COMMENT

TRANSOCEANIC TRASH: INTERNATIONAL AND UNITED STATES STRATEGIES FOR THE GREAT PACIFIC GARBAGE PATCH

"In a high-tech era of radiation, carcinogenic chemicals, and human-induced climate change, the problem of the trash produced by ocean-going vessels or litter swept out to sea must seem old-fashioned by comparison. . . . Regrettably, that perception is wrong." Senator Daniel Inouye.[1]

I. INTRODUCTION

Between Hawaii and California lies an expansive "patch" of garbage consisting of everything from clothing to bottles, to discarded fishing nets, to plastic bags.[2] Sun-bleached toys, ropes, and cups bob in the gentle waves,[3] mixing with pill bottles from India and various containers and plastic caps marked by Russian, Korean, and Chinese writing.[4] Eighty percent of the garbage in this area is some form of plastic[5]—persistent plastic that may remain bobbing for hundreds of years[6] as it slowly breaks down, into smaller and smaller particles,

[1] Statements on Introduced Bills and Joint Resolutions, 151 CONG. REC. S1261-02, S1295 - S1296 (daily ed. Feb. 10, 2005) (statement of Sen. Inouye).

[2] Thomas M. Kostigen, A Sea Change, Discover, July 2008, at 24, *available at* http://discovermagazine.com/2008/jul/10-the-worlds-largest-dump.

[3] Daniela Muhawi, EcoWorld, Algalita - Shrinking The World's Largest Garbage Patch, Jan. 26, 2009, www.ecoworld.com/blog/editor/muhawi/2009/01/29/algalita-shrinking-the-worlds-largest-garbage-patch/.

[4] Kostigen, *supra* note 2, at 25.

[5] Muhawi, *supra* note 3.

[6] JANE HETHERINGTON ET AL., THE MARINE DEBRIS RESEARCH, PREVENTION AND REDUCTION ACT: A POLICY ANALYSIS 10 (2005), *available at* www.columbia.edu/cu/

without ever fully biodegrading.[7]

In the open ocean, water currents and wind combine to form massive, swirling vortexes of water called gyres, which redistribute heat and nutrients in the ocean.[8] The heat redistribution changes the water's density and allows cold water, rich in dissolved oxygen and nutrients, to well up to the surface in the center of the vortex.[9] The North Pacific Subtropical Gyre is one of five major gyres on earth[10] and stretches over 10 million square miles.[11] Its center is in the middle of the Pacific Ocean—a remote and virtually uninhabited area.[12] In this area, a combination of high atmospheric pressure and the earth's rotation slows the ocean currents and moves them in a clockwise spiral.[13] Faster currents outside of this area push debris into the slowly swirling mass, where it becomes trapped.[14] Historically, the Northern Pacific Subtropical Gyre created a rich concentration of plankton and other organisms; recently, however, the gyre has become home to garbage drawn from all over the Pacific.[15] The result is two enormous masses of trash.[16] One, dubbed the Western Garbage Patch, is located west of Hawaii and east of Japan.[17] The second mass is the Eastern Garbage

mpaenvironment/pages/projects/sum2005/Marine%20Debris%20Final%20Report%20Sum2005.pdf.

[7] Photodegradation is different from biodegradation. When something photodegrades, sunlight breaks down the item into progressively smaller pieces, but the molecules of the item remain intact and are never fully absorbed back into the environment. Plastic molecules remain in the environment, because even small organisms such as bacteria cannot digest the plastic. In contrast, when an item biodegrades, small organisms are able to fully digest the molecules, and in this sense the item is returned to the environment, typically in the form of carbon dioxide or methane gas. *Compare* Charles Moore, *Trashed: Across the Pacific Ocean, Plastics, Plastics Everywhere*, NATURAL HISTORY, Nov. 2003, *available at* http://findarticles.com/p/articles/mi_m1134/is_9_112/ai_110737008/pg_2/?tag=content;col1, *with* USGS, Toxic Substances Hydrology Program, Biodegradation, http://toxics.usgs.gov/definitions/biodegradation.html (last visited Feb. 21, 2009).

[8] UNIV. OF CAL. LOS ANGELES MARINE SCI. CTR., INTRODUCTION TO CLIMATE AND CURRENTS 1-4, *available at* www.msc.ucla.edu/oceanglobe/pdf/climatecurents/currentsintro.pdf (last visited Mar. 12, 2009).

[9] *Id.*

[10] Moore, *supra* note 7.

[11] Daisy Dumas, *Landfill-on-Sea*, 37 ECOLOGIST 34, 35 (Sept. 2007), *available at* http://proquest.umi.com.ezproxy.apollolibrary.com/pqdweb?did=1330843871&sid=1&Fmt=4&clientId=13118&RQT=309&VName=PQD.

[12] Moore, *supra* note 7.

[13] *Id.*

[14] *See id.*

[15] *See id.*

[16] ENV'T & HUMAN HEALTH, INC., PLASTICS THAT MAY BE HARMFUL TO CHILDREN AND REPRODUCTIVE HEALTH 17 (2008), *available at* www.ehhi.org/reports/plastics/ehhi_plastics_report_ 2008.pdf.

[17] *Id.*

Patch located near the Northwestern Hawaiian Islands,[18] between Hawaii and California.[19] Together, these masses are known as the Great Pacific Garbage Patch (the Patch).[20]

The size[21] of the Eastern Garbage Patch is around twice the size of Texas;[22] combined, the Eastern and Western Garbage Patches are double the size of the United States.[23] The Patch spans the ocean for thousands of miles,[24] beginning approximately 500 nautical miles off the coast of California, flowing past Hawaii, and almost reaching Japan.[25] Although it contains an estimated 100 million tons of garbage,[26] the debris is hard to see because it bobs just below the surface[27] to depths of 100 feet or more, and it is not tightly packed.[28] Slowly degrading items may remain there for decades;[29] one piece of plastic found in the Patch was from 1944,[30] and some ecologists predict plastic degradation in the ocean could take 500 years or more.[31]

Ocean currents carry trash to the Patch from all over the world,[32] and debris that ends up in territories of the United States may have originated thousands of miles away.[33] Approximately four fifths of ocean

[18] HETHERINGTON ET AL., *supra* note 6, at 8.

[19] ENV'T & HUMAN HEALTH, INC., *supra* note 16, at 17.

[20] *Id.*

[21] The size of the Patch is difficult to determine because it is ever expanding; exact dimensions are unknown. *See* Catherine Clyne, *Captain Plastic on the Trail of Trash*, SATYA, Apr./May 2007, *available at* www.satyamag.com/apr07/moore.html. However, Texas is 261,797.12 square miles, while the U.S. is 3,537,438.44 square miles. U.S. CENSUS BUREAU, STATE AND COUNTY QUICKFACTS (2008), http://quickfacts.census.gov/qfd/states/48000.html. This means that the Eastern garbage Patch, estimated to be around twice the size of Texas, is about half a million square miles, and the Eastern and Western Patches combined, estimated to be around twice the size of the United States, are about 7 million square miles.

[22] ENV'T & HUMAN HEALTH, INC., *supra* note 16, at 17.

[23] Kathy Marks & Daniel Howden, *The World's Rubbish Dump: A Garbage Tip that Stretches from Hawaii to Japan*, INDEP., Feb. 5, 2008, *available at* www.independent.co.uk/environment/the-worlds-rubbish-dump-a-garbage-tip-that-stretches-from-hawaii-to-japan-778016.html.

[24] Kostigen, *supra* note 2, at 24.

[25] Marks & Howden, *supra* note 23.

[26] *Id.*

[27] Kenneth R. Weiss, *Altered Oceans: Plague of Plastic Chokes the Seas*, L.A. TIMES, Aug. 2, 2006, at A1, *available at* www.latimes.com/news/printedition/la-me-ocean2aug02,0,5594900.story?page=1.

[28] See Kostigen, *supra* note 2, at 24.

[29] *Id.*

[30] *See* Weiss, *supra* note 27.

[31] HETHERINGTON ET AL., *supra* note 6, at 10.

[32] *See* Kostigen, *supra* note 2, at 25.

[33] HETHERINGTON ET AL., *supra* note 6, at 19.

debris comes from land,[34] while only a small percentage is directly dumped from ships.[35] Urban runoff, including stormwater discharge, partially treated sewage, agricultural waste, and litter, is currently the fastest-growing source of ocean pollution.[36] Each year the Los Angeles River alone carries enough trash to the ocean to fill the inside of the Rose Bowl[37] between twenty feet and thirty-four feet high.[38] Moreover, a three-day sampling study of the Los Angeles and San Gabriel Rivers in 2004-2005 found that 2.3 billion pieces of plastic—totaling sixty tons—were flowing to the sea.[39]

Despite growing awareness of the Patch's environmental impacts, it is largely unaddressed by the law. Current international and U.S. laws address marine debris in a limited fashion, focusing primarily on ocean dumping from ships. Yet, based on these inadequate laws an argument exists that the United States[40] should begin cleanup on a portion of the Patch. Ideally, however, a new international treaty will need to be created to clean up the Patch.

