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Ocean Plastic Pollution: Guanabara Bay, Brazil

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Our Oceans Plastic Pollution– With Focus on Guanabara Bay, Rio de Janeiro, Brazil

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"Innovation and disposability join hands for one reason: profit" – Capt. Charles Moore

Abstract:

Plastic has completely consumed human life. We wake up to alarm clocks made of plastic, take showers with soaps and shampoos in plastic bottles, brush our teeth with plastic toothbrushes and this is only the beginning. Plastics expand into every aspect of our lives. Plastic has shaped daily lives in an unbelievable fashion since its creation and implementation in the early 1900s. Plastic was first created by a man named Leo Hendrik Baekeland, a Belgian-born American. Plastic has consumed lives and as a result entered into the ecosystems around us due to our wasteful society. This is the throwaway culture created by human societies that needs to be escaped. This idea of a throwaway culture is based on our continued waste of resources and items. Something created for the good of humans has been utilized in a throw-away society that has resulted in the complete destruction and pollution of our environment. This method of living has been detrimental to life forms across the globe. We have seen plastics infiltration into our oceans at a remarkable rate. Plastic waste in our oceans is said to be at 5.25 trillion pieces, much of which is hidden under the water in the ocean depths.[1] We have visible plastic patches across our great oceans, most famous is the Great Pacific Garbage Patch located between Hawai'i and California. There are an estimated 5 gyres across our planet now, with more certainly in the making. One of the main issues with our fight against ocean pollution is the fact that plastic waste is not always present and this develops the 'out-of-sight, out-of-mind' mentality that can be so destructive to our way of thinking and certainly impacts our way of living. When a sailor

[1] "Plastic Statistics." *Ocean Crusaders,* 4 Jan 2015, oceancrusaders.org/plastic-crusades/plastic-statistics/.

goes out in our oceans the number one man-made object they see, is plastic.[2] This is a time in our planets life that is very unstable and uncertain; we are increasingly seeing issues in global warming and climate change, financial insecurities, violence and wars; yet we cannot ignore the fact that our selfish consumption and waste is also harming the environment, the one thing sustaining us. The garbage patches that sit in our oceans are increasingly becoming more mainstream and the attention it gets needs to be transformed into action across the board; this is a time in our life where we need every human and nation to collectively combat the plastic waste entering our oceans. Right now is a turning point for our society in more ways than one and we cannot neglect the ill-effects of plastic ocean pollution because it does more than harm our planet and the life it sustains but it is also effecting the human food chain.

Introduction:

Plastic is a part of our everyday life, creating human convenience in ways we often ignore. As a result of plastic we have seen the slow and continued destruction of our planet and the life it sustains while our consumption and profit margins continue to increase. Worldwide it is estimated that 13,000-15,000 pieces of plastic are dumped into the oceans every day.[3] This increase in dumping results in an increase in animal ingestion of these plastic particles which will subsequently be ingested by humans who are consuming seafood. Plastic particles have been already been found in numerous species. Often when marine life is examined, post-death, plastic pieces are commonly discovered in their stomachs; as an animals stomach becomes full, they are

[2] Moore, C., & Phillips, C. (2012). *Plastic Ocean: How a Sea Captains Chance Discovery Launched a Determined Quest to Save the Oceans.* New York, NY: Avery Publishing Group
[3] "Plastic Statistics." *Ocean Crusaders,* 4 Jan 2015, oceancrusaders.org/plastic-crusades/plastic-statistics/.

unable to consume real food, starving the creature to death as a result. It is estimated that 100,00 mammals are killed due to plastic entanglement every year, and these are just the deaths that are discovered.[4] Plastic pieces can take anywhere from 20-100 years to break down into tiny pieces meaning the plastic we consume is almost guaranteed to outlive the consumer. So why do we continue to use plastic? It is often because of its convenience and affordability. It is difficult to avoid an item that is everywhere and almost impossible to avoid given that it is used to wrap or protect our food. Plastic production and waste has become an epidemic that only seems to be speeding up. The astonishing facts on plastic consumption and waste are countless. But facts are not going to get us anywhere, results need action and action needs knowledge. Once people realize the harm being done to our ecosystem and marine life the actions will follow.

