Our Weeping Beaches: The Most Effective Strategies to a Cleaner Coastline

(Ballona Creek at Washington Street) Photo Cred. Heal The Bay

Report by: Conrad Liebowitz
Supported by Occidental College
Urban and Environmental Policy Department
April 20th, 2013

Executive Summary

This report discusses the negative impacts of marine debris along the Los Angeles Coastline. By using the Santa Monica Bay as a case study this investigative study will inspect the most effective strategies to alleviate the negative impacts caused by marine debris. The population of Los Angeles has steadily grown over the years resulting in more trash input into the local coastal habitat. In response to this increase in trash input this study has been released to remain prevalent and provide up to date information and statistics.

Table of Contents:

Introduction

Growing up as a young kid in Santa Monica, California, the beach was like my backyard. It was my favorite place to visit, as I would spend hours playing in the sand, jumping through waves and playing football and Frisbee with my friends. But amongst these memories, I still hold a vivid image of a huge amount of trash scattered throughout the beach, creating a disturbance within my childhood playground. The beach and ocean have always maintained a special place in my heart and over the years I began to wonder: what are the most effective solutions for alleviating the issues caused by marine debris?

Marine debris remains a problem that extends past my childhood memories, as trash along the coastline poses a serious threat to humans, wildlife and the ecosystem. Marine debris has become very dangerous since it has no boundaries and moves with the flow of the Ocean to the farthest points on Earth. It has been documented that ocean litter has even tainted the remote Midway Island, an uninhabited island directly in the middle of the Pacific Ocean.[1] With no limits, marine debris has the power to kill wildlife, harm human wellbeing and release toxins and chemicals into the marine habitat. In the Santa Monica Bay this results in beach closures as the beaches are scattered with warning signs that read "Do Not Swim."

In this research paper I discuss the negative impacts caused by marine debris and what is the most effective techniques to alleviate the issue. I investigate how the state government, local government and non-profit organizations that work together to prevent more trash from entering the oceans.

---

[1] Shukman, David. "New 'battle of Midway' over Plastic." *BBC News*. BBC, 26 Mar. 2008. Web. 18 Apr. 2013.

Marine Pollution Overview

Defining Marine Pollution

To grasp the negative impacts of marine debris on beaches around the world, one must first have an understanding of what exactly makes up marine debris. In 1975, The National Academy of Sciences defined marine debris as, "Any solid materials of human origin that are discarded at sea or reach the sea through waterways or through domestic and industrial outfalls."[2] Essentially, marine debris is any sort of manmade trash scattered along the sand. All types of manmade products can become marine debris, including food containers, water bottles, plastic films and cigarette butts, although 60-80% of all marine debris consists of plastic items.[3]

However, not all marine debris is visible to the naked eye. Any type of trash can get swept into the ocean. At this point, debris can sink, float, wash up on the shore, or travel with ocean currents far out to sea.[4] Additionally, the constant movement of the ocean presents another challenge for the clean up process.

Sources of Marine Debris: Land vs. Off Shore

Marine debris can come from a variety of different sources, although people and their actions are the source of most marine debris. For this reason, it is important to determine

[2] Sheavly, Seba B. "National Marine Debris Monitoring Program: Lessons Learned." U.S. Environmental Protection Agency, Mar. 2010. Web.

[3] Thompson, Richard, La Belle, Bruce, Bouwman, Hindrik, Lev, Neretin. "Marine Debris: Defining a Global Environmental Challenge." Global Environmental Facility. May 11, 2001

[4] Setty, Karen E, Weisberg, Stephen B. "Oceanic Pollution." Southern California Coastal Water Research Project.

the difference between-land based and ocean-based debris.[5] By analyzing the types of debris, researchers believe that approximately

80% of marine debris comes from onshore sources that are either intentionally dumped or unintentionally washed or blown off the land, while the remaining 20% comes from offshore sources like ships and oil platforms.[6] Many challenges exist in deciphering the origin of marine debris as land-based debris can be blown, washed, or discharged into the water from land areas such as parking lots, shopping areas and storm sewers.[7] Storm drains off the city streets establish a direct path from inland to the coast, a common routine of trash when analyzing marine debris.[8] As most cities have a complete storm drain system, trash can travel vast distances from the inland, before reaching the coastline to become marine debris.

The only distinction between normal trash and ocean litter is that it must reach the coastline to be classified as marine debris. When applying this distinction to the Los Angeles County, the Los Angeles River and Ballona Creek are both major targets for marine debris. Both the LA River and Ballona Creek are moving bodies of water that have a direct outlet to the ocean. Additionally, the Santa Monica Bay has suffered from the effects of marine debris.

What are Micro-Plastics?

Often marine debris is assumed to be a large item that is visible to the eye. However, the majority of marine debris is actually made up of smaller pieces (<5mm), many of which

[5] Thompson, Richard, La Belle, Bruce, Bouwman, Hindrik, Lev, Neretin. "Marine Debris: Defining a Global Environmental Challenge." Global Environmental Facility. May 11, 2001

[6] Ibid

[7] Ibid

[8] Ibid

are preproduction plastic pellets.[9] Compared to other forms of marine pollution, micro plastics cause a catastrophic amount of damage and are nearly impossible to remove from the ocean environment.[10] Prior to production, plastic comes in the form of small pellets that are then melted down and molded into any shape. A report conducted in 1998 by the Southern California Coastal Water Research Project estimated that over 100 billion preproduction plastic pellets scattered the beaches of Orange County, California.[11] Over 60 billion pounds of plastic pellets are produced in the United States every year and are transported around the globe via shipping vessels.[12] Often pellets are accidentally released into the ocean and cause a path of destruction as the tiny plastic particles travel around the globe via the oceanic currents. Marine birds and mammals often confuse the tiny plastic pellets for food and die from starvation as they do not get the nutrients they need to survive.[13] Once the plastic pellets have entered the marine habitat they are very difficult to control since the constant movement of the ocean continually makes each piece smaller.

---

[9] National Oceanic and Atmospheric Administration. 2008. "Interagency Report on Marine Debris Sources, Impacts, Strategies & Recommendations." Silver Spring, MD. 62 pp

[10] "Microplastics." *Marine Debris Program*. National Oceanic and Atmospheric Association, n.d. Web. 18 Apr. 2013.

[11] Moore, Shelly L., Dominic Gregorio, Michael Carreon, Stephen B. Weisberg, and Molly K. Leecaster.

"Composition and Distribution of Beach Debris in Orange County, California." *Southern California Coastal Water Research Project*. (n.d.): n. pag. Web.

[12] Thompson, Richard, La Belle, Bruce, Bouwman, Hindrik, Lev, Neretin. "Marine Debris: Defining a Global Environmental Challenge." Global Environmental Facility. May 11, 2001

[13] Setty, Karen E, Weisberg, Stephen B. "Oceanic Pollution." Southern California Coastal Water Research Project.

The constant movement of the oceans physically breaks down larger plastic items into a fine emulsion that are characterized as microplastics. Unfortunately, once plastic items become microplastic, its usability as a raw material is limited. When faced with microplastic materials, recycling is not often a realistic solution since separating such small pieces of trash by type and category is very difficult and not cost effective. During beach clean ups, volunteers often pass by microplastics that are mixed in with the sand as the pieces are so small they do not catch the eye of the beach-sweeper.

(Photo Cred. Dru Bloomfield)

Microplastics are difficult to handle and clean up since they are so small, and they routinely get passed over and are swept into the ocean currents to be redistributed throughout the globe.[14] and By combining the degradation process with the complex ocean currents, the small particles of rubbish are left causing a wave of destruction as they travel throughout the delicate marine ecosystem.

[14] Ibid

Impacts on Wildlife:

Ingestion and Entanglement

The insertion of debris into the ocean has caused a wide array of negative effects, ranging from animal entanglement to the release of toxic chemicals into the marine habitat.[19] The Vantuna Research Group (VRG) has recognized the negative impacts of marine debris.

The VRG is an oceanic research monitoring group based out of Occidental College, that studies the changes in the wildlife, ecology and overall health of the marine habitat along the coastline of Southern California. During a field study, Professor Jonathan Williams of the Vantuna Research Group describes a horrific tale during his time doing field research off the coast of Catalina Island, California.

> We had set out a gill net and someone thought we were doing something illegal and they cut the buoys off of it, which is the worst thing you can do! And it ended up drifting over and somebody found and it had a bunch of sea lions and a blue shark tangled up in it. They [the people cutting their net] either thought they were helping out and cut our line, which is just overall wrong. Or they thought since I'm not allowed to gill net, you're not allowed to gill net. Either way, it ended up being a ghost net.[20]

With poor marine awareness, one person was able to cause a catastrophic amount of harm to the surrounding wildlife. Marine debris harms animals in a variety of ways, from entanglement in rope and netting, suffocation, or ingestion of microscopic fragments.[21]

Marine Litter and Green Sea Turtles

A study by the University of Rio do Grande Sol in Brazil, examined 50 deceased adult

---

[19] Setty, Karen E, Weisberg, Stephen B. "Oceanic Pollution." Southern California Coastal Water Research Project.

