

**Addressing the issue of marine debris through restoration  
and advocacy with Hawai'i Wildlife Fund**

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## **Abstract**

Michael's graduate internship project involved working over 700 hours with Hawai'i Wildlife Fund as a professional intern from October 2019 to October 2021. Hawai'i Wildlife Fund is a 501(c)(3) nonprofit organization devoted to the conservation and preservation of the unique coastal and marine wildlife species of the Hawaiian Islands. During this internship, he was able to assist both the Hawai'i and Maui-based HWF teams. On Hawai'i Island, he assessed the environmental issues of plastic waste leading to marine debris while developing solutions to address this global threat to our ocean resources and marine biodiversity. Furthermore, Michael conducted fieldwork, research, and spoke to experts on the issues to better understand the severity of marine debris impacting the state of Hawai'i and its coastal habitats. On Maui, he assisted with various projects, all of which helped to bring awareness and education to preserving marine wildlife. The work conducted during this professional internship has been crucial in my development as a professional in the field of conservation biology. He was on the front lines in the battle for conservation, collecting marine debris derelict fishing gear, conducting surveys, collecting data, building fences, going door-to-door advocating for light pollution reduction, presenting to public and college audiences, engaging in conversations with residents and tourists about the threats impacting native wildlife. Michael has become familiar with the realities of professional nonprofit fieldwork, and being a part of a team with a common goal. Furthermore, resulting in assistance to the community of Hawai'i in combating the issues that impact the delicate ecosystems.

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## **Project Description**

### **Introduction**

Plastic use has become ubiquitous in everyday life in our society, from manufacturers to consumers to individuals. Plastics are relatively cheap and easy-to-use materials that have been implemented on an unimaginable scale in the past 80 years, ramping up in the 1940s (Hosier et al. 1990). With our rapidly developing global populations, they have steadily become cheap and convenient means to satisfy the immediate needs of our growing societies. The plastics industry is vast and ever-expanding as plastic use spreads into all aspects of human life. Plastics make up an important part of materials in our present society, with a majority of common popular products including plastics or rubber in one form or another (Hosier et al. 1990), from tires, footwear, and food packaging, to transportation and public health applications.

The use of plastic can be traced back thousands of years (Hosler et al. 1999). However, it was not until post-World War II plastic innovation and production began widespread and would continue to do so for the foreseeable future. (Hosier et al. 1990). Plastic is undoubtedly useful and has indeed improved the quality of life for many people by providing clean drinking water to be distributed to those in need (bottled water), to keeping packaged food fresh for longer periods allowing it to be widely dispersed, to providing cheap and more readily accessible medical equipment, to reducing the carbon emission from vehicles (by decreasing their weight) for travel or transporting goods. For us to say that our future will not rely heavily on the continuous use of plastics is impracticable. Nevertheless, there is an overwhelming amount of evidence demonstrating the damage caused by our excessive plastic use. Through extensive research, it has become evident that our global reliance on plastic packaging is unsustainable and indisputably harmful to all forms of life. Through plastics, we have managed to develop a cost-efficient alternative to materials such as metal, wood, and textiles that can be molded into solid objects at an incredible scale, but with no plan for what to do with it once it has outlived its usefulness. Single-use plastics (SUPs), including plastic bags, water bottles, utensils, and packaging that are all intended to be used once or twice and disposed of, have become commonplace items in households around the world. It is hard to imagine that these SUP materials used once, often only for a few minutes, may take hundreds of years to deteriorate (McCallum 2018). Each year, we produce 363 million tons of plastic globally, and that number is growing annually (McCallum 2018). To compound this issue, only a small percentage of all plastics are properly disposed of in ways that do not contaminate air, water, or the environment. If society continues on the path that we are currently on, we will soon live in a world where the amount of plastic waste in the ocean outweighs marine life (C. Moore et al. 1997, McCallum 2018).

While many NGOs, businesses, and government organizations have created initiatives to ensure that plastic waste is properly disposed of, many domains have proven difficult to regulate, most notably, the ocean. According to Jambeck and colleagues (2015), there are an estimated five trillion pieces of plastic debris found in our oceans, and this study used data from 2015 so

this figure is undoubtedly larger now. This plastic waste can be lethal to both humans and aquatic wildlife in multiple ways (Lusher et al. 2017). For example, because fish provide a rich source of protein, it is an essential part of the diet of many people. People consuming fish that have ingested plastic are indirectly consuming plastic as well, which may impact public health and wellness.

With technology continuously advancing, society is implementing more suitable types of plastics that are biodegradable alternatives to traditional single-use plastics. It's apparent that our reliance on plastic is not decreasing, but evolving to new products and polymers. The type of source materials and chemicals in which we produce, reuse, recycle, and dispose of plastics may continue to change, including altering the way we deal with plastic waste in our waste management systems. Ultimately the end “solution” to the issue of plastic pollution should be aimed to reduce our global reliance on this material before it's produced. Then, redesign products in ways that they can be reused perpetually for a circular economy fashion.

### **Site description**

During my graduate internship with HWF, I conducted work all around the island of Hawai‘i including several parts of Maui. Nevertheless, due to the unanticipated events of the COVID-19 pandemic, a portion of work hours had to be performed remotely. A large portion of fieldwork conducted for this project took place at Lae o Kamilo or Kamilo Point, in Nā‘ālehu, Hawai‘i. The beach at Kamilo is sometimes referred to as “Trash beach” or “Plastic Beach” and is located in the Southeastern part of Hawai‘i Island. Kamilo and the surrounding coastline with the Ka‘ū Forest Reserve (Wai‘ōhinu Section) provide critical habitat to several threatened and endemic species. Endangered Hawaiian monk seals (*Neomonachus schauinslandi*) have been spotted occasionally on these debris-riddled shores, as well as endangered Hawaiian yellow-faced bees, (*Hylaeus anthracinus*). Furthermore, this area is vital due to its diverse population of coastal strand plants and a large anchialine pool complex. Volcanic substrate allows seawater to seep into the pools and mix with fresh groundwater from springs and upland sources. Anchialine pools provide habitat for native anchialine fauna including the endemic red pool shrimp or ‘ōpae ‘ula (*Halocaridina rubra*). These unique anchialine ecosystems were an important source of water and resources for native Hawaiians. Additionally, Hawai‘i is the only state in the nation where anchialine pools are found.

### **Agency**

Hawai‘i Wildlife Fund (HWF) is a 501(c)(3) nonprofit organization in Hawai‘i with a mission to protect native wildlife, focusing on coastal and marine wildlife species in the Hawaiian Islands. Founded on O‘ahu in 1996, HWF now mostly operates on the islands of Maui and Hawai‘i. Since 1990, Hawai‘i Wildlife Fund (HWF) has removed more than 350 tons of plastic pollution from the shores of Hawaiian archipelagos. HWF team members, volunteers, and co-founders have also worked in the Northwestern Hawaiian Islands in the 1980s and 1990s to remove marine debris that threatened wildlife and continue to host regular community cleanups at a debris-ridden beach on Maui since 2012 (Ka‘ehu Bay).

In 2013, the HWF team started keeping track of the brand names of collected debris (inspired by Break Free from Plastics' brand audit in the Philippines) and had been collecting photos of more common household brands since that time. HWF found that a large portion of marine debris collected during beach cleanups stemmed from multinational companies such as Coca-Cola, Nestlé, PepsiCo, and Oral B. They even sent certain brand-name plastics found back to the companies, along with a letter asking for creative solutions, circular product design, and other cooperation from these businesses to be better stewards of the environment. I am confident that if one of these major multinational companies designed and implemented a functional, non-plastic alternative, it would create a domino effect and other companies would follow in their footsteps. These major plastic producers and their lobbyists are trying to shift the blame from themselves to us as consumers, and this is nothing new. Plastics industry heavily promoted an anti-littering campaign in the 1980s (check dates) pushing the onus on the litterbug versus the corporation creating the product. However, the issues today with plastic pollution in our environment can not be solved on the individual level. We need to come together as a community to hold these companies responsible for their actions. This can be done by internalizing the cost of the pollution that they are creating, taking the form of extended producer responsibility "EPR" programs as have been successful in other parts of the world.

Furthermore, HWF has been the major force behind the hawksbill sea turtle recovery project on Maui. HWF staff and volunteers have been monitoring nesting of the critically endangered hawksbill sea turtles (*Eretmochelys imbricata*) since 1996. Since this time, they have safeguarded over 10,000 turtle hatchlings. Through various conservation efforts, including, dawn patrol and nest watch programs, coastal lighting reduction and other public awareness campaigns, dune restoration projects, fence repairs, and educational programs, HWF works to preserve and protect hawksbill populations and their coastal nesting habitats in Hawai'i. Another milestone for HWF was the launch of the Hawai'i Wildlife Discovery Center in October 2021. Hawai'i Wildlife Fund partnered with Whaler's Village to create the Hawai'i Wildlife Discovery Center at the Whalers Village in the Ka'anapali Resort Complex on Maui. The Hawai'i Wildlife Discovery Center allows guests to familiarize with Hawai'i's marine and terrestrial wildlife with several educational and interactive exhibits. Leading the community to help better safeguard the coral reef ecosystem and its inhabitants.

## Background

Research shows that humans have been benefiting from materials that are today termed 'plastic' since around 1600 BC when ancient Mesoamericans developed methods to process natural rubber into balls, figurines, and bands (Hosler et al. 1999). Since then, man has progressively relied more and more on plastics. Plastic use began with the exploitation of natural polymers like waxes, resins, and natural rubber, but by the nineteenth century, the creation of new thermoplastics facilitated the implementation of plastic usage on a wider scale. In 1839,

Charles Goodyear and Eduard Simon's breakthrough discovery of polystyrene had massive implications for both rubber and plastic production (Hosler et al. 1999). According to Hosler et al. (1999), the evolution of plastics grew exponentially in the early twentieth century when dozens of new varieties of polymers were discovered.

Today, six main categories of plastic make up the bulk of global production: polypropylene (PP), polyethylene (PE), polyvinyl chloride (PVC), polystyrene (PS), polyethylene terephthalate (PET), and polyurethane (PU) (Andrade 2009). These plastics have a diverse array of appealing properties such as durability, chemical corrosion, ultraviolet light resistance, low weight to high strength ratio, high thermal tolerance, electrical insulation capacity, and the ability to make it easily morphed into any desired shape compared to alternative materials (Mullan 2002; Andrade 2009). Over the years, these materials have proven useful in a wide spectrum of industries and uses. Plastics are resource-efficient and are designed with an unmatched range of functional temperatures. Plastics are easily produced from any feedstock with high hydrogen and carbon levels, such as sugar or corn, meaning carbon can be sourced from renewable materials. Around half of the carbon used to produce plastics is stored in the final product, and that energy can be kept in the system through appropriate recycling or reuse after their intended "lifecycle" has ended (Andrade 2009).

In 2019, the global plastics market was valued at USD 568.7 billion (Grand View Research 2020). The plastics industry is thriving globally, with nearly every country engaging in the use of plastics. There are dozens of industries that rely heavily on plastics including packaging, construction, electrical and electronics, automotive, medical devices, agriculture, furniture and bedding, consumer goods, and countless others. Some of these industries have higher rates of plastic consumption than others, especially the electronics, automotive, construction, and electrical industries. This is all forecasted to continue to grow with time. Furthermore, new regulations have been put in place to decrease the total weight of automotive vehicles to increase their fuel efficiency and ultimately lower carbon emissions by promoting plastics as a substitute for aluminum and steel in automotive components (Grand View Research 2020). Accordingly, the automotive sector is predicted to ramp up plastic consumption considerably. Other factors that have directly contributed to the growth of the global plastics market are our rapid population growth, urbanization, and industrialization (Thompson et al. 2009). With new standards and requirements for public infrastructure and quality of life, federal governments are compelled to increase infrastructure spending, especially in developing countries, ultimately leading to higher reliance on plastics (Thompson et al. 2009).

### **Societal Benefits from Plastics**

Plastics contribute to the health and safety of consumers through water and food packaging applications (Andrade 2009). Access to clean water is a pivotal issue in dense urban and remote areas around the globe, and lightweight, easy to manufacture plastics provide a way to transport and store safe drinking water. Different forms of plastic are also used in several essential water control systems such as irrigation, sewage, and land drainage (Shaxton 2009).



Additionally, plastic food packaging allows for reduced food waste as it can extend the shelflife of fresh produce and meat (Mullan 2002).

There are numerous ways in which plastic helps the medical industry and improves treatment care for patients including the use of disposable plastic products to help keep hospitals and labs sterile. Plastic materials are cheap, which helps to keep medical expenses low. Furthermore, plastics are versatile and have facilitated the advancement of biomedical equipment from high-tech surgical equipment to pill containers (Mullan 2002).

Implementing the use of plastics in transportation, construction, and packing, without exception, results in a remarkable reduction in fossil fuel energy use (Gehm 2006). For example, using lighter plastics in place of metal for new aircraft can significantly reduce the cost of fuel as well as assembly. Newly developed aircrafts such as the Boeing Dreamliner can be created with around 50% plastic parts (Gehm 2006). Today, plastic door liners, steering wheels, insulation, and electronics account for 12% of the average vehicle's total weight (Andrade 2009). This is important considering that two-thirds of all plastic consumption comes from packaging and building products such as plastic pipes or vinyl cladding. Furthermore, plastics often increase performance while lowering the cost of building materials.

Using plastic to package goods can also lower fossil fuel emissions. Estimates show that on average plastic packaging accounts for 1-3% of the total product weight (Gehm 2006). When comparing the transport, disposal, and energy costs of plastic packaging to other materials it is often the most efficient choice (Hopewell et al. 2009), however, this does not account for the emissions involved with transport and disposal costs of the packaging products once they are no longer needed. Without a doubt, plastics are improving certain aspects of human life in present-day society. In recent years, the technological progress of plastic applications has been accelerating at an unfathomable pace. It is predicted that between now and 2030, we will have made as much progress as we did over the last entire century and life in the year 2030 will be completely different when compared to life today (Hammond 2017). By then, the reliance on plastics in our life will be greater than ever, as they will serve many vital roles including components of organ transplants, synthetic human tissue, and more fuel-efficient vehicles (Hammond 2017). As fossil fuels become more scarce we will most likely rely on new versions of plastics made from renewable materials. It does not seem practical to imagine a future scenario where plastics are not a key factor in our society (Thompson et al. 2009).

### **Societal Negatives from Plastic**

Each year several million tons of plastic are produced globally, and less than half is recycled or transported to landfills (Rochman et al. 2013). The other half may still be in use or maybe contaminate the ocean and land. While it is common knowledge that plastics can physically harm wildlife, few people consider that many plastics are also chemically harmful to both wildlife and human health. Some plastics are in themselves conclusively toxic, while others adsorb harmful pollutants from the environment (Rochman et al. 2013). As stated by the United Nations Globally Harmonized System of Classification and Labelling of Chemicals, over 50% of

all plastics produced are hazardous (Lithner, et al. 2011). Ongoing studies are showing evidence of a chemical transfer of PVC additives from medical supplies into patients' blood (Rochman et al. 2013). Further, plastic waste that is sent to landfills can discharge chemicals into surrounding ecosystems (Rochman et al. 2013) and facilities that incinerate or burn plastics may release these same toxins as air pollution. In the past, plastics were thought to be inactive materials that could not alter biochemical pathways in the body. This belief was due to the large size of plastic polymer compounds in comparison to cell membranes, however, in the case of plastics in the marine environment, they carry chemicals of much smaller molecular size. These chemicals can puncture cells, link with biologically essential molecules, and disrupt essential pathways like those of the endocrine system (Teuten et al. 2009). In addition, it is now known that plastics are "photo-degrading" or breaking up into smaller and smaller fragments as chemical bonds weaken with exposure to UV light, and the resulting nano plastics formed can travel between cell membranes (Teuten et al. 2009).

