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Environmental Health

Marine Debris on the Washington Coast

Executive Summary:

While industrialism thrives and continues to grow and prosper, the marine debris problem is in full force, affecting every part of the globe. Additional debris ranging from cigarette butts to fishing equipment to street signs enter open waters every day, due both to human's negligence and natural events. The Misawa Docks that travelled to U.S. territories across the Pacific taught us a lot about the universality of debris and pollution in the oceans all around the world. With the oceans riddled with garbage of all sizes, current marine debris relief efforts have been proven to be somewhat successful, but there continues to be a flow of pollutant being dumped into the oceans daily. Today's efforts to combat the marine debris problem has not solved the issue, yet it has taught scientists a lot and it hints at future steps to maximize the efficiency of relief efforts.

Introduction:

As the world continues to progress industrially there appears to be continuous occurrences of environmental change and degradation. Global warming, acid rain, the extinction of particular species are a few of the many examples of the environmental setbacks that are caused by industrial and technological "advancement." However, not all forms of environmental shifts are negative side-effects of man's actions. Oftentimes natural disasters (volcanoes, tsunamis, hurricanes, tornadoes etc.) can severely impact environmental and

ecological orders of a certain region. One growing environmental concern that has been effected both by human “progress” and natural events is the continuous accumulation of debris in open waters.

Marine debris is growing to become the most widespread form of pollution and should be seriously considered as a major global issue. There isn’t anywhere in the ocean that is untouched by debris and its impacts as increasing amounts of waste including plastic, metal, fishing gear and much more enter the marine environment each day (NOAA 2015). While it is nearly impossible to determine the total amount trash in the ocean, the most common materials are plastics, glass, metal, paper, cloth, rubber, and wood, and they exist in massive quantities (NOAA 2015). Without boundaries, debris is able to drift all around the globe, making it nearly impossible to find its source; the issue has become an international dilemma. Marine debris pollution has become an increasingly worrisome problem, fueled by modern industrializations and natural events and disasters, including El Nino/La Nina and the 2011 tsunami that struck Japan. The Pacific waters and coastlines in Washington state show evidence of marine debris due to several different sources (NOAA 2015).

It is clear how marine debris, and aquatic pollution overall, has become an international crisis that requires the consideration and cooperation of all nations of the world. Debris have proven time after time to be detrimental to human health, the environment, navigational safety, and the economy (Register 2015). Large accumulations of pollution can pose as obstacles for boats and submarines, while also directly harming the health of fish and the industries and people that depend and consume the tainted seafood. International coalitions need to be established with the objective of adopting efficient methods of cleaning ocean

water and preventing further marine debris and pollution. Full-fledged collaboration will be required in order to see any progression made to enhance water quality. This has happened in March 2011, when representatives of varying government agencies, organizations, marine researchers from 38 countries met and proposed The Honolulu Strategy to “reduce the ecological, human health, and economic impacts of marine debris” (Register 2015).

Scientists and environmentalists have observed an increasing presence of marine debris due to technological advances including the fishing industry. Fishing equipment is oftentimes lost out at sea, causing extreme damage or alterations to important marine habitat, including, but not limited to, coral reefs (Register 2015). While entire habitats are being affected, wild animals are consuming and getting trapped in floating debris, causing sickness and even death. Unfortunately, due to an increasingly high demand in the fishery industry, an alarming amount of commercial fishing equipment is continuously lost at sea. In fact, it is estimated that “coastal fisherman in the state of Washington have lost an estimated 150 to 300 gillnets per year for a 30 year period” (Register 2015). While gillnets are effectively used for commercial fishing, when they are discarded they cause major problems in aquatic ecosystems, including, but not limited to, ghost fishing.

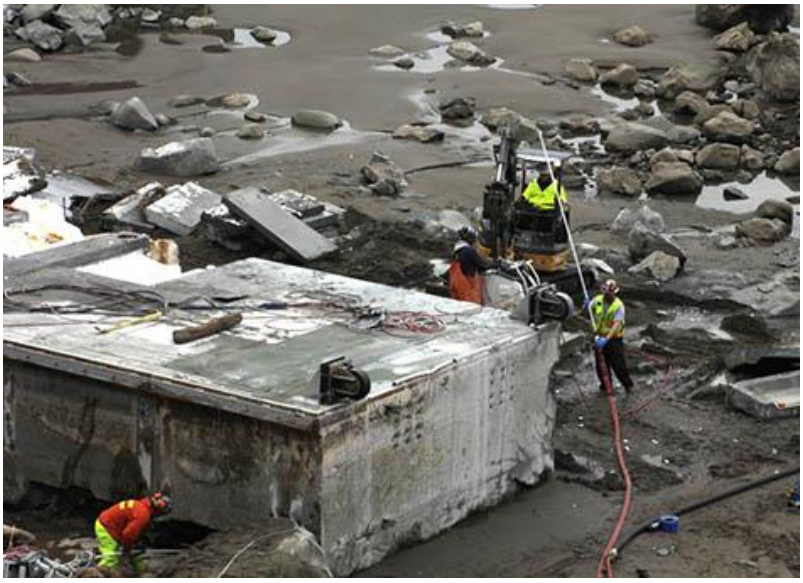
Ghost fishing is a term used to address the issue in which fish and other marine animals are caught in lost or abandoned fishing gear that is no longer under the control of the fisherman. While not all derelict fishing equipment results in the capture and death of wildlife, gillnets and other traps and wires can cause a lot of harm to individuals and to the ecosystem as a whole. Still, fishing gear has the potential to do much more damage than trapping and killing animals. Oftentimes, gear can cause structural damage to boats and natural landscapes