[20] Jonathan, Williams. Vatuna Research Group. Occidental College, February 7th, 2013.

[21] Setty, Karen E, Weisberg, Stephen B. "Oceanic Pollution." Southern California Coastal Water Research Project.

and juvenile sea turtles. The samples contained plastic bags within their stomach and esophagus, which was mostly clear and colorless.[22] Within the region, the study concluded that plastic debris ingestion is responsible for the deaths of 13.2% of green sea turtles off the coast of Rio do Grande Sol.[23] However, this percentage does not include the hazard of entanglement and the ghost fishing of sea turtles caused by abandoned fishing nets. Plastics were the most frequently ingested marine debris by turtles, with plastic bags, preproduction pellets and plastic ropes being the most abundant objects.[24] Throughout the specimens, the most abundant colors of bags were transparent (39%), white (28.9%) and black (18.4%).[25] Many studies have concluded that turtles confuse plastic bags for jellyfish and die from malnutrition and starvation. The number of plastic pieces varied greatly from 1-29 pieces per specimen.[26] However, the effects of non-lethal plastic consumption have not been concluded., though it is believed that post-hatchling sea turtles had a limited ability to compensate for their ingestion of plastic particles. This inability could result in reduced growth rates, longer developmental periods at sizes most vulnerable to predation, depleted energy reserves, decreased ability to reach appropriate offshore current systems and decreased survivorship.[27] Additionally, this study only examined the contents in the stomach and esophagus, not the entire digestive tract, so these numbers could have been an

[22] Bugoni, Leandro, Ligia Krause, and Maria Petry. *Marine Debris and Human Impacts on Sea Turtles in Southern Brazil*. Universidade Federal Do Rio Grande Do Sul, 2001.

[23] Ibid

[24] Ibid

[25] Bugoni, Leandro, Ligia Krause, and Maria Petry. *Marine Debris and Human Impacts on Sea Turtles in Southern Brazil*. Universidade Federal Do Rio Grande Do Sul, 2001

[26] Ibid

[27] Ibid

understatement of the deadliness of plastic debris.

In comparison, a study conducted by K.A Bjorndal titled, *Ingestion of Marine Debris by Juvenile Sea Turtles in Coastal Florida Habitats,* revealed marine debris was even more dangerous. Off the coast of Florida, they reported that 60.5% of green sea turtles ingested debris off the coast of Florida.[28] This study analyzed the entire digestive tract and revealed much higher numbers than the study conducted off the coast of Brazil. Bjorndal considers the obstruction of the digestive tract to be one of the most significant causes of death and concluded that even the smallest amounts of debris can kill marine animals.

Impacts on Human Health and Wellbeing

Human Health: Our Worsening Water Quality

The accumulation of trash along coastal cities severely impacts the natural beauty of the region, which hurts the economies and residents of that area. Marine debris also hinders many industries that use the ocean to attract business, including fishing, transportation and tourism, as well as governments and local communities. Anyone that uses the beach recreationally or lives in the surrounding area suffers from the negative economic and health impacts of marine debris.[29]

Marine debris can cause health hazards to common beach-goers. Innocent people encounter broken glass and medical waste on beaches or ropes and lines dangling in the ocean that pose threats to beach- goers, boaters, and divers.[30] The introduction of cigarette

---

[28] Ibid

[29] Setty, Karen E, Weisberg, Stephen B. "Oceanic Pollution." Southern California Coastal Water Research Project.

[30] Ibid

butts into the marine habitat releases a great amount of chemicals, tar and toxins into the ocean habitat. People unconsciously throw their used cigarette on the ground that eventually will make it to the coastline via the storm drain system.

Economic Impacts

Many monetary opportunities are lost when marine debris is present because tourists are turned off by the unsightly image of an unhealthy habitat, while local governments have to include the beach cleanup process into their annual budget.[31] Besides economic hardships, marine debris can also pose health hazards to any beach-goer. Essentially, anyone who enjoys activities along the coastline are effected by marine debris, but those living along the coastline are harmed the most because they interact with the coastline on a daily basis.[33]

Impacts on the Ecosystem

Aside from the aesthetic destruction and animal deaths, ocean litter also harms the ecosystem. The introduction of debris inhibits photosynthesis in marine plants, releases toxic chemicals, and introduces invasive species into a balanced habitat.[34]

Inhibition of Gas Exchange

The buildup of benthic (underwater) plastic debris inhibits the gas exchange between marine plants and the ecosystem.[35] As plastic floats at the surface and accumulates on the

---

[31] Thompson, Richard, La Belle, Bruce, Bouwman, Hindrik, Lev, Neretin. "Marine Debris: Defining a Global Environmental Challenge." Global Environmental Facility. May 11, 2001

[33] Setty, Karen E, Weisberg, Stephen B. "Oceanic Pollution." Southern California Coastal Water Research Project.

[34] Thompson, Richard, La Belle, Bruce, Bouwman, Hindrik, Lev, Neretin. "Marine Debris: Defining a Global Environmental Challenge." Global Environmental Facility. May 11, 2001

[35] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 23-24.

seafloor, it can block the gas exchange between oceanic plants and the water, causing environmental anoxia, wherethe lack of oxygen in the water can interfere with the normal function of the ecosystem.[36] Floatable debris can inhibit the growth of aquatic vegetation, decreasing spawning areas and habitats for fish and other living organisms. In particular, nano-sized plastic pellets impact the bottom of the food chain by inhibiting photosynthesis which causes oxidative stress in marine algae.[37] Algae and kelp play an essential role in keeping the ocean full of oxygen while also maintaining the alkalinity of the surface water.[38]

Debris interferes with this process by either physically blocking marine plants from the sun or by releasing toxins, such as BPA, that restrict photosynthesis.[39]

Release of Toxins and Chemicals

Additional research is necessary to assess the detrimental impacts of marine litter on the oceanic ecosystem, but the chemicals used in the production of plastics raise many potential concerns. Preproduction plastic pellets are a potential hazard for the release of toxins into the marine ecosystem. Pollutants associated with plastic resin pellets include: Polychlorinated biphenyl (PCBs), dichloro-diphenyl-dichloroethylene (DDE; a degradation product of the organochlorine pesticide, DDT), and polycyclic aromatic hydrocarbons (PAHs), all of which have the ability to harm the balanced marine ecosystem.[40]

However, resin pellets contain two types of hazards that deserve extra attention:

---

[36] Ibid

[37] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

[38] Ibid

[39] Ibid

[40] Ibid

nonylphenols and phthalates.[41] In 2005, The American Marine Research Foundation (AMRF) conducted a study that discovered that phthalates were abundant in all field samples from the Los Angeles and San Gabriel river.[42] It is believed that nonylphenols and phthalates exhibit endocrine disrupting effects in some marine species.[43] Even in low quantities plastic has been observed to disrupt the hormonal balances in marine animals.

Additionally, the study found concentrations of PAHs in the Los Angeles river that resembled storm water runoff at levels that reached 2.5 parts per billion (PPB). Similarly, a study by Mato, et al., analyzed samples off the coast of Japan that contained concentrations of PCBs and DDE that were up to 1 million times higher than the levels detected in other coastal areas.[44] Both studies concluded that areas with a higher level of industrialization and human development contained larger amounts of PCBs and other toxins than secluded areas.[45]

Invasive Species

Floating debris that travels with the ocean's currents also transport invasive and alien species, throwing off the imbalance of the marine food chain and ecosystem. Larvae of

---

[41] Charles Moore, Gwen Lattin, Ann Zellers, "A Brief Analysis of Organic Pollutants Absorbed to Pre and Post-Production Plastic Particles from the Los Angeles and San Gabriel River Watersheds," presented at *Plastic Debris, Rivers to Sea Conference* September 7-9, 2005.

[42]Charles Moore, Gwen Lattin, Ann Zellers, "A Brief Analysis of Organic Pollutants Absorbed to Pre and Post-Production Plastic Particles from the Los Angeles and San Gabriel River Watersheds," presented at *Plastic Debris, Rivers to Sea Conference* September 7-9, 2005.