The recycling process for plastics commonly involves melting or burning them; however, the incineration of plastics is another major source of greenhouse gases and other air pollutants (Verma et al. 2009; Rochman et al. 2013). The majority of municipal solid waste in the USA, which comprises around 13% plastics, is incinerated, releasing a plethora of toxic fumes such as polystyrenes, mercury, dioxins, furans, and polychlorinated biphenyls into the atmosphere (Verma et al. 2009). The release of toxic halogens and greenhouse gases contributes substantially to increased rates of climate change and is a threat to the planet as a whole, affecting humans, animals, and plants. Polystyrene, a common plastic polymer, is dangerous to the central nervous system when inhaled (Verma et al. 2009). Furthermore, dioxins released from burning settle in waterways, are absorbed by vegetation, and eventually enter food webs and the human body (Verma et al. 2009). There are multiple dioxin pollutants, but one of the most noteworthy is tetrachlorodibenzo-p-dioxin (TCDD), frequently referred to as Agent Orange. It is a highly hazardous compound that causes neurological harm, cancer, and repository issues such as emphysema and asthma (Verma et al. 2009). Incineration might seem like a good option to convert "waste to energy" and other such claims, but it may not be the most efficient or safe way of disposing of plastic waste when all byproducts are considered.

There are a variety of marine species that have been harmed by humanity's actions, many of which are threatened with extinction by the presence of plastics in the sea. The two main direct ways marine animals are affected by plastics are through ingestion and entanglement (Derraik 2002; Lusher et al. 2017). Marine animal mortality illustrates the importance of addressing the difficult problem of plastic debris in the ocean. With this in mind, solutions that mitigate the impact of plastics on marine ecosystems will be beneficial to both sea animals and the world's population at large. Some researchers have expressed that one potential way to address this issue is to educate people about the problems created by plastics (United Nations Environment Programme 2017). Another way these issues can be addressed is through legislation, where the governments of the world implement rules and regulations that focus on reducing the plastic build-up in the sea (Haward 2018). This is a promising way to reduce the

amount of debris found in the ocean; however, there are areas of the ocean which fall outside the jurisdiction of any one country, so boundaries can be difficult to regulate, and such maritime rules are exceptionally hard to enforce.

There is an estimated eight million metric tons of plastic rubbish in our oceans, but this is likely an underestimation as it is easy to undersample the amount of plastic waste scattered throughout the vast oceans (Ballerini et al. 2018). Detecting microplastics is complicated, which further suggests that the current estimate of the plastic load in the sea might not be accurate (Ballerini et al. 2018). When plastic gets into the ocean, it goes through a process of degradation, which includes biodegradation by microorganisms and photo-degradation (Jambeck et al. 2015). Degradation of plastic results in the formation of microplastics, or tiny plastic bits that are under five millimeters long, which can cause immense harm to marine animals (Jambeck et al. 2015). Most of the particles found on the surface of the ocean are floating plastic polymers, which float due to their low density compared to seawater. Floating plastics are harmful to the entire ocean ecosystem because they provide a landing surface for invasive birds to travel (Astudillo et al. 2009) and mimic an important food source to myriad marine wildlife species. There is, however, a large population of high-density plastics that do not float and their impacts are unaccounted for (Ballerini et al. 2018). More recent studies have been conducted in Hawai‘i about the various types of plastic polymers that exist in different environmental compartments, including the sediment/seafloor, windward, and leeward-facing beaches, and the ocean surface (Brignac et al. 2019). Additionally, the consumption of plastic materials by marine organisms might also contribute to inaccuracy in current marine waste estimations (Ballerini et al. 2018).

One of the major problems with plastic pollution is the formation of garbage patches in our oceans. Garbage patches are formed due to prevailing winds and large-scale currents in the ocean or other large water bodies. A large system of rotating ocean currents, also known as “gyres”, accumulates floating materials, including marine debris in the ocean that can reach concentrations of 46,000 pieces of plastic per square mile (Sesini 2011). There are five great garbage patches in the world’s oceans which are located in the North Pacific, South Pacific, North Atlantic, South Atlantic, and the Indian Ocean. These garbage patches do not consist only of surface plastics but also plastics that are dense that sink in the ocean and other organic material (seeds, larvae, etc.). One of the largest and most well-known garbage patches is the “Great North Pacific Garbage Patch” which is also known by oceanographers as the North Pacific Subtropical High. The potential damage that can be caused by these garbage patches has historically been underestimated. Garbage patches are detrimental to marine life because they force species to relocate outside of their natural range disrupting their behavior and ecosystems (Sesini 2011). Incidence of plastic ingestion by animals, the entanglement of animals, and the distribution of toxic chemical compounds (such as polychlorinated biphenyl or “PCB”) across the sea are increased in areas with garbage patches (Sesini 2011). There are at least 267 species worldwide that have died because of plastic in the ocean, but there is a need for further research to investigate the accuracy of this estimate, which may be much higher (Sesini 2011, Collignon et al. 2012). Furthermore, plastics in the ocean negatively affect filter feeders, such as

zooplanktons, when they mistake microplastics for their prey (Collignon et al. 2012). This is especially worrisome as filter feeders are integral members of many marine food webs (Collignon et al. 2012). Given that zooplankton has an important role in reducing the carbon content of the atmosphere (Collignon et al. 2012), it is evident that the consequences of plastic waste in our oceans have the potential to reach all parts of the globe, even ecosystems far from the sea.

Marine debris has adverse impacts on seabirds and marine mammals, both directly as discussed before and indirectly. The latter may occur through the process of bioaccumulation, in which a species consumes prey that has consumed microplastics with sorbed persistent organic pollutants or “POPs”. As predation occurs across different species and trophic levels, the plastic builds up across the food web and concentrates with the top predators (Besseling et al. 2012). Almost every seabird species that has been studied has had traces of microplastics in their digestive systems (Lusher et al. 2017). Possible sources include taking in water that has microplastics or ingesting prey that has consumed microplastics (Jambeck et al. 2015). Marine animals provide an early indication of the potential health hazards that plastics can cause to humans (Jambeck et al. 2015). A challenge with tracking microplastics is that they can be ingested by marine mammals and pelagic fishes that travel long distances, making it hard to identify the source of the contamination (Lusher et al. 2017).

Studies have also revealed that there are adverse ecological implications of marine plastic contamination (Jambeck et al. 2015). Most of the interactions that are known include the transport of toxic compounds. A limitation to the understanding of the ecological impacts is the dearth of knowledge on the physiological effects of microplastics on nature (Lusher et al. 2017). However, one study noted a decrease in the number of offspring produced by animals that had ingested plastic waste (Lusher et al. 2017). In addition, it is possible that ingesting microplastics can adversely impact an animal's body condition, growth, reproductive success, and metabolism (Jambeck et al. 2015, Thompsons 2017, Lusher et al. 2017, Prata et al. 2019). If not addressed, these issues can lead to the death and extinction of many aquatic and terrestrial animals. The standard approach to waste management was based on the hierarchy of the three R's which include: Reduce, Reuse, and Recycle. However, more recent iterations have included a 4th or even 5th “R” to Rethink and Redesign cover, and “Rethink” or “Redesign” (Prata et al. 2019, Practical Action 2018). Though the main priority must be to reduce the waste produced and also reuse it, it is important to make sure that the plastic produced and consumed is also well managed through a waste management system (Prata et al. 2019). The sad reality is that most food packaging does not get recycled (Jambeck et al. 2015), and packaging accounts for a third of all plastics produced today (Prata et al. 2019). Data collected by the US EPA tells us that as little as around 9% of plastics are recycled in the USA (Jambeck et al. 2015). Notably, reusing packaging is difficult because it involves a lot of sorting and recovery, and therefore it is hardly used outside of high-valued items such as vehicles (Prata et al. 2019).

Sadly, all the water bodies from the north pole to the south pole, in both the deep sea and the shallows, have been contaminated by plastic debris (Thompsons 2017). Most plastic is

resistant to degradation, and as a result, the amount of plastic in the environment has been steadily increasing over the years (Thompsons 2017). Plastics have a significant potential of escaping managed waters, and this is attributed to the different points of entry, including fisheries, tourism, and aquaculture (Allen et al. 2017) and rivers (Schmidt et al. 2017). Rivers are among the primary sources of ocean plastic pollution. They are the main source of transportation that carries waste from land to the ocean. Research found that rivers from the top 10 catchments contribute between 88 – 94% of the plastics in the world's oceans (Schmidt et al. 2017). The complexity of sources of plastic waste makes it harder to not only measure it but also manage it.

## **Alternatives**

From the literature, it is apparent that most of the solid waste environmental concerns from plastic are due to its packaging waste. Estimates suggest that plastic packaging accounts for as much as 40% of the overall plastic consumption every year, largely dominated by petrochemical polymers (Crimina 2019). A large portion of all packaging applications is implemented with fossil-fuel polymers, which are virtually all difficult to recycle or reuse due to their levels of contamination as well as being mainly non-biodegradable (Klingbeil 2000). However, this led to various regulations focused on reducing the number of plastics being generated. In more recent years there has been significant progress in the creation of biodegradable plastics, mainly from renewable resources. These new biodegradable materials will have the same functionality as oil-based polymers. By implementing these biodegradable plastics we have the potential to help restore finite resources, decrease greenhouse emissions, and reduce the impacts of non-biodegradable plastics around the world (Song et al. 2009).

There are various materials used for packaging which include glass, wood, paper, pulp, plastic, and combinations of each material. It's estimated that over 67 million tons of plastic are generated each year, and the recycling rates for these plastics remain relatively low (Murphy et al. 2004; Hopewell et al. 2009). It is a challenge to categorize plastic waste because there are a vast number of polymer types, plus an infinite combination of colors, additives, and plasticizers. This ultimately leads to recycling being uneconomic due to the chance of contamination during the use of these mixed plastics (Thompson et al. 2009b). However, Biodegradable Polymers (BDPs), also known as biodegradable plastics, are capable of undergoing decomposition turning into organic compounds, such as carbon dioxide or methane, which can then be measured in a specific period (Song et al. 2009) or captured for other purposes.

Significant ecological benefits will materialize if we switch to biodegradable types of plastics, as the BDPs are highly suitable for both industrial biological waste treatment and household composting (Teuten et al. 2009). By doing so, the total amount of waste sent to landfills is reduced and household compost products can later be beneficial to the surrounding soil. Biodegradable plastics that pass the compostability standards will be able to biodegrade well in industrial composting systems (Song et al. 2009; Teuten et al. 2009). More research has to be done on biodegradable types of plastics. In the meantime, the solution is to reduce our addiction and reliance on plastics, to begin with, fossil-fuel or plant-based.

Since biodegradable bioplastics are very well suited for packaging applications; the whole world would benefit from expanding the biodegradable plastics industry (Crimina 2019). Since this industry would be for the most part new, there will very likely be a lack of research or a skilled workforce. It is going to be crucial to be transparent in sharing discoveries, policies, advice, and research in this new economy (Pagliaro et al. 2019; Hakovirta et al. 2019).

Toxic substances are released via burning from plastics, open combustion, and incineration, posing a threat to the surrounding areas including to native wildlife and the health of individuals (Verma et al. 2009). Proper development of the policy concerning chemical exposure caused by plastics (harvest, production, transport, packaging, and disposal) must be written, and we must encourage further research in this direction. Connecting the global plastic pollution problem to human health issues would help the masses to be aware of the severity of the problem (the connection to their own lives) and hopefully inspire communities to adopt technologies that can pose fewer risk hazards on human health and the environment in developing nations (Verma et al. 2009). The scientific community needs to better communicate the impacts of the cumulative environmental exposures to plastics that may harm human health. For example, instead of combustion and incineration, pyrolysis is an alternative disposal method that is known to produce less toxic substances. Several pyrolysis systems have been initiated and people realized that it is the most efficient option, but proper scientific data and design of the unit and follow-up studies are very few (Verma et al. 2009). Recycling is better for minimizing stress on particular resources and utilizing “waste products” to create new resources without harvesting new oil resources, thereby increasing sustainability. Introducing recycling programs is a first step to making a change, but it is only the start to stem the rising problem of plastic pollution.

## **Conclusion**

The problem of what to do with plastic waste once we are finished with it is becoming increasingly more urgent. Policies for managing plastic debris are outdated and the resulting plastic pollution has been proven to threaten the health of people and wildlife (Rochman et al. 2013). The plastic packaging industry is flourishing, fueled by high demands in emerging economies all over the world, and is of particular concern for global health. Developing countries are estimated to account for around 35% of total plastic revenue by 2027 (Grand View research 2020).

The amount of pollution in the global society is ever-expanding. Thermoplastics are not biodegradable, therefore thermoplastic litter lasts in the environment for long periods (Andrade 2003). The precise “life cycle” of plastic waste depends on the chemical makeup of the plastic material and the environmental or chemical conditions in which the plastic is located. Degradation times vary significantly among different compostable and conventional plastics (Andrade 2003). When it comes to plastic pollution, waste littering is a behavioral problem that can hopefully be addressed through education. However, our waste systems, in general, are just not equipped to handle the sheer amount of plastic being produced (McCallum 2018) and many parts of the developing world have inadequate (or nonexistent) waste management systems. We

need to expend time and resources to increase awareness about the consequences of plastic waste on our communities and the environment.

With this in mind, an Integrated Waste Management System (IWMS) is a proposed plan for implementing methods of disposal and managing waste to reduce the damage to the environment (Prata et al. 2019). An effective integrated waste management system considers how to prevent overproduction, recycle, and manage solid waste in ways that most effectively protect human health and nature. San Francisco's IWMS plan allows the city to send the least amount of trash to landfills among cities in the USA. Examples of modern integrated waste management systems include water reuse, sorting and separation of waste collection, maximized reuse and recycling of used goods, waste prevention, and avoidance. It is important to note that the implementation of IWMS plans is costly and quite slow-moving, and developing countries might lack the resources to manage waste efficiently (Prata et al. 2019). However, given that plastic pollution is an international problem, there should be global cooperation aimed at helping developing countries manage their waste more effectively. Global zero waste movements have been successful in cities and counties across the USA and Italy. Educating communities about the possible ways of preventing waste build-up may also contribute to the reduction of waste deposits in rivers, lakes, and oceans. The younger generation is becoming increasingly environmentally conscious, and hopefully, this will lead to the adoption of better ways of dealing with our unsustainable waste culture. "The problem of plastic pollution affects us all, and therefore one for which we all share responsibility as individuals but also, more importantly, collectively." (McCallum 2018). Scientific literature suggests that the impacts of plastic pollution cannot be overlooked since our reliance on plastics continually increases, both economically and in our daily lives, especially in developing countries. The impacts on our world should be carefully considered so we can avoid further damage (Thompson et al. 2009a,b; Teuten et al. 2009).

### **Purpose of Internship**

The purpose of my professional internship project was to investigate, mitigate, and educate on the issue of marine debris in our oceans and along our coastlines. Additionally, I aimed to gain meaningful experience in the field of conservation biology with a respectable nonprofit organization. Being a student of conservation biology, I am constantly striving to better understand how our actions as a society impact the environment. During this internship, I became more familiar with how nonprofit work is conducted and organized, as well as the full cycle of our waste management system from producing, consuming, and disposing of our plastic waste (and on an island scale). I believe the most efficient way to combat the issue of plastic pollution leading to marine debris is through legislation and policy. Policies passed in the state of Hawai'i have been a progressive step in the right direction for dealing with and preventing pollution in the islands. By doing so, I believe Hawai'i is setting a positive example for other countries and communities, hopefully, sending them down a similar progressive path.

