Apr. 20, 2018); Jessica Lee, *The last straw? Seattle will say goodbye to plastic straws, utensils with upcoming ban*, SEATTLE TIMES: LOCAL NEWS, <https://www.seattletimes.com/seattle-news/the-last-straw-seattle-will-say-goodbye-to-plastic-straws-utensils-with-upcoming-ban/> (last updated Sept. 11, 2017, 9:13 AM); Alene Tchekmedyian, *Malibu bans restaurants from giving out plastic straws, stirrers and utensils*, L.A. TIMES (Feb. 28, 2018, 8:45 PM), <http://www.latimes.com/local/lanow/la-me-ln-malibu-plastic-ban-20180226-story.html>.

<sup>124</sup> Paul Welitzkin, *Starbucks to phase out plastic straws*, CHINA DAILY, <http://www.chinadaily.com.cn/a/201807/10/WS5b442560a3103349141e1d42.html> (last updated July 10, 2018, 11:17 AM).

<sup>125</sup> *See One Million Less Items of Trash in our Ocean*, PROJECT AWARE: NEWS (Mar. 27, 2018, 10:54 AM), [https://www.projectaware.org/news/one-million-less-items-trash-our-ocean?utm\\_source=mediapartners&utm\\_medium=social&utm\\_content=news-onemillionlesspr&utm\\_campaign=debris](https://www.projectaware.org/news/one-million-less-items-trash-our-ocean?utm_source=mediapartners&utm_medium=social&utm_content=news-onemillionlesspr&utm_campaign=debris); see, e.g., *Fighting for Trash Free Seas*, OCEAN

regular removals. For example, business entities may receive a tax cut in proportion to the amount they contributed to the removal. Also, a government may direct inmates to participate in the removal or provide off-season employment opportunities to fishermen.

### *B. International Collaborations*

Proactive bans and reactive measures are equally important to combat the ocean plastic crisis. Nations should collaborate and share the most advanced technologies to effectuate those measures. However, the international community may not have a unified proactive regulation scheme because each nation's situation is different. As the London Convention and the Resolution indicate, nations should start by developing their own measures with their discretion.<sup>126</sup>

For reactive measures, nations may try to agree on an international removal plan, but it would take time because there are too many factors to consider. For example, a nation must consider whether ocean plastic removal is its priority given the nation has other important domestic or international issues. If the nation decides to participate in the international removal, it must determine whether it can afford the cost of personnel, technologies, and equipment required. Nations might have difficulty investing in plastic removal without understanding how they may benefit from an international collaboration. A key issue to consider is where would waste go after removal from the oceans. If each nation keeps the amount of waste it removed, the removal does not necessarily benefit the environment unless the nation is capable of properly treating and recycling this extra waste. If the nation cannot properly treat the waste removed, it may have to dump the waste somewhere else within the boarder or transport it to another nation willing to accept the waste in exchange of certain benefits. Resolving this issue among nations is similar to establishing an international waste trading scheme. Essentially, the removal of waste can be easy, but the future of the waste is uncertain. Without a well-developed waste handling system, plastic removed from the oceans may again be dumped under a permit.

Therefore, technologies must support a worldwide solution. Eco-friendly technologies and products are developing fast. For example, to remove plastic from the oceans, a foundation headquartered in the

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CONSERVANCY: VOLUNTEER, <https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/volunteer/> (last visited Nov. 6, 2018).

<sup>126</sup> Convention of the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, *supra* note 74; E.A. Res. 3/7, *supra* note 117.

Netherlands has been developing a floating system which is “estimated to remove half the Great Pacific Garbage Patch in 5 years” and “set to be deployed mid-2018.”<sup>127</sup> Also, in Australia, “two avid surfers” developed a device called “Seabin” and have been applying it at “marinas, docks, yacht clubs and commercial ports” to suck floating plastic waste.<sup>128</sup>

Besides, some individuals and companies proactively developed or applied products such as biodegradable, edible six-pack rings and edible cutleries.<sup>129</sup> However, edible cutleries are available only through e-commerce and the company is looking for resellers or franchisees to expand the market and reduce logistic costs.<sup>130</sup> In addition, an Indonesian company developed drinkable bags made from cassava—a tropical plant.<sup>131</sup> The bags are dissolvable in water and can be recycled with paper.<sup>132</sup>

Despite all the waste removal devices and proactive innovations, humans still need to find ways to properly dispose of, decompose, or recycle existing ocean plastic. It may be too early for nations to agree on an international ocean plastic removal plan, but, during the interim, nations should encourage individual persons and companies to voluntarily develop, share, exchange, and trade eco-friendly technologies and support a market for alternative products. Once people can maintain a status quo by minimizing plastic waste and ocean dumping, the only question for nations to solve would be how to eliminate existing ocean plastic. Ideally, with the reactive technologies developed during the interim and people’s experience in working together implementing proactive measures, international collaborations for a clean marine environment will become much easier in the near future.

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<sup>127</sup> *HOW IT WORKS*, OCEAN CLEANUP: TECH., <https://www.theoceancleanup.com/technology/> (last visited Nov. 6, 2018).

<sup>128</sup> *WHAT’S A SEABIN?*, SEABIN PROJECT: FOR CLEANER OCEANS, <http://seabinproject.com/> (last visited Nov. 6, 2018); *How did it start?*, SEABIN PROJECT: FOR CLEANER OCEANS, <https://www.seabinproject.com/about-us/> (last visited Nov. 6, 2018).

<sup>129</sup> *ECO SIX PACK RINGS*, SALT WATER BREWERY: COMMUNITY, <https://saltwaterbrewery.com/pages/community> (last visited Nov. 6, 2018); *About Edible Cutlery*, BAKEY’S, <http://www.bakeys.com/> (last visited Nov. 6, 2018).

<sup>130</sup> *Do you want to be a part of this revolution?*, BAKEY’S, <http://www.bakeys.com/> (last visited Nov. 6, 2018).

<sup>131</sup> Geronimo, *Meet Avani, the Compostable and Drinkable Eco-friendly Bag*, EARTHBIDDIES: EUREKA GREEN (May 3, 2018), <https://earthbuddies.net/compostable-drinkable-bags/>.

<sup>132</sup> *Id.*

## VI. CONCLUSION

Plastic has been a dominating material for the past 150 years and has caused significant adverse environmental impacts to the marine environment and animals depending on it.<sup>133</sup> Because humans cannot efficiently treat and recycle plastic waste, roughly 10 to 20 million tons of plastic waste end up in the oceans each year.<sup>134</sup> As a result, marine animals get injured or die each day because of their inability to adapt to the environmental changes caused by ocean plastic. Although nations have recognized the importance of preserving the marine environment and developed domestic regulations, government-issued open dumping permits and international waste trading agreements opened a door for more plastic waste to enter the oceans. While imposing more stringent proactive regulations, nations should encourage voluntary technology development and sharing and support a market for eco-friendly alternative products.

By implementing and collaborating on proactive measures, people can start working together to minimize plastic waste and ocean dumping, and thus make time for the development of waste treating technologies and promote a unified international ocean plastic removal effort. As more people become aware of the ocean plastic crisis and start combating the crisis, we should feel confident in restoring the marine environment upon which animals and the humanity rely.

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<sup>133</sup> PATENT OFFICE, *supra* note 1.

<sup>134</sup> Gourmelon, *supra* note 22.