[43] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

[44] Y. Mato, et al, "Toxic chemicals contained in plastic resin pellets in the marine environment –spatial difference in pollutant concentrations and the effects of resin type," *Kankyo Kagakukaishi* 2002

[45] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

invasive species may attach to migrant debris and be transported into a foreign habitat.[46] Marine litter has been observed transporting organisms such as: bacteria, diatoms, algae, barnacles, hydroids, tunicates, and bryozoans. The introduction of alien species has aided in the extinction of many species and can be detrimental to coastal and intertidal ecosystems.[47]

California Policy

California's Ocean Action Plan

In California, the issue of marine debris has become a hot topic for debate as the U.S Commission on Ocean Policy assembled a comprehensive report of recommendations and improvements. On June 4th, 2004 Governor Arnold Schwarzenegger submitted his comments on a preliminary report from the U.S commission on Ocean Policy.[48] Governor Schwarzenegger recognized the urgency to improve the health of California's coastline stating, "Your report is a wake-up call that the oceans are in trouble and in need of help."[49] The Governor continued by saying that "In response to the report, actions must take place at the international, national, state and regional and local levels, as these issues are just as important globally as they are to the citizens trying to protect the waters off a local beach."[50]

---

[46] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

[47] Clavero, Miguel, and Emili Garcı´a-Berthou. "Invasive Species Are a Leading Cause of Animal Extinctions." *Institute of Aquatic Ecology, University of Girona* (2005):.

[48] *Protecting our Ocean: California's Action Strategy*. Prepared by California Resource Agency and California Environmental Protection Agency. September 2004.

[49] Ibid

[50] *Protecting our Ocean: California's Action Strategy*. Prepared by California Resource Agency and California Environmental Protection Agency. September 2004.

The Governor's words were clear. California must respond with urgency to protect our coastal resources.

The Schwarzenegger cabinet devised an action plan that will direct resources to help enact legislation that would support, protect and preserve our coastal resources. The Legislature enacted the California Ocean Protection Act (Section 35500, Public Resources Code) in 2004.[51] The act created the California Ocean Protection Council whose responsibilities are to implement Governor Schwarzenegger's Ocean Action Plan and to improve the protection and management of California's ocean and coastal resources.[52]

The responsibilities of the California Ocean Protection Council are as follows:

- Coordinate activities of ocean-related state agencies to improve the effectiveness of state effort to protect ocean resources
- Establish policies to coordinate the collection and sharing of scientific data related to coast and ocean resources
- Identify and recommend to the Legislature changes in law
- Recommend changes in federal law and policy[53]

The Governor's Ocean Action Plan installed several new Legislature initiatives to ensure the health of California's coastline improve for the years to come.

SB 1319: California Ocean Policy Act (COPA)

The Schwarzenegger administration worked closely with local interest groups, stakeholders and advisory boards to create the California Ocean Protection Act SB 1319, which established the California Ocean Council. The newly found council would be

---

[51] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

[52] *Protecting our Ocean: California's Action Strategy*. Prepared by California Resource Agency and California Environmental Protection Agency. September 2004.

[53] Ibid

responsible to fund any programs that strive to protect the ocean and marine resources.[54] The funding was put aside under the FY 04/05 budget which was approved by the legislature and signed into law by Governor Schwarzenegger. Since then, the California Ocean Council has completed oceanic and current monitoring, infrastructure improvements and funded statewide, public campaigns.[55] The budget provided $10 million in Tidelands Revenues for implementing ocean and coastal management programs.[56]

Implement the Marine Life Protection Act

As a result of the Ocean Action Plan a new effort to implement the Marine Life Protection Act was initiated. The state government developed a partnership between the California Resources agency, Department of Fish and Game, Resources Legacy Fund Foundation and others to establish the Marine Life Protection Act (MLPA). Implementation of the MLPA will lead to a network of marine reserves, marine parks, and marine conservations areas along the coastline of California.[57]

Launch the Coastal Currents Monitoring System

Former Governor Schwarzenegger approved the final funding for a $21 million investment to establish a statewide coastal currents monitoring system that provides real-time updates to assist with fisheries, debris movement and oil spillages. This real-time current monitoring program was the first step in a statewide ocean observation system and

---

[54] *Protecting our Ocean: California's Action Strategy*. Prepared by California Resource Agency and California Environmental Protection Agency. September 2004.

[55] Ibid

[56] Ibid

[57] Ibid

made California the national leader in Ocean current tracking.[58]

Develop a Long-Term Funding Strategy for Coastal Protection

The advisory board identified that California has an important investment in the ocean and coastal resources. The plan will include an analysis of the coastal management, enforcement, monitoring, research and education to identify gaps and areas of overlap to develop a long-term funding strategy.[59]

Basin Plan

The Regional Water Quality Control Board (RWQCB) has outlined a basin plan throughout California that identifies the beneficial uses, optimal health and water quality of each body of water within the region. In Los Angeles, the basin plan explains that "waters shall not contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses."[60] Water control policy in California has been established to reach the optimal health of each body of water and to protect their beneficial uses. The regional board is responsible for identifying the beneficial uses and protecting the water quality within the region. The basin plan has paved the way for the development of the Total Maximum Daily Loads measurement system.[61]

---

[58] *Protecting our Ocean: California's Action Strategy*. Prepared by California Resource Agency and California Environmental Protection Agency. September 2004.

[59] Ibid

[60] Los Angeles Regional Water Quality Control Board. *Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*. 1994.

[61] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

Total Maximum Daily Loads (TMDL)

Section 303(d) of the California Clean Water Act requires the state to identify any set of ill bodies of water and implement a TMDL for these waters (33 U.S.C. 1313(d)(1)). [62] A Total Maximum Daily Load specifies, "the maximum amount of a pollutant that a water-body can receive and still meet applicable water quality objectives and protect beneficial uses."[63] The California Clean Water Act requires a TMDL to be completed when an excess of pollution, debris or toxins affects the beneficial qualities of a body of water.

In 1998, the United States Environmental Protection Agency (EPA) identified that the Los Angeles River and Ballona Creek did not meet the standards of the Clean Water Act and issued a TMDL on both bodies of water.[64] A partnership was established with the U.S EPA, and environmental organizations, including the Natural Resources Defense Council, Heal The Bay, and the Santa Monica Bay Keepers. On March 22, 1999 the L.A Regional Control Board was required to adopt a TMDL to ensure pollution did not harm the beneficial qualities of the LA River and Ballona Creek.[65] On September 19th 2001, the Regional Control Board accepted changes to the Basin Plan to incorporate TMDL for trash in the LA River (Resolution No. 01-013) and Ballona Creek (Resolution No. 01-014).[66] By implementing TMDL for the LA River

---

[62] Ibid

[63] California Regional Water Quality Control Board. *Trash Total Maximum Daily Loads for the Ballona Creek and Wetland*. September 19th, 2001

[64] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

[65] California Regional Water Quality Control Board. *Trash Total Maximum Daily Loads for the Ballona Creek and Wetland*. September 19th, 2001

[66] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

and Ballona Creek a ten-year plan was implemented to reduce the amount of trash that enters the LA River and Ballona Creek and ensure a zero trash discharge.[67]

Clean Water Act

The Federal Clean Water Act (CWA) was passed in 1972 and is the primary law for the government protection over bodies of water.[68] The CWA places an emphasis on industrial facilities and business that create an excess of pollution. By law, dumping waste of any kind into a body of water violates the CWA and can be enforced by fees and incarceration.[69]

Marine Pollution in Los Angeles

Marine Litter in the Los Angeles River

The Los Angeles River flows 51 miles from the San Fernando Valley to the Pacific Ocean, ultimately draining its contents at the mouth in Long Beach, California.[70]

---

[67] California Regional Water Quality Control Board. *Trash Total Maximum Daily Loads for the Los Angeles River*. September 19th, 2001

[68] Clean Water Act Laws and Regulations." *State Water Resources Control Boa*. 19 Apr. 2013.

[69] Ibid

[70] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

Despite the concrete conversion, the Los Angeles River has many recreational uses and provides a habitat to several species of birds including the brown pelicans, herons, and the occidental bitterns. However, these beneficial qualities of the river are impaired by large accumulations of suspended and settled debris throughout the river system. Common items observed by the Regional Board staff include styrofoam cups, plastic bottles, plastic toys, plastic food containers, construction materials, and plastic bags.[72] All such items have been observed throughout the Los Angeles River as the amount of trash has exceeded the existing Water Quality Objectives which harms the beneficial uses of the river by depositing an excessive amount of trash into the Pacific Ocean.[73]

To grasp the severity of marine debris, a recent study conducted by the *Algalita Marine Research Foundation*, provided a comparative analysis of the amount of zooplankton in relation to plastic particles off the shore of Southern California. The study narrowed its focus by only examining plastic particles with a size around 333 microns in diameter, a similar size to zooplankton.[78] Their results were staggering when comparing plastic particles to the amount of zooplankton:

- The highest average density of 7.25 pieces/m3 was at the mouth of the San Gabriel River
- The Ballona Creek had an average density of 5.0 pieces/m3 at the surface.
- The Ballona Midwater bongo net samples averaged 3.05 pieces/m3.
- The epibenthic (Sea Floor) average density was slightly higher at 3.8 pieces/m3.
- The lowest average ratio of plastic to plankton dry weight at the surface was

---

[72] California Regional Water Quality Control Board. *Trash Total Maximum Daily Loads for the Los Angeles River*. September 19th, 2001