## **Learning Objectives**

During my time as a graduate student, I strove to become a more knowledgeable, open-minded individual, and learn to efficiently communicate to a broad range of backgrounds. By improving my communication, presentation, and writing skills, I became more confident in my ability to be an effective environmental advocate and steward. Professionally, I would like to get more real-world experiences with nonprofit organizations, fieldwork, field research, interacting with volunteers. I want the work conducted by this internship to further HWF's mission of "protecting native wildlife, focusing on coastal and marine wildlife species in the Hawaiian Islands".

## **Professional Internship Role & Responsibilities In Agency**

My role in the Hawai'i Wildlife Fund was to support staff in providing education and outreach on the issue of plastic pollution (marine debris) in our oceans for the greater community in Hawai'i and beyond. I took on several responsibilities, including assisting with the removal of debris from beaches while maintaining a safe, friendly environment for volunteers to enjoy while educating them on the issues at hand. I also delivered several presentations to various communities such as volunteers, rotary clubs, college and high school classes, or the general public at open symposiums. I was in charge of organizing and adding to the 2013-2021 Ka'ū marine debris brand inventory study (including all new data collected from January 2020), as well as Ho'okipa green sea turtle basking datasets on Maui in August 2021. I also supported dawn patrol (turtle nesting) reconnaissance efforts as well as created a scavenger hunt activity for the new Hawai'i Wildlife Discovery Center.

## **Expectations of a Professional Internship Project**

My completed internship project with the 501(c)(3) nonprofit organization Hawai'i Wildlife Fund satisfies the expectations of the TCBES graduate internship program. I wanted to convey the process of how I started the project and how I made a change so that it will inspire others and let them know that they have the power to make a change as well. I have read, seen, and experienced enough to know the issue of marine debris is impactful to all walks of life on Earth. However, similar to several other issues I have come across in my time as a conservationist, I do not see enough action and preventive measures being implemented to solve the issue. Our global waste culture is unsustainable, and poorly designed waste management systems have mostly failed to prevent and remove marine debris in the ocean. I want to do everything in my power to change that, and this education and internship program has equipped me with the tools to do so.



## Timeline

The duration of this internship was 700 hours from October 2019 to October 2021.

Month	Work completed
October 2019	Begin internship, Kamilo debris survey met and assisted Leah Sherwood (fellow TCBES student)
February 2020	Kamilo debris survey, Kamilo clean up
April 2020	Submitted testimony Bill 52 (Maui SUP bill)
July 2020	Kamilo beach clean up, update HWF marine animals current status (website), HWF Campaigns, Keiki marine debris talk with Megan
August 2020	Kamilo debris survey and interview, Data input and discussion with Drew (HPU grad student), provide feedback on SUP Ban (Hawai'i County), Net removal at Keawaiki (with DAR), Net removal at Puako (with DAR), Data input for HAW_3 HAW_4 exclude HAW_5, HWF hiking clean up event
September 2020	HWF reef-friendly campaign, HWF Kamilo Int'l Coastal Cleanup, HWF Kamilo coastal strand outplanting
October 2020	MD-MAP Debris survey #40 at Kamilo with HWF, Hiking clean up event South Point, Sent Email to Rep Tulsi Gabbard to support the new "Break Free From Plastic Pollution Act of 2020" (Senate Bill 3263, HR 5845), Support Ho'ōla One mission - Pinao Bay, Listened to Voyager Podcast with Hannah Bernard, O&M Manual - Ho'ōla One
November 2020	Net (recovery) patrol with HWF
December 2020	Submit testimony to COH's Environmental Management Commission, County of Hawai'i special meeting agenda, Create brands inventory google sheets
January 2021	Ho'ōla One preparation for trial operation at Kona DAR office, Brands inventory, Kamilo Beach clean up / debris survey / Net Patrol, Blue Generation data entry
February 2021	Submitted testimony through Hawai'i State Legislature on HB1316 EPR Bill, SB1298, Hiking clean up event at South Point with SOS club and HWF, Brands inventory, Marine debris survey Kamilo beach, Review hagfish trap data from NOAA MD-MAP surveys at Kamilo for Surfrider Kaua'i study
March 2021	Attend several Hawai'i Marine Debris Action plan workshop #3 Removals, Net Patrol, Deed collection, 2021 Hawai'i Marine Debris Action plan workshop #4 Ocean-based debris and abandoned and derelict vessels, Take UH Hilo MOP Sea Turtle Response Team volunteer training, Marine debris survey at Kamilo, Brands inventory, Marine Debris Monitoring, and Assessment Project (MD-MAP) data entry for survey #45
April 2021	Brands data analysis, Net patrol, MDMAP, Rotary club meeting presentation, HWF hiking event, Brands data analysis, TCBES

	symposium presentation and preparation, Net Patrol, Presentation for the MARE 410 class with Megan, Workday with the rotary club at Kamilo (gave the pre-cleanup briefing /introduction talk)
May 2021	Brands inventory, Beach cleanup near Kamilo, Net Patrol, Design Monofilament bin flyer, Lifeguard training, Host eco-tourism “Give Volunteers” group
June 2021	Eco-tourism GIVE group at Kamilo, Net patrol, Community clean up with Global water dancers, Eco-tourism GIVE group at Kaunamano, Brands inventory
July 2021	Supported HWF activities in Maui: lighting (pollution reduction) project, fence repair, honu watch, dawn patrol, Hawai‘i Wildlife Discovery Center
August 2021	AAUS Science Diver Training at UHH, Report writing, Brands inventory
September 2021	Brands inventory, Introduction to zero waste workshop #1, Report writing
October 2021	Drafted both HI-MDAP newsletter blurb and HWF Blog about the brand inventory, Report writing, Preparing final presentation, Closeout the internship

### **Approach-- Education and outreach**

Through education and outreach, our efforts benefitted the program for years to come. We highlighted the issues associated with plastic pollution so community members gained a better understanding of how to combat it. The endeavors performed during this internship are meant to have lasting impacts on not only the organization itself but also the volunteers who assist as well. Most of the population can agree that our high rates of consumption are not sustainable. However, it is difficult to make individuals passionate about an issue unless they are personally impacted by it. Whether one believes it or not, our plastic pollution negatively impacts all walks of life without one even realizing it. If one truly experiences the severity of this issue they might be more open-minded and willing to make a difference on the issue. From this internship, HWF will continue to get more support and volunteers. When community members become educated and passionate on this issue of plastic pollution, they will continue to stay passionate for life.

### **Fieldwork, Research, & Removal Efforts**

#### ***Brands inventory survey methods***

Hawai‘i Wildlife Fund collected data on brand names, material, item type, and origin of waste since 2013. We undertook this inventory study to better understand which manufacturers were polluting our shores and better hold them responsible. Sadly, the beaches will continue to be polluted unless we “turn off the tap”. In order to collect data, we would log brand name items and take pictures of items that were collected during either our community clean up events, net

patrols, or regular NOAA MD-MAP surveys conducted at Kamilo. All data were collected within the Ka‘ū District on the southeast corner of Hawai‘i Island. Data was input into an excel datasheet which also documented the material, item type, brand name, and origin of debris. Once all the data was collected we investigated the sources of origin based on the information available (e.g., brand names or countries listed) and data was uploaded into R to create useful visuals.

### ***Data Management***

For the duration of this project, I was in charge of managing a few datasets, including the brand inventory study from 2020 to 2021 (which included data from 2013 - current), and the Ho‘okipa “Honu Watch” count data from 2014 to 2021 (compiled in July 2021). I kept folders on my laptop and in the HWF Google Drive with all important and relevant documents regarding the internship. Furthermore, all logged hours for the internship project were put on a Google spreadsheet that was shared in real-time with my advisor. Throughout this internship, I took plenty of pictures and videos for reference, all of which will be stored in the same locations.

### ***Beach cleanups***

Beach cleanups were the main activities carried out during this internship. We would arrange carpools to take the least amount of vehicles down to the beaches for the cleanups (before COVID-19 prevented carpooling). From the meeting area at Wai‘ōhinu Park, we would conduct safety briefings and introductions to get to know the group of community or visiting volunteers. We would then begin the long off-road drive down to the remote work areas. HWF owns a large four-wheel-drive truck named “Ruby” with a cage and dump bed for placing all the marine debris found at the worksite. Once we have collected sufficient amounts of debris for the workday, we head back to the County transfer station in Wai‘ōhinu for drop off.

### **Legislation & Policy efforts**

For legislation & policy efforts, HWF was vocal in their newsletters and social media platforms on important local bills relating to plastic pollution. In order to be more proactive, I also signed up for other organizations' monthly newsletters that were revealing current legislation and policy initiatives. I also frequently visited the Hawai‘i State Legislature website for more information on current and upcoming issues. Throughout this internship, I also spoke to local community members and conducted surveys about knowledge levels on the legislative issues at hand.

### **Assessment Method**

The assessment method used in evaluating the standard operating procedures conducted by this internship was determined by my mentor, Megan Lamson, along with the number of hours it took to complete the task. The completion of the internship was determined by the completion of the brands’ inventory survey, my TCBES coursework, and exceeding the required 600 internship hours.

## Outcomes & Deliverables

Internship organization: Hawai'i Wildlife Fund (HWF)

Internship Mentor: Megan Lamson

Internship Advisor: Lisa Canale

Internship general focus: **Marine Debris**: Outreach, Education, Volunteering, Legislation, Policy, Fieldwork, and Research

### 1. Outreach & Education

- Assisted in making flyers for the new monofilament fishing line collection bin at NELHA. HWF partnered with the Marine Mammal Center's Ke Kai Ola volunteer, Katie Cartee, to create monofilament fishing line stations in order to educate fishermen about monofilament recycling. By creating these flyers we can encourage shoreline fishermen to dispose of their fishing line properly and also provide a place for anyone to discard fishing lines they find in the NELHA area. The monofilament gets sent to Berkley Fishing which has recycled over 9 million miles of fishing line since 1990. Berkley Fishing provides free pre-paid shipping labels for Hawai'i Island's monofilament to be sent to them ensuring free recycling of the monofilament line. (Appendix F)
- Worked at numerous community clean up events. These events would allow volunteer members of the community to contribute to beach clean ups. Community cleanup events were a great outlet to educate and inspire guests on the issues associated with marine debris.
- We conducted several beach cleanups with ecotourism GIVE Volunteer groups. Ecotourism GIVE groups consisted of students from several parts of the country getting an opportunity to experience other parts of the world to support conservation efforts. This was a great way for visitors from around the country to get a sense of the cultural and natural aspects of the island rather than the typical tourist attractions. We would teach these GIVE groups about marine debris by showing them the impacts on our beaches then educating them and how to prevent the issue.
- Gave a presentation on the current state findings of the brands' inventory survey at the Spring 2021 TCBES Symposium.
- Presented our findings of the brands' inventory survey for the MARE 410: Marine Debris in the Pacific class with Megan.
- Assisted Megan with HWF's marine debris talk with the Pahoia Rotary club.
- Recorded a podcast through the school's TCBES program. I interviewed one of the head engineers for the Ho'ō'la One, a marine debris machine that sifts out microplastics from our shore. We discussed his passions, difficulties, and expectations with his project.
- Participated as guest speakers on a podcast from a young-inspired conservationist from O'ahu. We discuss all things Marine debris. From bleak realities of plastic consumption to tackling the global issue.

- Wrote a blog post for *Life of an Environmental Scientist* web page on humans' unsustainable waste culture, leading to marine debris in the ocean (Appendix G).
- Was the host of a conservation talks show named "Conservation Conversations" on the university radio station 101.1FM university radio KHUH. Where I would discuss local and global issues in the field of conservation. Additionally, I would have guest speakers fellow TCBES students to educate the listeners about the research projects they are working on.
- Maintained communication with mentors through multiple platforms such as Facetime, Zoom, Google meet, phone calls, and emails.
- Assisted in the 2021 Hawai'i Marine Debris Action Plan workshop through NOAA on Prevention, Ocean-based, Removal, Research Goals for the Hawaiian archipelago.
- Looked into the future of plastic materials and other alternative materials.
- Took lead on the HWF nesting sea turtle lighting project in southern Kīhei. We would go door to door on beachfront property leaving educational flyers or engaging in discussion about the harms of improper lighting on the coasts to the nesting sea turtles.
- We were in partnership with Blue Generation which is a team of passionate individuals who are committed to reducing communities' impacts on the environment through education about plastic consumption. Their goal is to equip communities with the knowledge to make a difference on the issue. Blue Generations developed technology helps assist in the tracking of plastic use in our communities, by scanning the products' barcode, weight, brand, and plastic material type they can better understand the unsustainable reliance on plastic packaging. Our partnership with Blue Generation will help create this international community of well-informed citizens who work with one another to mitigate the plastic pollution issue through technology and science-based solutions. During my time working with Blue Generation, I assisted in collecting plastic use data in Hawai'i by collecting plastic and logging the plastic weight, barcode, plastic type, and plastic brand from college students at University of Hawai'i at Hilo. By doing so we were able to compare our consumption trends to those of other blue generation databases around the world.
- Presented with Megan for the Keāhole Center for Sustainability's Community Connection over zoom (avail on the HWF YouTube channel).

## **2. Fieldwork, Research, & Removal Efforts**

- In Maui, HWF partnered with the U.S. Fish & Wildlife Services for the fence repair project. We worked at Kealia boardwalk repairing and building a fence made out of recycled plastics. The structure is designed to keep nesting turtles from getting hit by vehicles on the North Kihei road as they search for adequate nesting locations. The work conducted even made it on the front page of *The Maui News*. (Appendices H)
- Assisted with dawn patrol" efforts at two different beach locations Baldwin beach and Ho'okipa. During nesting seasons we would walk along these beaches at first light and

investigate for any signs of nesting sea turtles on the beach.

- Assisted with dawn patrol at Ho‘okipa. During honu watch, we would first record beach and weather conditions. Then count the number of Green sea turtles arriving and departing from every 30 mins. Additionally, recording guest numbers on the beach as well as any markings or tags on resting sea turtles. We were also lucky enough to be visited by two different Hawaiian Monk seals during our work hours. With the data we recorded, I was in charge of compiling and analyzing data for Honu watch from 2013.
- Had a voluntary beach cleanup workday with the Rotary Club at Kamilo point. I gave an introduction talk, work plan, and safety briefing for the event.
- We conducted regular NOAA MDMAP (Marine Debris Monitoring and Assessment Project) surveys at the given site in Kamilo. The data would then be uploaded onto the MDMAP website where it could be seen and analyzed with other marine debris data from around the world.
- Wrote blog post to NOAA MDMAP on findings in brands inventory survey. (Appendix C)
- Conducted weekly nets patrols along the several-mile coastal stretch of Ka‘ū. Where we would scout for large derelict fishing gear or dirty beaches for the next potential cleanups.
- Assisted with Ho‘ōla One operation and transportation to remote and microplastic-ridden beaches in Ka‘ū and Kona DAR (Division of Aquatic Resources) office.
- Transportation of fishing nets to transfer stations where they will be delivered to H power in O‘ahu. Turning fishing nets into energy.
- Collected data on over 500 items on brand names, material types, and origin of debris recovered that had washed ashore the beaches of the southeastern facing shores of the island. Compiled the data from 2014 to the present day and presented the findings. (Appendices A & B)
- Assisted in data collection for a graduate student at UH Mānoa studying the impacts of derelict fishing nets in our oceans.
- Assisted UHH TCBES graduate student, Leah Sherwood, in her thesis research on applying AI object detection to marine debris.
- Assisted with the opening of the Hawai‘i Wildlife Discovery Center in Maui. This discovery center will allow guests to become familiar with Hawai‘i’s unique marine and terrestrial wildlife through education and interactive exhibits. By doing so, we can provide information for the community and visitors to help safeguard the oceans.
- Participated in outplanting and native seed collection workdays. During this internship, our team collected seeds from several native coastal strand species, and planted native palms in Ka‘ū Forest Reserve. Seeds were saved from ‘akoko, maiapilo, and mau‘u (*Fimbristylis* sp.) plants for further propagation and for seedbanking. Additionally, we planted 5 small coastal loulu palms (*Pritchardia maideniana*) that were approx 2 years old within the Ka‘ū Forest Reserve. Since native Hawaiian plants are not heavy feeders and are often phosphorus-deficient we implemented a Nutraccoat and triple-super

phosphate fertilizer for the new seedlings. We then continued to check on the plants on workdays in the area.