Plastic is one of the most versatile materials ever created by humans. Plastic is typically made of petrochemicals and composed of hydrocarbons. They are synthetic or organic polymers, meaning made of many tiny pieces, which is why when they slowly decompose they turn into the tiny plastic particles, commonly referred to as 'nurdles', which is so easily mistaken as food by marine life. The first step to making plastic is with petrochemicals like coal, crude oil or natural gas; further developing human dependency on the oil industry. This is the starting point of plastic creation where additives such as, stabilizers and fillers, complete the process. Plastics are usually solid or highly durable objects created to withstand most destruction creating an extremely long degradation phase. [5]

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[4] "Plastic Statistics." *Ocean Crusaders,* 4 Jan 2015, oceancrusaders.org/plastic-crusades/plastic-statistics/.

[5] "Science of Plastics." *Chemical Heritage Foundation, 20 Dec. 2016,* www.chemheritage.org/science-of-plastics

The effects of plastic in our ocean and its ecosystem are extensive. This is a direct result from human waste and the throw away culture we have created and live in. This lifestyle has created injustices to the oceans and its ecosystem, directly effecting life and the future generations of humans and all ocean life. This problem stems from many different areas of the globe and from various sources. "Well over a billion, single-use, plastic bags are given out for free every single day."[6] This alone poses a huge threat to marine life by mistaking plastic bags for food and also the potential of entrapment. When plastic bags are consumed by sea turtles it traps food within their stomachs and causes them to become buoyant, unable to dive for food. The issue with these plastic bags is that they never biodegrade but rather breakdown at a very slow rate. They are also full of toxic chemical additives that are released during the breakdown process as well as released inside marine life if consumed. These chemicals have direct effects on ocean life by throwing off the balance of hormones and effecting the organs of the animals. These chemicals can cause an increase in estrogen resulting in some male fish having female sex organs.[7] Plastic is dominating our society and changing the direction we, as a civilization, are heading. Change is necessary but change can only happen through education, awareness and a desire for something better.

This study will look at how plastic negatively effects our oceans through pollution and accumulation, its effects on marine life and the implications for humans. The study will also examine some forms of governmental policies and prevention of plastic pollution. I have chosen

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[6] "Plastic Pollution: An Ocean Emergency." *Marine Turtle Newsletter*, www.seaturtle.org/mtn/archives/mtn29/mtn129p1.shtml?nocount

[7] "The pollution of the marine environment by plastic debris: a review." *Marine Pollution Bulletin*, Pergamon, 28 Aug. 2002, www.sciencedirect.com/science/article/pii/S0025326X02002205

this topic for my love and interest in the ocean and the growing presence of plastic pollution in our oceans and on our beaches. Growing up, plastic waste at the beach was normal to experience, but as time has passed and I have been educated through people, documentaries and articles it has become a significant issue for me. My eyes have opened to see that plastic pollution is a serious threat to our oceans and the life in it; it breaks my heart to see beaches full of waste and images of animals with plastic filled stomach's, ultimately causing their death. The goal of this study is to better inform myself, educate others and in some way make a change in the way we use plastic, dispose of plastic, and interact with our oceans. As Captain Charles Moore mentioned in his book, *Plastic Ocean*, it is through images and realization of harm being done by plastic that people will begin to care.[8] "The sea is as near as we come to another planet." – Anne Stevenson, I hope through this research I can better educate others and be a part of the change in saving our oceans from plastic pollution.

Why should you care?

Because, "The ocean is the largest habitat on earth, home to more than twice the number of species found on land, with more discovered all the time. The ocean is the planet's womb."[9] Because, plastic is also reliant on petrochemicals, further establishing dependence on the multi-

[8] Moore, C., & Phillips, C. (2012). *Plastic Ocean: How a Sea Captains Chance Discovery Launched a Determined Quest to Save the Oceans*. New York, NY: Avery Publishing Group.

[9] Moore, C., & Phillips, C. (2012). *Plastic Ocean: How a Sea Captains Chance Discovery Launched a Determined Quest to Save the Oceans*. New York, NY: Avery Publishing Group.

trillion dollar fossil fuel industry. Because, plastic packaging helped create a shift away from local food production further leading us away from sustainable living. Because, chemicals of plastic are not only contaminating our oceans but the fish as well, which eventually end up in the human food chain.

Lit Review:

This research study attempts to inform, motivate and change the way humans see plastic, how we dispose of it and how we treat our water environments. The main question is, how does plastic pollution negatively affect our oceans, the life it sustains, as well as the issues faced in Guanabara Bay, Brazil?

