PalArch's Journal of Archaeology of Egypt / Egyptology

IMPACT OF PLASTIC POLLUTION ON AQUATIC ECOSYSTEM

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Manas Ranjan Das, Aditya Dash: Impact Of Plastic Pollution On Aquatic Ecosystem -- Palarch's Journal Of Archaeology Of Egypt/Egyptology 17(6). ISSN 1567-214x

Keywords: Great Lakes, Marine Pollution, Micro-plastics, Ocean Gyres, Plastics.

ABSTRACT

Most of the consumer goods which have been frequently used today consist of various forms of plastic. Near about 300 million tons of plastic materials are manufactured worldwide and most of it occurs in landfills or rivers every year. Whereas plastics are cheap, lightweight, and long-lasting, these same qualities may cause harm to the aquatic wildlife, particularly when waterborne. When seaborne, contaminants are more often used to flow in one of five main gyres of the ocean: one in the Indian, two in the Pacific, and two in the Atlantic. Such areas of coastal waste are not sturdy plastic islands; rather, they are a turbid plastic combination. Latest work has reported related issues on the soils of the Great Lakes. An increasing concern is that once plastics reach the wild, they can cause ingestion death, entanglement, and carry invasive species. Several leading edge techniques have been piloted to track or extract plastics currently in the atmosphere and turn them back into energy in expectations of reducing the harm to the environments done by plastics.

1. Introduction

Nowadays, most of the consumers products used by the consumers are made up of plastic, culminating in an average production of plastic items globally approaching 3.35 * 10 ^ 8 tonnes and rising at a pace of 0.3 *10 ^ 8 tonne acre-1. Plastic goods eventually reach the marine ecosystem on the grounds of their industrial manufacture and use: for example, more than 2.3 *10 ^ 5 tons of plastic waste is expected to float on the global ocean floor. Throughout the

marine world, plastic waste may be broken by human, visual, and biodegradation into micro plastics (debris < 5 mm in diameter) [1].

Micro-plastic waste research has concentrated mainly on the coastal world, like Canada, the UK and nearby countries like deep-sea sediments in Arctic and Netherlands. Micro plastic aquatic pollution may be a possible leading factor to the depletion of biodiversity and a potential danger to human safety. Plastics effects on marine organisms are determined by the debris scale: large plastic debris, like discarded fishing nets and lines, frequently lead invertebrates, insects, rodents and tortoises to get entangled. Smaller plastic products may trigger bottle caps and less durable plastics results in cause of intestinal obstruction for aquatic animals [2].

Plastics and their degradation agents are consumed by a range of marine life spanning from invertebrates to fish with varying effects, all of which are actually under study – for example, a propensity to eat fewer food has been identified for reptiles, sharks, moulds, seabirds, etc. Human wellbeing may be influenced by the introduction of micro-plastics via the food chain. In addition, the chemical and physical properties of micro-plastics have been shown to promote the sorption of pollutants on their surfaces, hence micro-plastics that serve as a vector of pollutants to species after ingestion. The prevalence of plastic litter in the atmosphere is one of the major environmental concerns and a growing problem that can impact people's ability to preserve ecosystems. Micro-plastic contamination is especially severe in estuaries, suggesting that inland water intake is a significant source of micro-plastics for marine and coastal ecosystems. Knowledge of the impacts of micro-plastic contamination of freshwater ecosystems, though, is only in its infancy compared with that of coastal settings, given the reality that freshwater is a drinking water source [3].

Unfortunately, scientists have discovered over the last 40 years that plastics' valuable qualities are what often render them dangerous for the climate. This is because plastic waste is hard to remove since it does not biodegrade naturally, but only photo-degrades into tiny pieces. The chemical connections that form plastic between the molecules not only make them durable but even impervious to natural degradation. In the past four decades the proportion of plastics that make up the gross solid industrial waste has increased by 14 percent. Nearly one third of the plastics produced are used for the production of single-use plastics, like stirrers, coffee cup lids or Strokes.