[73] Ibid

[78] Moore, Charles, Et al. *A Comparison of NeustonicPplastic and Zooplankton Abundance in Southern California's Coastal Waters*. Algalita Research Foundation. 2004

5.44:1 for the 2000 survey.
- The 2002 survey surface ratio was 6.90
- The 1999 surface ratio was 6.1:1.
- The average ratio over all depths from the Ballona Creek study was 1.40:1 and for the San Gabriel River study was 2.5:1 plastic to plankton at the surface. (C.J. Mzoore, G.L. Lattin, A.F. Zellers)[79]

However, a strategy has been implemented to stop the debris from reaching the marine environment. A buoyant plastic "sea curtain" holds a metal screen that is intended to catch the debris before it enters the local marine habitat.[81] The screen prevents approximately 200 tons of debris from flowing into the Pacific Ocean each year, but still the solution is not perfect.[82] The safety net does an excellent job of keeping solid debris from entering the ocean, but small particle objects, oil, and paint can get through the screen causing serious pollution to the river itself and the ocean, as stated by Mark Gold (the former President of Heal the Bay), "the net generally does an admirable job of keeping trash off the beaches, but fails to help clean the creek."[83] However, the screen meets its match during the storm season in Los Angeles. When faced with heavy rains the safety net is designed to prevent flooding and can burst in a heavy rain, as it did in January 2006 and released pollution into the ocean.[84]

Still, the abundance of debris flowing down the Los Angeles River requires expensive cleanup measures by local city municipalities. Additionally, the screen is not perfect and remains the only barrier between the river mouth and the ocean. In the case that debris is

[79] Ibid

[81] Graverson, Brad. *Ballona Creek's 'Sea Curtain' has produced Net Gains*. Daily Breeze January 22nd, 2006.

[82] Ibid

[83] Graverson, Brad. *Ballona Creek's 'Sea Curtain' has produced Net Gains*. Daily Breeze January 22nd, 2006.

[84] Ibid

not trapped or removed from the river, the trash will flow directly out to the Pacific Ocean, harming local beach communities and the marine habitat. Similar to the Los Angeles River, the Santa Monica Bay suffers from an abundance of floating debris.

Methods

For this report I gathered information by interviewing coastal experts. This article consists of interviews from a marine biologist, city council members and staff members of coastal non-profit organizations. The report uses information from Heal the Bay and the Los Angeles Water Keepers. Within those organizations I interviewed members who are responsible for beach clean ups, anti-plastic, and public education campaigns to get answers that are most relevant to my questions. Interviews provide the necessary information to answer the question of what are the most effective strategies for alleviating and preventing marine debris.?

By gaining insight from coastal experts will provide the necessary insight and expertise about the most effective preventative and clean up methods., a
These Interviews were conducted in a structured style but, had open-ended questions, allowing the interviewee to elaborate to in-depth answers.

Santa Monica Bay: A Case Study

The Santa Monica bay is located on the Westside of the Los Angeles County, with Malibu and the Santa Monica Mountains located to the North and the Palos Verdes Peninsula to the South. The Santa Monica Bay contains a diverse geographic layout, including rocky mountains and soft bottom habitats and beaches, establishing an array of beneficial uses throughout the bay. However, debris flooding into the Santa Monica Bay harms the pristine

nature of the Bay which provides a habitat for more than five thousand species of plants, fish, birds and mammals.[85] Additionally, the economy of coastal cities adjacent to the Santa Monica Bay relies heavily on visitors and tourism. As a result, between 50-60 million visitors travel to the Santa Monica Bay to engage in a variety of recreational activities, including surfing, swimming, boating, fishing and scuba diving.[86] However, the abundance of tourism and the intense recreational usage of the Santa Monica Bay have impacted both the habitat and health of such species as the sandy beaches are important foraging and nesting grounds for many oceanic birds.[87]

High Urbanization

Marine litter has been a hot issue of research for coastal awareness organizations. Professor Jonathan Williams of the Vantuna Research Group (VRG) associated with Occidental College, described the Santa Monica Bay as, "A highly urbanized location that potentially has a lot of impacts with water quality, anthropogenic input, and extraction, like harvests and fishing."[88] Professor Williams has been working with the VRG for 11 years and has completed dozens of dives in the Santa Monica Bay and has observed that, "The two biggest issues we run across right now, are outfalls from public land treatment works and storm drains. It is starting to become a heavy focus for our research. Also balloons are very common, people love to release balloons, especially around mothers' day."[89] Because of the

---

[85] Los Angeles Regional Water Quality Control Board. *Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*. 1994.

[86] Heal The Bay. *Annual Beach Report Card*. 2013

[87] Heal The Bay. *Annual Beach Report Card*. 2013

[88] Jonathan, Williams. Vantuna Research Group. Occidental College, February 7th, 2013.

[89] Ibid

massive amount of input, storm drain runoff has become a hot issue for research in the Santa Monica Bay.

In August 10 2009, the regional board staff members conducted site visits along the Santa Monica Bay to document the trash problem. Using the rapid trash assessment method, researchers found trash at all beaches along the Santa Monica Bay, with the most common items being plastic bags, candy wrappers, cigarette butts, styrofoam products, and plastic straws.[90] However, more marine debris was observed in places with higher visitation rates, such as the Santa Monica Pier, Will Rogers Beach, and Venice Beach adjacent to the oceanfront boardwalk.

Outlet for Storm Drains

Additionally, areas closest to a nearby storm drain also experienced higher concentrations of debris.[91] During wet seasons in Los Angeles, trash along the street, parking lots, sidewalks and industrial areas often gets swept away into a nearby storm drain, which often leads directly into the ocean as the trash continues its journey to becoming marine debris. This is consistent with the fluctuations of the seasonal water quality in the Santa Monica Bay.

In 2012, Heal the Bay released their annual beach report card, issuing all fifteen state beaches within Santa Monica Bay a passing grade during the dry season and a failing grade during the wet season.[92] Since storm drains often lead directly to the ocean, the city of Santa

---

[90] Sheavly, Seba B. "National Marine Debris Monitoring Program: Lessons Learned." U.S. Environmental Protection Agency, Mar. 2010. Web.

[91] California Ocean Protection Council. "An Implementation Strategy for the California Ocean Protection Council Resolution to Reduce and Prevent Ocean Litter." *Ocp.ca.gov*. Oceanic Protection Council, n.d. Web. 12 Feb. 2013

[92] Heal The Bay. *Annual Beach Report Card*. 2013

Monica has taken the initiative and has retrofitted the storm drain located at the Santa Monica Pier with a new screened drain to prevent the release of trash and debris into the marine environment.

Urchin Barrens

In highly urbanized areas like the Santa Monica Bay, storm drain runoff brings a large amount of debris and sediment that covers the seafloor and blocks photosynthesis in marine plants. With massive sediment output from storm drains, Santa Monica Bay has become completely bereft. In an area where a kelp forest would naturally occur marine pollution wiped out any chances of establishing fruitful life, resulting in an ocean desert overrun by sea urchins. (Photo Cred. Bryan Murray)

Without kelp, urchin barrens lack any type of protection, food, or shelter for fish and marine mammals.During his water quality research with the VRG, Professor Williams observed.

> We certainly do have issues with storm drains, especially along the Palos Verdes Peninsula, which is the main rocky portion of the whole [Santa Monica] Bay. We are starting to look at areas where storm drains are going into the ocean and the area near the mouth gets covered with sediment. With that, you cannot get any algal growth and without algal growth, nothing really lives there. And probably more to the point, we are seeing more input from those storm drains directly onto reefs, we are starting to see that be a potential cause for why urchin barrens grow in the Santa Monica Bay.[93]

Additionally, heavier debris can impact bottom feeders and cause sediment contamination. Benthic litter can restrict the gas transpiration between the ocean water and the seafloor habitat and disturbs the food chain as more litter sinks to the ocean's floor.[94] Some types of debris like used diapers, medical waste, and chemicals can introduce bacteria

---

[93] Jonathan, Williams. Vantuna Research Group. Occidental College, February 7th, 2013.

[94] Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 24-25.

and other toxins into the delicate marine habitat.[95]

California Clean Up Efforts

Ocean Protection Council: A Plan of Action

Due to the increasing amount of land based marine debris a new plan of action was proposed to limit the amount of litter that reaches the ocean. On November 20th 2008, the Ocean Protection Council (OPC) drafted the final *Implementation Strategy to Reduce and Prevent Ocean Litter*.[96] The report offers a strategy to improve how California handles, generates and disposes materials that routinely becomes marine litter. The new plan of action offers sixteen recommendations ranging from anti-litter education in schools, banning smoking on beaches, and cleanup initiatives.[97] The strategy is divided into three essential priorities.

