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COLLABORATIVE GOVERNANCE INITIATIVE

Syracuse University
Maxwell School of Citizenship and Public Affairs
Program for the Advancement of Research on Conflict and Collaboration

The Great Pacific Garbage Patch
SIMULATION

The Great Pacific Garbage is a collection of debris and trash, mostly plastic, found in the north central Pacific Ocean between the Hawaiian Islands and California, approximately 1,000 miles from either location. Although the location of the patch moves and varies based on ocean currents, it generally lies in the middle of the North Pacific Subtropical Gyre, located about 30 to 40 degrees north latitude and 135 to 145 west longitude.[1] A gyre is a circular current caused by wind patterns and the rotation of the earth. The North Pacific Subtropical Gyre is "made up of four large, clockwise-rotating currents - North Pacific, California, North Equatorial, and Kuroshio."[2] Because of this gyre, the Garbage Patch is also known as the Great Pacific Plastic Vortex, since it slowly circulates a clockwise direction.

[1] Berton, Justin. 30 October 2007. Feds want to survey, possibly clean up vast garbage pit in Pacific SFGate Accessed: http://www.sfgate.com/news/article/Feds-want-to-survey-possibly-clean-up-vast-3301752.php#photo-2449091
[2] http://marinedebris.noaa.gov/info/patch.html

The Garbage Patch was discovered in 1997 by Charles Moore, who was taking a short cut home from Hawaii to Los Angeles. Instead of steering his ship around the Pacific Ocean gyre, he headed directly through it. Moore explained that every day he traveled through the gyre he encountered more and more trash. While the size of the patch is contested (with estimates of it being twice the size of the state of Texas), research suggests that the amount of trash in the patch has increased 100 times in the past 40 years.[3] Moreover, much of the waste will not "breakdown in the lifetime of the grandchildren of the people who threw [it] away."[4]

The United Nations reports that in every square kilometer of sea you can find over 13,000 pieces of plastic. "Plastic only became widespread in the late '40s and early '50s, but now everyone uses it and over a 40-year range we've seen a dramatic increase in ocean plastic. Historically we have not been very good at stopping plastic from getting into the ocean so hopefully in the future we can do better."[5]

The annual production of plastic resin in the United States has roughly doubled in the past 20 years, from nearly 60 billion pounds in 1987 to an estimated 120 billion pounds in 2007, according to a study by the American Chemistry Council, which represents the nation's largest plastic and chemical manufacturers.

It is estimated that we use about 10 million tons of plastic each year, and that about 10% of the plastic finds its way into the ocean. Of this, about 20% of the plastic comes from ships and other sea vessels, while 80% comes directly from land. "When a plastic cup gets blown off the beach in, say, San Francisco, it gets caught in the California Current, which makes its way down the coast toward Central America. Somewhere off the coast of Mexico it most likely meets the North Equatorial Current, which flows toward Asia. Off the coast of Japan, the Kuroshio Current might swoop it up and yank it eastward again, until the North Pacific Current takes over and carries it past Hawaii to the garbage patch."[6] Trash from the coast of the United States, among other countries, travels through the ocean currents reaching the garbage patch 1 to 6 years later.

Of the trash that finds its way into the oceans, nearly 70% sinks to the bottom; the remaining 30% floats near the surface.[7] The majority of this trash stays in the ocean and forms garbage patches throughout the