Part II of this Comment provides an overview of the debris found in the Patch and the associated health impacts. Part III reviews the Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matters (the London Convention) with its corresponding international and U.S. laws, and then separately examines the U.S. Marine Debris Research, Prevention, and Reduction Act (MDRPRA). Part IV argues that the laws identified in Part III can be applied to provide a means to clean up the portion of the Patch affecting U.S.

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[34] Weiss, *supra* note 27.

[35] *See* Charles B. Anderson, *Ocean Dumping and the Marine Protection, Research and Sanctuaries Act*, 1 LOY. MAR. L.J. 79, 80 (2002).

[36] Weiss, *supra* note 27.

[37] The Rose Bowl is a stadium located in Southern California that has the capacity to seat over 90,000 people. The highest point is 100 feet above ground, and it would take approximately 84,375,000 gallons of water to fill the stadium. "The stadium measures 880 feet from north to south rims and 695 feet from east to west rims. The circumference of the rim is 2,430 feet, while the inside at field level is approximately 1,350 feet. The turfed area inside the bowl measures 79,156 square feet." RoseBowlStadium.com, Rose Bowl Stadium Facts, www.rosebowlstadium.com/RoseBowl_general-info.htm (last visited Mar. 28, 2009).

[38] The twenty-foot to thirty-four-foot measurement is based on an average building-story height of fifteen feet. *See* Weiss, *supra* note 27; *see also* Yahoo Answers, How Many Feet Tall is a 30 Story Building?, http://answers.yahoo.com/question/index?qid=20060922104312AAMklxg (last visited Mar. 28, 2009).

[39] Charles James Moore, *Synthetic Polymers in the Marine Environment: A Rapidly Increasing, Long-Term Threat*, 108 ENVTL. RES. 131, 135 (2008), *available at* www.algalita.org/pdf/YENRS5200.pdf.

[40] The author focuses on how U.S. laws affect the Patch because of her interest in the U.S. legal system.

territory. Part V briefly surveys the United Nations Framework Convention on Climate Change (Kyoto Protocol) and the U.S. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to provide an understanding of the proposed structure and mechanisms that can be used to create a new international treaty. Part VI details a proposed hybrid cleanup model of international law, using CERCLA and the Kyoto Protocol.

II. OVERVIEW OF DEBRIS AND ASSOCIATED HEALTH IMPACTS

A. DEBRIS

The Patch consists of many types of debris,[41] but plastic, in its myriad forms, presents the greatest challenge. More and more plastic is found in the Patch as societies' use of this material grows.[42] The average American used 223 pounds of plastic in 2001,[43] and annual global consumption of plastic has reached approximately 110 million tons—a twenty-fold increase since the 1950s.[44] Most plastics are derived from crude oil or natural gas monomers.[45] These monomers join together, forming a long chain that is so intertwined the surface cannot be penetrated by water or by bacteria that would normally break down debris.[46] Still, plastic can break down into smaller pieces from exposure to light,[47] and such partial degradation is enough to release the plastic's toxic chemical constituents into the ocean.[48] Recent trawl studies[49] throughout the Patch found that 30% to 60% of zooplankton had

[41] *See* Kostigen, *supra* note 2, at 24.

[42] *See id.*

[43] Weiss, *supra* note 27.

[44] *See* Waste Online, Plastics Recycling Information Sheet, www.wasteonline.org.uk/resources/InformationSheets/Plastics.htm (last visited Feb. 15, 2009). A conversion was made from the article's use of metric tons (tonnes) to U.S. short tons.

[45] Stephen Fraser, *What a Dump*, 94 CURRENT SCI. 6, 7 (2008), *available at* http://proquest.umi.com.ezproxy.apollolibrary.com/pqdweb?did=1557164201&sid=1&Fmt=3&clientId=13118&RQT=309&VName=PQD. Note that while there are vegetable-based plastic products, these are not yet in wide use due to high cost. *See* Brendan I. Koerner, *Paper or Plastic . . . or Neither*, SLATE, Nov. 6, 2007, www.slate.com/id/2177490/.

[46] Fraser, *supra* note 45, at 7.

[47] *See* ENV'T & HUMAN HEALTH, INC., *supra* note 16, at 17.

[48] *See* Kostigen, *supra* note 2, at 25.

[49] Trawl studies from 1999 to 2004 were conducted by the Algalita Marine Research Foundation and the Southern California Coastal Water Research Project. *See* C.J. MOORE ET AL., MEASURING THE EFFECTIVENESS OF VOLUNTARY PLASTIC INDUSTRY EFFORTS' AMRS'S ANALYSIS OF OPERATION CLEAN SWEEP 1, *available at* www.algalita.org/pdf/Measuring%20Effectiveness%20of%20Voluntary%20Indust.%20Efforts(2).pdf.

consumed plastic fragments less than five millimeters in size and those fragments remain in the organisms.[50] In the Patch, plastic outweighs zooplankton six to one.[51]

Nurdles are small plastic pellets used to manufacture plastic products and are the most widely seen plastic debris around the world.[52] Approximately 5.5 quadrillion nurdles— about 250 billion pounds—are produced worldwide each year,[53] and vast numbers are spilled when transferred in and out of rail cars.[54] One study of ten plastic manufacturers reported that spilled nurdles were commonly found in adjacent parking lots, storage areas, driveways by loading docks, public walkways, creeks, gutters, adjacent building lots, and dumpster areas.[55] Spilled on the ground by the millions each day, nurdles often wind up in oceans because rain washes them down storm drains, through streams and rivers, and into the ocean.[56] As a result, during research trawling[57] in the Patch, every single trawl netted nurdles.[58]

B. MARINE LIFE HEALTH

Plastic ocean debris affects marine life through ingestion and digestion, as well as entanglement.[59] When a marine animal, whether a plankton or large mammal, mistakes plastic for food, the plastic can become lodged in the animal's body, poisoning it, tearing its internal organs, and eventually killing it.[60] In 2002, one expedition to the Patch produced photographs of transparent zooplankton with colored plastic fragments in their bellies.[61] Nurdles, in particular, are a seemingly perfect fish egg replica in the eyes of zooplankton, fish, and birds.[62] Fish eat

[50] *Id.*

[51] Kostigen, *supra* note 2, at 25.

[52] *See* Weiss, *supra* note 27.

[53] ALAN WEISMAN, A WORLD WITHOUT US 112-29 (2007), *available at* www.worldwithoutus.com/excerpt.html.

[54] *See* MOORE, *supra* note 49, at 15.

[55] *See id.* at 5-12.

[56] *See* Weiss, *supra* note 27.

[57] "Trawl" is the term used to define the process of setting long nets behind boats to gather ocean debris.

[58] *See* Inst. for Figuring, The Great Pacific Garbage Patch, www.theiff.org/reef/reef4.html# (last visited Feb. 15, 2009).

[59] Fraser, *supra* note 45, at 7.

[60] *Id.*

[61] Moore, *supra* note 7.

[62] Thomas Hayden, *Trashing the Oceans*, U.S. NEWS & WORLD REP., Nov. 4, 2002, *available at* www.mindfully.org/Plastic/Ocean/Trashing-Oceans-Plastic4nov02.htm.

contaminated zooplankton; they also ingest plastic particles that they have mistaken for zooplankton.[63] As plastic fragments drift in the ocean, a sponge-like effect occurs, with the fragments absorbing hydrophobic pollutants like polychlorinated biphenyls (PCBs) and Dichloro-Diphenyl-Trichloroethane (DDT).[64] These toxins poison the animal as it leaches into its environment and its body.[65] The hormonal disruptions caused by PCBs can create hermaphroditic fish.[66] In addition, the toxins bioaccumulate in the fatty tissues of marine organisms and then biomagnify[67] up the food chain.[68] For example, the contamination level of a swordfish that ate a mackerel that had eaten a shrimp will have a much higher concentration level of toxins than the shrimp alone.[69] This biomagnification through the food chain leads to plastic toxins finding their way into the foods we eat.[70]

Ingestion and digestion of plastic affects all forms of marine life, not only zooplankton, fish, and crustaceans.[71] Researchers have watched in horror as hungry turtles ate floating plastic bags that resemble jellyfish.[72] Seabirds mistake old lighters and toothbrushes for fish, choking on the trash when trying to regurgitate it for their starving chicks.[73] Seals and sea turtles grow to adulthood trapped and disfigured by plastic six-pack rings.[74] Gray whale carcasses have been found containing plastic bags and sheeting.[75] Additionally, 40% of newly born albatrosses near the Patch die within one year because they consume

[63] *See* ENV'T & HUMAN HEALTH, INC., *supra* note 16, at 17.