### **3. Legislation & Policy efforts**

- Attend formal Hawai‘i County Council and State Senate / House hearings (remotely) and provided written and verbal testimony related to proposed plastic pollution and waste-management bills and resolutions.
- Submitted testimony in support of Bill 52 related to the sale and the use of plastic disposable food ware (Appendix D).
- Submitted testimony in support of SB1298 to increase the advance disposal fee.
- Wrote letters to several public officials in Hawai‘i and California about the importance of the Break Free From Plastic Act.
- Spoke to the County’s Recycling Specialist about waste management efforts in Hawai‘i (Appendix E).
- Wrote a paper in about local laws and enforcement policy related to the waste management system on the island (Appendix E)
- Delved into policy associated with plastic pollution, including the fishing industry, everyday items, solid waste management, and any additional factors contributing to marine debris locally.
- Discovered steps being taken by NGOs, community groups, and agencies statewide to create and implement relevant plastic policies.
- Conducted surveys to the average citizens’ knowledge about the legislative process.

### **5. Achievements**

- Successfully conducted an internship during a global pandemic (Appendix I).
- In order to keep our volunteers safe while conducting beach cleanups near the ocean, our team members became or renewed their lifeguard certification. I Completed Lifeguard with CPR/AED for Professional Rescuers and First Aid training.
- Ran in a 3-hour marathon fundraiser for Hawai‘i Wildlife Fund at Volcano Winery.
- Become a UH authorized American Academy of Underwater Sciences (AAUS) scientific diver. Received NAUI/DAN DIVING FIRST-AID FOR PROFESSIONAL DIVERS; NAUI NITROX DIVER; and NAUI MASTER DIVER.

### **Discussion**

I spent over 700 hours interning with the local nonprofit conservation organization, Hawai‘i Wildlife Fund (HWF). This organization has collectively removed over 350 tons of marine debris from the shores of the Hawaiian Archipelago (Hawai‘i Island, Maui, Midway, French Frigate Shoals) since it was formed in 1996. HWF has also participated in the creation and passing of several policies banning the single-use plastics in Hawai‘i including both the County-level plastic bag reduction bills on Maui and Hawai‘i, and the polystyrene foam

reduction bills on Maui, Hawai‘i Island, and Kaua‘i. I assisted with the policymaking process by contributing testimony of support and opposition for relevant statewide and county bills. This internship was heavy on community outreach, stewardship, and education. We conducted multiple beach cleanups a month with volunteers and other members of the organization. Furthermore, we operated the Ho‘ōla One, a unique machine that sorts out sand and microplastics on the beach.

The work and outreach conducted by the Hawai‘i Wildlife Fund benefited the surrounding communities and collaborators. Our work provided tools to make a difference in the issue of humanity’s plastic pollution (marine debris) in the ocean through education, outreach, and restoration (volunteering). Our beach cleanups will give community members who want to make a difference on the issue an opportunity while allowing them to experience the problem first hand. We presented educational material to a broad spectrum of ages and audiences. Our information was easily accessible making it effortless to share through a wide spectrum of platforms. Additionally, we increased awareness for future generations on the dangers of man-made pollution, increasing our chances of a greater change to be made. Our HWF collaborators such as ZeroWaste Hawai‘i and local school teachers can use this educational material and example activities to assist in the spreading of awareness on the issue. Furthermore, legislation and policy-making will directly assist the Hawai‘i Marine Debris Action Plan network reach their 2030 goal to reduce the amount of marine debris threatening protected species and the environment. The issue of plastic pollution is one that negatively impacts all walks of life. The sooner that the majority of society recognizes the consequences of plastic pollution; the sooner a change will be made.

The work conducted for this internship project impacted the community and visitors of Hawai‘i. This allowed Hawai‘i’s state and county representatives and waste management groups to take action and create regulations and guidelines for better management practices. I learned that simple changes can lead to dramatic changes for this issue. The work being conducted will not go unnoticed in other countries and communities. Furthermore, our efforts restricted the levels of waste entering the ocean so the reduction of pollution in our oceans will result in less marine wildlife endangerment due to entanglement or consumption of plastics. We can make our voices heard as mass producers (and consumers) and make wiser choices with our purchases. Our actions will lead others to seek out more eco-friendly alternatives which can reduce damage to our marine environments.

## **Conclusion**

Pursuing my master’s degree from the TCBES program has been an opportunity of a lifetime. Between my graduate courses and internship with HWF, I was equipped with the knowledge and tools to become a confident professional in the field of conservation. The broad



coursework helped me expand my interest in the field, and get an opportunity to learn new concepts. Surrounding myself with like-minded and determined conservationists has been truly encouraging me to pursue change for our planet. My fellow classmates have been incredibly supportive and kind throughout this entire process, which I will be forever grateful for.

While conducting work on this internship, I have met several individuals within the community. They shared their stories, struggles, and beliefs about the land. These stories and interactions are priceless in my eyes and makes me desire to continue to help communities in any way I am able to. This program opened my eyes to better understand the perspectives of others and how to effectively communicate information to diverse audiences. My internship project solidified my desire to make a lasting impact on our fragile environment through conservation. Throughout my time in the program, I have discovered that our global waste management systems are simply not equipped to handle the sheer amount of waste that is being produced. Major societal and governmental changes will be needed in order to combat these issues. I have been provided the tools and experience to make a difference, and I plan to do so as I look for employment opportunities. Overall, this program has been a blessing and I will continue to cherish the memories made during this time for years to come.

### Literature Cited

- Allen, A. S, Seymour A. C, & Rittschof, D. 2017. Chemoreception drives plastic consumption in a hard coral. *Marine Pollution Bulletin*, **24**(1), 198-205.
- Andrady A. L, Neal MA. 2009. Applications and societal benefits of plastics. *Philosophical Transactions of the Royal Society B: Biological Sciences* **364**:1977–1984.
- Andrady A. L. 2003. In *Plastics and the environment*. West Sussex, England: John Wiley and Sons.
- Astudillo J, Bravo M, Dumont C, Thiel, M. 2009. Detached aquaculture buoys in the SE Pacific: Potential dispersal vehicles for associated organisms. *Aquatic Biology - AQUAT BIOL.* **5**. 219-231. 10.3354/ab00151.
- Ballerini, T., Andrady, A., Cole, M., & Galgani, F. 2018. Plastic pollution in the ocean: what we know and what we don't know about. *Plastic and Ocean Platform*.
- Besseling E, Wegner A, Foekema EM, Koelmans AA. 2012. Effects of Microplastic on Fitness and PCB Bioaccumulation by the Lugworm *Arenicola marina* (L.) | *Environmental Science & Technology*. Available from <https://pubs.acs.org/doi/abs/10.1021/es302763x>
- Church JA, Stuart GJ, Jackett DR, McDougall TJ. 1990. A Model of Sea Level Rise Caused by Ocean Thermal Expansion. Available from <https://journals.ametsoc.org/doi/abs/10.1175>.
- Collignon A, Hecq JH, Pierre GF, Goffart CF. 2012. Neustonic microplastic and zooplankton in the North-Western Mediterranean Sea | *Elsevier Enhanced Reader*. Available from <https://reader.elsevier.com/reader/sd/pi/i/S00253>.
- Ciriminna, R., & Pagliaro, M. 2019. Biodegradable and Compostable Plastics: A Critical Perspective on the Dawn of their Global Adoption. *ChemistryOpen*, **9**(1), 8–13. <https://doi.org/10.1002/open.201900272>.
- Derraik JG. 2002. The pollution of the marine environment by plastic debris: a review. *Marine pollution bulletin* **44**: 842-852.
- Gehm R.2006. Plastic on the outside. *Automotive Engineering International*. August [Google Scholar].
- Grand View Research. 2020. *Plastics Market Size, Share, Industry Analysis Report, 2020-2027*. <https://www.grandviewresearch.com/industry-analysis/global-plastics-market>
- Hakovirta M., Lucia L., Nat. Biotechnol. 2019. Informal STEM education will accelerate the bioeconomy. **37**, 103–104. [PubMed] [Google Scholar].
- Haward, M. 2018. Plastic pollution of the world's seas and oceans as a contemporary challenge in ocean governance. *Nature communications*, **9**(1), 667.
- Hopewell J., Dvorak R., Kosior E.2009. Plastics recycling: challenges and opportunities. *Phil. Trans. R. Soc. B* **364**, 2115–2126 (doi:10.1098/rstb.2008.0311) [PubMed] [Google Scholar].
- Hosler D., Burkett S. L,Tarkanian M.J.1999. Prehistoric polymers: rubber processing in ancient Mesoamerica. *Science* **284**, 1998–1991 (doi:10.1126/science.284.5422.1988) [PubMed]
- Hocking M. B.2006. Reusable and disposable cups: an energy-based evaluation. *Environ. Manag.* **18**, 889–899 [Google Scholar].
- Kayla C. Brignac, Melissa R. Jung, Cheryl King, Sarah-Jeanne Royer, Lauren Blickley, Megan R. Lamson, James T. Potemra, and Jennifer M. Lynch *Marine Debris Polymers on Main Hawaiian Island Beaches, Sea Surface, and Seafloor*  
*Environmental Science & Technology* 2019 53 (21), 12218-12226  
 DOI: 10.1021/acs.est.9b03561

- Klingbeil M. 2000. Working document of biodegradable waste management Brussels: European Commission [Google Scholar].
- McCallum, W. 2018. How to give up plastic. Penguin books.
- Murphy R., Bartle I. 2004. Summary report, biodegradable polymers, and sustainability: insight from life cycle assessment. National Non-Food Crops Centre, UK [Google Scholar].
- Mullan W. M. A. 2002. Science and technology of modified atmosphere packaging. See <http://www.dairyscience.info/map-science.asp>.
- Jambeck J, Geyer R, Wilcox C, Siegler TR, Perryman M, Andrady A, Narayan R, Lavender- Law K. 2015 Plastic waste inputs from land into the ocean, *Science*, **347**:6223, pp. 768-771 2.
- Lithner, D., Larsson, A. & Dave, G. 2011. Plastic Resilience and Future Implications. *Sci. Total. Environ.* **409**, 3309–3324
- Lusher A, Hollman P, & Mendoza H J. 2017. Microplastics in fisheries and aquaculture: status of knowledge on their occurrence and implications for aquatic organisms and food safety. *FAO Fisheries and Aquaculture Technical Paper*, (615).
- National Oceanic and Atmospheric Administration (NOAA). 2019. Gulf of Maine Marine Debris Action Plan.
- Pagliaro M., Meneguzzo F., *Chem. Eur. J.* 2017, A Bioeconomy and Solar Energy Institute at Italy's Research Council in the Context of the Global Transition to the Solar Economy. **23**, 15276–15282. [PubMed] [Google Scholar].
- Pagliaro M., *Energy Technol.* 2019. Renewable Energy Systems: Enhanced Resilience, Lower Costs 7, 1900791. [Google Scholar].
- Prata J C, et al. 2019. Solutions and integrated strategies for the control and mitigation of plastic and microplastic pollution. *International journal of environmental research and public health*, **16**(13), 2411.
- Rochman, C, et al. 2013. Classify plastic waste as hazardous. *Nature* **494**, 169–171. <https://doi.org/10.1038/494169a>.
- Schmidt C, et al. 2017 *Environmental Science & Technology* Export of Plastic Debris by Rivers into the Sea 51 (21), 12246-12253 DOI: 10.1021/acs.est.7b02368
- Sesini, M. 2011. The garbage patch in the oceans: the problem and possible solutions. Columbia University, New York.
- Song, J. H., Murphy, R. J., Narayan, R., & Davies, G. B. 2009. Biodegradable and compostable alternatives to conventional plastics. *Philosophical transactions of the Royal Society of London. Series B, Biological Sciences*, **364**(1526), 2127–2139. <https://doi.org/10.1098/rstb.2008.0289>.
- Teuten E. L., et al. 2009 Transport and release of chemicals from plastics to the environment and wildlife. *Phil. Trans. R. Soc. B* **364**, 2027–2045 (doi:10.1098/rstb.2008.0284) [PMC free article].
- Thevenon F, Carroll C, & Sousa, J. 2014. Plastic debris in the ocean: the characterization of marine plastics and their environmental impacts, situation analysis report. Gland, Switzerland: IUCN, 52.
- Thompson R. C., Swan S. H., Moore C. J., vom Saal F. S. 2009. Our plastic age. *Phil. Trans. R. Soc. B* **364**, 1973–1976 (doi:10.1098/rstb.2009.0054) [PMC free article] [PubMed] [Google Scholar].

Thompson R. C., Moore C. J., vom Saal F. S., Swan S. H. 2009 Plastics, the environment, and human health: current consensus and future trends. *Phil. Trans. R. Soc. B* **364**, 2153–2166 (doi:10.1098/rstb.2009.0053) [PMC free article] [PubMed] [Google Scholar].

United Nations Environment Programme. 2017. Marine litter: Socioeconomic study. UN Environment, Nairobi, Kenya.

## Appendices

### Appendix A. Brands inventory blog post write up

#### Hidden Meanings: What brand names reveal about marine debris along our southern shorelines

For this inventory survey, Hawai‘i Wildlife Fund (HWF) has collected the brand or product name, material, item type, and origin of waste that has washed ashore on Hawai‘i Island beaches since 2013. This study was conducted to better understand which manufacturers were the top producers of plastic products polluting our shores and better hold them responsible. We as consumers have shouldered much of the blame for plastic pollution, and have been convinced that we need to be the ones to dispose of plastic waste in a sustainable way. However, in reality, beaches across Hawai‘i will continue to be polluted unless the plastic “tap” is turned off. The behavioral change needs to come from the manufacturers themselves, and not just the consumers.

Hawai‘i Wildlife Fund has hosted cleanups at numerous different sites across the island. However, most of the marine debris is recovered in the district of Ka‘ū, on the southeastern windward-facing shores of the island. Over 95% of the first 300 tons of trash that HWF has removed from the island came from the district of Ka‘ū. This is due to a large system of rotating ocean currents, known as gyres, which cause smaller eddies and garbage patches to form off the Ka‘ū coast and get pushed onto its beaches with strong onshore winds. After eight years of data collection, it was no surprise that plastic made up a staggering 89% of all material collected for this brand inventory survey that included 544 items in total. Some of the survey areas are also popular campsites and fishing spots, resulting in some locally-sourced trash in addition to that washing in from afar via currents. During beach cleanups, team members find a wide array of marine debris, sourced from all over the world. The most common types of debris found for this study were bottle caps, containers, bottles, and lids. In total, we identified products from over 283 different manufacturers, including many brands written in, and others with only partial characters that we were unable to identify. Out of the 283 brands recorded, Euro-cap (37), Nestlé (30), Crocs (22), Coca-Cola (10), and Colgate (8) were among the five most prevalent brands in this study. Until recently, Nestlé was the most common brand name observed, however, within a short period of time, Euro-cap products became wildly abundant. The sudden increase in this specific form of debris led us to believe there may have been a container spill, which is not uncommon in the shipping industry.