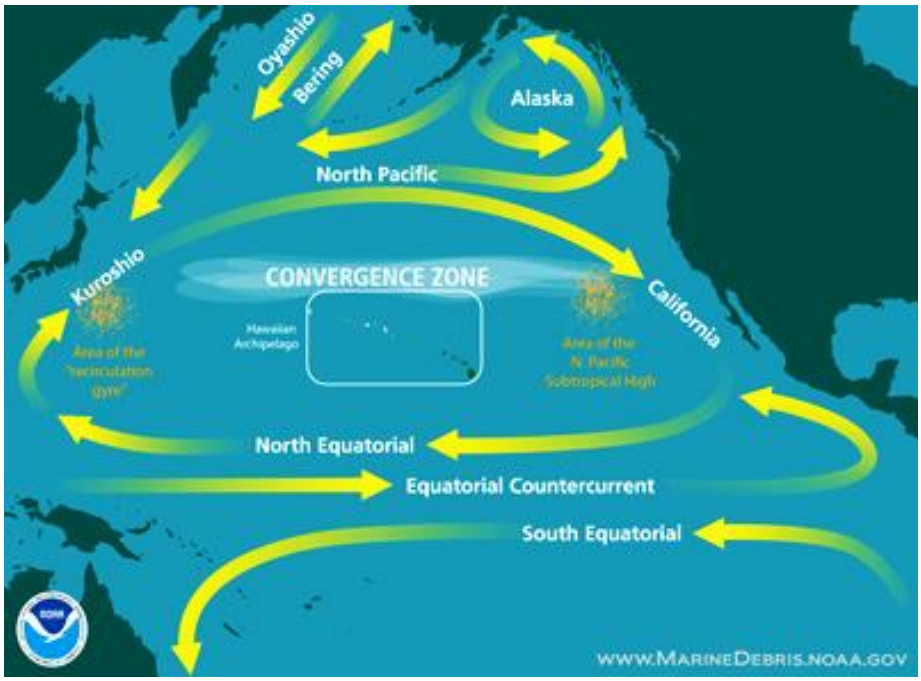
[3]Johnston, Ian. 9 May 2012. "Study: Plastic in 'Great Pacific Garbage Patch' increases 100-fold." MSNBC.com Accessed: http://worldnews.nbcnews.com/_news/2012/05/09/11612593-study-plastic-in-great-pacific-garbage-patch-increases-100-fold?lite

[4] Greenpeace. 2013. The Trash Vortex. Greenpeace International. Accessed: http://www.greenpeace.org/international/en/campaigns/oceans/pollution/trash-vortex/

[5] Ibid.

[6] Kostigen, Thomas M. 2008. "The World's Largest Dump: The Great Pacific Garbage Patch." *Discover Magazine.*

[7] Greenpeace. 2013. The Trash Vortex. Greenpeace International. Accessed: http://www.greenpeace.org/international/en/campaigns/oceans/pollution/trash-vortex



oceans of the world, with the Great Pacific Garbage Patch being the most notorious. Better described as plastic soup, the Great Pacific Garbage Patch is mostly comprised of micro-plastics.[8] The patch is not visible from satellite photos; it is almost 80% plastic, translucent, and found between the depths of one inch to 300 feet.[9] Regardless, the Garbage Patch is a critical problem for ocean habitats and for people.

Most of the plastic in the ocean is broken down by a process called photodegregation, during which sunlight and UV rays degrade the plastic into tiny pieces of debris that outnumber plankton 6 to 1.[10] This debris, called nurdles, is hydrophobic and absorbs harmful chemicals such as PCBs and DDT.[11] Marine animals and birds believe the trash to be food. The United Nations Environment Program estimates that plastic debris in the ocean has caused over a million deaths in seabirds and over one hundred thousand deaths in marine mammals. Consumption of the nurdles not

[8] National Geographic. 2013. "Great Pacific Garbage Patch." National Geographic Accessed: http://education.nationalgeographic.com/education/encyclopedia/great-pacific-garbage-patch/?ar_a=1
[9] Berton, Justin. 30 October 2007. Feds want to survey, possibly clean up vast garbage pit in Pacific SFGate Accessed: http://www.sfgate.com/news/article/Feds-want-to-survey-possibly-clean-up-vast-3301752.php#photo-2449091
[10] http://curiosity.discovery.com/question/prevents-cleanup-great-pacific-garbage
[11] Kostigen, Thomas M. 2008. "The World's Largest Dump: The Great Pacific Garbage Patch." Discover Magazine.

only leads to the death of animals, but also poses threats to humans. Fish that eat the plastic waste become part of the food chain - they are eaten by other marine animals and sometimes end up on the dinner tables of humans.[12]

Recent studies also report a threatening rise in the number of jellyfish in the oceans, due to several reasons, including trash.[13] This has negative socio-economic impacts on tourism (due to hazardous swimming environments) and fisheries (jellyfish eat small fish and fish eggs).[14] More important is the devastating impact on marine life. "The jellyfish, a predatory plankton, feeds on things like plankton, crustaceans, small fish and fish eggs, it depletes the food resources of larger mammals like whales."[15]

No institution currently exists to monitor the oceans, especially the high seas, a term referring to the approximate 64% of oceans that lie outside the control of any one specific country. Although there are rules in place to protect the ocean, there is no governing body to enforce these rules. As a result, the Great Pacific Garbage Patch—and others like it—will continue to grow. Because everyone uses the ocean, but no one has legal ownership of it, the Garbage Patch has been called a "tragedy of the commons." In short, *despite the problems with and dangers of the Garbage Patch, no nation will take responsibility because it is located in international waters beyond any national claims and will be extremely costly to clean up.*

Moving Forward

Although no one is in charge, there are several isolated efforts and proposed solutions to rectify the problem. These efforts and solutions generally fall into four categories: (1) Prevention, (2) Manufacturing, (3) Clean-Up, and (4) Regulation.