Last year people use more than 40 million disposable bottles and 480 billion plastic bags, much of which wind up in the oceans and around the coasts. Water bodies, particularly ocean gyres found in the Atlantic, Pacific and Indian Oceans, are becoming the ultimate destination for many of those polymers are non-biodegradable. Thanks to Earth's rotation and surface waves, these gyres propagate currents induced by the deflection of currents or Coriolis Effect. Earth's coastal and agricultural habitats, and wildlife are adversely impacted as a consequence of plastic pollution. New technologies are being piloted to address problems caused by plastics, this involve monitoring waste via RFID tags and cellular transmitters, monitoring plastic debris through their devices,

utilizing drones or barriers to gather plastic debris, and converting plastics back into energy or fuel [4].

2. Discussion

1. Issues of Waterborne Plastics:

Plastics contamination in environment is the product of unsuitable storage or inappropriate disposal. Because they are durable and lightweight, plastics can travel long distances; ends up in terrestrial environments, around shorelines, even in the deep seas. For e.g., pill bottles from India were found on the southern sections of Hawaii along with oil and detergent containers from Korea, Russia and China. When contaminants circulate in the seas, aquatic biodiversity becomes affected. Itinerant plastics not only end up in the stomachs of animals or around their heads, but there is also increasing fear that plastics serve as a source for invasive organisms. Hard plastic structures are now an ideal medium to be bound to harmful organisms like molluscs, barnacles, and algae, opposed to the natural substrate that had borne invasive species for centuries before. With the injection of plastics into the oceans at present, the aggregation of invasive species can intensify rapidly [5].

2. Ocean Garbage:

The United Nations has reported that 6–12 million tons of plastics accumulate between Japan and California in the North Pacific Ocean, but a precise volume of waste is impossible to pin down. The North Pacific Subtropical Gyre is also named "The Great Pacific Ocean Garbage Patch" which is reported to be twice the scale of Texas. It is here where the colliding currents lock plastics in a stream where circulates. The Pacific Ocean Gyre, sometimes wrongly interpreted as a plastic reef, is simply a large nebulous mess of small and big plastic pieces, which are extended deeply up to 120 ft [5].

Researchers also found other large pollution fields that contain about as much debate as the South Pacific Subtropical Gyre, the Subtropical Gyre in the North and South Atlantic, and the Subtropical Gyre in the Indian Ocean. The North Atlantic Ocean and the Caribbean Sea are reported to have 300,000 bits of plastic per square kilometre represents a question with equal size to the Pacific Ocean. It is estimated that eighty percent of the plastics that exist in the oceans come from shorelines, 15 percent from fishing equipment and 15 percent from vessels and aircraft. About 12,000 shipping containers fall into the ocean per year from freight ships. Nearly 15 years earlier a transport container holding 27,000 disposable ducks was lost at sea in the Pacific Ocean between Hong Kong and the USA. Total of 3000 ducks are suspected to be circulated in the Great Pacific Garbage Zone, although some have been reported offshore in Alaska, Hawaii, Europe, South America, and the north-western Atlantic. The resilience of plastics is observed every time either of these ducks appear in still intact sea [6].

3. Impact of Plastics on Marine Biodiversity:

In the last few decades, the amount of plastic waste taken to sea has increased dramatically. Wildlife is frequently damaged by encroachment or

contamination of the contaminants present in the area. For procellariforms like shear waters, albatrosses, or petrels, the presence of damaged plastic pieces is analogous to other kinds of food they consume. Micro-plastics are similar to phytoplankton consumed by fish and cetaceans. It has been found that ingested plastic debris decreases stomach ability, impedes development, causes internal injuries and produces intestinal blockages [7].

Plastic clogging of fishing nets or many other ring-shaped items may contribute to strangulation, decreased feeding capacity and drowning in certain situations. Because of natural interest, at a young age, pinnipeds sometimes get entangled in aquatic debris, which can constrain their bodies as they develop, thereby reducing quality of life. Globally, it is estimated that plastic waste threatens at least 25 per cent of aquatic mammal species, 30 per cent of seabird species and 74 per cent of sea turtle species.