> Priority 1: Implementing a producer take-back (EPR) program for convenience food packaging.
> Priority 2: Prohibit single-use products that pose significant ocean litter impacts where a feasible less damaging alternative is available.
> Priority 3: Assess fees on commonly littered items. [98]

Priority #1: Implement a producer take-back (EPR) program for food containers

The OPC describes an extended producer responsibility program (EPR) as a regulation that places the authority of collection and disposal on the producers,

---

[95] Sheavly, Seba B. "National Marine Debris Monitoring Program: Lessons Learned." U.S. Environmental Protection Agency, Mar. 2010. Web.

[96] Ibid

[97] California Ocean Protection Council. "An Implementation Strategy for the California Ocean Protection Council Resolution to Reduce and Prevent Ocean Litter." *Ocp.ca.gov*. Oceanic Protection Council, n.d. Web. 12 Feb. 2013.

[98] California Ocean Protection Council. "An Implementation Strategy for the California Ocean Protection Council Resolution to Reduce and Prevent Ocean Litter." *Ocp.ca.gov*. Oceanic Protection Council, n.d. Web. 12 Feb. 2013.

manufacturers and distributers. An EPR program would be an incredible policy breakthrough, but has met a great amount of resistance by producers and manufacturers. By placing a financial burden on the company an EPR program strives to motivate manufacturers to collect, reuse and reduce the amount of waste produced by their products.[99]

The first EPR program for packaging materials was implemented in Germany where a 14% reduction in packaging waste was achieved in the first year.[100] In comparison, the U.S. Environmental Protection Agency (EPA) reported that from 1960 to 2006 packaging waste increased by 293%.[101] The OPC believes an EPR program would be highly effective in reducing the amount of trash that becomes marine litter, since packaging and food containers are the largest components of municipal trash in California (80 million tons/31.7%).[102] A focus on plastic food containers will narrow the amount of resources and target the highest contributor of marine litter. The OPC concludes that the California Integrated Waste Management Board (CIWMB) should have the complete authority to implement and regulate an EPR program.[103] The goal of an EPR program would place the

---

[99] Ibid

[100] B. Thorpe, I. Kruszewska, A. McPherson, Extended Producer Responsibility: A waste management strategy the cuts waste, creates a cleaner environment and saves taxpayers money, Clean Production

[101] US EPA Municipal Waste Characterization Study 2006: http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/06data.pdf.

[102] U.S. EPA, Municipal Solid Waste Generation, Recycling and Disposal in the United States: Facts and Figures for 2006 p. 6, available at: http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/msw06.pdf.

[103] Ibid

moral accountability and financial burden on the industries to track their waste and to collect and reuse their materials to prevent it from becoming trash.

Priority action #2: Prohibit single use products that pose serious ocean litter impacts

A major contributor of marine debris is single use plastic bags and polystyrene food take-out containers. The OPC is targeting both of these items to reduce, reuse and restrict their use in California.[104] Alterative solutions are strongly encouraged when economically feasible such as, reusable bags or unbleached paper take-out containers. Coastal communities suffer greatly from the single use of plastic products since the majority are only used once and are then disposed as trash. Areas that have already implemented a plastic ban argue that the negative environmental impacts severely outweigh the convenience value of single use plastic items.[105]

Polystyrene Container Prohibition

Recently, the OPC has recognized the detrimental effects marine debris causes to coastal communities. The council plans to specifically limit the amount of polystyrene we use for common day items.

Polystyrene is a type of plastic commonly used in food packaging, clear cups, trays, and to-go clamshells.[106] Polystyrene is also the leading material for the production of Styrofoam and other foamy plastic materials.[107] According to the California Integrated Waste

---

[104] California Ocean Protection Council. "An Implementation Strategy for the California Ocean Protection Council Resolution to Reduce and Prevent Ocean Litter." *Ocp.ca.gov*. Oceanic Protection Council, n.d. Web. 12 Feb. 2013

[105] California Ocean Protection Council. "An Implementation Strategy for the California Ocean Protection Council Resolution to Reduce and Prevent Ocean Litter." *Ocp.ca.gov*. Oceanic Protection Council, n.d. Web. 12 Feb. 2013

[106] Ibid

[107] Ibid

Management Board (CIWMB), Californians use 165,000 tons of polystyrene each year for food and packaging alone, without any beneficial recycling program in place.[108] In 1999, 300,000 tons of polystyrene was disposed, costing a total of $30 million in disposal costs.[109]

Since polystyrene is not biodegradable, it harms the marine habitat for several generations. A study conducted by Caltrans from 1998-2000 found that polystyrene represents 15% of the total debris taken out of storm drains.[110] Coastal cities throughout California have already implemented local bans on polystyrene. In 2008 San Francisco reduced their amount of polystyrene by 36% after a ban was enforced there starting in 2007.[111]

Plastic Bag Ban

The OPC believes a plastic bag ban would drastically reduce the amount of litter entering the ocean each year. In 2001, the CIWMB recorded that 19 million plastic grocery bags are distributed in California each year and less than 5% are recycled.[112] Since then the amount of plastic bags collected during beach cleanups have increased 5.4% each year. This significant increase was enough for former Governor Schwarzenegger to sign AB 2449 in

---

[108] California Integrated Waste Management Board, Use and Disposal of Polystyrene in California, 2004. Available at: http://www.ciwmb.ca.gov/Publications/Plastics/43204003.pdf.

[109] Ibid

[110] California Integrated Waste Management Board, Use and Disposal of Polystyrene in California, 2004. Available at: http://www.ciwmb.ca.gov/Publications/Plastics/43204003.pdf.

[111] Ibid

[112] Ibid

2007.[113] AB 2449 requires grocery stores to provide a greater incentive for customers to recycle their plastic bags. Additionally, grocery stores are required to provide an incentive for customers to bring their own, reusable bags.

Priority Action #3 – Assess fees on commonly littered items

In addition to polystyrene and plastic bag ban the OPC recommends a litter fee should be applied to items with little or no recyclable value. Any item that is discarded and cannot be recycled would be taxed at the sale of purchase. The collected revenue from the pollution fee could be used to fund clean up efforts, provide extra resources to city municipalities or aid non-profit organizations in the local community. [114]

Findings:

Los Angeles Clean Up Efforts:

The Los Angeles Department of Public Works has recognized the city's trash problem and has implemented infrastructure to stop litter from entering the local ocean. Industrial beach sweepers and storm drain screens have both been utilized to stop more trash from reaching the ocean. However, these strategies have only been partially successful. Sweeping the beach only captures big pieces of trash and superficially cleans the beach, while storm drain screens get clogged easily and do not catch small pieces of debris. Although these techniques have been slightly helpful at capturing trash marine experts participating in this study unanimously agree that local government policy, public education, litigation and advocacy by non-profit organizations are all still necessary tactics.

Beach Sweepers:

Physically sweeping the beach does an admiral job at getting big pieces of trash off the sand. Several times a day the beaches in Santa Monica are sifted with big industrial trucks

---

[113] Ibid

[114] California Ocean Protection Council. "An Implementation Strategy for the California Ocean Protection Council Resolution to Reduce and Prevent Ocean Litter." *Ocp.ca.gov*. Oceanic Protection Council, n.d. Web. 12 Feb. 2013

and raked to get the left over litter from beach goers. Superficially, sweeping the beach does an excellent job at getting large pieces of trash off the beach; however this method does not aid in preventing trash or retrieving trash that has already entered the ocean. Eveline Bravo the beach programs manager at Heal the Bay describes how, "Beaches in LA country are raked daily to pick up the big trash, but it does not pick up the little stuff. We [Heal The Bay] focus on the smaller stuff, Bravo said. The beach will get "racked and combed several times a day and is quite effective at getting the big stuff but bad at getting the smaller stuff that is really harmful to animals and the environment."[115] When analyzing the impacts of marine debris, the smaller the plastic particle the more damage is done to the wildlife and surrounding environment. Simply put, physically sweeping the beach only makes the beach appear clean to the common beach goer. All the marine experts involved in this report expressed that beach sweepers are helpful, but additional policy and non-profit activism are necessary to alleviate the negative effects of marine litter.

Storm Drain Screens:

Los Angeles has a highly developed storm drain system that is a direct pathway for trash to reach the ocean. When it rains, any trash on the street is swept away and enters the storm drain system. Once it enters the storm drains, it has a clear path to the ocean. The city of Los Angeles has recognized this issue and has installed over 134 metal screens in hopes of catching large pieces of litter before it enters the environment.[116] Storm drains are a serious problem when trying to prevent the spread of marine debris. For the VRG, storm drains are a

---

[115] Bravo, Eveline. Coastal Cleanup Day Manager. Heal The Bay. February 15th, 2013.

[116] Barboza, Tony. "Keeping Trash from Going with the Flow." *Los Angeles Times*. Los Angeles Times, 19 Sept. 2010. Web. 19 Apr. 2013.

major issue of concern, as Professor Williams of Occidental College describes the flaws of the screen method.