Prevention

The essence of the prevention argument is that (a) we lack concrete information about the size, shape, and impacts of the Garbage Patch, and (b) clean-up is cost-prohibitive. Until a comprehensive study is completed, efforts should focus on prevention.

Charles Moore, the oceanographer who discovered the Great Pacific Garbage Patch, is a pioneer on this front. After sailing through the patch, he reportedly went home and immediately sold his entire inheritance to start a foundation. Moore explains that any attempt to clean up this garbage patch would bankrupt any nation. Thus, he offers one simple solution: "stop putting trash into the ocean."[16] Others rally behind this call, asserting that clean-up is not cost effective.

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[12] Marks, Kathy. 2008. "The world's rubbish dump: a garbage tip that stretches from Hawaii to Japan" *The Independent*.
[13] http://www.isciencetimes.com/articles/5368/20130610/jellyfish-blooms-rising-population-sign-oceans-trouble.htm
[14] http://qz.com/194036/climate-change-will-mean-way-less-sushi-and-way-more-jellyfish/
[15] http://www.isciencetimes.com/articles/5368/20130610/jellyfish-blooms-rising-population-sign-oceans-trouble.htm
[16] DeFranza, David. "Isn't it Time to Clean Up the Great Pacific Garbage Patch?" TLC Accessed: http://tlc.howstuffworks.com/home/clean-up-great-pacific-garbage-patch.htm

> Suppose we were to attempt to clean up less than 1% of the North Pacific Ocean (a 3-degree swath between 30° and 35°N and 150° to 180°W), which would be approximately 1,000,000 km.[2] Assume we hired a boat with an 18 ft. (5.5 m) beam and surveyed the area within 100 m off of each side of the ship. If the ship traveled at 11 knots (20 km/hour), and surveyed during daylight hours (approximately 10 hours a day), it would take 67 ships one year to cover that area!
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> At a cost of $5,000-20,000 per day, it would cost between $122 million and $489 million for the year. That's a lot of money—and that's only for boat time. It doesn't include equipment or labor costs. Also, keep in mind that not all debris items can be scooped up with a net.[17]

Several options to improve and increase prevention efforts have been proposed. For example, some have asserted that we need to extend and enlarge recycling programs, particularly on California beaches. Others argue that to stop trash from entering the ocean, we need to raise awareness through programs such as reverse distribution.[18,19] Still others argue that we need to support government initiatives to study the problem. In general, proponents of the prevention approach strongly and stridently reject any initiatives aimed at stopping or slowing the production of plastics.

In sum, proponents of this approach assert that prevention is the key factor in stopping the plastics from finding their way into ocean waters. This is not a laissez faire attitude; it is a practical one. The best way to stop the garbage patch from growing is to stop the trash from getting to the ocean.

Manufacturing

A second option involves both prevention and addressing manufacturing issues, including slowing down the production of plastics and changing the types of plastics that are produced. The essence of this argument is that prevention is necessary, but insufficient. No matter how hard we work, plastics will find their way into the oceans - from beaches, barges, cruise liners, and ships and other sea vessels.

Oceanographer Curtis Ebbesmeyer is a strong advocate of this approach. Ebbesmeyer points to several studies conducted over the past 10 years. During one expedition to the Garbage Patch, researchers

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[17] U.S. Department of Commerce | National Oceanic and Atmospheric Administration. 19 July 2012. "How Much Would it Cost to Clean up the Pacific Garbage Patches?" Accessed: http://response.restoration.noaa.gov/about/media/how-much-would-it-cost-clean-pacific-garbage-patches.html

[18] Berton, Justin. 30 October 2007. Feds want to survey, possibly clean up vast garbage pit in Pacific SFGate Accessed: http://www.sfgate.com/news/article/Feds-want-to-survey-possibly-clean-up-vast-3301752.php#page-2