To understand plastic pollution in our oceans we first need to understand what plastic is. For this section an article by the "Chemical Heritage Foundation" describes in detail what plastic is, how it is made, the science behind it and the structure of plastics. It is important to know what plastic is, and what it is made from to really understand the implications plastic pollution has on our oceans and life on earth. Plastics are complex materials, full of chemicals, that take hundreds of years to degrade. Plastic is involved in almost everything we see or touch. The variety of plastics is astounding. Plastics make life easier, more convenient and cheaper but it has huge negative implications. It is most commonly derived from petrochemicals, which makes it a huge business globally. Plastic was first created in 1907 and since its creation has brought convenience to everyday life but everything has a consequence and plastics just happens to have life changing consequences. The way plastic has been created to be almost indestructible and take centuries to breakdown has significant impacts on our environment and the life that lives in it.

The article, “Plastic Statistics” puts emphasis that plastics have made their way into every part of our life and into every part of our planet. Plastic pollution has become a devastating phenomenon throughout our lifetime, with lasting effects. Plastic pollution is continually getting worse. For plastic ocean pollution I will gather information from at least six different sources and some documentaries. This will be the main focus of the study and some of the research will be dedicated to the pollution and affects. It will cover facts, concerns, threats, and the emergency of plastic in the oceans. The first section will cover the facts of plastic pollution in our oceans by Oceancrusaders.org. The oceans are believed to carry 5.25 trillion pieces of plastic. The main contributor to this number is micro plastics that are often under the surface and hard to identify. The surface carries about 270,000 tons of plastic. The number one man made thing a sailor sees in our oceans are plastic bags. Plastic bags made floods in Bangladesh in the 80s and 90s worse because they clogged the storm drains resulting in the banning of plastic bags in Bangladesh. It costs US$4000 to recycle one ton of plastic bags. The list of mind boggling facts could go on for quite some time but the theme presented from the source is, plastic is ruining our planet and all life within it. We as humans are all responsible for the cause and effects of this plastic invasion. The bottom line of this source is that it is up to us to change the world and prevention is better than a cure.

This article covers plastic pollution effects on marine life. Plastic pollution of the marine environment has adverse effects on the ecosystem. This is already a huge problem but is becoming increasingly worse. This article brings together information from most literature published on the topic. A very reliable source with plenty of information and citations to confirm its legitimacy. Large amounts of marine life are harmed or killed by the invasion of plastic in our seas. We, as the human species, are responsible for the effects on our marine life. This scholarly

article can also be used as a source to elaborate and describe plastic debris. The article also lists a chart on the percentage of plastic to waste ratio in various locations across the globe. This detailed article will also be used throughout the entirety of this research.

The article, “An Ocean Emergency”, offers a well referenced review on plastic pollution and how it is an ocean emergency. They start out by mentioning how our oceans gave become like garbage bins for our plastic waste. They give a quick review of plastic and its effects. They transition into the impacts on the oceans wildlife as well. They mention how in almost all marine life there can be found traces of plastic within them. Most species will ingest small pieces of plastic mistaking it for food or becoming entangled in plastic debris. Although ingestion is far more common than entanglement. They also open up the fact that in the ocean, plastic bags may be mistaken for jelly fish. They offer a special section on sea turtles and the impacts of plastic pollution that they face. They also hope to encourage you by offering ways to reduce, reuse and re-design plastic.

This article cites their sources as four different websites. Its basic question is if the ocean is becoming a big enough environmental concern for consumers and governments to take action. This source covers plastic pollution and if it is a big enough concern to finally involve both governments and consumers. This article does well at explaining the involvement in how plastics are composed of in a simple, understandable way. The article says there is more a cause of concern than a cause of alarm, stating that many other ocean problems affect life like ocean acidification and overfishing. Plastic has become an important additive in our everyday life, not entirely for good. Most plastic we use is used once and disposed of, normally improperly. It also points out that most plastic is negatively buoyant meaning it will sink to the bottom of the ocean. As a result of this plastic pollution they claim 100,000 marine mammals are killed each year due

to consumption or entanglement of plastic. This source does a good job at presenting a variety of issues due to plastic and the effects of plastic as well as asking questions like human health and does a good job at answering them for the reader. It is a detailed source that can also be used throughout the project as well as focusing on the effects on the oceans and ecosystems.