Additionally, out of the 36 countries identified with this survey, most marine debris recovered had multinational origins or was coming from the USA. We estimated that 11% of debris collected was locally sourced, while 89% was non-locally sourced. Each item’s origin was determined by considering several factors including the item type, condition, brand name, and location. For example, if a metal bottle cap in good condition was found near a campfire we confidently assumed that it came from a shoreline user. If a plastic container was found in the

swash line with foreign characters and evidence of biofouling we assumed that it was non-locally sourced.

It is troubling to realize that no number of beach cleanups are going to stop the issue of marine debris in Hawai'i. Marine debris from around the world will continue to litter our beaches unless a real change is made by manufacturers. Hopefully, by conducting this survey we can show policymakers how important it is to force plastic manufacturing companies to change their designs and behavior, and by internalizing the cost of the plastic pollution that they are creating. This could take the form of implementing extended producer responsibility (EPR) programs that could potentially inspire significant global changes to waste management. While it is crucial that we as consumers make choices to reduce our personal waste, manufacturers need to be held accountable for their unsustainable plastic production practices, and surveys such as the one conducted by HWF are the first step in identifying where the action is needed the most.

Published on Nov. 3rd, 2021 at

<https://www.wildhawaii.org/hidden-meanings-what-brand-names-reveal-about-marine-debris-along-our-southern-shorelines/>

## Appendix B. Brands inventory survey visuals

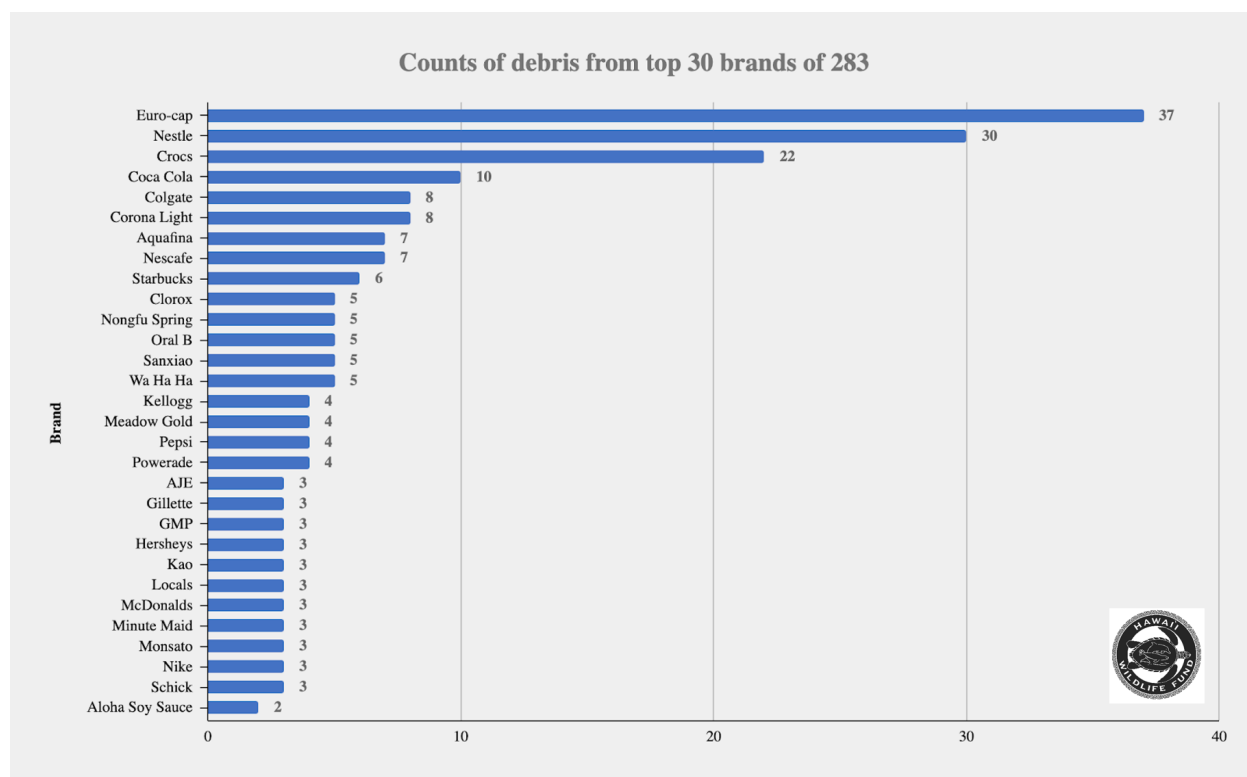


Figure 1. Counts of debris from the top 30 brands of 283.



Counts of debris by item type

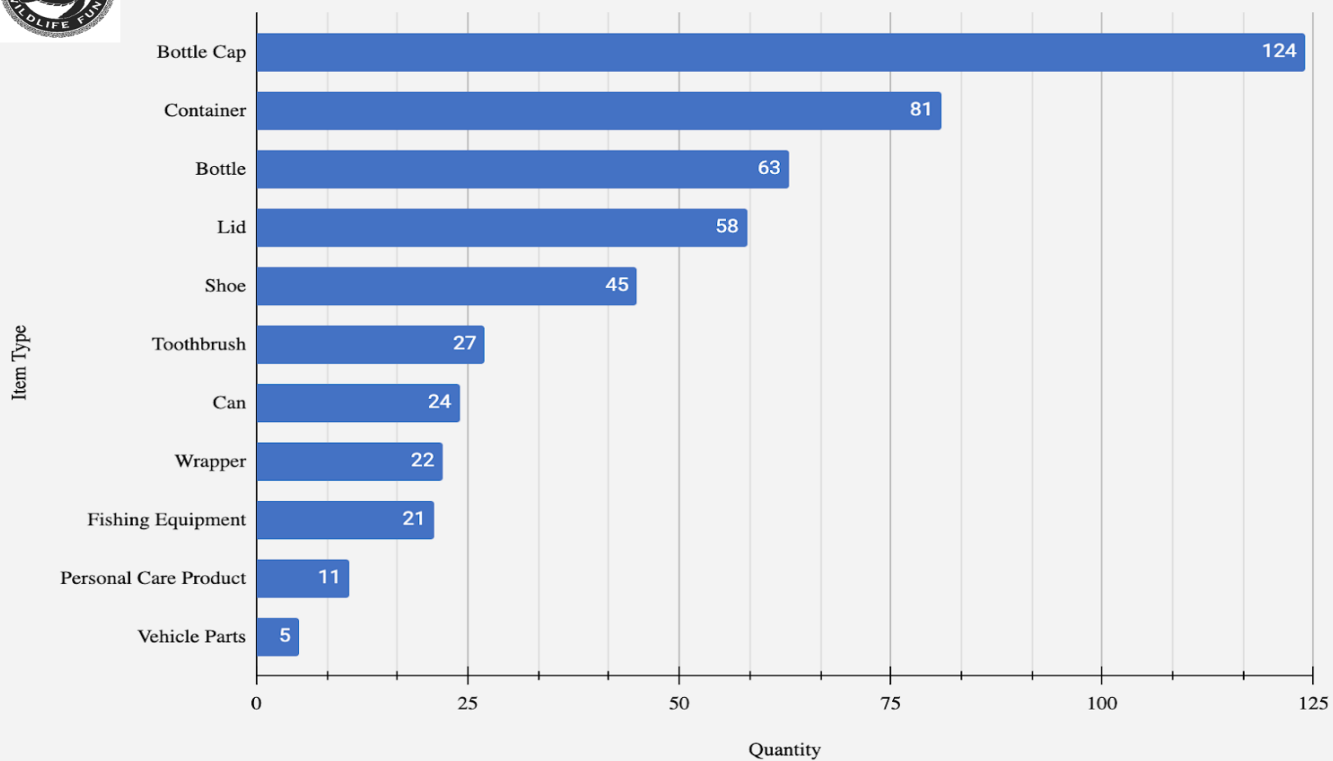


Figure 2. Counts of debris by item type.

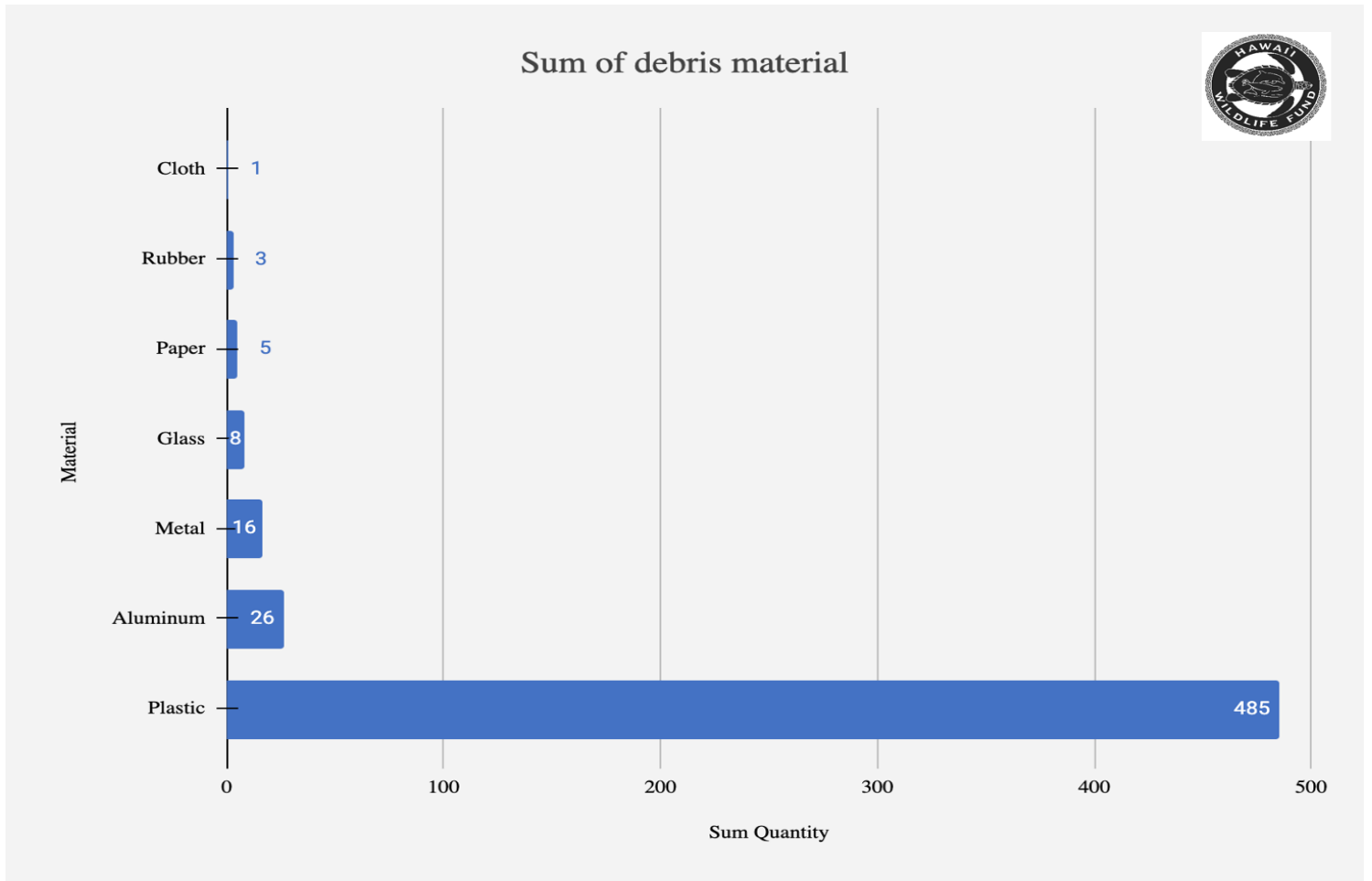


Figure 3. Sum of debris material.



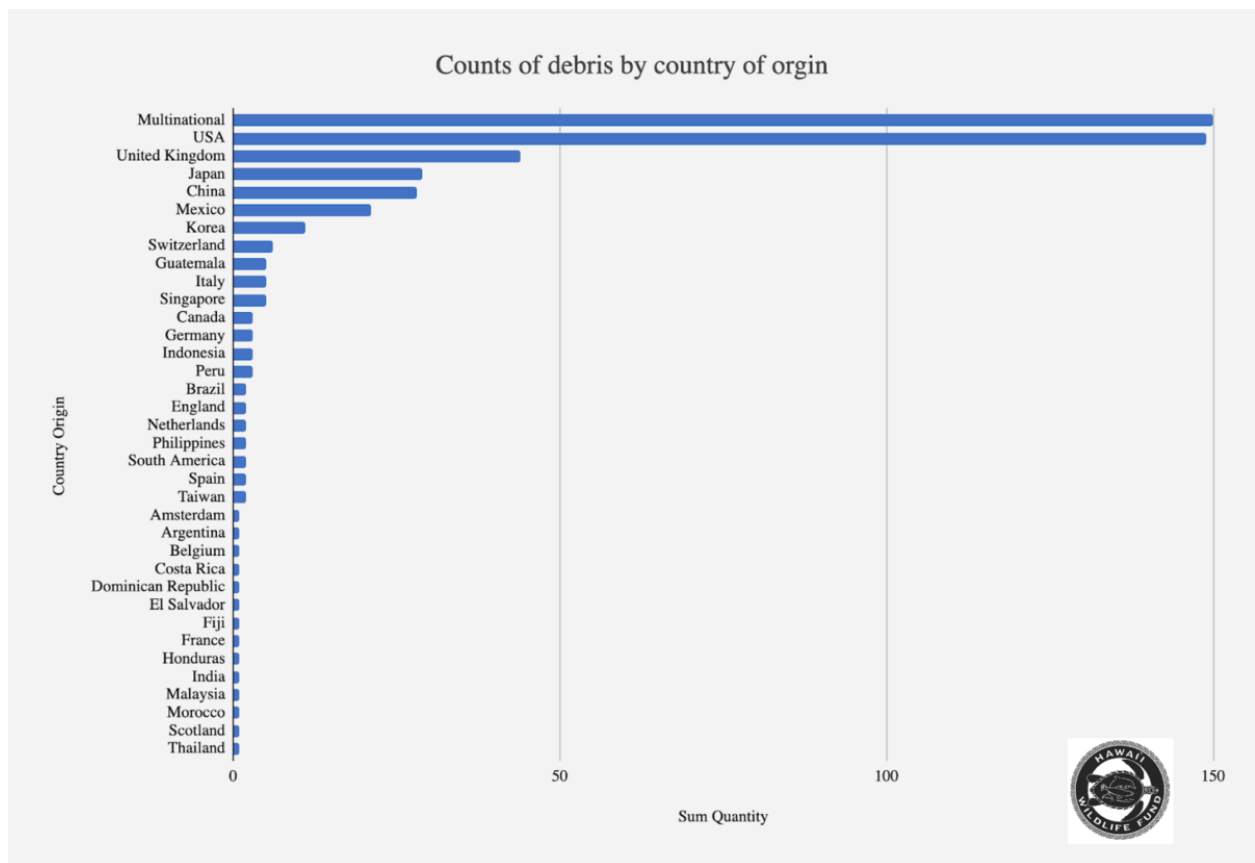


Figure 4. Counts of debris by country of origin.