[19] A reverse channel is when wastes, packages, and defective/obsolete products are "climbing back" the supply chain. In some cases (such as a defective product), distributors will take back the merchandises, but in many others, a specialized segment of the distribution industry aims at collecting and then recycling goods and parts. Thus, reverse logistics (or reverse distribution) is concerned about the movements of previously shipped goods from customers back to manufacturers or distribution centers due to repairs, recycling or returns (http://people.hofstra.edu/geotrans/eng/ch5en/conc5en/forwardreversedistribution.html)

collected 100 different samples, and found a "shocking" amount of plastic and debris. The research team concluded that "trash vortex" is somewhat of a misnomer, and "plastic confetti" was a more appropriate term.[20] Another study found that this plastic confetti (along with other plastics) was harming sea life; 9% of fish from the Garbage Patch area have some form of plastic in their stomachs. That said, the effects of plastics on marine life have yet to be studied extensively. Ebbesmeyer asserts, "the only solution [is] to switch to using biodegradable plastic and let the plastic gradually disperse, we can't clean it up. It's just too big. You'd have to have the entire U.S. Navy out there, round the clock, continuously towing little nets. And it's produced so fast, they wouldn't be able to keep up."[21]

In sum, proponents of this approach believe that prevention is important, but that we must also address manufacturing. They argue that since we can only stop some, but not all, plastics from getting into the oceans, we must find ways to change the manufacturing and production of plastics. Manufacturing less plastic and ensuring that plastics are biodegradable is the best long-term solution for addressing the Garbage Patch.

Clean-Up

A third approach explicitly rejects the argument that clean-up is cost prohibitive, and instead asserts that we need to collect and recycle the trash - and particularly the plastics - in the ocean.

Mary Crowley, a former sea captain, is an advocate of this approach. Specifically, she and a team of researchers have proposed sending two large boats to the Garbage Patch to collect debris with nets and/or floating receptacles that capture big pieces of trash.[22] Once the trash is collected, plastics would be recycled or reused, rather than put into a landfill. One option for this is pyrolysis, a process that takes plastic waste, heats it (to over 550° F) until it breaks down, and converts it into synthetic oil.[23] Proponents argue that pyrolysis could take place on floating rigs in the ocean, and could potentially break down over 85% of plastics. Although each floating rig is estimated to cost around seven million dollars, these costs could be recovered through the sale of the oil.[24]

In sum, proponents of this approach assert that we have a moral and ethical responsibility to clean-up the mess that we have made of the ocean. They believe that clean-up is not only cost-effective, but that it

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[20] National Geographic. 4 September 2009. "PHOTOS: Giant Ocean-Trash Vortex Documented--A First." National Geographic *Photograph courtesy Scripps Institution of Oceanography* Accessed: http://news.nationalgeographic.com/news/2009/09/photogalleries/pacific-garbage-patch-pictures/index.html
[21] Johnston, Ian. 9 May 2012. "Study: Plastic in 'Great Pacific Garbage Patch' increases 100-fold." MSNBC.com Accessed: http://worldnews.nbcnews.com/_news/2012/05/09/11612593-study-plastic-in-great-pacific-garbage-patch-increases-100-fold?lite
[22] Stone, Daniel. 9 December 2009. "Can the Pacific Garbage Patch Be Cleaned Up?" Newsweek Accessed: http://www.thedailybeast.com/newsweek/2009/12/09/the-great-pacific-cleanup.html
[23] Ibid.
[24] Ibid.

could, over time, generate important revenues that could be used for the further protection of our oceans.

Regulation

The final approach involves regulation. The essence of this approach is to compel nations to better protect ocean environments through soft-law. Advocates of this approach are pushing for the creation of a High Seas Biodiversity Agreement to regulate the oceans.

According to the United Nations Environment Program (UNEP) "deficiencies in the implementation and enforcement of existing international, regional, national regulations and standards that could improve the [marine litter] situation, combined with a lack of awareness among main stakeholders and the general public, are other major reasons why the marine litter problem not only remains, but continues to increase worldwide."[25] Proponents of regulation suggest that a High Seas Biodiversity Agreement would help ameliorate the challenges of implementation and enforcement. Specifically, the assert that such an agreement is urgently needed to ensure healthy and productive marine ecosystems across the world's oceans. They believe only a global agreement can provide a coherent and integrated approach in all areas beyond national jurisdictions.