A journal writing titled; Plastic Pollution in the World's Oceans, conducted detailed research across mainly southern hemisphere waters over a span of about 10 years. This journal offers detailed, research based statistics and has been reviewed by a great number of authors. This research journal is a very reliable source of first-hand experience that I anticipate will be extremely useful throughout the study. Their research was done by towing net to retrieve plastic floating particles as well as testing plankton. Through their extensive research they have estimated that 5.25 trillion particles of floating plastics span the oceans. This report, along with many other of my sources emphasize the global perspective of plastic pollution and how it effects almost all of us. Even nations that are landlocked are likely eating some seafood containing plastic and some forms of toxins as a result of the plastic pollution. This source, based on it research has found connections between gyres and plastic pollution and highly populated regions. They also took into account wind and current patterns generating this plastic floating islands. This source does a good job at tying the general information of the others sources together through research and findings of their own.

The article is titled, "Plastic Debris in the Open Ocean". Another well cited source with plenty information, statistics and charts. This source stresses the rising concern of our oceans plastic accumulation as a result of human error. Like the rest of my sources this article stresses the worldwide distribution of plastic in our oceans. This period in time has been referred to as the "plastic age". It is a result of its convenience and cheap prices. These reasons cause us to be

careless with the disposal and typically only use an item one and then it is trashed. This source is quite similar with the rest, giving valid, cited information on the issues of plastic pollution and the problems we face as a world. This source, like the research done in the plos research, both tend to focus on the floating plastic debris.

"With millions of tons of plastic in our oceans, more scientists studying impact", is an article written for National Geographic. Most ocean debris come from the land. We, humans, are the source of the marine life suffering. This article covers the main topics of plastic pollution and the effects it has on the ocean and the marine life, similar to the other articles. It asks new questions to this old problem. It also suggests options for how we can prevent ocean pollution and what we can do to help clean it up. I will use this source as a good transition point from the effects of plastic ocean pollution to organizations helping clean up and prevent more contamination.

This is a short-film on Rio's plastic problem. The film is shown through the eyes of a young 9-year-old boy who lives in one of Rios favelas. With plastic harming Guanabara Bay, the city and government seek out ways to combat the growing problem; the issue is, the solutions are one-time solutions and the waste comes back, often in greater amounts. The documentary is influential in its use of video, photos and facts regarding the plastic epidemic Guanabara Bay faces. The most important quote from the short-film was, in English translation, "If you're worried about your next meal, you don't care about your empty containers from yesterday." The young boys' words "We did it to ourselves, now we need to fix our mistake.", is a testament to the change that needs to come and hopefully will.

Is an article that regards the micro plastic pollution in Guanabara Bay. This article has research based on the concentrations and distributions of micro plastics found on certain beaches

and discusses the environmental consequences of this issue. They recognize plastic debris as an important marine environment pollutant. They note that Guanabara Bay is one of the most polluted Bays on the Brazilian coastlines based on data retrieved.

This is a short series on Guanabara's ocean pollution, called "Toxic Guanabara". It focuses on trash, oil and chemicals but for the purpose of this research we will limit information used to plastics and trash. The video states that 100 tons of trash per day is dumped into Guanabara Bay and labeled it as "the abandoned side of Rio". The main guy believes the government does not care about the bay and the pollution that goes into it. This video series is extremely useful to get some video and facts from a fisherman/activist who is first-hand experiencing all the problems that occur in the Bay as well as the fight with government.

This is an e-book on the neglect and resistance at Guanabara Bay. It is an excellent, well-written, book on the causes, effects and solutions. The book covers more than plastic and trash pollution but focuses more on oil, chemical, sewage etc. Of all the sources used in the study I believe this one to be one of the best. It touches on so many issues the Guanabara Bay and its inhabitants face. It does a great job at outlining and highlighting important issues and facts. It also uses excellent graphs and charts.

This is a textbook definition of Sustainability. By definition, sustainable is the ability to maintained at a certain level or rate. The Theory of Sustainability attempts to explain a form of both society and economy that can be lived on a global scale for a long period of time. It can also be used as a way of responding to environmental and cultural problems faced by society. Perspectives on this theory will vary from culture to culture as well as religion, age, gender, economic standing and region.

The Theory of Waste Management, as with other theories will depend on some factors but as a whole this theory aims at preventing waste that can cause harm to the environment and humans. How waste is defined plays a large role in the management of ‘waste’. It aims to define waste, why waste is created and finding a logical, sustainable solutions to the cause.