[64] Kostigen, *supra* note 2, at 25.

[65] *See* Donovan Hohn, *Sea of Trash*, N.Y. TIMES MAG., June 22, 2008, *available at* www.nytimes.com/2008/06/22/magazine/22Plastics-t.html?pagewanted=1&_r=1&ei=5070&en=e2c410d172a8f8c1&ex=1214884800&emc=eta1; *see* Fraser, *supra* note 45, at 7.

[66] WEISMAN, *supra* note 53, at 112-29.

[67] The term "biomagnify" means that as one predator in the ocean consumes another, toxic levels concentrate more strongly each time the larger predator consumes a lesser one. Thus, the higher animal in the food chain becomes more toxic to consume. *See* GreenFacts, Glossary: Biomagnification, www.greenfacts.org/glossary/abc/biomagnification-biomagnify.htm (last visited Feb 15, 2009).

[68] Hohn, *supra* note 65.

[69] *Id.*

[70] Kostigen, *supra* note 2, at 25.

[71] *See* Dumas, *supra* note 11, at 36.

[72] Hayden, *supra* note 62.

[73] *Id.*

[74] Moore, *supra* note 7.

[75] Steve Sorenson, *Save the Oceans, Save Ourselves*, OAKLAND TRIB., Sept. 18, 2008, *available at* http://proquest.umi.com.ezproxy.apollolibrary.com/pqdweb?index=2&did=1557753221&SrchMode=1&sid=1&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1235352363&clientId=13118.

plastic pieces instead of food,[76] and 90% of Laysan albatross chick carcasses that were examined contained plastics.[77] Altogether, "[a]n estimated one million seabirds choke or get tangled in plastic nets each year."[78] Furthermore, coral reefs are damaged from trash; for example, during 2003, 122 tons of debris was removed from the reefs around the Northwestern Hawaiian Islands.[79]

Entanglement in derelict fishing gear (DFG) also kills marine life,[80] and DFG has been identified as the most serious human-related threat to fragile coral reefs.[81] DFG is abandoned fishing gear that largely consists of trawling nets and lines[82] made mostly of plastic and designed to last thousands of years.[83] Nets alone can weigh 9000 pounds and create masses that are forty feet high and several hundred feet long.[84] Each year, roughly 100,000 seals, sea lions, whales, dolphins, sea turtles, and other marine mammals get tangled in nets and die.[85] DFG is common in the Patch[86] and continues to catch and kill marine animals long after it has stopped being used for fishing.[87] The Patch contains miles upon miles of fishing nets and lines that tangle and snarl, creating massive balls of netting.[88] The large amount of DFG in the Patch is demonstrated in the Northwestern Hawaiian Islands when debris from the southern portion of the Patch washes ashore.[89] Since 1996, more than 500 metric tons of DFG has been removed from the area,[90] and from 1982 to 2000,

[76] Ursula Kazarian, *Islands of Garbage Continue to Grow in Pacific*, 7 SUSTAINABLE DEV. L. & POL'Y 63, 63 (2006).

[77] Kostigen, supra note 2, at 25.

[78] Weiss, *supra* note 27.

[79] HETHERINGTON ET AL., *supra* note 6, at 5.

[80] *See* Fraser, *supra* note 45, at 7.

[81] *Fisheries Conservation, Wildlife and Oceans: Hearing on S.362 Before the Subcomm. on Fisheries Conservation, Wildlife and Oceans, Subcomm. on Coast Guard and Maritime Transp., Comm. on House Resources, Comm. on House Transp. and Infrastructure,* 109th Cong. (2005) (statement of Timothy R.E. Keeney, Deputy Assistant Sec'y, Commerce for Oceans and Atmosphere Nat'l Oceanic and Atmospheric Admin. U.S. Dep't of Commerce), *available at* WL 2428051 [hereinafter *Keeney Statement*].

[82] Hayden, *supra* note 62.

[83] *See* Louis Sahagun, *Divers Cut Away at Net that Has Been Killing Marine Life*, L.A. TIMES, Jan. 12, 2009, at B1, *available at* http://articles.latimes.com/2009/jan/12/local/me-net12.

[84] *Id.*

[85] Weiss, *supra* note 27.

[86] *See* Hayden, *supra* note 62.

[87] *Keeney Statement, supra* note 81.

[88] Hayden, *supra* note 62.

[89] *See* Hohn, *supra* note 65.

[90] *Id.*

over 200 endangered Hawaiian monk seals were entangled in DFG.[91]

C. HUMAN HEALTH

Worldwide, around 2.5 billion people eat fish, and when the ocean is polluted, those people eat the pollution.[92] Captain Charles Moore, founder of Algalita Marine Research Foundation[93] and the world's foremost Patch expert,[94] believes all food extracted from the ocean contains plastic.[95] The ingestion of plastics, most of which are derived from petroleum, harms humans.[96] The chemical components of plastics have been linked to reductions in testosterone and fertility as well as to increases in prostate cancer and mutations in the genitals of baby boys.[97] For example, a study of Di(2-ethylhexyl) phthalate (DEHP), one of the most widely used chemical plastic ingredients, found that high exposure to DEHP caused undescended male testicles and abnormalities in the penis.[98] The study also linked DEHP exposure with the demasculinization of male genitalia as indicated by a reduced distance between the anus and the base of the penis.[99]

In addition to human-health-related risks of food pollution, the Patch also impacts beaches, boat navigation, recreational sports, and important natural resources. When the Patch drifts close to an island it discharges debris on beaches, obscuring the sand with a sheet of plastic and other garbage.[100] DFG that entangles commercial, recreational, and submarine boat propellers can disable vessels.[101] Plastic bags and sheeting can clog seawater intakes and evaporators on engines, leading to failure and costly repairs.[102] People can also become entangled in marine

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[91] *Keeney Statement, supra* note 81.

[92] Kostigen, *supra* note 2, at 26.

[93] *See* Algalita.org, About Us – Agalita Marine Research Foundation, www.algalita.org/about-us.html (last visited Oct. 19, 2008).

[94] *See* Valerie Williams, *Plastic Island: Icon of Consumption*, Aug. 20, 2008, http://greenmuze.com/action/plastics/184-plastic-island-icon-of-consumption.html.

[95] Kostigen, *supra* note 2, at 26.

[96] *See* Weiss, *supra* note 27.

[97] *See id.*

[98] Bette Hileman, *Panel Ranks Risks of Common Phthalate*, 83 CHEM. & ENG'G NEWS 32, Nov. 14, 2005, *available at* http://pubs.acs.org/cen/coverstory/83/8346specialtychem5.html.

[99] *See id.*

[100] *See* Weiss, *supra* note 27.

[101] *Keeney Statement, supra* note 81.

[102] *Fisheries Conservation, Wildlife and Oceans: Hearing on S.362 Before the Subcomm. on Fisheries Conservation, Wildlife and Oceans, Subcomm. on Coast Guard and Maritime Transp., Comm. on House Resources, Comm. on House Transp. and Infrastructure,* 109th Cong. (2005) (statement of Monita W. Fontaine Vice President, Government Relations National Marine

debris from common activities like swimming.[103] Lastly, the oceans provide a wealth of other natural products that are important to the global economy,[104] such as mining materials and seafood. To the extent that natural resources are contaminated or otherwise destroyed, those who depend on them for their economic well-being will suffer—with health impacts as a consequence.[105]

III. THE LONDON CONVENTION AND MDRPRA

The international and domestic laws relevant to this discussion are largely aimed at preventing ocean pollution; their cleanup provisions are inadequate or lacking altogether. However, two legal mechanisms—the Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matters (the London Convention)[106] and its corresponding laws, along with the U.S. Marine Debris Research, Prevention, and Reduction Act (MDRPRA)[107]—could be combined to create a functional approach to marine debris cleanup.

A. THE LONDON CONVENTION AND INTERACTING U.S. LAWS

The London Convention was "designed to provide the basic framework for global control of the deliberate disposal of all wastes in the oceans"[108] and has been in force since 1975.[109] The United States ratified the London Convention in 1974, and it entered into force August 30, 1975.[110] In 2008, eighty-five countries were signatories.[111] While

Manufacturers Association), *available at* WL 2428056.

[103] *Id.*

[104] 151 CONG. REC. S7926-04 (2005), *available at* WL 1541998.