4. Effects on Fish:

No reported research on the impact of plastics on fish have been found; but there is plenty of evidence to support the use of plastics by fish. For the six different organisms surveyed in the North Sea, only 2.4 per cent of the 1302 fish examined had bits of plastic in the digestive tract. When the English Channel analysed the gastrointestinal tracts of 406 animals, 32.8 per cent included plastics. Inconsistent findings between studies significant factors, like location, plastic aggregation and fish species may likely be suggested. A North Pacific Central Gyre analysis showed that 43 per cent of the 580 fish examined had a net sum of 1485 bits of plastic in their stomachs. This is equal to about three pieces per shrimp. Much of the fragments of plastic is white, blue or transparent and are the same colours as plankton, the main source of fish food. In a related analysis in the Subtropical Gyre of the North Pacific, 8.3 per cent of the 151 fish studied had plastics in their stomachs. Based on these results, researchers estimate that fish eat between 14,000 and 26,000 t of plastic annually. Knowing the impact of plastics as eaten by fish is of interest as the tiny plastic particles may promote the movement of swallowed toxins to animals inside the food chain [8].

5. Effects on Cetacean*:*

Most cetaceans reside well away from the shoreline that restricts the amount of marine debris ingestion work. If plastic triggers premature death, the cetaceans are more likely to fall to the ocean floor. Cetaceans may sometimes wash ashore allowing for post-mortem tests. Because of the echolocation capabilities of cetaceans, misunderstood plastic use is impossible. Ingestion is most definitely attributed to bringing the debris in with the appropriate meal. In 2012, two sperm whales were discovered off the northern coast of California, with a significant volume of fishing equipment in their gastrointestinal tracts. Two of the sperm whales had a stomach breach triggered by nylon netting in the third compartment; the other one has fishing tape, netting, and plastic bags separating the stomach from the intestines altogether. A juvenile porpoise (Phocoenidae) has been found dead on the coast of Nova Scotia, Canada, with

a crumpled up piece of black plastic in the oesophagus trapped with three spined stickleback fish. In Brazil, the stomach examination of a beaked whale (Mesoplodon densirostris) from a Blainville revealed the existence of a large bunch of blue plastic string that occupies a considerable part of the stomach area [9].

In the last decade at least 6 migrating humpback have been endangered the whales (Megaptera novaeangliae) were seen towing tons of twisted nylon rope and other objects like a crayfish bowl and a marker pole buoy. An endangered right whale in the North Atlantic has been identified with fishing rope tied around its head. Because of its risky nature, rescuers were only able to safely cut 260 feet of the industrial fishing line and expected that the remainder of the rope would dislodge itself from the mouth. At present, not enough patterns have been identified in collected evidence that show that ingested plastics are the primary cause of death leading to the deterioration of cetaceans. Such cases, though, indicate that plastic marine litter can contribute to direct cetacean mortality, or even establish crippling situations that render mammals more vulnerable to disease or predation.

6. Effects on Sea Turtles:

Numerous autopsies have found that swallowed debris and tar are the main culprits of trauma and non-natural mortality for sea turtles. Debris is removed from tortoise digestive tracts from fishing lines, cables, nets, six pack chains, Styrofoam, and plastic bags. Plastic bags that float in the water mimic the form of medleys, a key source of food for sea turtles that leads to swallowing of the bags. The population of leatherback sea turtles (Dermochelys coriacea) has decreased over the last 3 decades owing to anthropogenic effects and put them on the critically endangered IUCN list [10].

Among the 352 autopsies carried out on leatherback turtles, 34.3 per cent contained plastic in their gastrointestinal tracts. These autopsies were carried out for last 30 years. While it is not clear if the plastic consumed was the cause of death, 7.6 percent of the turtles probably had a plastic bag that prevented the flow of food. Plastic was also observed to prevent female eggs from going through. Researchers in a recorded review, they had taken out 15 Plastic pieces from female cloaca. This allowed the eggs to be laid but there remained sign of internal injury.