This is an article on waste and super-capitalism as it relates to The Throw Away Society which can certainly be used as theory. It states that over time we have shifted away from the re-use of things for the more convenient lifestyle of throwing away, often after one use. We no longer get glass milk delivered and picked up from our homes, the repair of shoes and clothes has faded as buying a new one is more convenient and often preached through marketing. Our policy on waste and recycling has been deemed one of the greatest policy failures in the last 50 years. This issue arose largely because of capitalism, and overconsumption. Most goods are made in low-cost, low-labor markets where items are consumed and repair costs are high, making it not worth the effort and money to repair but rather dispose and buy another.

The definition used for The Broken Windows Theory comes from the Britannica. The Broken Windows theory was created to explain disorder within a neighborhood. Its idea is to form a bridge between disorder to the reoccurrence of crime. It was formed on the reality that disorder causes crime and will continue to do so. The theory was manipulated to fit this projects topic on the basis that poor regions face the effects of plastic pollution in their oceans more than others as well as on the beaches. If people, see waste on the beach or ocean already they will think it is okay to continue or begin disposing of their waste in the same manner. This further harms the environment and makes it more difficult to combat the issue at hand.

An article used for referencing a sustainable city explores the sustainability of the Brazilian city of Curitiba. It touches on the 'revolution' they had toward a sustainable future when they were faced with city-threatening issues. They have been a model city for Brazil and the world. With improvements to more than just waste management, Curitiba has taken responsibility for their actions and are all doing their part for a brighter future. This city will be used as a model that Rio could possibly follow to combat the waste problems they face as well as some social and transportation issues.

What are the impacts of a plastic polluted ocean on the ocean ecosystems, marine life, humans and how can we stop this epidemic, specifically, in Guanabara Bay?

Theoretical Framework:

My theories of use throughout this study are: The Sustainability Theory, Waste Management Theory, Broken-Windows Theory, as well as Throw-Away-Society Theory. All four theories are interconnected and do a fantastic job at explaining and allowing for analysis in the issue of plastic pollution in our oceans. These four theories are of significant importance to this study's topic because they do a great job at explaining why we live the way we do and how it affects our plastic waste which directly affects our oceans. Although most of us are not disposing of waste directly into the oceans, chances are the waste is somehow making its way there. The Sustainability Theory describes an economy and society that allows for longevity on Earth for both humans, the planet and its inhabitants.[10] The Theory of Waste Management suggests, or expects, that humans can prevent waste from

[10] *Berkshire encyclopedia of sustainability*. (2010). Great Barrington, MA: Berkshire Pub. Group.

causing harm to both the planet and humans by properly disposing of all types of waste.[11] The Broken-Windows Theory is an interesting theory when regarding the plastic pandemic; the theory stems from the idea that "broken-windows" or a run-down building/neighborhood insinuates that no one cares or is in control of the area, allowing for more harm to the environment (under this context we refer to environment as an area or space).[12] I have decided to use this theory for this project because I think it relates to the issue at hand, when waste is present, it opens the door for more waste to be added, people will be more inclined to disregard morals and laws based on the present appearance of a "run-down" beach, river or ocean. Similar to the Theory of Waste Management, The Throw-Away-Society theory states that due to our consumerism and the planned obsolescence of big business, we often discard objects frequently, do not re-use multi-use items and are prone to an excess of one-use plastics. This type of culture has been detrimental to the ecosystem. Throwaway society is heavily influenced by consumerism, which is built through capitalism. Throwaway culture describes the current social and economic structure of society in which the unwanted goods of society go to waste. The throw-away-society we live in is the most important issue in the fight against plastic pollution.[13] All of these theories are applied to the studies in which I will use, either directly or indirectly. The way they will be applied to the studies are on the basis of how our society functions, which results in the pollution. These theories allow for

[11] Pongrácz, E. (2002). *Re-defining the concepts of waste and waste management: Evolving the theory of waste management*. Oulu: Oulun Yliopisto

[12] McKee, A. J. (2017, December 13). Broken windows theory. Retrieved April 10, 2018, from https://www.britannica.com/topic/broken-windows-theory

[13] Why capitalism creates a throwaway society. (n.d.). Retrieved April 10, 2018, from https://www.newstatesman.com/society/2008/08/waste-supercapitalism-policy

awareness of the issues, hold us accountable and explain why certain things happen the way they do.