> The ones that have been put in place in the past have helped. But, the screens get clogged pretty quickly and then you end up with minor flooding issue or it just opens up and releases its contents. The metal screens are heavy on the maintenance side as well. It would be a great solution, if there were not such large pieces of trash. Any time you get a bag of chips that flushes down the drains, it ends up blocking the screen.[117]

Similar to beach sweeping, there are many limitations with storm drains screens. The screens get clogged rather easily and require a high amount of maintenance to ensure they are clean and do not obstruct the normal flow. All of the marine experts who participated in this study agreed that screens are helpful but further government policy and preventative techniques are necessary to alleviate the issue of marine debris.

Los Angeles Becomes Bagless:

The city of Los Angeles has passed an ordinance to ban businesses from distributing plastic bags in hopes of preventing more plastic from entering the local waterways. By a 13-1 vote, Los Angeles passed an ordinance in hopes of preventing two billion plastic bags from entering the local waters.[118]

The ordinance is still under review by the state legislature, but is expected to be enforced in June, 2013. Each year, Los Angeles uses 2 billion plastic bags and 400 million paper bags. The majority of these items either make it to the land fill or end up in the

---

[117] Jonathan, Williams. Occidental College, Vantuna Research Group. March 3rd, 2013.

[118] Heal The Bay. *L.A. City Council Approves Ban on Plastic Bags*. May 23rd, 2012

ocean.[119] By banning plastic bags the city will significantly reduce the amount of trash that reaches the ocean.

Heal the Bay was a prominent supporter of the ban throughout the process and views the ban as a monumental victory in preventing marine litter. Kristin James, the director of water quality at Heal the Bay said, "Today, the Los Angeles City Council took a prudent step to protect our environment and bolster our economy. The vote further emphasizes the fact that plastic bags are an out dated convenience in California."[120] By placing a plastic ban on business it greatly lowers the amount of plastic that enters the water and has become an excellent strategy for preventing marine litter.

Los Angeles becomes the largest city in the United States to ban businesses from distributing plastic bags. In addition to stopping marine debris, the ban will also save California municipalities $25 million each year that is spent just to collect and dispose plastic bag waste. Additionally, less than 5% of plastic grocery bags are recycled each year statewide.[121] 100% of Marine experts in the study agree that a plastic bag ban stops marine litter at the source and is a necessary to alleviate the ailments of marine litter.

In an interview with Heal the Bay, City Council Member Paul Koretz describes his feelings about the plastic bag ban:

> I am deliriously excited about the passage of this measure. Ever since I first heard about the floating plastic island in the Pacific, while I was still in the state legislature, I have been trying to move the ball forward on banning plastic bags in this state. With this action today, we have taken a giant step in that direction. As the largest city in the country to ban plastic bags, I hope we have set an example that the rest of the world to follow. My great thanks goes to the Heal the Bay and

[119] Heal The Bay. *L.A. City Council Approves Ban on Plastic Bags*. May 23rd, 2012
[120] Heal The Bay. *L.A. City Council Approves Ban on Plastic Bags*. May 23rd, 2012

[121] ibid

> all the other environmental organizations involved for their years of leadership and activism on this issue.[122]

The bag ban will limit the amount of paper and plastic that reaches the local waters. Bag bans are a necessary tool that prevents plastic from ever entering the waters. Council Member Eric Garcetti, a longtime supporter of the ban, said in an interview with Heal the Bay, "Plastic bags clog our landfills, clog drainage systems, and litter neighborhoods. This ban will help us keep our communities healthy and clean."[123] Los Angeles has completed a monumental step by banning plastic bags in the city, an improvement that will significantly limit the amount of city trash that reaches the ocean.

Non-Profit Organizations

Non-profit organizations have been critical in preventing and alleviating the impacts caused by marine pollution. For this study, the programs of two non-profits were examined; The Los Angeles Water Keepers (LAWK) and Heal the Bay (HTB) both of whom have been leaders in protecting the coastline and L.A.'s waterways. Although each organization has a different strategy, the end result is to keep our oceans clean. However, each organization shares some similar tactics. A staff member at each organization described a strategy that had an aspect of advocacy, litigation and education. By combining these three techniques non-profit organizations have yielded a great amount of success and are a necessary opponent of marine pollution. Non-profit organizations are constantly fighting to get new laws passed and to make issues publicly known.

Los Angeles Water Keepers:

---

[122] Heal The Bay. *L.A. City Council Approves Ban on Plastic Bags*. May 23rd, 2012

[123] ibid

The Los Angeles Water Keepers have been an incredible proponent of improving the health of the ocean and the Los Angeles water way. The overall goal of the organization is to keep the ocean clean. Liz Crosson, the executive director for the Water Keepers, describes that "We [The Water Keepers] clean water ways, advocate for stronger water quality limits and regulate industrial facilities and prevent pollution in rivers and our ocean and to enforce the regulation."[124] The non-profit uses a tandem approach of litigation and advocacy to ensure new regulations are being respected.

Advocacy

Non-profit organizations will advocate for certain issues like storm drains and marine protected areas to gain media attention to make it a publicly known issue. The Los Angeles Water Keepers utilizes advocacy to ensure businesses, industrial areas and the city are up to date and compliant with the Federal Clean Water Act. Liz Crosson the executive director describes, "We use the Federal Clean Water Act to ensure our water ways are protected." Crosson continued to explain, "By advocating for stronger water quality and stronger regulations that regulate cities, industrial facility and industries that are major polluters in California."[125] Advocacy is an essential tool to ensure the local industries are aware and compliant with the current laws. Simply put, we need advocacy to bring light to issues that could potentially remain in the dark.

For the Water Keepers, marine debris has attracted a major amount of attention. Ultimately, the Water Keepers strive to reach a zero trash input into the local waters. However, with marine debris perfection is nearly impossible. For this reason, "We do focus

---

[124] Crosson, Liz. Executive Director. Los Angeles Water Keepers. March 12th, 2013

[125] Ibid

on the issue of marine debris." Crosson said. "One place we do it is in our advocacy work. We have been involved in establishing limits on the amount of marine debris that can enter our water ways. which translates to permit limits for cities and how much trash they are allowed to discharge."[126] Non-profits have been very helpful at alleviating the impacts of marine debris, however these organizations still face an up hill battle.

The coastline of Southern California has been a growing metropolis as people continue to migrate west, causing "Los Angeles to have a pretty serious trash epidemic where we see trash travelling down our major water ways, every time it rains from our streets and storm drains." Crosson said. "Some very progressive limitations have been put in place that will force cities and industrial facilities to implement certain regulations that will stop trash from ever reaching our water ways." Once the regulations have been implemented the Water Keepers still "work with community groups and volunteers to monitor trash in our water ways so that we can evaluate the effect and success of those measures that we have fought so hard for," Crosson explained. She explained that "Right now we [LAWK} are exploring some marine debris monitoring tecniques from our boat that we take out in the Santa Monica Bay."[127] However, for the Water Keepers a tandem approach of advocacy and litigation has proven to be the most effective strategy for defeating marine litter.

Litigation

Advocacy and litigation complete the strategy for the Water Keepers. Advocacy paves the road for new policies while litigation provides the reinforcements to ensure the

[126] Crosson, Liz. Executive Director. Los Angeles Water Keepers. March 12th, 2013

[127] Crosson, Liz. Executive Director. Los Angeles Water Keepers. March 12th, 2013

regulations are respected. Litigation simply means backing up the new regulation with legal enforcement and lawsuits.

For the Water Keepers, the combination of these two strategies has resulted in a cleaner coastline along Los Angeles. The organization, "Uses Litigation to enforce some of those regulations," Crosson said. She explained that, "Some of the campaigns that we {LAWK} advocate for, we then enforce with the Clean Water Act which allows citizens to enforce water pollution limits." Litigation becomes the necessary strength for the organization. While advocacy alone is very helpful in passing new regulations, the new policies mean nothing if they are ignored. Litigation ensures that cities and industrial areas are compliant or a law suit will be delivered. In the case that, "A city or industrial facility is violating their permit or water quality limits we can then bring a civil action to get them back to compliance and to protect the local water way," Crosson explained.[128] The combination of litigation and advocacy has resulted in a significantly less amount of trash that enters the California coastline. This tandem tactic has been highly successful and a necessary agent in cleaning the Los Angeles waters.

The Water Keepers Alliance

The Los Angeles Water Keepers have established a very effective coalition to expand the scope of their work. As a whole, the "LA water keepers are 1 of 12 Water Keepers in California," Crosson explained. The "Water Keepers are a network of organizations that reach out to over 200 braches globally." The established alliance between multiple Water Keepers branches makes the organization a very effective group at improving the health of the ocean. Cooperation between branches ensures, "Any regulations, science or environmental issues

[128] Ibid

are tackled from multiple angles," Crosson said. "We band together with the rest of our Water Keeper friends and fight for certain advocacy or legislation together on a regular basis."[129] The alliance has been extremely effective at maximizing the efficiency of the organization and to effectively use the limited amount of funding available.