Loggerheads (Caretta caretta) and Green turtles (Chelonia mydas) and were located in predicaments close to those. The Local, according to investigators, Marine Fisheries program has gained 48 loggerheads in the Atlantic Ocean by by-catch. 32 per cent of these have been reported to have plastic pieces in their digestive tract. 72.4 per cent of the 50 loggerheads illegally collected by fishermen in western Mediterranean contained plastics in their gastrointestinal tracts. A turtle brought in for recovery died in Brazil, Paraiba, after they excreted 15 hard plastic pieces and 10 plastic bag. Similarly, a juvenile green sea turtle was minimally sensitive and defecated over 64 foreign items from a number of plastics whilst rehabilitating. The turtle was eating about 7 g of food per day before passing the debris. The food consumption was up to 80 g a day,

after all the debris left. While certain turtles might be able to get through their digestive system with plastic, it may also inflict internal injuries. All that cannot move the plastic inevitably starve to death because plastics pool in their cavities of the intestine [11].

7. Effects on Birds:

Seabirds (Procellariiformes) sometimes confuse tiny plastics, like bottle caps, for fish. It has been observed in some experiments that diving birds feeding on fish in the water column have fewer plastic in their stomachs relative to those who were surface eaters. It may be because birds that follow a zooplankton diet may not be able to differentiate between plastics and their primary food source due to the colour or form of the plastic components. Because several of the adult birds regurgitate what was consumed as a means they pass the dose containing the plastic pieces over to their young to feed their chicks.

Within the first zone birds like the shearwater and albatross got more plastic off their gizzards and stomachs, suggesting that, as such plastics were regurgitated, during eating, they should be passed on to their children. This has been observed that young shearwaters and albatross eat more plastics than adults. Similar to the other marine life, the swallowed plastic can damage and obstruct the digestive system of a bird, thereby reducing its foraging capacity. Scientists hypothesized that ingested plastics, based on the findings of a study utilizing domestic chickens, and could decrease the growth rate, health, and food intake of seabirds. The amount of plastic consumed by various bird species may be an indication of plastics accumulation in an environment. Researchers found that shearwaters in the North Atlantic had shown an increase in plastics consumption from 1975 to 1980 compared to 1981–86. This is related to the rise of plastics in the oceans. A research investigator noticed in 2010, that only 8 of the 262 Laysan Albatross (Phoebastria immutabilis) autopsied from the North Pacific Midway Atoll did not produce any swallowed plastics [9].

Another study in the eastern North Pacific revealed that of the 356 consumed items recovered from 15 seabird species, 26.2 per cent were industrial pellets and 68.4 per cent were broken pieces of plastics used on a daily basis. Between 2010 and 2012, the stomach content of 62 fulmars washed up on the beaches along the eastern North Pacific contained an average of 35 plastics. Considering that 89.4 per cent of the fulmars accounted for this, researchers speculated that this meant an increase in plastics intake.

8. Impacts of Plastic Pollution on Great Lakes:

Several experiments have been performed to establish the dispersal, economic effect and amount of plastic waste in aquatic environments, but nothing is understood about plastic pollution from fresh water. Scientists also know that the same issues that have been identified in the ocean gyres and around coastlines occur in freshwater bodies. The North American Great Lakes are the world's biggest freshwater networks. The five bodies of freshwater in the Laurentian Great Lakes represents Lake Ontario, Lake Huron, Lake Erie, Lake

Michigan, and Lake Superior. Such glacial lakes have become a research subject on the impact of freshwater plastic pollution in recent years.

Lake Huron's shores in Canada represent one of the first locations where researchers researched plastic waste concentration, form, and distribution around the Great Lakes. The commercial side of the lake, according to the scientists, held the most plastics; the remainder of these were tiny pellets used for processing products. It was suspected that many of the pellets were lost during processing or transported by wind-induced displacement of the cyclonic surface current and changes in temperature of water.