Methodology:

Research Question

What are the impacts of a plastic polluted ocean on the ecosystem, marine life and human's, specifically in Guanabara Bay? This has a global perspective because it relates all oceans, all people, all sources of pollution and involves all parties that are effected. Data from some of the sources I have found will be used. Most data are from well researched ocean advocacy groups or boat crews that conducted research. Information on Guanabara Bay will come from combined sources of case studies as well as first-hand documentaries and mini-series. Both diachronic and synchronic methods of analysis will be used although primarily diachronic, as this issue is more historical rather than comparing, since we all are effected and in some ways contribute to the problem. It will cover the short history of plastic ocean pollution. Data and analysis on this topic is limited due to the recent introduction of plastic and even more recent discovery of such impacts of plastic in our oceans. Most sources are both primary and secondary sources, with some containing research, others are research backed and some are articles based on research done by others. This method of retrieving information allows for different perspectives as well as a variety of mutually agreed ideas and perspectives.

Findings:

Guanabara Bay in Rio de Janeiro, Brazil is one of the worlds most effected bays by waste pollution. One of the most common things in Rio's waste is plastic. Plastic pollution is choking the life out of Guanabara Bay marine life as well as the locals that live in this once clean and stunningly beautiful beach cities. This beautiful beach town has been damaged by waste and the stench that comes with the garbage; much of the waste in the area is in the form of some sort of plastic. The problem arose as a result of the introduction and use of plastic, uneducated use and disposal of plastic, disregard for the environment and lack of proper waste removal services. The issues that lead to the plastic ocean epidemic can be related to social and income inequalities. The article/mini-series, "'The Discarded' Plastic in Rio's Bay"[14] contained an extremely powerful quote from a local in the area, "If you're worried about your next meal you are not worried about your empty containers from yesterday."[15] The plastic waste issue stems from a variety of issues, for this area, one of the most important is poverty and lack of access to certain resources that many locals are faced with. However, this is not purely a problem of a disadvantaged society as the well-off residents and regions of Rio are just as much to blame for the crisis created at Guanabara Bay. Furthermore, this is a human caused problem, an ethical issue and lack of education is at the root of the problem. On the bright side this is a crisis that only humans can work to find solutions for and implement changes to lifestyles giving us hope for a better future since we are more or less completely in control.

Guanabara Bay is a national symbol of Brazil, world renowned for its beauty, its beaches and the people, the sad thing is in postcards and from afar all you see is the beauty, if you could

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[14] 'The Discarded' Plastic in Rio's Bay. (n.d.). Retrieved April 10, 2018, from http://www.plasticpollutioncoalition.org/pft/2016/1/19/the-discarded-plastic-in-rios-bay

[15] 'The Discarded' Plastic in Rio's Bay. (n.d.). Retrieved April 10, 2018, from http://www.plasticpollutioncoalition.org/pft/2016/1/19/the-discarded-plastic-in-rios-bay

smell the pollution and trash most people's opinion on this region would change. In 2012, Guanabara Bay was protected by the UN as a World Heritage Site.[16] However, with the Olympics being held in Rio in 2014, the area received some negative attention for the hazard and excess waste present in the bay. This drew attention from the international community as to how bad the bays pollution is. The money is there to clean-up the bay but the political coordination is not. This is a far deeper issue than politics and the environment but I firmly believe it comes down to the people of the community to change the way they handle waste and consumption. I say this with a heavy heart because I know the reality of many people that live in poverty are far more concerned with their own health, well-being and next meal rather than where their waste goes or if what they consume contains plastic. What I have found true, in my case, is that no matter what statistics I read nothing has a greater impact than seeing pictures or watching videos on the issues at large.