Successes and Limitations

The Los Angeles Water Keepers have been very successful in alleviating the impacts of marine debris. The tandem tactic of advocacy and litigation has been "Very successful. We [LAWK] have been around since 1993 and have settled dozens of cases that enforce clean water laws," Crosson said. In particular the Water Keepers have seen a drastic "Improvement in the way facilitates are conducting their business to ensure they are also making a profit while still striving to meet water quality laws," Crosson explained. In addition to industries, the organization has also held the city accountable. Crosson explains that in "1999 we [LAWK] sued the city of Los Angeles and reached a settlement with them in 2005 on a huge number of sewage spills that were affecting the water ways and reaching the beaches in Los Angeles." Since the settlement, "the sewage spills have been reduced by about 84%."[130] However, despite the organization's strong success, they still face some limitations.

The Waters Keepers are an organization that has a larger presence and impact despite their limited resources. The nonprofit has been described as a "Small, yet fierce organization," Crosson said. She continued to explain that "Our [LAWK] biggest limitation is just how small we are and the lack of resources that are available to small non-profits." However, the Water Keepers are still able to make an enormous positive impact. Liz Crosson

---

[129] Crosson, Liz. Executive Director. Los Angeles Water Keepers. March 12th, 2013

[130] Crosson, Liz. Executive Director. Los Angeles Water Keepers. March 12th, 2013

explained, "I think our strategies are right on, but they can be expanded and have a further reach with an increase in resources."[131] The Los Angeles Water Keepers have been an amazing ally for the ocean and have achieved numerous victories that have resulted in less plastic in the ocean.

Heal The Bay

Heal The Bay has been a leader in maintaining the health of the Los Angeles coastline. Heal The Bay uses a slightly different strategy than The Water Keepers. The non-profit utilizes pubic education and advocacy as their main weapons. By holding public workshops, beach clean ups and advocating for new policy, Heal the Bay has been extremely effective at improving the health of the Los Angeles waters.

Public Education

Heal the Bay has developed an extensive public education program that has raised the public's awareness about the marine hazards associated with plastic. The organization holds public workshops that aim to educate the public about the deadly effects of trash. The endless stream of trash means, "We can clean up for the rest of our lives, but we will not get to the source of the problem," said Eveline Bravo, the beach programs manager at Heal the Bay. She advocates that the organization's "Main goal is to educate and to make people aware of how the trash got to the beach in the first place and to get trash out of the ocean." [132] Heal the Bay has successfully launched several education workshops to inform to public about marine litter.

---

[131] Ibid

[132] Bravo, Eveline. Coastal Cleanup Day Manager. Heal The Bay. February 15th, 2013.

Heal the Bay views education as a holistic strategy that targets the source of the issue rather than the symptoms. Education has yielded a great amount of success to limit the amount of trash that makes it to the water. For this reason Heal the Bay "Ties every program to education," Bravo mentioned. The organization strives to educate the public about "How everything on the street will make it to the ocean through the storm drain system. It's hard to control free flowing trash so we try to prevent that material from ever becoming trash." Educating the public has been an effective tactic. The main facility for public education is "The Santa Monica Pier aquarium," Bravo said. "We use that facility to hold a number of workshops, including the Key to the Sea classroom session, field trips to the polluted Malibu Creek and by having guest speakers."[133] Through workshops and education, Heal the Bay has improved the public's awareness about the marine hazards caused by plastic.

Beach Clean Ups

Contrary to the belief that beach clean ups improve the health of the coastline, these clean ups have an alternative goal. Instead, non-profits organize coastal clean ups to get people involved in the coastal protection movement and to raise the consciousness of the common person. Beach cleanups have become a public education event, where the goal is to, "Not just pick up the trash, because we will do that job for ever and will make no difference," said Bravo. Together, Heal the Bay volunteers will collect, "20-30 pounds of trash a year, an insignificant amount compared to the 7 million pounds of trash that is sent out to the ocean each year. The number one goal is to change habits and to change how people see trash," Bravo said. Each month, Heal the Bay holds their *Nuthin but Sand* coastal cleanup event. These beach cleanups have been very successful at getting people to become hands on and to

[133] Bravo, Eveline. Coastal Cleanup Day Manager. Heal The Bay. February 15th, 2013.

raise the consciousness of the common person about the detrimental effects of marine debris.

The most abundant item picked up during clean up events are cigarette butts. Smokers unconsciously believe the world is their ash tray and litter their left over cigarettes, not knowing the filters are made of plastic and fiberglass. Cigarettes are a major concern because, "Cigarette butts are actually plastic and do not biodegrade," comments Bravo. Additionally, "Animals mistake a lot of the trash found on the beach for food and they think they are full, but in reality they only have a tummy full of plastic with no nutrients." *Nuthin' but Sand* provides a firsthand experience about the negative implications of marine debris. The event allows volunteers an up close experience about how important it is to keep our coastline clean.

In addition to cigarette butts a vast array of other objects are picked up during coastal clean ups. Trash in all shapes and sizes end up on the beach as volunteers are constantly picking up "bottle caps and all sort of water bottles." Bravo mentioned. Additionally, the "third most abundant [is] Styrofoam. This material is dangerous because it is rarely found intact or as a whole container instead we find tiny, little pieces." The small pieces and rough condition of the trash make it completely unusable for recycling. Bravo explained, "Only about 1% of trash picked up at coastal cleanup is recycled, at the most."[134] Although beach cleanups are an excellent method to improve the public's awareness about marine debris, it does little at actually improving the health of the ocean in the grand scheme

[134] Bravo, Eveline. Coastal Cleanup Day Manager. Heal The Bay. February 15th, 2013.

Recommendations:

Marine debris is an environmental hazard caused by the choices our society has made. The major issues associated with marine debris can be alleviated in a variety of ways. Such ways include a new cohesive task force, increasing public education, new anti-littering laws and more plastic and styrofoam bans throughout California. This section will go into depth about recommendations that have the potential to drastically improve the health of the coastal waters.

Inter-Agency Task Force:

Currently there are many government agencies that strive to protect and improve the California Coastline. These agencies have done an admiral job of providing excellent research to provide the community with information necessary to brainstorm solutions. However, government agencies often work very independently of each other and lack a cohesive approach. These agencies need to work together to ensure resources are being optimized and that each body of water has protection. The task force should consist of these agencies:

- California Coastal Commission
- California Parks and Recreation
- Santa Monica Bay Restoration Commission
- California Integrated Waste Management Board
- California Department of Boating and Waters
- Ocean Protection Council
- California Department of Conservation

Together these six organizations can form a powerful task force that can become more efficient than working independently. The coalition will be responsible for enforcing existing regulations and to establish new policies to prevent marine debris. Representatives

from each agency should hold regular meetings to ensure they are allocating resources in an efficient manner.

Coalition of Non-Profit Organizations

Similar to forming a network of government agencies, forming a coalition of non-profit organizations would result in a cleaner coastline. Currently each organization independently fights for funding and resources. By forming a coalition, resources and funding could be efficiently utilized to ensure the coastline is receiving the protection it needs. The coalition should consist of these organizations:

- Heal the Bay
- Los Angeles/ Santa Monica Water Keepers
- Surf Rider's Foundation
- Friends of the Ballona Wetlands

Together these five organizations can form an extremely effective coalition. By using the Water Keepers alliance as a model, these organizations can take on the battle of marine debris together.

Establish Litter Control Programs

The most effective anti-litter strategies strive to prevent, rather than remove trash. New litter control programs would get the public more involved in protecting the ocean. Such components of a litter control program would include K-12 marine education, enhanced litter laws, beautification projects and media events. Prevention and education are the best strategies to maintain and increase the health of the coastline and should be implemented whenever sees fit.

Increase Litter Awareness Education in Schools (K-12)

Prevention begins with educating our youngest citizens about the importance of maintaining the health of our coastal resources. It is essential that young people understand

the importance of oceans, how to prevent litter and to learn about how marine debris harms not only the coastline, but also people. This strategy would carry a long term goal of increasing the awareness of our youngest citizens and transforming them into ocean proponents and protectors.

Reduce Cigarette Related Debris

Since cigarette related debris is the most commonly found item during beach clean ups, establishing an effective strategy to prevent cigarette litter is essential to improving the health of the ocean. A statewide initiative needs to be implemented to raise the consciousness of smokers and to break the common misconception that the world is their ashtray. This campaign should have multiple strategies involved to ensure the decline of smoking debris. Such strategies are:

- Implement a $1000 fee for littering cigarettes
- Smoke free beaches
- New laws that make it illegal to publically smoke in neighborhoods adjacent to waterways (Venice, Marina del Rey, Santa Monica, Malibu)

Education will be an essential aspect at lowering the amount of cigarette material that enters the marine environment. After the consciousness is raised about the harms of littering cigarettes a strict penalty should be implemented throughout California for littering cigarettes. Additionally, in areas adjacent to an open water ways, it should be illegal to smoke in public. These strict regulations can significantly reduce the amount of litter that becomes marine debris.