(Latshaw 2010). Fishing lines and cables can cause damage to the seafloor by dragging along the bottom of the ocean, while floating debris is often what entangles and drowns marine mammals (Lee 2010). Ghost fishing, and the issue of lost fishing equipment in general, has become a growing issue in areas in which the fishery industry is foundational, including, but not limited to, Washington State.

With such a booming fishery industry in the Pacific Northwest, there is no surprise that ghost fishing has become a prominent issue within the Washington fisheries. Unfortunately, over the past three decades, from fisheries in Washington State alone, a total of 4,500-9,000 gillnets were lost at sea (Register 2015). When fish get caught in a lost net or trap they simply become trap bait for more fish and, even if they escape, they are still very likely to die as a result of their confinement. Even in the Puget Sound nearly 54,000 animals (51,588 invertebrates, 1,355 fish, 731 birds, and 44 mammals) were killed and removed from 2,775 derelict fishing nets, and this was described as a mere "snapshot of the damages the nets have done for decades" (Latshaw 2010). Over 190 different species have been caught and retrieved from abandoned nets. Lost fishing equipment even has the potential to cause significant harm to a regions industry, primarily ones in which their economy is based around fisheries. Over time the wide-spread environmental and economic effects have become explicit, and measures have been made to counteract ghost fishing, and ultimately abandoned fishing gear. Overall, some pretty significant strides have been made due to the Northwest Straits Marine Conservation Initiative's efforts; over 300 tons of aged gear at 19 ports in seven states around the country were recovered in a serious effort to cleanse the ocean. However, there is still more degradation than reparations being made to improve the quality of aquatic ecosystems.

In addition to pollution via the fishery industry, storm water runoff, sewage waste water, landfills, industrial facilities, and offshore gas and oil platforms all add to the continuing accumulation of marine debris. Everyday consumption and pollution, especially improper waste management, are major contributors to the massive amounts of pollution in the oceans. The proactive approach of reducing, reusing, and recycling is effective to a certain point; however, with the oceans at their current state more than these voluntary actions need to be taken in order to clean and restore aquatic conditions and ecosystems sufficiently. A lot of the debris found in the ocean would have been impossible to prevent, so marine cleansing and revitalization is necessary to remove large percentages of the total marine debris. Large amounts of debris that cause issues have been introduced to the ocean through natural disasters like the tsunami that struck Japan in 2011.

Detrimental Results from Natural Disasters:



(NOAA 2015)

After the storm hit Japan in March 2011, there was an estimated five million tons of debris that was washed into the ocean. The Japanese government predicted that about 70 percent of the debris sank, leaving 1.5 million tons floating around wreaking havoc on animals and their ecosystems. However, like all marine debris, objects from Japan have been nearly impossible to prove their point of origination. Since the tsunami struck, the National Oceanic and Atmospheric Administration (NOAA 2015) has received 1900 reports of debris from at-sea vessels and beachgoers, however only 60 items were able to be confirmed as Japanese artifacts. Even though only roughly 60 objects can be solidly proven as a result of the tsunami, "there are undoubtedly tsunami-related objects on U.S. shorelines that cannot be confirmed" (NOAA 2015). However, one major piece of debris unmistakably travelled across the pacific and made it to the coastline of Washington State.

During the tsunami, four docks were separated from the Misawa Harbor and sent out to the Pacific. Soon enough two of the four docks made their way across the ocean to the waterfront of the Oregon and Washington coasts. In June 2012, the first dock was found washed up on Agate beach on the coast of Oregon covered in living native Japanese marine wildlife (Bernea 2013). This revealed that not only could debris easily travel great distances across through vast waterways, but also that foreign organisms could survive the journey and potentially harm local ecosystems in the U.S. Pacific (Barnea 2013). After this discovery, looking for large chunks of debris became a main concern in scientific and marine safety communities.

As locating and removing large pieces of marine waste became a primary goal, aircraft and satellite platforms were introduced in order to detect and track large chunks of debris, including the Misawa dock that washed up on the Washington coastline about 6 months later in

December 2012. While satellite and aircraft technology was helpful in retrieving and removing large pieces of pollutant such as the Misawa docks, they do not prove to be very effective in tracking the majority of marine debris which includes fishing equipment and smaller waste. Most debris that has been found and recovered from the oceans has been done with at-sea vessels and shore-based observations (Barnea 2013).