Guanabara Bay has 55 main rivers that extend from inland to the bay; of those, 47 are currently 'dead' due to being turned into the dumping grounds of residents.[17] This is a direct result of the inhabitants of the slums that don't have roads or lack access to dump trucks meaning their waste is left in streets or thrown in rivers which either flow to the bay or sit in these dead rivers. This is a sad reality for the many people that call Rio home. This is proof of the lack of waste management, sustainable living and respect for the society and environment present in parts of Brazilian society. I am ashamed to admit this but the situation left a deep and lasting

[16] Brazilian Government signs up to UN Clean Seas campaign. (n.d.). Retrieved from https://www.unenvironment.org/news-and-stories/press-release/brazilian-government-signs-un-clean-seas-campaign

[17] Emanuel Alencar. Guanabara Bay: Neglect and Resistance. (n.d.). Retrieved April 10, 2018, from https://www.boell.de/en/2017/01/05/guanabara-bay-neglect-and-resistance

impression on me; it was just last year I was at a park, in which a small creek ran through, in Recife, Brazil, a coastal city, with my grandfather smoking a cigar which came in a plastic wrapper. After removing the cigar from its plastic, one-use wrapper I stood up to walk to the garbage some 10 yards away and my grandfather insisted I throw the trash in the creek directly behind us and as I declined and proceeded to walk he told me the creek is there to throw trash into! This came from a well-educated, wealthy, 75-year-old man and I could not have been more blown away. Situations like this give me little hope for the future of our planet in regards to the way we dispose of items.

Some governmental policies have been put in place to protect our oceans from pollution. The Resource Conservation and Recovery Act, passed in 1976 by congress allowed for a shift in the economics of plastic waste. "The generators of the garbage flow – manufacturers – were off the hook. The consumer/taxpayer – you and me – would pick up the tab in the form of merchandise markup and hauling service or tax-subsidized garbage collection. The state of California alone shells out about $750 million per year of taxpayer funds to landfill just plastics."[18] How is this acceptable?

Another work of lawmakers is The Act to Prevent Pollution from Ships which was amended in 1987[19]. This was one of the first steps toward a cleaner ocean although holding people to these standards has been difficult. In 2017 Brazil signed the UN Clean Seas Agreement which aims to bring international awareness to marine litter and its reduction. It realizes proper waste management infrastructure is necessary to combat the problem, something Brazil struggles

[18] Moore, C., & Phillips, C. (2012). *Plastic Ocean: How a Sea Captains Chance Discovery Launched a Determined Quest to Save the Oceans*. New York, NY: Avery Publishing Group.
[19] "Laws that Protect Our Oceans." EPA, Environmental Protection Agency, 9 De. 2016, www.epa.gov./beach-tech/laws-protect-our-oceans

immensely with. Brazil's involvement in this agreement is huge for the nation as well as the rest of the global community as the fight against plastic in our oceans and beaches continue. [20]

Analysis:

This issue and its causes prove to be a societal and ethical issue of waste management, as well as a lack of respect for the environment; it all comes down to education and knowledge of issues as well as a conviction to be better. The four theories used in this study: The Sustainability Theory, Waste Management Theory, Broken-Windows Theory as well as Throw-Away-Society Theory all tie in together to explain our crisis of plastic pollution in our oceans. Although they all go hand-in-hand I must credit this crisis to our throw-away-society. To me this is our biggest issue, our over-consumption through capitalism and the lack of waste management have led us

[20] Brazilian Government signs up to UN Clean Seas campaign. (n.d.). Retrieved from https://www.unenvironment.org/news-and-stories/press-release/brazilian-government-signs-un-clean-seas-campaign

all to this point. Obviously this is an individual problem but corporations make it easy for us to continue living like this while encouraging our increased consumption. This is clearly not a sustainable way of living which is where the sustainability theory comes into play. Another problem that adds to the crisis comes from the broken-windows theory which neglects poor regions based on their appearances and when they are dirty or full of waste it is much easier to continue inappropriately disposing of items. Guanabara Bay is not alone; this is happening all over the globe especially in developing countries. Changes need to happen on a greater level. The planet needs our collective effort now more than ever and I think that is exactly what is happening in Guanabara Bay as individuals and organizations are beginning to educate and dedicate their life to bettering the region. Mario Moscatelli, a Biologist and Ecosystem Manager in Rio, is a vocal activist to protect the environment. He has worked on numerous environmental clean-up projects and has worked hard to bring awareness to the issues in Guanabara Bay.