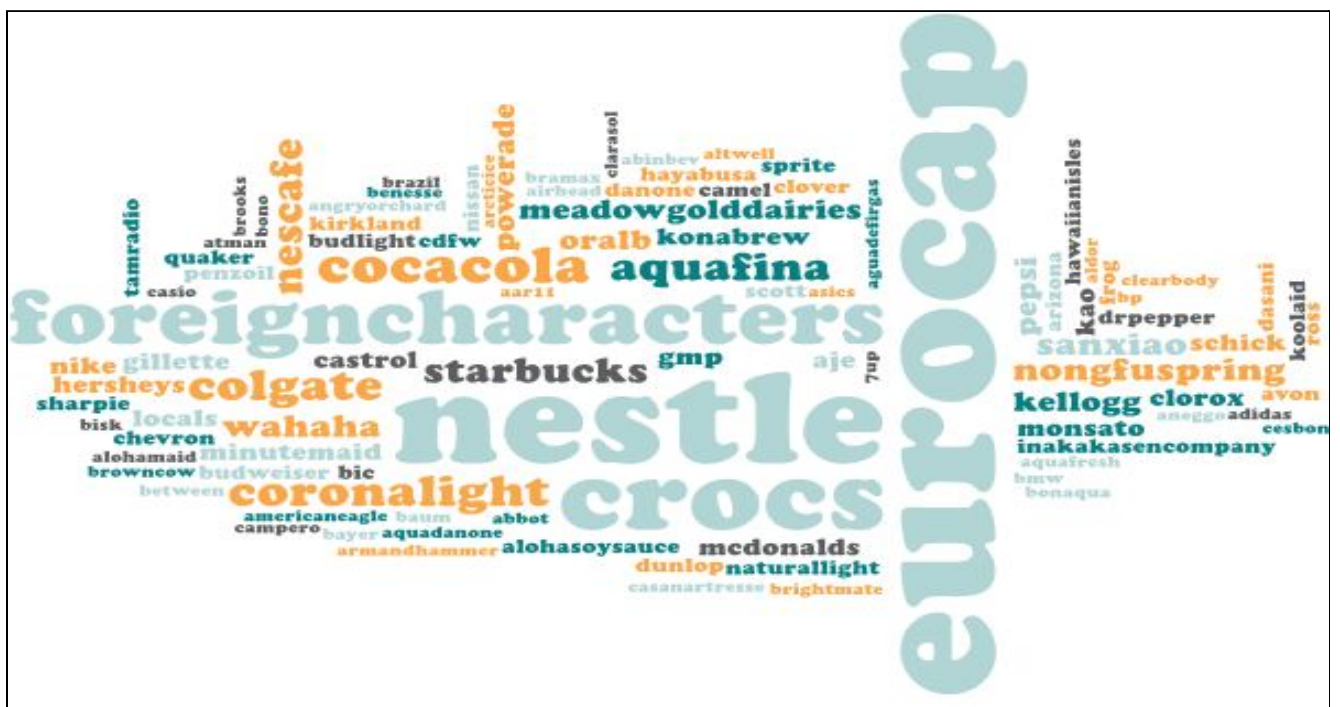


Figure 5. Word art of most relevant brands in the survey study.

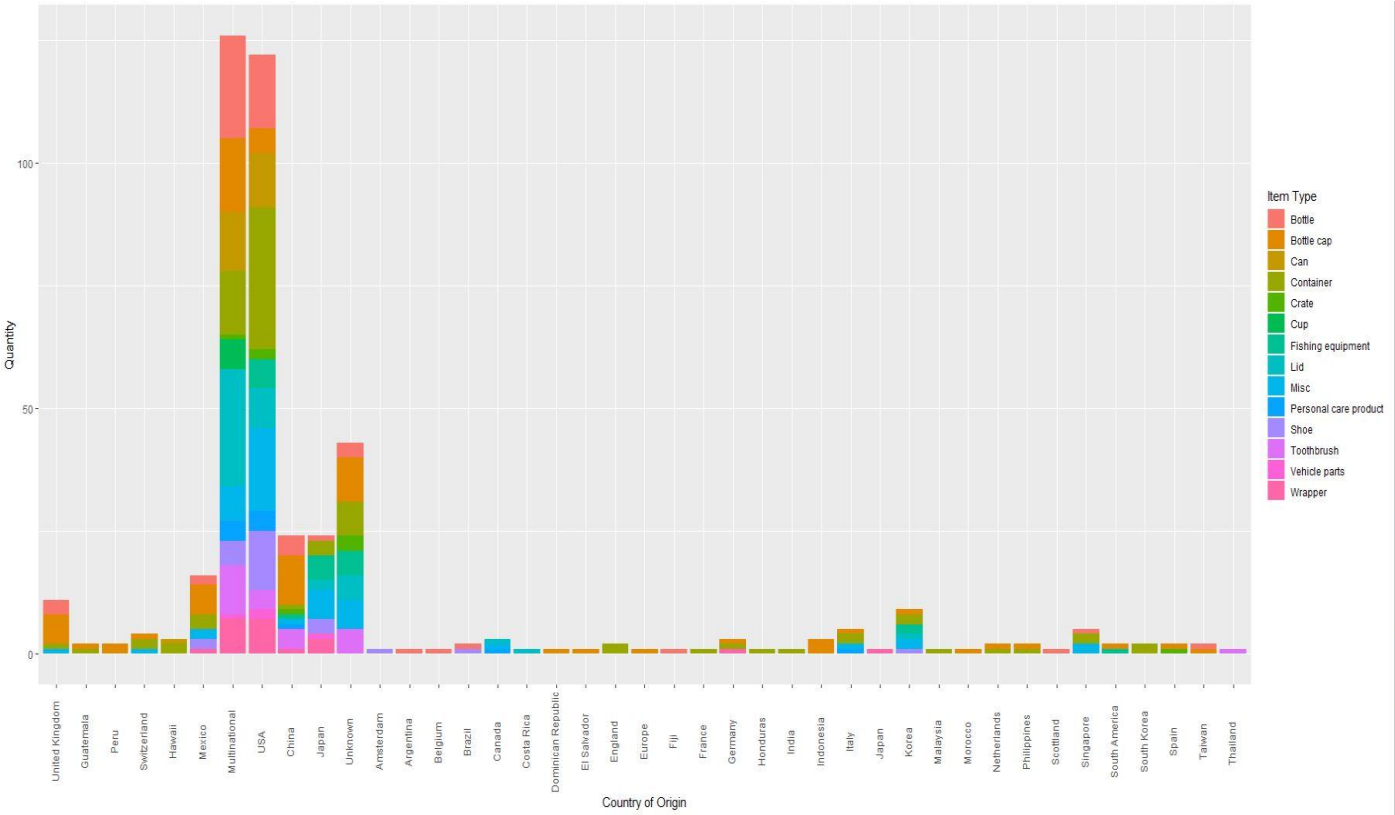


Figure 6. Which countries were producing certain plastic item type materials.

## Appendix C. NOAA MDMAP- HWF Inventory Survey

Written by Mike Stone / HWF Intern and UHH TCBES Graduate Student

Hawai'i Wildlife Fund (HWF) has collected the brand name, material, item type, and origin of marine debris items that have washed ashore on beaches in Ka'u, Hawai'i since 2013. This study was conducted to better understand which manufacturers were the top producers of plastic products polluting our shores and better hold them responsible. After several years of collection, it was no surprise that plastic took up a staggering 89% of all material collected for this survey (N = 544). Out of the 283 brands that were recorded, Euro-Cap (37), Nestlé (30), Crocs (22), Coca-Cola (10), and Colgate (8) were among the five most prevalent brands in this study. By conducting this survey we hope to show policymakers the importance of plastic manufacturing companies changing their behavior related to the pollution they create. More info avail on the HWF website blog.

## Appendix D. Submitting testimony

14 April 2020

TO: Maui County Council Chair Alice Lee  
Vice-Chair Keani Rawlins Fernandez  
Maui County Council Members

SUBJECT: Bill 52 related to the sale and the use of plastic disposable food ware

Aloha Maui County Council Members,

My name is Michael D. Stone, I am a graduate student in the Tropical Conservation Biology and Environmental Science Program at the University of Hawai'i at Hilo studying the global impacts of plastic pollution.

First, I would like to thank you all for this opportunity for my voice to be heard. I hope by doing so I can help the cause and get more colleagues and students familiar with the process of exercising our voice within the community. I am in **strong support of Bill 52** related to the sale and the use of plastic disposable food ware.

In the field of conservation biology, there is a common theme of hopelessness. I have learned dozens of issues regarding the current health of our planet, including record amounts of CO<sub>2</sub> in our atmosphere, high extinction rates, and extreme weather conditions happening all over the world. I witnessed the droughts and wildfires wreak havoc to ecosystems in California,

observed the coral bleaching in Australia and Hawai‘i, and it's especially discouraging when it feels like there is nothing that can be done on an issue. Out of all the issues I have studied, I find humans' unsustainable “waste culture” leading to plastic pollution globally particularly worrisome. Furthermore, each year the amount of solid waste from humans entering the oceans increases. Just about everywhere scientists have looked from the Arctic and Antarctic to the deepest point of the ocean there have been traces of plastic pollution, traces of humans. Plastics are being consumed by everything from the smallest plankton to massive whales thus entering our food chain at multiple levels. Research shows that 90% of seabirds contain some type of trash in their guts. Not only is this continued cycle of consumption and disposal of this trash killing wildlife, but it is also altering their behaviors in troublesome ways.

I witnessed this issue in person during my beach cleanup activities with Hawai‘i Wildlife Fund on “Kamilo ” beach otherwise known as the trash beach here in Hawai‘i. We found trash from all over the world. After removing truckloads of waste from the beach I was told within a week or two it would all look the same. This made me want to act even more on the issue. However, if you think about the grand scheme of things; no matter how many beach cleanups are conducted it won't stop the real issue. That brings the question of **how might a stressed out, broke graduate student attack such a global issue as plastic pollution?**

Well, without a doubt, there is enough literature and evidence to convince anyone who reads that plastic pollution is extreme. To change the world, we must act locally and within our communities. The time to act is now, and I believe that the legislative process and prevention policy is the weapon of choice. No waste or recycling station in the world is equipped to deal with the ever-increasing volume of plastic pollution we are creating. Too much single-use packaging is being produced with no plan for what to do with it afterward.

Furthermore, we must act to **prevent** any further impact, versus **react** later which will be far more expensive, and perhaps too late. Recently, the US EPA instructed the Hawai‘i Department of Health that it must consider plastic a pollutant in their bi-annual assessment of “impaired” waters. The state must begin monitoring coastal waters for plastic pollution and come up with ways to prevent such an impact as this Bill proposes. I believe that passing Bill 52 will set a great example for the generation to come and will help combat such pollution. The people of Hawai‘i have always been progressive on the issues regarding the environment, and I hope we can continue to keep that legacy of protecting our land and oceans.

Mahalo for your time and consideration on an issue impacting all walks of life.

Michael D. Stone  
UH Hilo Masters Candidate

## Appendix E. Law paper regarding waste management systems in Hawai‘i

### The Good, the Bad, and the Ugly of Laws and Nature

Laws govern our everyday lives. We are surrounded by rules and regulations, all of which seem normal to us. Some of these laws we can all collectively agree on benefit both society and the integrity of the common good, while others seem to be the product of biased agendas and are passed regardless of the general public’s opinion. Until recent years, I have lived my life in a sort of ignorant bliss of the laws and rules around me. I grew up believing these laws and regulations have always been flawless and efficient, assuming our traffic, criminal justice, waste management, and legislative systems were made to their absolute potential. However, after increasing my knowledge and experience in this field, it has become clear that the above-mentioned systems are ever so detailed, complex, everchanging, flawed, and not always equitable. Sometimes a law created with good intentions ends up causing more negative consequences than before the law was implemented, and receives heavy backlash, resulting in a loss of trust in lawmakers. Experts in the field suggest laws are more likely to accomplish their mission by earning the goodwill of citizens than by winning victories in court (Sagoff 1997).

When it comes to the process of making laws and regulations several different factors outside of ‘legal studies’ are considered, including religion, culture, politics, attitudes, and self-interests (Brigham 2009). As average citizens, we do not always see all these things factored in, so seeing jurisdiction in action can give us more faith in the process. There is nothing on this earth that has not been impacted by humans. We must recognize the severity of our impact on this planet to make laws and regulations that we can all collectively agree on to sustain the integrity of our planet. To get a better grasp of the local laws and statutes associated with my area of interest, waste management systems, I had a long and informative talk with a librarian named Mark from the Hawai‘i State Law Library System. We had a great discussion about the issues associated with our waste management system and like me, he was also displeased with what he saw. He gave me several wonderful resources including MARPOL Annex V, 342G Hawai‘i revised statutes dealing with abandoned or derelict vehicles, HRS 142 animals dumping permit, and the County of Hawai‘i Department of Environmental Rules of Practice and Procedures documents.

Even after laws get passed that does not mean that they will be enforced properly, or even make the intended difference in the area in which they are implemented. An example of this is the enforcement of Section 9 of the Endangered Species Act. According to Section 9, the government need not compensate landowners when they are subjected to species protecting restrictions that deprive them of all economic use of their land. This leads to worry among landowners that the Fish and Wildlife Service will bankrupt American farmers, loggers, and ranchers. The phrase “shoot, shovel, and shut up” (Sagoff 1997), referring to the practice of landowners killing an endangered species found on their land rather than dealing with the potential threat of shutting down production on their land, has become common. Some experts argue that section 9 of The Endangered Species Act might trigger the takings clause of the Fifth Amendment which states if the government takes or restricts one person’s property rights for any reason other than to protect the rights of others it must pay for compensation of these takings. The act does not imply any compensation to the owner of the land, and is considered by some to be of questionable legality, so why would landowners abide by these regulations and report endangered species if it may result in massive property value loss? It is much easier to risk the

penalty and quietly remove the ‘problem’ species. This shows that habitat conservation plans will not succeed on private property without the support of the public. They must focus more on creating an honest and fair dialogue with citizens rather than forcefully applying regulations via the court system which do not always promote ecological understanding or even create feelings of injustice (Sagoff 1997).

Another example of waste management regulation that is poorly enforced is the issue of garbage being dumped at sea. Homeport (a part of the US Department of Homeland Security) and the United States Coast Guard held an International Convention for the Prevention of Pollution by Ships and agreed upon a set of rules and regulations called the Marpol Annex V. Annex V refers to the ship-generated trash and its goal is to prevent ships from dumping both plastics and other persistent wastes into our oceans. In this case, Annex V defines “garbage” as a broad term that applies to most kinds of waste generated during normal ship operations (MPPRCA). To enforce proper waste disposal, Annex V requires terminals to provide reception facilities at ports and to receive plastics and other garbage from visiting vessels. Additionally, this annex features a ban on the dumping of plastics and synthetic materials in specifically designated coastal places and sets conditions for dumping other garbage farther out at sea. It is important to note that Annex V specifically states “Dunnage, lining and packing materials that float may be disposed of beyond 25 miles from the nearest land. Other garbage that will not float may be disposed of beyond 12 miles of land, except that garbage which can pass through a 25mm mesh screen (approximately 1 square inch), may be disposed of beyond 3 miles” (MPPRCA).