Several international regulations already exist. For example, the constitution for the oceans, the UN Convention on the Law of the Sea (UNCLOS), sets out the rights and obligations that countries have when operating in the high seas, including the responsibility to protect ocean life from harm. In 1974, the UN started the Regional Seas Program (RSP) to link countries sharing a common body of water through an environmental management agreement designed to protect their shared marine surroundings. Such agreements have been enacted by 143 countries and involve 13 different regional sea programs. Similarly, the 1995 Global Program of Action for the Protection of the Marine Environment from Land-based Activities (GPA) enables nations to target major threats and work collaboratively to help maintain the "health, productivity and biodiversity of the marine and coastal environment."[26] Although the GPA evaluates threats to the marine environment and provides guidance and implementation tools to help alleviate problems, implementation must be done by nations in conjunction with neighboring countries and regional actors. However, neither the GPA nor the RSP have strong monitoring and enforcement protocols.[27]

Accordingly, advocates of regulation assert a High Seas Biodiversity Agreement would help with the needed monitoring and enforcement functions. These proponents assert that the management of the

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[25] United Nations Environment Program. "Regional Seas Program." United Nations Environment Program. Accessed: http://www.unep.org/regionalseas/about/default.asp

[26] United Nations Environment Program. Global Program of Action for the Protection of the Marine Environment from Land-based Activities (GPA) United Nations Environment Program Accessed: http://www.gpa.unep.org/

[27] United Nations Environment Program About the GPA. United Nations Environment Program Accessed: http://www.gpa.unep.org/index.php/about-gpa; United Nations Environment Program. "Regional Seas Program." United Nations Environment Program. Accessed: http://www.unep.org/regionalseas/about/default.asp

high seas is undertaken by many different organizations serving a vast array of interests (some want to drill for oil; some want to preserve a specific group of fish or coral; some want to regulating fishing of specific species). These groups rarely work together and are not monitored; thus, it is difficult to determine whether their environmental impact reports are complete and correct. "A high seas biodiversity agreement would make clear the obligation of countries to protect ocean life that is found both in high seas waters and the seabed in areas that are beyond the jurisdiction of any one country." Specifically, this new agreement would: (1) ensure that all marine reserves are properly identified and protected; (2) monitor environmental impact assessments, particularly by corporations; and (3) coordinate all organizations regulate the oceans, including protection agencies.

In sum, advocates of this approach assert that regulation is needed to get all nations to uphold their obligations to keep the oceans clean and safe. Specifically, the would like to see the creation of a new international agreement that would create the monitoring and enforcement mechanisms needed to protect the oceans.

Next Steps

This brief overview only scratches the surface of the Garbage Patch problem and its potential solutions. Representatives of several institutions and organizations are voluntarily coming together for the first time to discuss the Garbage Patch. The expectation is that the groups will start to shape a collaborative governance regime that will work to address the problems of the Garbage Patch. As one of the representatives, your bosses expect you to stand for your organization and its positions and interests during the deliberations (although as a citizen you might have a different view). The deliberations will focus on the following questions:

1. Is this a problem that your organization should be involved in solving?
2. [redacted]
3. What is the best solution to addressing the Garbage Patch? (There is no need to go into specific scientific details at this point.)
4. What should be the process for solving the problem?
5. Who should assume the responsibility for the solution and for ensuring the process takes place?

In short, you are to determine **whether** and **how** to proceed. Beyond addressing these questions, there are no set expectations for the results of your deliberation.

Great Pacific Garbage Patch

Public Information on Actors Involved

National Oceanic and Atmospheric Administration (NOAA)

NOAA's Mission: *Science, Service, and Stewardship; To understand and predict changes in climate, weather, oceans, and coasts; To share that knowledge and information with others; and, To conserve and manage coastal and marine ecosystems and resources*

NOAA's Vision of the Future: *Resilient Ecosystems, Communities, and Economies; and Healthy ecosystems, communities, and economies that are resilient in the face of change*

The National Oceanic and Atmospheric Administration (NOAA) is a government agency responsible for conducting scientific research, sharing knowledge, and organizing conservation efforts through collaboration. NOAA has long standing relationships with the scientific community and regional governing bodies. Citizens trust its research and value its recommendations. When interacting with the international community, NOAA provides all relevant policy and decision recommendations to public officials. Since 2006, NOAA was authorized through the U.S. Congress to "identify, determine sources of, assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, marine environment, and navigation safety" through the Marine Debris Program. This program has specific jurisdiction over researching and determining action in regard to the Great Pacific Garbage Patch.