As Guanabara Bay and the Rio region face a serious issue of waste management it is crucial to find a place to model. No place offers a better model than the capital city of Curitiba in Paraná, Brazil. Curitiba is by far the most sustainable city in Brazil and certainly in the discussion as one of the most sustainable cities in the world. They do an incredible job with waste management as well as designating 'green' areas, a shift toward less vehicles and more bikes and a reliable, effective transit system. For waste management they have developed a system that encourages proper waste disposal as well as a reward program that encourages recycling with the benefit of receiving tickets, bus tickets, etc. in return.[21]

[21] Alexe, A., & Green Cities Projects & Cities Urban. (2017, September 29). Curitiba, Brazil: The world's first sustainable city. Retrieved April 10, 2018, from http://urbanizehub.com/curitiba-brazil-worlds-first-sustainable-city/

What has been discovered is that the plastic ocean is a global issue which means we are all responsible in some shape or form and some more responsible than others. A lot of factors go into the issue we face but it is important to get governments involved, policies in place, education to the public and a return to the natural world. When we are aware and realize our bond with the planet I think we will begin to make more educated decisions and do our part to make a change that will prevent plastic consumption and pollution.

Value has shifted from a penny saved to time saved and that is what has brought us to the throwaway living we have created.

Conclusion:

Emanuel Alencar, of *Guanabara Bay: Neglect and Resistance,* states: "…to discuss the clean-up of Guanabara Bay when more than 1.6 million of houses in Rio do not even have sewage systems is a fantasy. Or dishonesty."[22] This raises an extremely valid and important reality to the people of Rio. How can such money and time be invested into cleaning up and protecting the bay when there are people homeless, without food or basic clothes living in the slums above? Is this ethically okay to be investing in the environment when local inhabitants struggle for basic human needs? Should the government and community first seek to help the people in need, educate them and then proceed to clean and protect the waterways in Rio? Or what about the possibility of employing these people with jobs surrounding the bay that work to keep it clean or advocate for a healthier environment? That would just be a band-aid to both

[22] Emanuel Alencar. Guanabara Bay: Neglect and Resistance. (n.d.). Retrieved April 10, 2018, from https://www.boell.de/en/2017/01/05/guanabara-bay-neglect-and-resistance

social and economic inequality as well as to the issue of plastic pollution in the first place: plastic manufacturing and consumption. I think these suggestions would be beneficial to the region, its people and the environment but of course it is much easier said than done. With so many issues at hand it is difficult to tackle them all at once but we all must do a better job. The first step to being better against plastic pollution is to first be aware of your consumption patterns, because that is where it all starts and then be aware of how you dispose of plastics. These are two small steps that can begin to have an impact; lead by example and other people will begin to follow, commence the lifestyle change and others will take notice.

Our patterns of consumption and waste are far beyond what the eye can see. Guanabara Bay is not alone in their issues with waste and plastic in their waters. Recently scientists have discovered, "Up to 12,000 pieces of micro plastic particles were found per liter of sea ice in core samples taken from five regions on trips to the Arctic Ocean – as many as three times higher than levels in previous studies." [23] This alone shows the global impact plastic on Earth. Plastic is reaching places that do not see much human-traffic but are feeling the consequences of human choices. We must protect our oceans from waste disposal, chemicals, overfishing and plastic pollution. Without the ocean there is no us. The oceans are responsible for a large amount of our oxygen, about 97% of Earths water and helps regulate our climate. [24] With something so precious how can we neglect its health? And this goes beyond the marine life and ecosystems within the

[23] Taylor, M. (2018, April 24). Record levels of plastic discovered in Arctic sea ice. Retrieved from https://www.theguardian.com/environment/2018/apr/24/record-levels-of-plastic-discovered-in-arctic-sea-ice

[24] No Ocean, No Us: 3 Reasons We Should Care About the State of Our Oceans. (2014, December 16). Retrieved from http://www.onegreenplanet.org/animalsandnature/reasons-we-should-care-about-the-state-of-our-oceans/

ocean; our lack of accountability and total disregard for our environment is destroying the very things that allow for our existence.

Change will only happen when we see a shift in our thinking and our hearts and put to action what is necessary to produce sustainable and eco-friendly living. It all starts and ends with us so we must do more to protect this environment that we so heavily rely on for survival. One of the best ways to begin this journey is by reconnecting with nature, this will provide the perfect starting point for a brighter, cleaner, plastic-free life.

"Science… determines policy. Science plus strong public sentiment are even more powerful drivers of policy shift. If you can also harness law, when policy can be proven to do harm or lack enforcement, you have a recipe for change."[25]

[25] Moore, C., & Phillips, C. (2012). *Plastic Ocean: How a Sea Captains Chance Discovery Launched a Determined Quest to Save the Oceans*. New York, NY: Avery Publishing Group.

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