While studying and observing the docks and debris originating from Japan, there was some wonder and concern as to whether the pollutant could be radioactive, due to Fukushima's nuclear plant that was struck by the tsunami. However, through extensive examination, the Washington State Department of Health had concluded that Japan-originated debris does not have above-normal radiation levels, a comforting realization (Barnea 2013). Luckily, the radiation as a result of the incident in Fukushima has not spread very far to reach international shores across the Pacific, however, there still may be impacts through radiation that have not been observed or noticed yet.

Marine Debris Relief Efforts:

Unfortunately, tracking and removing debris from the oceans can be extremely difficult. First off, even with modern technology, it is hard to locate lost debris like fishing lines and nets. However, there is a lot of effort put towards cleaning the seas both domestically and internationally. The Northwest Straits Marine Conservation Initiative was funded with $4.6 million from federal sources, resulting in a doubling of gillnets retrieved since July 2009 (Latshaw 2010). Most fishing equipment is found and removed by divers, however they cannot remove debris that any deeper than 100 feet. At 100 feet and deeper, other techniques,

including underwater cleaning robots need to be used (Lee 2010). Making small adjustments would allow for fisheries to reduce trap loss and ghost fishing.

Altering the design of the trap may reduce the chances of losing a trap during a storm, there have even been biodegradable gillnets and traps that have been designed (Register 2015). However, precautions regarding trap collision also need to be seriously considered. In Washington State, there have been trap-free lanes established in order to organize flow of fishing boats and reduce colliding nets and traps (Breen 1990). However, even with these measures made decades ago to combat ghost fishing, marine debris continues to kill marine life and damage entire ecosystems.

Like most pollutant and debris-relief movements, the funding for locating and attaining the dock was a significant obstacle to overcome. It was estimated that to remove the Misawa dock in Washington it would cost $500,000; a much higher price tag than the $84,000 used to retrieve the Oregon dock. Through federal funding and gift funds through Japan, the relief program gathered $628,000 ($478,000 from Japan and rest from federal funds) to work with (Barnea 2013). Methods for funding debris removal is on a case-by-case basis, in which federal, state, local, and tribal representatives need to agree upon, which is often a lot harder than it seems.

Funding for marine debris removal is primarily presented in the form of grant designated either towards further research, education, or removal of aquatic pollution. Typically, organizations or coalitions that deserving of funds, such as The Northwest Straits Marine Conservation Initiative, are awarded the grants. Thousands, even millions of dollars are allotted to different organizations nationwide in order to research and effectively remove

present debris, and prevent further pollution all across America. While there is a good chunk of federal funds that are reserved for pollution control, more funds should be implemented in order to enforce new restrictions and statutes. Federal funds can be more effective if they are used to proactively solving that problem as opposed to retroactively repairing the, otherwise preventable, dilemma.

Further Steps to Reduce Pollution/Conclusion:

The tsunami that struck Japan and its nearly world-wide impacts not only raised awareness about the growing issue of marine debris, but it also taught scientists lessons regarding the removal of debris. This particular incident taught us about the behavior and movement of marine debris, while also revealing "a better understanding of the marine debris community's capabilities, limitations, and needs in modeling and detecting that debris as it migrated across the Pacific" (NOAA 2015).

While marine debris continues to be a growing worldwide issue, it is still a preventable and reversible form of pollution. However, serious changes will only be observed if everyone who partakes in it is willing to actively make a change, which calls for all of us to adjust our behavior. Whether that requires for us to recycle, reduce, and pick up litter, it is essential that everybody does their part to revitalize current aquatic conditions while also limiting future degradation of the water. Unfortunately, since marine debris can travel far and wide, it is hard, if not impossible, to determine where it originates and who is to blame. Due to this anonymity around marine debris, people will tend to keep polluting the waters since they know it will be nearly impossible to trace it back to them.

One way to limit future marine debris is through outlawing and **strictly** enforcing dumping of waste into the water ways. Dumping should be illegal everywhere not just to prevent marine debris, but also simply to protect and respect the rights of the ocean's inhabitants. If improper waste disposal was effectively monitored and controlled, we would observe astronomical changes in the growth of marine debris. While the U.S. government has placed restrictions on dumping and improper waste disposal, there is a lack of strong enforcement so people and industries continue to add pollutant to the oceans. However, that is not to say that government efforts have been ineffective, but they are missing something that greatly limits their potential.

In order to significantly reverse the impacts and presence of marine debris, the actions of individuals and industries need to be manipulated to act appropriately. Both incentives and disincentives should be incorporated in pollution management practices and statutes in order to maximize the productivity of the relief efforts. When people, and businesses, are rewarded for good actions and reprimanded for the bad, it is possible to condition certain behaviors that are beneficial and discard the ones that are harmful.

While current relief efforts have made important incremental effects on the marine debris problem, our current techniques are lacking some crucial steps. Implementing restrictions and statues against pollution and recovering litter is important, but proactive actions need to be made to prevent the continuation of polluting the oceans. In order to see substantial change, the current efforts need to be met with stronger enforcement of restrictions and encouragement towards environmentally beneficial actions. Until then, we will

continue to observe the degradation of thousands of aquatic ecosystems and its impacts on entirety of the globe.

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