[105] *See, e.g.,* John C. Fairfax, *Cause of Crises May Be Simple*, SOLOMON TIMES ONLINE, Jan. 5, 2009, www.solomontimes.com/letter.aspx?show=1346 ("Collapse of fishery employment and subsistence trade worldwide has [a] massive impact that is most severe at the bottom of the economy where poverty is causing stress and preventing people buying adequate food.").

[106] Convention on the Prevention of Marine Pollution of Dumping of Waste and Other Matters, Dec. 29 1972, 26 U.S.T. 2403, *available a*t WL 165565.

[107] Marine Debris Research, Prevention, and Reduction Act of 2006, 33 U.S.C.A. §§ 1951-1958 (2009).

[108] John Charles Kunich, *Losing Nemo: The Mass Extinction Now Threatening the World's Ocean Hotspots*, 30 COLUM. J. ENVTL. L. 1, 77 (2005).

[109] INT'L MARITIME ORG., THIRTIETH CONSULTATIVE MEETING OF CONTRACTING PARTIES TO THE LONDON CONVENTION & THIRD MEETING OF CONTRACTING PARTIES TO THE LONDON PROTOCOL 1 (Oct. 2, 2008), *available at* www.imo.org/includes/blastDataOnly.asp/data_id%3D23854/2.pdf.

[110] *Id.* Annex 1, at 3.

[111] *Id.*

the Convention bans intentional disposal of some hazardous substances, it permits coastal nations to dump other substances under a permit process.[112]

The International Maritime Organization (IMO), in London, is the administrative board that oversees control of the London Convention.[113] The IMO is an agency within the United Nations and keeps and records all dumping permits that signatories have issued.[114] IMO management duties also include serving as the Secretariat for the Convention, disseminating information to the Convention's signatories, and holding periodic consultative and scientific group meetings.[115]

The U.S. Marine Protection, Research, and Sanctuaries Act of 1972, also known as the U.S. Ocean Dumping Act, was enacted to comply with the obligations of Article VI of the London Convention.[116] The U.S. Ocean Dumping Act's purpose is to regulate the dumping of material transported from outside the United States by any person into the territorial sea or the contiguous zone.[117] It also regulates the transportation of material originating in the United States for the purpose of dumping the material into ocean waters by any U.S.-based person, vessel, aircraft, or agency.[118] Ocean waters are defined as "those waters of the open seas lying seaward of the base line from which the territorial sea is measured, as provided for in the Convention on the Territorial Sea and the Contiguous Zone" (the Law of the Sea Treaty).[119]

The Law of the Sea Treaty allows coastal nations to claim 200 nautical miles[120] from shore as an exclusive economic zone (EEZ).[121] The United States has not signed the Law of the Sea Treaty,[122] but

[112] Kunich, *supra* note 108, at 78.

[113] *Id.*

[114] *Id.*

[115] *Id.*

[116] *See* Envtl. Law Inst., *Law of Environmental Protection, Ocean Dumping--Jurisdiction and Coverage of the MPRSA*, 3 L. OF ENVTL. PROT. § 13:135 (2008).

[117] Marine Protection, Research, and Sanctuaries Act of 1972, 16 U.S.C.A. § 1401 (Westlaw 2009).

[118] *Id.*

[119] *Id.* § 1402.

[120] A nautical mile is based on the circumference of the Earth, and one minute of the earth's arc is equal to one nautical mile. A nautical mile is equal to 1.1508 miles in the English measurement system. How Stuff Works, What is a Nautical Mile, and How Does it Differ from a Normal Mile and a Kilometer?, http://science.howstuffworks.com/question79.htm (last visited Mar. 8, 2009).

[121] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397, *available at* www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf.

[122] *See* U.N. Law of the Sea Treaty Info. Ctr., The Law of the Sea Treaty (LOST) – Background, www.unlawoftheseatreaty.org/42.html (last visited Mar. 24, 2009).

President Reagan adopted the Law of the Sea's definition of the EEZ in his Presidential Proclamation of 1983.[123] In the EEZ, the coastal nations have exclusive rights to assert sovereign authority over natural resources, to maintain fisheries, and to regulate and manage all living and nonliving resources.[124] The Law of the Sea Treaty charges the signatory with the "principal role in preserving and protecting biological diversity in the marine ecosystem" in the EEZ, and permits the enforcement of all laws and regulations "adopted to conserve and manage living resources."[125]

Specific titles under the U.S. Ocean Dumping Act call for deeper attention to marine debris and provides for the establishment of marine sanctuaries. Title II, in part, authorizes the Secretary of Commerce, in conjunction with the Coast Guard and the U.S. Environmental Protection Agency, to initiate ongoing research.[126] The research is to focus on possible long-range effects of pollution and other man-made changes in ocean waters and ecosystems, including scientific assessment of damage to natural resources from spills of petroleum products.[127] Title II also calls for the investigation of alternative disposal methods and the determination of means to minimize or end ocean dumping.[128]

The Patch directly affects a designated marine sanctuary located in the Pacific Ocean.[129] Thus, Title III of the U.S. Ocean Dumping Act is also paramount in addressing Patch cleanup, because it authorizes the Secretary of Commerce to identify and designate national marine sanctuaries.[130] Title III calls for the protection and maintenance of natural biological communities in national sanctuaries, and where appropriate, for "restor[ing] and enhanc[ing] natural habitats, populations, and ecological processes."[131] Moreover, the Act makes it illegal to "destroy, cause the loss of, or injure any sanctuary resource managed under law or

[123] Exclusive Economic Zone of the United States of America, Proclamation No. 5030, 48 Fed. Reg. 10,605 (March 10, 1983).

[124] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397, *available at* www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf.

[125] Christopher C. Joyner, *Biodiversity in the Marine Environment: Resource Implications for the Law of the Sea*, 28 VAND. J. TRANSNAT'L L. 635, 651-52 (1995).

[126] Marine Protection, Research, and Sanctuaries Act of 1972, 16 U.S.C.A. §§ 1441-1442 (Westlaw 2009).

[127] *Id.*

[128] *Id.* § 1443.

[129] *See* D. Kapua Sproat & Aarin F. Gross, *The NW Hawaiian Islands Marine National Monument*, 22 NAT. RES. & ENV'T 57, 58 (2008).

[130] Title III's purpose is "to provide authority for comprehensive and coordinated conservation and management of these marine areas, and activities affecting them . . . ." Marine Protection, Research, and Sanctuaries Act of 1972, 16 U.S.C.A. § 1431 (Westlaw 2009).

[131] *Id.*

regulations for that sanctuary . . . ."[132]

One such marine sanctuary, the Papahānaumokuākea Marine National Monument[133] (the Monument), established under the Antiquities Act of 1906, is the largest marine protected area in the world and the biggest single conservation area created in U.S. history.[134] The Monument includes the Northwestern Hawaiian Islands and nearly 140,000 square miles of ocean, coral reefs, atolls, and other land masses.[135] The Northwestern Hawaiian Islands are "home to hundreds of miles of pristine coral reef and critical habitat for diverse fish and wildlife."[136] The Monument, however, is located in the southern part of the Patch,[137] and the islands within the region are more damaged by marine debris and derelict fishing gear than any other area of the United States.[138]

B. THE U.S. MARINE DEBRIS RESEARCH, PREVENTION, AND REDUCTION ACT (MDRPRA)

The U.S. Marine Debris Research, Prevention, and Reduction Act of 2006 (MDRPRA)[139] was established to identify the origin, location, and impacts of marine debris, including its projected movement within U.S. navigable waters, the U.S. exclusive economic zone, and the high seas.[140] It focuses primarily on marine debris affecting navigational safety, the quality of the marine environment, and reduction of DFG.[141] The Act also covers removal of marine debris within the U.S. EEZ.[142]

The MDRPRA established three mechanisms to address marine debris. First, the Act created a marine debris prevention and removal

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[132] *Id.* § 1436.

[133] The Papahānaumokuākea Marine National Monument was formerly called the Northwestern Hawaiian Islands Marine National Monument.

[134] *See* Sproat & Gross, *supra* note 129, at 57-58.

[135] *See id.*

[136] OCEAN CONSERVANCY, THE MARINE DEBRIS AND RESEARCH ACT OF 2005: A COMPREHENSIVE APPROACH TO MARINE DEBRIS 1, 1 (2005), *available at* www.oceanconservancy.org/site/DocServer/fs_debrisBill05.pdf?docID=1023.

[137] Papahānaumokuākea Marine Nat'l Monument, Map of Northwestern Hawaiian Islands Marine National Monument, http://hawaiireef.noaa.gov/images/maps/State_ExpandMap_WebLrg.jpg (last visited Oct. 19, 2008).

[138] OCEAN CONSERVANCY, *supra* note 136, at 1.