APPENDIX A TO §§ 151.51 THROUGH 151.77 — SUMMARY OF GARBAGE DISCHARGE RESTRICTIONS			
Garbage Type	All Vessels Except Fixed or Floating Platforms and Associated Vessels		Fixed or Floating Platforms & Assoc. Vessels <sup>3</sup>
	Outside special areas (33 151.73)	In special areas <sup>2</sup> (33 CFR 151.71)	(33 CFR 151.73)
Plastics—includes synthetic ropes and fishing nets and plastic bags.	Disposal prohibited (33 CFR 151.67).	Disposal prohibited (33 CFR 151.67).	Disposal prohibited (33 CFR 151.67).
Dunnage, lining and packing materials that float.	Disposal prohibited less than 25 miles from nearest land and in the navigable waters of the U.S.	Disposal prohibited (33 CFR 151.71).	Disposal prohibited.
Paper, rags, glass, metal bottles, crockery and similar refuse.	Disposal prohibited less than 12 miles from nearest land and in the navigable waters of the U.S.	Disposal prohibited (33 CFR 151.71).	Disposal prohibited.
Paper, rags, glass, etc. comminuted or ground. <sup>1</sup>	Disposal prohibited less than 3 miles from nearest land and in the navigable waters of the U.S.	Disposal prohibited (33 CFR 151.71).	Disposal prohibited.
Victual waste not comminuted or ground.	Disposal prohibited less than 12 miles from nearest land and in the navigable waters of the U.S.	Disposal prohibited less than 12 miles from nearest land.	Disposal prohibited
Victual waste comminuted or ground. <sup>1</sup>	Disposal prohibited less than 3 miles from nearest land and in the navigable waters of the U.S.	Disposal prohibited less than 12 miles from nearest land.	Disposal prohibited less than 12 miles from nearest land and in the navigable waters of the U.S.
Mixed garbage types.	See Note 4.	See Note 4.	See Note 4.

These requirements demand sufficient waste reception facilities at all U.S. ports and manned ships of certain sizes to display pollution prevention placards. Further, it necessitates certain ships to develop a waste management plan and that ships maintain waste disposal records. This applies to all recreational, fishing, uninspected, and inspected vessels, and foreign flag vessels on the navigable waters and all other waters subject to the jurisdiction of the United States, out to and including the Exclusive Economic Zone of 200 miles (MPPRCA and 33 CFR 151.51).

However, these strict and rigorous guidelines and regulations introduced by the Marpol Annex V did not stop the issue of illegal dumping of garbage off ships. The Princess Cruise Ship, which is a sub-company of Carnival Cruise Lines, has repeatedly received fines due to illegally dumping waste out in the open ocean. Furthermore, we are only aware of the times that they were caught illegally dumping. When they were caught the penalty fee cost less than the cost of properly disposing of the waste. Why, then, would these major cruise lines change their ways if they are saving money by breaking the law? Carnival has had a long history of dumping plastic trash and oily discharge from its ships, with violations dating back to 1993 (Kennedy et al. 2019). Environmental groups were angered because they had repeatedly seen the companies get fined with penalties “that cannot even be characterized as a slap on the wrist.” (Kennedy et

al. 2019). The company did a superb job covering its tracks until 2013 when an engineer on the cruise line revealed the illegal dumping of contaminated soil and waste from the ship (Kennedy et al. 2019). The Princess was bypassing the ship's water treatment system and dumping waste straight into the ocean. In 2016, government officials required several of the cruise lines to submit to court-supervised monitoring which is how the entirety of their violations was revealed. It took a \$20 million fine and threats to block carnival cruise ships from docking at any U.S. ports for them to make significant attempts to obey the environmental laws (Kennedy et al. 2019). But even then, \$20 million is still considered less than a slap on the wrist to the company's \$24 billion net worth.

“Law in the landscape is much less rigid than law in the library” (Brigham 2009). I find this quote rings true in Hawai‘i, where several environmental protection laws are implemented but no one is enforcing them. An extensive local issue here on the island, which I am sure most residents have encountered, is the struggling waste system. From careless disposal of vehicles to tires to dead animals, our waste management system has been struggling for some time now to control illegal dumping, and the County’s regulations to reduce the stress on the recycling and waste systems have only made the issue worse. Hawai‘i County transfer stations used to accept dead animals, animal parts, or similar organic wastes until late 2006. Now if you want to dispose of any of the above-mentioned organic wastes there is only one place on the entire island to dispose of it, the West Hawai‘i Sanitary Landfill by appointment only. With recently rolled back hours and a fee that can be anywhere up to \$240 depending on the weight being disposed of, this system does not encourage adherence to disposal regulations. An honest coffee farmer in South Kona who had a wild pig run in front of his truck and die. I have two choices. First, call and make an appointment to drop off the dead bloody pig 2 hours and 45 mins away and pay a fee on top of the time and gas money it would take to make the round trip. Or simply dump the pig on a remote road and risk getting caught and paying a fine. Incentives and lack of enforcement combine to make compliance with dumping laws almost nonexistent.

You can find abandoned tires and vehicles just about anywhere you look here in Hawai‘i. The Department of Hawaiian Home Lands and Hawai‘i County just recently discovered and removed close to 400 abandoned vehicles and approximately 700 tires from agricultural homestead lots in Makuu (Salmon 2020). I imagine there are more derelict cars around the island not accounted for. Abandoned automobiles and parts not only take away from the natural and wonderful beauty of Hawai‘i but also may contain toxic substances such as coolants, fuels, metals, and oils that leach into the ecosystem. When rainfall events occur, these substances are then flushed into our waterways. Mercury is particularly dangerous, even in very small quantities, because when it is released to the atmosphere and returns to earth as rainfall it endangers aquatic life and public health. Automotive tires can also become breeding grounds for mosquitoes that transmit various diseases. The State of Hawai‘i and the County of Hawai‘i both passed legislation mandating the proper disposal and management of waste tires. However, very little improvement has been seen since the passing of this law. To mitigate this issue in the state of Hawai‘i the price of tires includes a non-refundable fee that retailers use to pay for recycling or disposing of the old tires. This allows you to leave your old tire with the retailer that sold it to you at no cost because you already paid the fee upon the original purchase. According to Hawai‘i Revised Statutes (§342I-22), the disposal of whole tires at any landfill and all island-wide transfer stations is prohibited. Therefore, to dispose of old tires properly when you are not purchasing new ones you must take them to one of five companies on the island for a fee of \$7.50-\$25 (depending on the size of the tire and whether it has a rim attached). These companies



will either recycle the tires or legally dispose of them by baling or compressing them down and shipping them to Korea. After doing more research on the subject I found out that only two of these five locations have permits to legally dispose of tires. There are only three facilities on the entire island where you can properly dispose of a vehicle, two in Kea'au and one in Kona, and of course, there is a fee. These fees may be worth paying, as the consequence for getting caught illegally dumping anything in Hawai'i is substantial, including civil penalties of up to \$10,000/day for each offense (§342H-9, HRS) and a class C felony offense for knowingly disposing of solid waste without the written approval of the Director of the Department of Health (§342H-37, HRS). Unfortunately, I find it difficult to believe much energy is being dedicated to catching illegal dumping. While the County has several resources for the average citizen to report illegal dumping, reports are rare.

Additionally, in some cases, laws are passed that make doing the right thing even more difficult. I intern for a nonprofit called Hawai'i Wildlife Fund whose mission is to protect native wildlife, focusing on coastal and marine species in the Hawaiian Islands. Unfortunately, the Hawaiian archipelago is close to the North Pacific subtropical convergence zone and during certain seasons and storm events windward facing beaches become hot spots for marine debris. To protect our endangered native wildlife we conduct beach cleanups in these hot spots which consist of us hauling away garbage coming from essentially all over the planet. Unfortunately, depending on the site, for the Hawai'i Wildlife Fund to conduct beach cleanups we must first jump through several hoops. First, we must receive Hawai'i Department of Land and Natural Resources (DLNR) permits for both of our work vehicles and purchase liability vehicle insurance, which runs to be almost a million dollars for both vehicles. Then we must receive a State of Hawai'i Department of Hawaiian Homeland (DHHL) permit, and there must be a 30-day break between permits, i.e., no consecutive months (the reasons for which are unclear). After that, we need to send a request to the County of Hawai'i Department of Environmental Management for a waiver of tipping fees. Not to mention, the DLNR Department of Forestry and Wildlife (DOFAW) researches and collects permits. All of which seems excessive to charge a dumping fee for nonprofits spending the weekends picking up trash that is not even locally sourced. At this point, it would be more cost and time-efficient to just pick up trash alone without the rules and regulations associated with being a nonprofit. All these hoops serve to make it appear these government groups do not want trash to be removed from critical habitats.

During my last beach clean with Hawai'i Wildlife Fund at Kamilo Point, otherwise known as the "trash beach" or "plastic beach", I was able to interview a fellow volunteer to get his view on all the waste management issues, rules, regulations, and outcomes. For the sake of keeping his identity anonymous, I will refer to him by the pseudonym Andy. Andy moved to the island of Hawai'i over twenty years ago and has been a volunteer with the Hawai'i Wildlife Fund ever since. I asked him about the rules and regulations of the nearest transfer station and he expressed just the sheer amount of trash being illegally dumped along the road on which he resides. "Dumps are closing around the island and limiting their hours. I remember when the transfer station stopped taking pig carcasses, it was in late 2006 early 2007, and immediately after I noticed illegal dumping of remains off the bridges here on the island. People are going to dump whatever they want wherever they want whenever they want. If the transfer station isn't open or refuses to take certain items it makes it an easy decision for them to dump all their [trash] at once, usually off a bridge." When I told Andy that the landfill in Hilo does accept dead animals, animal parts, or similar organic wastes he was surprised. "See, the County does not inform us on these issues and they sure as well don't keep the workers informed at the transfer

station. I've seen people arguing with the dump workers when they had no clue what was going on as well." Andy was more familiar with the permits and fees associated with these beach cleanups and when asked about them he replied "An abomination! The county actively works against us, making it more difficult to clean up this trash from the ocean. It's a job program to keep them employed. All this paperwork and extra steps are just to keep someone employed and to have something to do." Andy also has some other descriptive adjectives in regards to county regulations that I will have to refrain from using in this paper.

From the public point of view, it is easy to shift blame to the County. The island of Hawai'i has rolled back the recyclable items that it will now accept at our local transfer stations. As of October 16, 2019, paper and plastic materials are no longer accepted. According to [www.Hawai'i ZeroWaste.org](http://www.Hawai'i ZeroWaste.org), "Due to significant decreases in the global market for recyclables the County of Hawai'i will no longer accept some of the types of materials collected in the Two-Bin Recycling Program at the Recycling & Transfer Stations. However, the County will continue its ongoing efforts to evaluate potential alternatives to remain environmentally and economically responsible". The only material currently being collected is clean corrugated cardboard, brown paper bags, and non-HI-5 glass containers. The Volcano transfer station will only accept clean corrugated cardboard and brown paper bags. Kalapana, Miloli'i, Ocean View, and Pa'auilo transfer stations will not accept any two-bin recycling materials at all. Not to mention that if any of these above recyclables are not deemed clean they will not be accepted. It is 2021 and our island has no plan or intentions for attempting to recycle plastic materials. For plastics (all types and forms, including plastic bags) and expanded polystyrene (foam #6 resin code plastic, a.k.a. styrofoam) the website simply states, "No current recycling options. Please dispose of your regular rubbish". I found this personally surprising because the state of Hawai'i prides itself on its recognition and appreciation of the land we call home. Hawai'i strives as a county to be stewards of the land while being environmentally conscious, like the ancestors who lived here before us, yet it is coming up on two years since plastics stopped being recycled and Hawai'i as a state has acted minimally on the issue in response to the negative backlash.

There were a lot of questions I had about our local waste management system so I decided to interview a friend I met through Zero Waste Hawai'i Island who is a recycling specialist from the County of Hawai'i Department of Environmental Management. For the sake of keeping her identity anonymous, I will refer to her by the pseudonym Sandy. According to Sandy, "Transfer stations are set up for residential waste, not commercial. The landfill in Hilo is closed and has been full for years. The landfill was so high it was on the same eye level as the air traffic control towers. Birds are attracted to landfills not making an ideal situation being so close to the airport. This led to the FAA not allowing for any more waste to be entered into the landfill". All the waste on the island eventually makes its way to the landfill on the Kona side. I asked her how she thinks we can improve compliance with the many waste management laws and regulations that have been passed. When I asked her about why Hawai'i stopped accepting recyclables she said this "The global market for recyclables shut down which is a reason why Hawai'i stopped accepting some recyclables in October 2019". Previously it was all shipped to China. Unfortunately, China was unhappy with the United States' careless dumping, mixing of recyclable materials and had recycling problems of its own to deal with. Sandy states, "Here in Hawai'i, we don't have the capacity here on the island to set up recyclable programs. We're such a small market in the middle of the ocean. People can barely pay rent, let alone follow proper recycling techniques. People generally want to do the right thing but it has to be easy and convenient. It is not about if the material is recyclable, it's about what you can recycle where you

live. The biggest frustration of my job is people improperly dumping their materials. In this day and age, especially during covid, with the old administration, and several other factors people feel hopeless. They want to do something and their 'wish cycling' makes them feel better. Recycling isn't going to save the world. People get mad at me because they want to recycle, however, recycling is more complex than people think. The front end of recycling is as easy as simply just putting it in the bin. Once it's in the bin it's now considered a commodity. It was then cleaned, weighed, sealed, and tagged for shipping to Taiwan. Since the County doesn't pay for collecting they pay for recycling they make sure it's profitable recyclables and have to ensure the operation and quality control."

According to Sandy "When it comes to recycling it's considered the 'stepchild' to health and safety, especially during this time of covid. Funding recycling is much more complex than just landfilling. When money is tight it's easy to put the County on the butcher's block. Even though your elected officials are the ones cutting the budget, the County takes all the blame. The Recycling Section (Diversion) does not have the budget that we get to work with throughout the year. Solid Waste Division does, we are given X amount of dollars from Solid Waste to budget and work with, however it can be cut at any time based on the whim of Solid Waste and their needs. This goes back to the priority – and rightly so – set on managing 'putrescibles' (from the word 'putrid' it means likely to become putrid) and the requirement on solid waste operations to properly dispose of that. I would love it if our DEM was structured like Maui County: their Dept of Environmental Management is made up of three Divisions instead of two (we have Waste Water and Solid Waste) They have Waste Water, Solid Waste, and Environmental Protection & Sustainability, Division." The County is underfunded and taking on a considerable responsibility on this island. After hearing Sandy's take on the issue I now better understand the reality of the issues we are facing on this island.

As humans, we tend to overlook the harm and damage to the environment due to our self-interest (Stone 2010). Our greed leads us to prioritize self profit over the cost to the environment. The illegal dumping of vehicles, tires, garbage in the ocean, and our struggling waste management system all are dealing with convenience and saving a dollar here and there. Humans have only been on this earth for a fraction of a percent of the span that the earth has been around during that time we have exploited natural resources beyond belief. We must be wary of the "tipping point" (Stone 2010). We are depleting our energy and natural resources at a rate that takes little account of the needs of even the humans now living, not to mention the humans of the future (Stone 2010). The biggest issue we are facing is how to sustain our planet's resources with an ever-increasing population. In the field of ecology, we learn that everything is connected, however, the politics of ecology recognizes that some connections are more important than others (Purdy 2015). There's no place or living thing that we have not changed. If we want a self-sustaining world, both social and natural, we must build and preserve it. National self-interest breeds weak responses and failure to promote cooperation between countries, but cooperation is exactly what is needed to combat our exploitative culture (Purdy 2015).

Laws are not fool-proof, but certain laws have more impact and compliance than others. In regards to waste management in Hawai'i, I have heard the county's points of view, the residents' point of view, and investigated the laws on the subject. This issue is complex and interwoven with other governmental/societal/ecological issues. No matter how high the penalty is, it is almost impossible to completely control the actions of people through law. Human trafficking, poaching, illegal smuggling of drugs, murder, and so many more terrible crimes will always be happening no matter how severe the legal penalty is. In the case of the Marpol Annex

V, the fines were not severe enough to stop profitable cruise ships from dumping garbage into the ocean, for the Endangered Species Act, failure to compensate those who abide by it led to hostility toward endangered species, with the attempts to control illegal dumping of tires and dead animals lack of convenient disposal options and fees encouraged abandonment. If we are to see positive change in Hawai'i's waste management, we need meaningful, enforceable, understandable, well-thought-out laws, but establishing such laws is no easy feat.