American Chemistry Council (ACC)

ACC's Mission: *To deliver business value through exceptional advocacy using best-in-class member performance, political engagement, communications and scientific research. We are committed to sustainable development by fostering progress in our economy, environment, and society. The business of chemistry:*

- *Drives innovations that enable a more sustainable future.*
- *Creates nearly 800,000 manufacturing and high-tech jobs—plus more than six million related jobs—that support families and communities.*
- *Enhances safety through the products of chemistry and investment in research*

The American Chemistry Council (ACC) is a trade association that represents U.S. plastic producing firms. ACC is very influential among private actors and can aid in setting industry standards. ACC seeks to create a sustainable market with profits for industry, job growth, and maintenance of consumer health and safety, including environmental effects.

Great Pacific Garbage Patch

Public Information on Actors Involved

Plastic materials are found in everyday life in both highly developed and developing countries. Products include packaging, electronics, household décor, sporting wear, cooking utensils, and more. It would be hard to imagine life without plastic in this day and age. That being said, plastic manufacturing is around to stay.

Research Institutes

Scripps Institution of Oceanography Mission: *to seek, teach, and communicate scientific understanding of the oceans, atmosphere, Earth, and other planets for the benefit of society and the environment.*

Algalita Marine Research Foundation Mission: to work on *the protection and improvement of the marine environment and its watersheds through education and research on the impact of plastic pollution.*

Ocean Voyage Institute Mission: to *teach maritime arts and sciences and preserving the world's oceans.*

As a group of international sailors, educators, and conservationists, the above research organizations seek to eliminate future plastic waste as the costs of clean-up are too high and efforts unmanageable. These groups also share a common interest in conducting and distributing research that informs decision and policy making. Their goals are to delve into cutting edge research and provide the best information in order to preserve the Earth's environment.

A common theme among all three organizations is the commitment to education. This includes education among academic institutions, everyday consumers, private firms, and governments. They know without the right knowledge, decision making influence diminishes. A potential downside to the information each research organization maintains is the variance in reports. This has been one of the greatest problems with the garbage patch as reports vary in its actual size and breadth of environmental impact.

Great Pacific Garbage Patch

Public Information on Actors Involved

Greenpeace

Greenpeace's Mission: *to use non-violent, creative confrontation to expose global environmental problems, and to force the solutions which are essential to a green and peaceful future. Greenpeace's goal is to ensure the ability of the earth to nurture life in all its diversity, through the protection of biodiversity in all its forms, prevention of pollution and abuse of the earth's ocean, land, air and fresh water, ending all nuclear threats, and promoting peace, global disarmament and non-violence*

Greenpeace is an independent activist, campaigning international nongovernmental organization (NGO) seeking to promote environmentally safe activities through advocacy and the promotion of meaningful solutions. Headquartered in Amsterdam, Holland, the organization has a mixed reputation in the United States and abroad. Its main criticism is that it sometimes performs too radical of advocacy means while others highly acclaim its efforts.

United Nations Environment Program (UNEP)

UNEP's Mission: *To provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations.*

UNEP's Mandate: *To be the leading global environmental authority that sets the global environmental agenda, that promotes the coherent implementation of the environmental dimensions of sustainable development within the United Nations system and that serves as an authoritative advocate for the global environment.*

As an intergovernmental organization, the United Nations (UN) as a whole seeks to improve standards of living across all nations. One such means is through environmental stewardship. In 1972, the UN created the UN Environment Program to be the environmental bodying responsible for conducting research for informed decision making in every nation regardless of economic status. Today, the UNEP seeks to be the leading authority on global environmental matters, although still unable to become a regulatory body. Its main power occurs through recommendations it may put forth to nations around the world.

Great Pacific Garbage Patch

Public Information on Actors Involved

Japan (Ministry of the Environment)

Ministry of the Environment Mission: *Aiming to create a sustainable society, works to make a country which enables simple and high-quality living environment. The ministry will then transmit this idea to the world.*

It is commonly known that a large portion of Japan's food supply comes from regional marine environments. The government has vested interest in the fishery industry; the country is ranked among the top five in the world in the tonnage of fish caught (15% of the global catch). In 2010, the country's total fisheries production was around 5million fish. Coastal fishing by small boats and nets accounts for about one third of the industry's total production and offshore fishing by medium-size boats accounts for more than a half.