[139] Marine Debris Research, Prevention, and Reduction Act of 2006, 33 U.S.C.A. §§ 1951-1958 (Westlaw 2009).

[140] *Id.* §§ 1951-1952.

[141] *See* Constantine G. Papavizas & Lawrence I. Kiern, *2005-2006 U.S. Maritime Legislative Developments*, 38 J. MAR. L. & COM. 267, 289 (2007).

[142] 33 U.S.C.A. § 1952(b)(1)(C) (Westlaw 2009).

program within the National Oceanic and Atmospheric Administration to enhance the ability to track and mitigate the effects of marine debris.[143] Second, the Act mandated the U.S. Coast Guard to reduce marine debris infractions by enforcing, amending, and enlarging existing regulations.[144] Third, the duties of the Interagency Marine Debris Committee were expanded to include facilitating international collaboration and advising Congress.[145] The committee was to report within one year about sources of debris and the ecological, economic, and social impacts of such debris.[146] The report was also to provide alternatives to reduce harmful effects of marine debris and to make "recommendations to reduce marine debris both domestically and internationally."[147] The MDRPRA authorized $15 million for each fiscal year 2006 – 2010.[148] Although the Senate unanimously approved the Act, actual funds have yet to be allocated.[149]

IV. THE LONDON CONVENTION AND MDRPRA: MANDATING CLEANUP NOW

To be sure, international efforts should be required to clean up the Patch, and countries all around the globe are responsible for the debris. In the absence of a new treaty, however, a solution to Patch cleanup can be found through combining the London Convention, and its corresponding laws, and MDRPRA.

A. CLEANUP THROUGH THE LONDON CONVENTION AND U.S. INTERACTING LAWS

International obligations under the London Convention are complied with domestically through the U.S. Ocean Dumping Act.[150] Arguably, through the U.S. Ocean Dumping Act and the Monument edict, the United States should *begin* cleanup on the portion of the Patch

[143] *See* The Marine Debris Research and Reduction Act, Legislative Summary on S. 362, 109th Cong. (Feb. 10, 2005), *available at* http://commerce.senate.gov/pdf/SUMMARY%20-%20Marine%20Debris.pdf [hereinafter *Legislative Summary*].

[144] *See* HETHERINGTON ET AL., *supra* note 6, at 23.

[145] *Id.* at 7.

[146] 33 U.S.C.A. § 1954 (Westlaw 2009).

[147] *Id.*

[148] CONGRESSIONAL BUDGET OFFICE, S. 362 MARINE DEBRIS RESEARCH, PREVENTION, AND REDUCTION ACT 1 (2005), *available at* www.govtrack.us/congress/billreport.xpd?bill=s109-362&type=cbo.

[149] *See* Marine Log, *Senators Move To Clean Up Oceans*, Mar. 1, 2005, at 12.

[150] Envtl. Law Inst., *supra* note 116.

that is adjacent to the Monument so that it is in compliance with its own laws. Under the U.S. Ocean Dumping Act, it is "unlawful to destroy, cause the loss of, or injure any sanctuary resource managed under law or regulations for that sanctuary."[151] The Monument is a marine sanctuary, and islands located in the Monument,[152] including the Midway Atoll, are being injured—if not ruined—by the Patch.[153] Curtis Ebbesmeyer, an oceanographer and leading expert on marine currents and debris, has said, "When it gets close to an island, the garbage patch barfs, and you get a beach covered with this confetti of plastic."[154]

Since the Monument was established under the Antiquities Act, protection of it is strictly mandated and there is no size or geographic restriction—the President is given great discretion to make these determinations.[155] However, because the Antiquities Act does not require congressional approval, no funding was appropriated when the Monument was created.[156]

Protection of the Monument is also supported under the Law of the Sea Treaty because the treaty grants the United States jurisdiction over research and conservation in the EEZ.[157] Therefore, as a matter of international law, signatory coastal nations have broad authority to regulate and conserve EEZ resources as they deem best.[158] In addition, all nations have a duty to take measures that "may be necessary for the conservation and management of living resources of the high seas."[159] Nations are also required to make certain that their citizens abide by these measures.[160] It appears, then, that the United States should begin cleanup of the southern part of the Patch that falls within 200 nautical miles from its shores because the Antiquities Act mandates protection of

[151] Marine Protection, Research, and Sanctuaries Act of 1972, 16 U.S.C.A. § 1436(1) (Westlaw 2009).

[152] *See* Papahānaumokuākea Marine Nat'l Monument, *supra* note 137.

[153] Weiss, *supra* note 27.

[154] *Id.*

[155] Note that the Antiquities Act has "no requirement that the protected resources be managed for the maximum beneficial or sustainable use or enjoyment of people . . . ." Sproat & Gross, *supra* note 129, at 58.

[156] *Id.*

[157] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397, *available at* www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf; *see also* Robin Kundis Craig, *Taking Steps Toward Marine Wilderness Protection? Fishing and Coral Reef Marine Reserves in Florida and Hawaii*, 34 MCGEORGE L. REV. 155, 166 (2003).

[158] *Id.*

[159] Joyner, *supra* note 125, at 653.

[160] *Id.*

the Monument[161] and there are no jurisdictional issues.

B. CLEANUP THROUGH MARINE DEBRIS RESEARCH, PREVENTION, AND REDUCTION ACT

MDRPRA[162] can be used in combination with the above to require partial cleanup of the Patch. Legislative history links passage of MDRPRA to the Patch and shows that Senators Daniel Inouye (D-Hawaii) and Ted Stevens (R-Alaska) drafted the bill "in order to address the gap in federal attention to this serious problem."[163] In a hearing before several congressional committees, Jennifer Samson, Principal Scientist of Clean Ocean Action,[164] noted that the vast amount of marine debris collected around the country demonstrates that the current laws are insufficient in controlling the problem.[165] Samson testified that marine debris is a costly national and international hazard and that MDRPRA would allow multiple agencies to work together to prevent and remove marine debris.[166] She also asserted that this Act would create the national and international level of control that was needed to tackle the problem.[167] Also speaking in support of MDRPRA, Senator Inouye stated that the bill was intended to remove man-made marine debris from the ocean.[168] Senator Inouye testified that Hawaii was particularly affected by marine debris because of the North Pacific Subtropical

[161] Outside the scope of the argument for regulating the Patch, there are other economic benefits that the United States is potentially missing out on because it is not a signatory of the Law of the Sea Treaty. *See* Martin Kady II, *Law of the Sea Adrift in Senate Committee*, CQ WEEKLY ONLINE, May 2, 2005, http://0-109-000001650494.library.cqpress.com.library.ggu.edu:80/cqweekly/weeklyreport.

[162] Marine Debris Research, Prevention, and Reduction Act of 2006, 33 U.S.C.A. §§ 1951-1958 (Westlaw 2009).

[163] *Legislative Summary*, *supra* note 143.

[164] "Clean Ocean Action (COA) is a leading national and regional voice working to protect waterways using science, law, research, education, and citizen action. . . . Clean Ocean Action (COA) is a broad-based coalition of 125 business, community, conservation, environmental, fishing, boating, diving, student, surfing, women's, and service groups. These 'Ocean Wavemakers' work to clean up and protect the waters of the New York Bight. The groups came together in 1984 to investigate sources, effects, and solutions of ocean pollution." Clean Ocean Action, About COA, www.cleanoceanaction.org/index.php?id=2, (last visited Feb. 28, 2008).

[165] *Fisheries Conservation, Wildlife and Oceans: Hearing on S.362 Before the Subcomm. on Fisheries Conservation, Wildlife and Oceans, Subcomm. on Coast Guard and Maritime Transp.*, *Comm. on House Resources, Comm. on House Transp. and Infrastructure,* 109th Cong. (2005) (statement of Jennifer Samson Principal Scientist, Clean Ocean Action), *available a*t WL 2428057 [hereinafter *Samson Statement*].

[166] *Id.*

[167] *Id.*

[168] *Supra* note 1.

High.[169] Finally, in passage of MDRPRA, congressional findings reported that the problem of marine debris is so important, and so pervasive, that it merited an entire chapter of the 2004 Report of the U.S. Commission on Ocean Policy and that the bill was aimed to help remove man-made marine debris from the list of ocean threats.[170] One critic noted in 2006 that it was unclear if MDRPRA would have a direct effect on the Patch except for preventing further debris accumulation.[171] However, the legislative history described above shows that MDRPRA was conceived to provide for both cleanup and prevention. Unfortunately, while MDRPRA calls for, *inter alia*, developing and implementing marine debris-removal strategies for the EEZ and the high seas,[172] it has failed to do so due to lack of funding.[173]

V. THE KYOTO PROTOCOL AND THE U.S. CERCLA

Ideally, a new international treaty will be created to clean up the Patch. Specific elements from both the United Nations Framework Convention on Climate Change (Kyoto Protocol) and the U.S. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) can be combined to provide a flexible international solution for cleaning up the Patch. Both laws have proven over time that a malleable approach to addressing toxicity leads to improved outcomes. It is important to understand the basic structure and relevant provisions that can be applied to create new law for the Patch cleanup.