### Literature Cited

A Politics for the Anthropocene by Jedidiah Purdy (Cambridge, MA: Harvard University Press, 2015) (pp. 1-50; 188-255)

"Environmental Law in the Anthropocene" (Ch. 7) from *After Nature: A Politics for the Anthropocene* by Jedidiah Purdy (Cambridge, MA: Harvard University Press, 2015) (pp. 1-50; 188-255)

"HOMEPORT US DEPARTMENT OF HOMELAND SECURITY UNITED STATES COAST GUARD MARPOL Annex V." *MARPOL Annex V*, 19 Oct. 2017, [homeport.uscg.mil/Lists/Content/DispForm.aspx?ID=896&Source=%2FLists%2FContent%2FDispForm.aspx%3FID](http://homeport.uscg.mil/Lists/Content/DispForm.aspx?ID=896&Source=%2FLists%2FContent%2FDispForm.aspx%3FID).

Kennedy, Merrit, and Greg Allen. "Carnival Cruise Lines Hit With \$20 Million Penalty For Environmental Crimes." *NPR*, NPR, 4 June 2019, [www.npr.org/2019/06/04/729622653/carnival-cruise-lines-hit-with-20-million-penalty-for-environmental-crimes](http://www.npr.org/2019/06/04/729622653/carnival-cruise-lines-hit-with-20-million-penalty-for-environmental-crimes).

"Muddle or Muddle Through? Takings Jurisprudence Meets the Endangered Species Act" by Mark Sagoff (William and Mary Law Review 38 (1996-1997) (pp. 1-148)

"Property Rights and the Economy of Nature: Understanding *Lucas v. South Carolina Coastal Council*" by Joseph L. Sax in *The Legal Geographies Reader*, edited by Nicholas Blomley, David Delaney, and Richard T. Ford (Malden, MA: Blackwell, 2001) (pp. 221-236).

Salmons, Stephanie Hawai'i Tribune-Herald | Saturday, November 14. "Hundreds of Abandoned Vehicles Removed from Makuu: Hawai'i Tribune." Herald, 14 Nov. 2020, [www.Hawai'itribune-herald.com/2020/11/14/Hawai'i-news/hundreds-of-abandoned-vehicles-removed-from-makuu/](http://www.Hawai'itribune-herald.com/2020/11/14/Hawai'i-news/hundreds-of-abandoned-vehicles-removed-from-makuu/).

"Seeing Jurisdiction: Some Jurisprudential Issues Arising from Law Being "...All Over" by John Brigham (Law & Policy, Vol. 31, No. 4, 2009, pp. 381-404).

"Should Trees Have Standing": Law, Morality, and the Environment by Christopher Stone (Oxford University Press, 2010) (pp. 1-31).

"Solid Waste Division & Recycling Section." *County of Hawai'i Department of Environmental Management*, 23 Sept. 2020, [www.Hawai'izerowaste.org/recycle/](http://www.Hawai'izerowaste.org/recycle/)

U.S. Fish and Wildlife Service/Endangered Species Program. "Endangered Species Act: Section 9." *Official Web Page of the US Fish and Wildlife Service*, 24 Apr. 2021, [www.fws.gov/endangered/laws-policies/section-9.html](http://www.fws.gov/endangered/laws-policies/section-9.html)

## Appendix F. Monofilament recycling flyer




# MONOFILAMENT LINE CAN BE RECYCLED





Dispose of used monofilament by removing hooks, swivels, sinkers and bundling it before disposing in recycling bin. Please do NOT dispose cans, bottles, bait, or trash in the bin. It is sorted by volunteers from Ke Kai Ola who will send the line to Berkley Conservation to be recycled. If a bin is full or you want a bin in your area, please contact us

BigIslandMonofilamentRecycling@gmail.com

### Recycle monofilament line HERE at Keahole Point

look for the bin near the  
parking lot by Ho'ona



You are a part of a  
community who can  
prevent life threatening  
entanglements. Marine  
life in Hawai'i suffers  
when fishing equipment  
is littered. Using a  
barbless circle hook  
and collecting used  
monofilament for  
recycling helps the 'āina  
and oceans stay healthy.  
If you see an entangled  
marine animal call  
888-256-9840.



Proper disposal of monofilament can prevent entanglements. A Hawai'i monk seal pup suffered a life threatening entanglement around his neck in 2020. Ke Kai Ola staff were thankfully able to cut the line and he survives with only a scar.

**Before**



**After**





NOAA Permit #18786

Sp Adobe Spark



## Appendix G.

### **Blog post on the Life of an Environmental Scientist web page**

#### **Garbage talk #1 With Thee Garbage Patch Kid – Frightening truth behind recycling nobody wants to believe**

When it comes to dealing with the issue of plastic pollution, I have noticed a popular trend to highlight "solutions" such as recycling or "cleaning up" our mess. Despite the best intentions of such recycling campaigns and beach cleanups, avid recyclers are fighting a losing battle as they attempt to clean up the ever-increasing amount of plastic produced each year. An NPR study entitled, "How Big Oil Misled The Public Into Believing Plastic Would Be Recycled" revealed that if the U.S. government does not modify the current legislation, our annual plastic production values are on course to increase upwards of five-fold in the next ten years. Arguably, the worst part about this study is that society has been led to believe that sorting out plastics from garbage to recycle is doing the environment a favor, which may be among the most widespread and sinister lies of our lifetime. In reality, the idea that recycling plastic was a feasible solution was a fabrication from the start. Oil and gas companies who produce plastic have spent millions on campaign ads advocating recycling knowing full well that most plastic will never be recycled. These companies make far more money-making new "virgin plastics" than reusing or recycling old plastics, but recognize that producing plastic waste looks bad from a public-relations perspective. Recycling programs serve to make people believe they are doing their part to protect the environment and ease their guilt in purchasing plastic products so that they continue to consume plastic and make money for the plastics industry. As such, plastic waste issues can be blamed on those not 'doing their part' by recycling instead of pointing the finger at the manufacturers.

Recycling has become a part of our culture, but sadly it is not the solution we were promised. It was just a lie to make consumers believe that their waste could be safely disposed of so packaging manufacturers could continue to turn a profit. The bulk of the blame got shifted from the producers to the consumers and we believed it. Another study conducted by researchers showed that out of all the plastic ever produced, only 9% has been recycled (Mahdawi 2020). No waste management system in the world is equipped to deal with the sheer amount of plastics being produced. Which begs the question: Where does the other 91% go? Well, a majority of plastics either end up getting incinerated (releasing toxic chemicals into the atmosphere in the process), filling up our landfills, or scattered throughout terrestrial and marine environments (garbage patches), and even now our atmosphere ("space trash").

U.S.-based plastic companies recognized that recycling was not economically feasible on our own soil, resulting in the decision to ship a large majority of our plastics to China. Until three years ago, China was purchasing over 70% of the globe's plastic, but in late 2019 China decided it would no longer accept foreign plastics. While frantically searching for a new place to stash

our waste, the U.S. has been incinerating around 14% of plastic produced (Totterman 2020). Major plastic companies have now set their sights on Africa, and have been reportedly lobbying to send plastics there to be dealt with by someone else. I am disgusted by the indifference demonstrated here, which is clearly fueled by greed.

I want you all to ask yourself a question, “How do you imagine the issue of plastic pollution will play out? From start to end, how would you describe it?” The signs of plastic pollution are clear, but we are often too distracted to take notice of it. It is easy for people to grow apathetic about plastic waste when it is floating miles out to sea or is swept away to a developing country. Out of sight, out of mind. However, plastic pollution impacts are widespread, irreversible, and suffocating. Wildlife is the first to be hit, we find our plastic pollution in the trophic web of our ecosystems. Then we start to be affected ourselves, as plastic is indirectly consumed by humans through contamination of food and water. Less-developed nations that lack the means to deal with the sheer volume of plastic waste will be hit the hardest. The ones least impacted will be the powerful and wealthy, the same individuals who created the plastic, to begin with. The only way we get out of this situation is through immediate and meaningful policy that limits plastic production. We can do better!

### **Literature Cited**

Borrelle, S. B., Ringma, J., Law, K. L., Monnahan, C. C., Lebreton, L., Mcgovern, A., . . . Rochman, C. M. (2020). Predicted growth in plastic waste exceeds efforts to mitigate plastic pollution. *Science*, 369(6510), 1515-1518. doi:10.1126/science.aba3656

Cockburn, H. (2020, September 18). Global plastic waste is on course to increase six-fold by 2030. Retrieved September 19, 2020, from <https://www.independent.co.uk/environment/climate-change-plastic-pollution-global-waste-environment-b484442.html>

Mahdawi, A. (2020, September 15). Most plastic will never be recycled – and the manufacturers couldn’t care less | Arwa Mahdawi. Retrieved September 22, 2020, from <https://www.theguardian.com/commentisfree/2020/sep/15/most-plastic-will-never-be-recycled-and-the-manufacturers-couldnt-care-less>

Stark, K. (2020, September 01). Not This Year, Either: Landmark California Plastic Recycling Bill Fails Again. Retrieved September 26, 2020, from <https://www.kqed.org/science/1969101/landmark-plastic-recycling-bill-fails-in-california-for-second-year-in-a-row>

Sullivan, L. (2020, September 11). How Big Oil Misled The Public Into Believing Plastic Would Be Recycled. Retrieved September 20, 2020, from <https://www.npr.org/2020/09/11/897692090/how-big-oil-misled-the-public-into-believing-plastic-would-be-recycled>.

Totterman, A. (2020, September 18): The disturbing truth about plastic recycling. Retrieved September 20, 2020, from: <https://www.cnn.com/2020/09/18/opinions/the-disturbing-truth-about-plastic-recycling-totterman/index.html>

## Appendix H. Maui News Article On Fence Repair In Maui


**Wage increase**  
 \$15 an hour becoming norm  
 On Page A5


**Maui Invite**  
 2021 bracket released  
 On Page B1


**Moore wins gold**  
 Oahu surfer takes top spot in Tokyo  
 On Page B1

# The Maui News

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WEDNESDAY, July 28, 2021

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## Pulehu Solar project moves forward

Special use permit granted by planning commission

By MELISSA TANUI, Staff Writer

A 370-acre solar and battery project in Kula that could power 15,000 homes is closer to fruition after the Maui Planning Commission on Tuesday granted a county special use permit for the project.

The commission's approval by a 6-0 vote — with one member excused and two absent — pushes forward the Pulehu Solar project, which will sit on a portion of a 1,087-acre Haleakala Ranch parcel south of Pulehu Road.

The 40-megawatt alternating current utility-scale solar project with ground-mounted photovoltaic arrays and a 160-megawatt-hour battery energy storage system could be up and running by April 2023. Valued at \$102 million, the project will connect to existing 69-kilovolt power lines with the electricity going across the island, according to a presentation by Pulehu Solar.

The project was selected by Hawaiian Electric Co. in its competitive request for proposals for renewable energy.

"I think it's a great project," said commission Vice Chairwoman P. Denise La Costa, who made the motion to approve it.

After more than an hour of back-and-forth between Pulehu Solar, commissioners and county officials, Wren Wescott of Pulehu Solar said the company would go along with the more than 20 conditions set forth by the Planning Department and work out any issues later on.

One of those conditions involved revegetating the site with native plants after the project is decommissioned. Pulehu Solar wanted the condition to be revised or removed, noting that native plants could be eaten quickly by deer and pigs in the area and an effort would be made to choose plants that are not palatable to the animals.

Pulehu Solar also said in a letter to the Planning Department that plants used in revegetation would also depend on the landowner's intended use for the site.

Two other conditions Pulehu Solar had wanted to amend dealt with public access to culturally sensitive areas and identification of those sites. Pulehu Solar and two testifiers Tuesday said that cultural practitioners and lineal descendants of the area want to restrict public access to any culturally sensitive sites, which include petroglyphs, for their protection.

However, the approved conditions say that "regulated access for schoolchildren shall be given to the project site and cultural sites on the parcel so they can learn about solar projects, renewable energy and the cultural sites." Another condition also says that "regulated access shall be given to cultural sites on the parcel for cultural practices."

Wescott said a variety of changes were made to the project after getting community input, including moving



The Maui News / MATTHEW THAYER photo

Hawai'i Wildlife Fund Hawksbill Sea Turtle Recovery Project Coordinator Mandy Lloyd (left) and intern Mike Stone repair a section of turtle fencing Saturday morning at Kealia. The fencing made out of recycled plastics is designed to keep nesting turtles from getting hit by cars on North Kihei Road as they search for places to lay their eggs. An endangered hawksbill turtle full of eggs was once hit by a car and killed in the area. The fencing is frequently damaged, causing gaps that turtles can crawl through.

## Endangered turtles near road face risk of Kealia area traffic

Nonprofit urges community to protect special fence line

By KEHAULANI CERIZO, Staff Writer

Endangered honu'ea risk being struck and killed by Maalea vehicles if a shoreline turtle fence isn't protected from human damage, community groups say.

The approximately 1.5-mile stretch of special fencing on Kealia Coastal Strand isn't necessarily about keeping humans out — it's about keeping rare hawksbill turtles and their key habitat in, according to the leader of a local nonprofit.

"All of us understand that there's sensitivity, especially in Hawaii, but all over, with beaches being cut off — we don't want to cut off access to beaches," Hannah Bernard, Hawai'i Wildlife Fund executive director, said Tuesday. "We are not trying to stop foot access — we just don't want people to drive their cars down onto the beach and break the fence in order to do it."

Her nonprofit has worked with U.S. Fish & Wildlife Services, which constructed the

See TURTLES on Page A4

## CDC changes course on indoor masks

By MIKE STOBBE

Biden dismissed concerns that the new

Article avail at The Maui News .com. Published by The Maui News on July 28th, 2021.



## **Appendix I. Strategies For Conducting An Internship During Covid-19 Pandemic**

Due to the unpredictable nature of the novel virus COVID-19, Hawai‘i Wildlife Fund’s marine debris program postponed its scheduled activities and volunteer events from mid March through May 2020. In accordance with federal, state, and local regulations, proactive measures were taken to prevent the increased exposure and transmission of the COVID-19 virus. Businesses are required by the state to restrict the general public from attending any sort of large gathering, and size limits are enforced for indoor and outdoor activity.

While the full impacts of the Covid-19 virus are uncertain we must be proactive on the issue rather than reactive. Furthermore, I have proceeded to develop an action plan with steps to continue to proceed with the scheduled internship for the timely completion of the said internship. Since future regulations regarding combating COVID-19 are unknown I have based the list of the regulations that are currently being used by local and state administrations. It is crucial to consider the list of actions taken that are subject to change at any time regarding our current situation of the pandemic.

Conducting internship work amidst COVID-19 pandemic:

- Learn more about Hawai‘i’s waste and recycling systems on the island and see if there are any potential improvements that other parts of the nation are implementing.
- Access narratives from large plastic packaging industries and producing companies.
- Look into the future of plastic material or other alternative materials.
- Maintain communication with mentors through multiple platforms such as Facetime, Zoom, Google meet, phone calls, and emails
- Create information that can be used to inform the general public on effective ways to minimize their plastic use.
- Present to schools and clubs about findings during the internship.
- Create informational videos (post to YouTube and/or HWF website) about the most efficient strategies to impact marine debris.