It is also likely that capsized cargo may have led to the build-up of plastic on Lake Huron shores because this waterway is part of a big transportation path. The 5 Gyres Institute sailed through Lake Erie, Lake Superior and Lake Ontario in the summer of 2015 to conduct the lakes' first open-water survey. Whilst trawling the chemicals reservoirs, researchers found that Lake Erie has the highest accumulated rates of micro-plastics reliably contrasted with Lake Superior and Lake Huron.

9. Plastics Management:

The transport of contaminants and the impact on biodiversity in aquatic ecosystems has been studied for over 40 years. Awareness of ocean currents from Lagrangian drifters monitored by satellite was used to predict moving underwater debris trajectory. Lagrangian drifters are instruments used in oceans, lakes and rivers to measure water flows and collect other environmental information such as salinity and temperature. Scientists aren't the only ones that track or monitor waste. The Marine Debris Tracker is a citizen science initiative that encourages community participants to use their smartphones to monitor marine debris collected along coastlines and rivers, which are then tracked using GPS.

A solution to ridding the Earth's waters of plastic waste to reduce its impact on aquatic wildlife remains a big challenge, despite the ability to track waste movement. While the United States has adopted the Clean Water Act, and the United States and Canada agree to update the Great Lakes Water Quality Treaty to mitigate contamination in places of risk, more contaminants tend to collect in the Great Lakes annually. These plastics inevitably make their way into the sea through stream networks and river, and then into the ocean gyres. Because the gyres are located in foreign waters, no government claims blame for the ocean cleaning. Instead, there are many private organisations focused on solving the issue. Private businesses piloted groundbreaking technology to help classify, reduce and remove plastics in environments, including monitoring pollution by RFID tags and cellular transmitters, utilizing robots or barriers to gather plastic debris, and converting plastics back into oil [12].

Recycling is one of the most accepted strategies possible for rising the effect of waste on landfills and community by resource reuse. Regardless of whether an individual is recycled or not, there is no indication that the waste finishes in its expected destination. The Massachusetts Institute of Technology uses RFID tags and cellular transmitters to monitor waste and recycling in Seattle and

New York because of this lack of evidence. According to researchers, "Garbage Track" helps researchers to observe where the garbage was, how long it travelled until it was deposited, and where it was deposited and at the final stage, the trash accumulates.

10. Sources of Micro-plastics:

Also in marine ecosystems the extent of separation and deterioration of plastics is uncertain. Various degrees of physical powers, like waves in water systems; environmental factors like pH, sunshine, and temperature; and the plastic it self's chemical and physical properties are known to play a role in plastic degradation. Given milder physical forces than in aquatic settings, plastics in freshwater structures often experience physical and environmental degradations. For example, studies have shown that plastic fragments can be exposed to fairly extreme weathering due to strong ultraviolet penetration in poorly nourished lakes. However, aggregate trends of deterioration of freshwater micro plastics were observed to be close to those in the coastal environment: holes, cracks and adherent fragments. For example, studies have shown that plastic fragments can be exposed to fairly extreme weathering due to strong ultraviolet penetration in poorly nourished lakes. However, aggregate trends of deterioration of freshwater micro-plastics were observed to be close to those in the aquatic environment: holes, pits and adherent pieces [13].

3. Conclusion

About 300 species, including turtles, whales, seabirds, and rodents, have suffered reduced movement, malnutrition, or death due to ingestion or entanglement of plastic waste. Researchers obtained a variety of knowledge, there is also a need to take full note of the number of species threatened by contaminants in the seas, including also ecosystems impacted in even smaller bodies of water, including the Great Lakes. The plastic-collecting drone can be used to collect the bulk of plastics in the oceans and the Great Lakes, or the Evolucient Method may be the only method of recycling by thermal degradation. The only solution to the plastics overuse is recycling although the destination of a large volume of recyclable content is also under review. Solutions need to be created to ensure products are correctly recovered or disposed of. Also with modern technology, science, recycling, and Alternate packaging options can be used to reduce reliance on disposable items. Plastics will not go anywhere and can stay forever impacting ecosystems in habitats until the contamination is that. "Water is what any live organism can't survive without on this earth. If this resource is so valuable that without it life cannot exist, one should not contaminate it."

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