A. THE KYOTO PROTOCOL

Although the United States is not a signatory to the Kyoto Protocol,[174] provisions of the agreement can be used as a model to create a new international agreement to address the Patch. The Kyoto Protocol

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[169] *Id.* (explaining that "North Pacific Subtropical High" is a term used to describe how atmospheric forces cause ocean surface currents to move. The North Subtropical High is why the Northern Subtropical Gyre exists, and hence why garbage collects in the Patch's slow-moving currents.)

[170] 151 CONG. REC. S7926-04 (2005), *available at* WL 1541998.

[171] Kazarian, *supra* note 76, at 63.

[172] *See* Marine Debris Research, Prevention, and Reduction Act of 2006, 33 U.S.C.A. § 1952 (2009).

[173] *See* Jan TenBruggencate, *Bush Not Funding Marine Debris Bill*, Mar. 17, 2005, http://the.honoluluadvertiser.com/article/2005/Mar/17/ln/ln29p.html.

[174] *See* United Nations Framework Convention on Climate Change, Kyoto Protocol: Ratification Status, http://maindb.unfccc.int/public/country.pl?country=US (last visited Mar. 30, 2009) [hereinafter *Kyoto Protocol*].

is an international agreement connected to the United Nations Framework Convention on Climate Change in which signatories commit to stabilize greenhouse gas emissions (GHG).[175] The major feature of the Kyoto Protocol is that it binds signatories to reduce GHG emissions through using set mechanisms to determine individual emissions reduction targets.[176] These mechanisms include emissions trading, a clean-development mechanism, and joint implementation.[177] To stop the Patch from increasing in size, mechanisms similar to those in the Kyoto Protocol could be applied to prevent and reduce direct and indirect ocean dumping.[178]

In addressing Patch *cleanup*, it is the structural overlay of the Kyoto Protocol that will be most useful. Under the Kyoto Protocol, countries are designated as either developed or non-developed and subjected to a "common-but-differentiated-responsibilities"[179] approach that has become increasingly recognized in international law.[180] The Kyoto Protocol places a heavier burden on developed countries because those countries are more responsible for existing toxicity.[181] "*Common* suggests that certain risks affect and are affected by every nation on earth," and hence all nations will benefit from reduced toxicity.[182] Responsibilities are said to be *differentiated* in that not all countries contribute equally.[183] Thus, the "common-but-differentiated responsibilities" approach helps to entice non-developed countries to become signatories to the Kyoto Protocol, since it allows for flexibility and privileges, such as more-favorable timetables.[184]

B. THE U.S. COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

The central purpose of the U.S. Comprehensive Environmental Response, Compensation, and Liability Act's (CERCLA, also known as

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[175] *See id.*

[176] *See id.*

[177] *See id.*

[178] Pollution prevention is undoubtedly central to ongoing efforts to address the Patch. While this Comment addresses some aspects of prevention, a full discussion of prevention is beyond its scope.

[179] *See Kyoto Protocol*, *supra* note 174.

[180] Christopher D. Stone, *Common But Differentiated Responsibilities in International Law*, 98 AM. J. INT'L L. 276, 276 (2004).

[181] *Kyoto Protocol*, *supra* note 174.

[182] Stone, *supra* note 180, at 276-77.

[183] *Id.* at 277.

[184] *See id.* at 277-80.

Superfund) is to provide for prompt cleanup of hazardous-waste-disposal sites[185] and to impose costs of cleanup on those responsible for the contamination.[186] Additionally, where no responsible party can be identified, CERCLA provides for cleanup of hazardous sites through a trust fund.[187]

The U.S. Environmental Protection Agency (EPA) is the primary agency charged with monitoring and investigating hazardous waste sites.[188] The EPA has the option to clean up a site and seek cleanup costs from responsible parties, or to require the responsible parties to clean up the site.[189] Additionally, private individuals are permitted to clean up hazardous sites and recover costs from the trust or responsible parties.[190]

Allocation of liability under CERCLA is generally an ultimate issue.[191] Where parties are jointly and severally liable, liability costs can only be shifted between the parties through contribution.[192] However, if parties are not jointly and severally liable because the harm is divisible, then one party may assert a claim against another, and there is no right to contribution.[193]

Although there is an express right of contribution under CERCLA,[194] the courts exercise discretion, using various factors such as the *Gore Factors*,[195] when determining parties' contributions to a particular waste site.[196] The *Gore Factors* were created prior to CERCLA's express right of contribution as courts explored ways to apportion CERCLA liability.[197] The courts had used a variety of factors, but it was one court's set of six factors that became the most widely used.[198] In 1980, Congressman Albert Gore proposed the imposition of

[185] United States v. M/V Santa Clara I, 819 F. Supp. 507, 510 (D.S.C. 1993).

[186] United States v. Pesses, 794 F. Supp. 151, 155 (W.D.Pa.1992).

[187] U.S. Envtl. Prot. Agency, CERCLA Overview, http://epa.gov/superfund/policy/cercla.htm (last visited Aug. 11, 2009). The trust fund was established through taxing chemical and petroleum industries. *Id.*

[188] Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C.A. § 9604 (Westlaw 2009).

[189] 61C Am. Jur. 2d Pollution Control § 1276 (Westlaw 2009).

[190] Id. § 1270.

[191] *See* 32 AM. JUR. 2D *Federal Courts* § 135 (Westlaw 2009).

[192] 61C AM. JUR. 2D *Pollution Control* § 1467 (Westlaw 2009).

[193] *Id.*

[194] Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C.A. § 9613 (Westlaw 2009); Envtl. Transp. Sys., Inc. v. ENSCO, Inc., 969 F.2d 503, 508 (7th Cir. 1992).

[195] *Id.* at 509.

[196] 42 U.S.C.A. § 9613 (Westlaw 2009).

[197] *See Envtl. Transp. Sys., Inc.*, 969 F.2d at 508.

[198] *See id.* at 508-09.

joint and several liability under CERCLA and recommended the use of the six factors as part of a 1980 amendment to the House Superfund Bill.[199] The bill did not pass, but the legislative history of the later enactment of the express right of contribution allows courts to consider the *Gore Factors* in deciding whether to grant apportionment in a contribution action.[200] The first *Gore Factor* is typically the ultimate issue at trial[201]–that is, "the ability of the parties to demonstrate that their contribution to a discharge, release or disposal of a hazardous waste can be distinguished."[202]

Since no single list of factors will cover all hazardous sites, CERCLA provides flexibility.[203] This is particularly true where allocation of responsibility is complex.[204] For instance, "a party contributing only ten percent of the waste may be held liable for a third of the clean-up costs where the chemical it released was much more toxic and difficult to remove than the chemical released by another party."[205] The broad approach under CERCLA has been effective where determining contribution is difficult.[206]

VI. HYBRID CLEANUP MODEL

Several international and domestic laws address marine debris pollution prevention, but nothing exists to establish cleanup procedures for the Patch. Since no current international laws directly address cleanup of the world's oceans, an annex to an established international convention could be a vehicle to implement an effective cleanup protocol. To fund that protocol, a global fund would be needed, based on the percentage of each country's contribution to the Patch. Additionally,

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[199] *Id.* at 508.

[200] *Id.*

[201] *See* 32 AM. JUR. 2D *Federal Courts* § 135 (Westlaw 2009).

[202] *See Envtl. Transp. Sys., Inc.*, 969 F.2d at 508. Other *Gore Factors* include but are not limited to the following:

(1) the degree of toxicity of the hazardous waste involved;
(2) the ability of the parties to demonstrate that their contribution to a hazardous waste site can be distinguished;
(3) the degree of involvement by the parties in the generation of the hazardous waste; and
(4) the degree of care exercised by the parties taking into account the characteristics of such hazardous waste. *Id.*

[203] *See* Daniel A. Farber, *Apportioning Climate Change Costs*, 26 UCLA J. ENVTL. L. & POL'Y 21, 51-2 (2007-2008).

[204] *See id*. at 54.

[205] *Id.* at 50.

[206] *See id.* at 51.

corresponding domestic agencies already in place could manage the fund and monitor the cleanup progress. The structural overlay of the Kyoto Protocol's common-but-differentiated responsibilities and the balancing aspect of the *Gore Factors* from CERCLA could be used to determine each nation's share of the cleanup cost.