Business Incentives

The local government should implement a reward system for businesses that significantly lower their waste output. Tax breaks or subsidies can be used as a reward

system for companies that display a commitment to limiting the amount of trash they release. Additionally, business would be rewarded for using alternative materials (paper, bio-plastic, etc) that do not harm the environment like plastic or Styrofoam. To encourage businesses to engage in marine friendly behavior a competition could be established for the business that emits the least amount of trash. This alternative incentive could push business to compete for being the most eco-friendly. The winner of the competition could either get a monetary reward or a city contract. For example if a great salad restaurant reaches a zero plastic output and also make delicious salads they would be granted a contract to do the catering for city events and thus become wildly successful with business.

Plastic Bans

In the instance businesses do not respond favorably to monetary incentives, more comprehensive plastic bans should be implemented throughout California. Although 76 incorporated cities have already adopted a plastic ban of some sort, the state, as a whole, should outlaw single use plastic items (straws, plastic bags, to go food containers etc). To enforce this new regulation, businesses should pay a fee for each violation they commit.

Implement a Complete Outlaw of Styrofoam Products

In our modern age, Styrofoam has become an outdated material. However, despite the development of new, environmentally friendly materials restaurants and packaging stores still heavily use Styrofoam. Styrofoam alone threatens the health of the ocean and poses a serious problem as it degrades and breaks down. As more environmentally friendly materials are released Styrofoam should progressively become less accessible and eventually should be completely illegal to use in California. By outlawing Styrofoam we will prevent a deadly material from ever coming in contact with the ocean.

Develop New Ecofriendly Materials

If a plastic and Styrofoam ban is implemented it will be critical to develop new, alternative materials to replace the old technology. Although unbleached paper and bioplastics have evolved as a better solution to traditional plastic, they are still not perfect. Both paper and bioplastic need specific conditions (high heat, pressure, etc) to completely biodegrade. A new material, that can easily biodegrade in colder water or sunlight, needs to be developed to replace the outdated plastic and Styrofoam materials.

Upcycling Programs

To help fund new anti-littering campaigns, upcycling programs can be implemented. Upcycling simply means using a product for something other than its original use.[135] For example, using soda cans to make a hand bag would be upcycling since the soda cans were designed to hold liquid, not be a hand bag. This can be very profitable and will also lower the amount of trash that is sent to the landfill. Even materials that do not qualify for recycling can still be upcycling into a useful product. Upcyling programs could be intertwined with beach clean ups. During beach clean ups, volunteers pick up hundreds of pounds of trash that mostly cannot be recycled and eventually ends up at the landfill. Instead of simply sending it to the landfill that trash can be transformed into trendy, useful and beautiful products that could be sold. The profits from this business can then be re-invested into the beautification of our ocean and help fund non-profits and other pro-ocean organizations.

---

[135] Pol, Vilas Ganpat. "Upcycling: converting waste plastics into paramagnetic, conducting, solid, pure carbon microspheres." *Environmental science & technology* 44.12 (2010): 4753-4759.

Conclusion

In a world with constant hunger, violence, and injustices we have become desensitized to the constant suffering that occurs in this world. On a daily basis, major issues occur that monumentally affect our lifestyle and ultimately trump the negative impacts of marine debris. However, marine debris illuminates as an issue that has met a significant amount of resistance limiting the useful tactics that are readily available. It is an issue where the smallest of improvements can be a great help. But preventing marine debris is not the individual's responsibility. As a community, we must bind together and form a higher level of awareness to change our habits to benefit the ocean.

Humans are at a pivotal point to change how we view and interact with our waterways. In the past we have polluted, blemished and disrespected our oceans and rivers for the benefit of convenience. As a society we must progress past our shortsightedness and break our false association about the convenience of plastic. These old practices are no longer logical or convenient to use, when analyzing the entire life cycle of the plastic item. We are starting to see that any convenience associated with plastic is significantly outweighed by the negative environmental impacts it causes.

We are all in it together. As a society we must learn to understand the sensitive nature of our ocean and that our industrial influence has been harmful. We have been beating, over fishing and polluting our oceans for hundreds of years. It is time for us to improve our habits and to consider the sensitive equilibrium that occurs in the ocean that keeps our Earth fertile, beautiful and full of life.

Work Cited

B. Thorpe, I. Kruszewska, A. McPherson, Extended Producer Responsibility: A waste management strategy the cuts waste, creates a cleaner environment and saves taxpayers money, Clean Production

Barboza, Tony. "Keeping Trash from Going with the Flow." *Los Angeles Times*. Los Angeles Times, 19 Sept. 2010. Web. 19 Apr. 2013.

Bravo, Eveline. Coastal Cleanup Day Manager. Heal The Bay. February 15th, 2013.

Bugoni, Leandro, Ligia Krause, and Maria Petry. *Marine Debris and Human Impacts on Sea Turtles in Southern Brazil*. Universidade Federal Do Rio Grande Do Sul, 2001.

California Integrated Waste Management Board, Use and Disposal of Polystyrene in California, 2004. Available at: http://www.ciwmb.ca.gov/Publications/Plastics/43204003.pdf.

California Ocean Protection Council. "An Implementation Strategy for the California Ocean Protection Council Resolution to Reduce and Prevent Ocean Litter." *Ocp.ca.gov*. Oceanic Protection Council, n.d. Web. 12 Feb. 2013

Clavero, Miguel, and Emili Garcı´a-Berthou. "Invasive Species Are a Leading Cause of Animal Extinctions." *Institute of Aquatic Ecology, University of Girona* (2005): n. pag. Web.

Crosson, Liz. Executive Director. Los Angeles Water Keepers. March 12th, 2013

Gordon, Miriam. "Eliminating Land-based Discharges Of Marine Debris In California: A Plan of Action from The Plastic Debris Project." *California Coastal Commision*(2006): 1-52.

Graverson, Brad. *Ballona Creek's 'Sea Curtain' has produced Net Gains*. Daily Breeze January 22nd, 2006.

Heal The Bay. *Annual Beach Report Card*. 2013

Heal The Bay. *L.A. City Council Approves Ban on Plastic Bags*. May 23rd, 2012

Los Angeles Regional Water Quality Control Board. *Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*. 1994.

Moore, Charles, Gwen Lattin, Ann Zellers, "A Brief Analysis of Organic Pollutants Sorbed to Pre and Post-Production Plastic Particles from the Los Angeles and San Gabriel River Watersheds," presented at *Plastic Debris, Rivers to Sea Conference* September 7-9, 2005.

Moore, Shelly L., Dominic Gregorio, Michael Carreon, Stephen B. Weisberg, and Molly K. Leecaster. "Composition and Distribution of Beach Debris in Orange County, California." *Southern California Coastal Water Research Project*. (n.d.): n. pag. Web.

Moore, Charles, Et al. *A Comparison of NeustonicPplastic and Zooplankton Abundance in Southern California's Coastal Waters*. Algalita Research Foundation. 2004

National Oceanic and Atmospheric Administration. 2008. "Interagency Report on Marine Debris Sources, Impacts, Strategies & Recommendations." Silver Spring, MD. 62 pp

Pol, Vilas Ganpat. "Upcycling: converting waste plastics into paramagnetic, conducting, solid, pure carbon microspheres." *Environmental science & technology* 44.12 (2010): 4753-4759.

Pasadena, California. Chapter 8.65 Pasadena Municipal Code: Ordinance #7214. December 31, 2012

Protecting our Ocean: California's Action Strategy. Prepared by California Resource Agency and California Environmental Protection Agency. September 2004

Setty, Karen E, Weisberg, Stephen B. "Oceanic Pollution." Southern California Coastal Water Research Project.

Sheavly, Seba B. "National Marine Debris Monitoring Program: Lessons Learned." U.S. Environmental Protection Agency, Mar. 2010. Web.

Thompson, Richard, La Belle, Bruce, Bouwman, Hindrik, Lev, Neretin. "Marine Debris: Defining a Global Environmental Challenge." Global Environmental Facility. May 11, 2001

United States Environmental Protection Agency : *Data from US EPA Municipal Waste Characterization Study* .2006 http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/06data.pdf.

United States Environmental Protection Agency, Municipal Solid Waste Generation, Recycling and Disposal in the United States: Facts and Figures for 2006 p. 6, available at: http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/msw06.pdf.

Williams, Jonathon. Occidental College, Vantuna Research Group. March 3rd, 2013.

Y. Mato, et al, "Toxic chemicals contained in plastic resin pellets in the marine environment –spatial difference in pollutant concentrations and the effects of resin type," *Kankyo Kagakukaishi* 2002