The first *Gore Factor* requires analysis of the amount of hazardous waste involved, and thus underscores the hesitation for cleanup of the Patch. The potential amount of the waste is nearly unfathomable: 100 million tons of debris[207] stretched over 10 million square miles.[208] The amount of waste and its continuing growth are primary reasons to establish cleanup. As the Patch accumulates more debris that is slow to degrade, such as plastic, associated environmental and health problems expand. This is not a problem that will simply resolve itself through natural degradation.[209] The international nature of the Patch and the logistical difficulties of capturing its countless small particles compound the basic problem of its overall size.[210] Due to the remoteness and quantity of garbage in the Patch, cleanup costs are estimated to be about $716 million per year for 41 years—roughly $30 billion.[211]

The second *Gore Factor* analyzes the degree of toxicity of the hazardous waste involved,[212] and under CERCLA, a priority list for cleanup is established.[213] Since the Patch is the first international dump site of its kind, creating a priority list for cleanup would not be as pertinent as other factors. However, it is an important component to include in any new treaty because there are several other gyres around the world—each with the same potential to collect garbage. As for the toxicity in the current Patch, the debris is undoubtedly harmful to marine life and human health.[214]

The third *Gore Factor* considers the ability of the parties to demonstrate that their respective contributions can be distinguished.[215]

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[207] Marks & Howden, *supra* note 23.

[208] Dumas, *supra* note 11, at 37.

[209] For a comparison of photodegradation and biodegradation, see *supra* note 7.

[210] NationMaster.com contains a hypothetical that depicts the costs and scenario needed to clean up the Patch. *See* NationMaster.com, Great Pacific Garbage Patch, www.nationmaster.com/encyclopedia/Great-Pacific-Garbage-Patch (last visited Sept. 23, 2008).

[211] *See id*. This website contains a nice hypothetical that depicts the costs and scenario needed to clean up the Patch.

[212] Envtl. Transp. Sys., Inc. v. ENSCO, Inc., 969 F.2d 503, 508 (7th Cir. 1992).

[213] Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C.A. § 9604 (Westlaw 2009).

[214] *See* Kostigen, *supra* note 2, at 25-26.

[215] *Envtl. Transp. Sys., Inc.*, 969 F.2d at 508.

As Jennifer Samson, Principal Scientist of Clean Ocean Action,[216] stated in a hearing before several legislative committees, "It's all one big ocean and what leaves the [New York/New Jersey] Harbor, or the Mississippi River, or the San Francisco Bay, and every river and tributary, impacts the global marine system."[217] Since the vast majority of the debris in the Patch is not distinguishable by country of origin, the Kyoto Protocol's model of common-but-differentiated responsibilities should be followed. This would acknowledge global contributions to the Patch and form a sound basis for the widest possible cooperation and participation by responsible countries.[218] This structure would be an effective and appropriate international response, taking into consideration each country's share of responsibility, its respective capability, and its socio-economic conditions.[219] This distinction would compel developed countries to take the lead in combating marine debris and the adverse effects thereof while still addressing the specific needs and special circumstances of those countries.[220] Non-developed countries would be allowed to reduce their contribution percentage so that participation is manageable.

The fourth *Gore Factor* looks to the degree of involvement by each party in generating the waste.[221] One of the most significant challenges will be bringing countries together to agree on their respective amounts of waste contribution. Possible measurements should include a country's population, consumption, overall policies, and infrastructure.

A. POPULATION

Population directly correlates to consumption and consumption correlates to pollution.[222] While adopting a differentiated-responsibility approach as seen in the Kyoto Protocol, population must play a role in determining contribution to the Patch. Non-developed countries that are more densely populated should be allocated a higher contribution than countries similarly situated with a lower population. An analogous consideration should apply for developed countries so that the most

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[216] For background information on Clean Ocean Action, see *supra* note 164.

[217] *Samson Statement, supra* note 165.

[218] *See, e.g.*, United Nations Framework Convention on Climate Change, opened for signature May 29, 1992, 1771 U.N.T.S. 107 (entered into force Mar. 24, 1994).

[219] *See, e.g.*, *id.*

[220] *See, e.g.*, *id.*

[221] Envtl. Transp. Sys., Inc. v. ENSCO, Inc., 969 F.2d 503, 508 (7th Cir. 1992).

[222] *See* Yoav Hammer, *Expressions Which Preclude Rational Processing: The Case for Regulating Non-Informational Advertisements*, 27 WHITTIER L. REV. 435, 469 (Winter 2005).

populous ones are allocated responsibility for a higher proportion of the waste found in the Patch. This type of allocation would allow a flexible approach to assigning contribution and still hold non-developed countries with high populations responsible for their part in aiding cleanup.

B. CONSUMPTION

Although population can be a starting point for determining contributions to the Patch, it cannot be viewed in a vacuum. Consumption has reached unparalleled heights in the United States and other industrialized countries, and global consumption levels are set to further expand as a result of economic growth in China, India, and other developing countries.[223] Increased consumption has resulted in global pollution and ecological damage,[224] as evidenced by the ever-increasing size of the Patch. The wealth of a country will need to be a key factor in determining consumption. "In 2005, the wealthiest 20% of the world accounted for 76.6% of total private consumption,"[225] while the poorest fifth accounted for 1.5% of consumption.[226] Using consumption statistics such as these will help determine what portion of the Patch's cleanup should be allocated to each country so that the process remains fair to those with a high population but a low consumption rate.

Another *Gore Factor* weighs the degree of care exercised by the parties, taking into account the characteristics of hazardous waste.[227] Here, plastic consumption and manufacturing must be brought into the mix since the Patch is composed mostly of plastic[228] and plastic-bag waste.[229] In 2006, per capita plastic consumption was 228.8 pounds in Western Europe, 46.2 pounds in Asia (excluding Japan, where it was 198 pounds), and 235.4 pounds in Canada, the United States, and Mexico combined.[230] These per-pound figures could then be offset against the

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[223] Albert C. Lin, *Virtual Consumption: A Second Life for Earth?*, 47 BYU L. REV. 49, 51 (2008).

[224] *Id.*

[225] Anup Shah, Global Issues, Consumption and Consumerism, http://www.globalissues.org/issue/235/consumption-and-consumerism (last visited Mar. 25, 2009).

[226] *Id.*

[227] Envtl. Transp. Sys., Inc. v. ENSCO, Inc., 969 F.2d 503, 508 (7th Cir. 1992).

[228] Muhawi, *supra* note 3.

[229] Hank Lacey, *Senate Kills Plastic Bag Ban*, DENVER STATEHOUSE EXAM'R, Feb. 25, 2009, *available at* www.examiner.com/x-2819-Denver-Statehouse-Examiner~y2009m2d25-Senate-Kills-Plastic-Bag-Ban.

[230] JOHN FELDMANN, BASF, PLASTICS, TOWARD NEW LEVELS OF PERFORMANCE 6, www.corporate.basf.com/basfcorp/img/investor/events/ir_day/070625/BASF_IR-Day_Feldmann_Plastics.pdf?id=9It06D3jtbcp25L (last visited Oct. 19, 2008). Please note a

countries' plastic recycling rates. For example, the amount of plastic waste generated annually in the United Kingdom is estimated to be nearly 3 million tons, while only an estimated 7% is being recycled.[231] Additionally, Asia is a special case because, despite its comparatively low per capita consumption rate, it is the biggest plastic consumer in the world.[232] This exemplifies why population must also be considered.

However, to rely on general plastic consumption alone as a factor would not suffice, because many types of plastics—such as large post-production components from cars or commercial-size plastic dumpsters—are not found in the Patch. This highlights the importance of breaking plastic consumption further down into subareas to include major items found in the Patch, like plastic bags and nurdles.

Plastic bag consumption ratios should be one of the separate factors in determining contribution rates, because they are ubiquitous in the Patch.[233] The United States alone currently uses 100 billion[234] to 380 billion[235] plastic bags per year. Similar to the offsetting method used above, mechanisms that reduce plastic bag consumption, such as taxes or bans, could reduce a country's required contribution. For example, in 2001 Ireland used 1.2 billion plastic bags, but after introducing a thirty-seven cent per bag tax, consumption was reduced by ninety percent.[236] Similarly, San Francisco, California, accomplished a reduction in consumption through a partial ban.[237] The partial ban applied to grocery stores with gross sales over two million dollars and was set to gradually expand to other retailers.[238] Since the partial ban was enacted, San Francisco has cut plastic bag consumption by five million bags per

conversion has been made from kilograms to pounds.

[231] Waste Online, *supra* note 44.

[232] JOHN FELDMANN, BASF, PLASTICS - MATERIALS OF THE 21ST CENTURY 10, www.corporate.basf.com/en/presse/konferenzen/k2004/vortrag-V-1.htm?getasset=file2&name=V-1-261e.pdf&MTITEL=Presentation+with+Charts%3Cbr%3E(PDF-file,+1023+KB)&suffix=.pdf&id=9It06D3jtbcp25L (last visited Oct. 19, 2008).

[233] *Compare* Lacey, *supra* note 229, *and* C.J. MOORE ET AL., DENSITY OF PLASTIC PARTICLES FOUND IN ZOOPLANKTON TRAWLS FROM COASTAL WATERS OF CALIFORNIA TO THE NORTH PACIFIC CENTRAL GYRE, in Proceedings of the Plastic Debris Rivers to Sea Conference, 2005 www.algalita.org/pdf/Density%20of%20Particles%20spellchkd11-05.pdf (last visited Sept. 22, 2008), *and* Inst. for Figuring, *supra* note 58, *and* Hayden, *supra* note 62.

[234] Jennie Reilly Romer, *The Evolution of San Francisco's Plastic-Bag Ban*, 1 GOLDEN GATE U. ENVTL. L.J. 439, 442 (Winter 2007).

[235] Food Democracy, Plastic Bags and Oil Consumption, July 16, 2008, http://fooddemocracy.wordpress.com/2008/07/16/plastic-bags-and-oil-consumption.

[236] Ireland has since reduced its plastic bag consumption by 90% through implementing a plastic-bag tax. *See id.*

[237] *See* Romer, *supra* note 234.

[238] *Id.* at 458.

month.[239] Taxes and bans such as these would lead to a reduced consumption and hence a lesser contribution rate.

Like plastic bags, nurdles are a major source of plastic in the Patch.[240] By calculating the number of major plastic manufacturers in each country and the volumes of plastic they produce, the contribution to the Patch could be relatively apportioned. Determining a country's contribution in this manner would promote cleanup, while reducing ocean-borne waste and overall consumption of plastics, and would improve regulation of nurdle debris.

C. POLICIES

In determining a country's contribution rate, general tax policies on plastic and consumption could be used to offset the amount owed. As demonstrated by plastic-bag taxes, taxes can lead to reduced use and consumption.[241] Taxes have already been used in some countries to reduce gasoline, sulfur in fuel, waste oil, pesticides, plastics, packaging materials, and chlorofluorocarbons.[242] Countries could use the same tax theory to further reduce overall plastic use and thereby argue for reduced obligations. However, tax obstacles may be significant, because of political opposition and policies that encourage consumption as part of economic growth.[243]

Additionally, if a country creates policies, or has working policies in place, specifically to reduce marine debris and urban runoff, then the country should benefit from a reduction in its contribution rate, because these measures will slow the growth of the Patch. However, prior to reducing a country's contribution rate, the policies should first be proven to be successful.[244] To be sure, controlling marine debris is a challenge—while the United States has made tremendous improvements over the past twenty-five years, it is still working to create better control of marine debris from nonpoint sources.[245] For example, under the Clean Water Act, urban runoff is a nonpoint source of pollution and therefore is

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[239] Food Democracy, *supra* note 235.

[240] *Compare* Weiss, *supra* note 27, *with* Inst. for Figuring, *supra* note 58.

[241] *See* Romer, *supra* note 234.

[242] Lin, *supra* note 223, at 74.

[243] *Id*. at 76-77.

[244] *See, e.g.*, U.S. Envtl. Prot. Agency, Stormwater Case Studies Search Results, http://cfpub.epa.gov/npdes/stormwater/casestudies_specific.cfm?case_id=2&CFID=2785611&CFTOKEN=65295474 (last visited Mar. 12, 2009).

[245] *See* Robin Kundis Craig, *Urban Runoff and Ocean Water Quality in Southern California: What Tools Does the Clean Water Act Provide?*, 9 CHAP. L. REV. 313, 322 (Spring 2006).

not regulated unless a city or county first collects the runoff in storm drains or stormwater systems.[246] Urban runoff was not readily addressed until 1990, when the Coastal Zone Act Reauthorization Amendments were passed to address nonpoint source pollution.[247] This is but one small example of how a country may institute a policy that has the appearance of being effective but leaves areas unaddressed. A country should receive the benefit of contribution-rate reduction only if its policies directly impact and control marine debris and urban runoff.

D. INFRASTRUCTURE

Infrastructure such as waste sequestration and sewage systems should also be used to calculate a country's contribution rate, because these systems directly reduce marine debris. For example, the Santa Monica Urban Runoff Recycling Facility (SMURRF) prevents 350,000 gallons of dry-weather urban runoff from pouring into the Pacific Ocean every day.[248] SMURRF filters out items such as Styrofoam cups, plastic bags, and other waste and then transports it to landfills.[249] Moreover, the system uses ultraviolet light and other mechanisms to sterilize water that has trapped engine oil, brake dust, and other chemicals.[250] This water is then recycled to irrigate local parks and cemeteries, and even to flush toilets at the local police headquarters.[251] Systems like SMURRF are helping to stop the Patch from increasing in size not only for the large items that are filtered out, but also for smaller particles: it is capable of filtering out particles that are less than five millimeters in size.[252]

Although the proposed cleanup model focuses primarily on countries that have direct access to oceans, this is not meant to imply that landlocked countries could not also benefit from efficient waste management. What is dumped (directly or indirectly) into a river of a landlocked country has the potential to travel thousands of miles and may still end up in the ocean. Landlocked countries with efficient waste-sequestration and sewage systems should be able to benefit from contribution-rate reduction, and there may need to be a more substantial reduction because of the lack of direct ocean access. In comparison, countries that have direct ocean outlets are arguably more likely to

[246] *See id.* at 320-21.
[247] *See id.* at 324.
[248] U.S. Envtl. Prot. Agency, *supra* note 244.
[249] Weiss, *supra* note 27.
[250] *See* U.S. Envtl. Prot. Agency, *supra* note 244; Weiss, *supra* note 27.
[251] Weiss, *supra* note 27.
[252] *See* U.S. Envtl. Prot. Agency, *supra* note 244.

process a higher degree of waste simply because of the flow of water from rivers to oceans. Therefore, a country with a direct ocean outlet should be able to receive a reduced rate because it would be required to deal with a larger amount of waste, and hence would need costlier facilities. A comprehensive study would need to be completed on waste-sequestration and sewage systems to balance how a country, whether landlocked or with direct access to the ocean, can receive a contribution-rate reduction.

Additionally, there would be a need for countries to negotiate a base waste system in order to compare efficiency standards. This could be done by selecting a series of base models for various needs and creating a sliding scale for contribution-rate determinations. This would be a necessary feature because not all waste systems will be as efficient as others. For instance, SMURRF does not operate during rainy days.[253] According to the Environmental Protection Agency, it was not "economically feasible to design the SMURRF to treat the extremely high volume of stormwater generated during rain events."[254] Hence, when it rains, unfiltered stormwater runoff is discharged directly into Santa Monica Bay.[255]

Finally, enforcement standards, reduction goals, and reporting would need to be clearly established under the new annex. One form of enforcement could be to fine countries that do not meet annual financial contribution rates. The fines must be large enough to deter noncompliance, yet cannot be so large that countries will withdraw due to financial risks. Realistic goals also must be set to reduce the amount of garbage in the Patch and to encourage participation. In determining the timeframe for reducing the debris in the Patch, the calculation should include the amount of time it takes a vessel to travel to and through the Patch, weather patterns that may affect cleanup efforts, and machine maintenance. Informed consideration of each situational influence would help determine a time frame so that the goals are attainable. Like enforcement and cleanup standards, reporting measures would have to be timely and appropriate; parties would have to be informed as problems arise, so that progress is not unduly impeded.

VII. CONCLUSION

The United States, compelled by the London Convention with its

[253] *Id.*
[254] *Id.*
[255] *Id.*

corresponding international and U.S. laws, along with the cleanup component of the MDRPRA, can provide an interim approach to Patch cleanup. The United States, by passing MDRPRA and various other laws, has acknowledged the importance of clean oceans.

The Patch affects the whole world and requires an international solution. As plastic consumption increases and debris continues to find its way to the Patch, the ocean becomes more polluted, the marine life is destroyed, and the human population is increasingly threatened. The Kyoto Protocol and CERCLA provide workable provisions that can be adapted to craft a solution to the cleanup challenge. The Kyoto Protocol's common-but-differentiated responsibilities allow developed and non-developed countries to participate in cleanup efforts, while the application of CERCLA's *Gore Factors* can help determine how to allocate mandates. In addition to cleaning up the Patch, this model would also help foster laws to prevent ocean debris through using contribution-rate reductions for certain progress and policies. To date, no country and no private efforts—other than studies—have been made to clean up the Patch. The Patch is a growing problem that cannot continue to wait for a cleanup solution.

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