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Impact of COVID 19 on Ocean Plastic Pollution: A review

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ABSTRACT
The health of the seas is in danger due to a sharp rise in the use of masks and gloves as well as a decrease in recycling initiatives. Due to COVID-19 financial constraints, recycling systems all around the world are beginning to fail. As a result, plastic tsunami is growing in strength in our oceans due to the COVID-19-related proliferation of single-use plastic. This paper demonstrates the issues to alarm us and to take necessary action for keeping the earth sustainable for future generations.

Keywords: Plastic pollution, ocean, micro plastic, COVID-19 pandemic, Single use plastic, Financial strain

I. Introduction

Literally wherever we walk, plastic is present. On the beach, in the sea, and in our parks and rivers. The majority of the objects we use in life are made of plastic from which we cannot escape. Plastic first gained significant popularity in the 1940s, and from that time to the present, it has been overused as a single-use material, which is the primary cause of the environment's decline. Single-use plastics are substances that are used once and then discarded. The COVID-19 pandemic has merely exacerbated this already unmanageable issue as throwaway masks, gloves, and other PPE are used at an alarmingly high rate [25].

II. Major sources of ocean plastic pollution:

Just over a century have passed since the invention of plastic made from fossil fuels, making it one of the most durable materials ever made. Our way of life has undergone a full change. Today, we are all aware that plastic can take hundreds of years to dissolve, and research indicates that it is feasible for plastic to only partially degrade before becoming what we refer to as microplastic [9]. Littering is the primary source of plastic pollution in the ocean. Throwaway plastic products, such as food wrappers, bags, bottles, razors, and other items, wind up in the waterways and finally the ocean when we buy or use them and fail to properly dispose of them. 80 percent of marine pollution is made up of plastic garbage, and every year, 8 to 10 million metric tonnes of plastic enter the ocean. According to research, all the fish in the ocean by 2050 will probably be outweighed by garbage [9]. The most frequent sources of plastic waste that is dumped into the ocean directly are shipping and fishing [26].

In addition to killing more than 8 million people annually, smoking is one of the biggest threats to worldwide public health and dramatically increases ocean plastic pollution. The billions of cigarettes sold each day throughout the world contain hazardous chemicals and plastic filters. These trash at landfills will either injure and pollute the ecosystem, or their disposal may jeopardise marine life in the sea. For more than 25 years, cigarette butts have been the main item collected during the International Coastal Clean-up [25].

The main source of ocean plastic pollution is improperly disposed of plastic trash. As a result, instead of being collected and dealt with through recycling or incineration, plastic waste is simply dumped into the environment and not cleaned up [26]. Plastic pollution in our oceans and on our beaches has become a global crisis. Global crisis: the build-up of plastic in our waters and on our beaches. Plastic pollution has inundated all five of the Earth's major ocean gyres. The Great Pacific Garbage Patch is the name given to the largest of these [8]. Unfortunately, the increase in demand for plastic products is outpacing the ability to treat the waste plastic. Waste management is challenging, especially in epidemic epicentres [7], and not all used PPE and packaging are handled or recycled [8,9]. Then, a percentage of this improperly managed plastic waste (MMPW) is released into the environment and ends up in the ocean [10]. The released plastics could travel a long way in the ocean, come into contact with marine life, and possibly endanger or kill marine life [11-14]. For instance, a recent study estimated that 1.56 million face masks would find their way into the oceans by the year 2020. In a study published in March, the first instance of a fish caught in a medical glove was described. The fish was found during a canal cleanup in Leiden, the Netherlands. In Brazil, the stomach of a dead Magellanic penguin was discovered to contain a PFF-2 protective mask. According to the From Pollution to Solution report by the United Nations Environment Programme (UNEP), the amount of plastic pollution entering aquatic ecosystems has increased significantly over the past few years and is expected to more than double by 2030. This will have a serious impact on human health, the global economy, biodiversity, and the climate. The study points out that plastic makes up 85% of marine litter and issues a dire warning that by 2040, 23–37 million metric tonnes of plastic waste will be added annually, nearly tripling the amount of plastic pollution contaminating marine environments. This corresponds to around 50kg of plastic every metre of coastline around the planet.

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III.Plastic and its application during the COVID-19 pandemic:

Because of lockdown and social distancing, there is an increased reliance on online shopping and home delivery of basics like food, medicine, and groceries [1]. It has raised the demand for single-use plastic (SUP) and plastic used for packaging. Furthermore, customers' preferences for plastic packaging have changed as a result of the false belief that single-use plastics are more hygienic than other options [2]. 368 million tonnes of plastic were produced worldwide in 2019 [13] 49 percent of which were single-use goods [14]. Its production increased dramatically between 1950 and 2015, going from 2 Mt to over 380 Mt [15]. Gloves, surgical/medical face masks, goggles, face shields, gowns, respirators (N95 or FFP2 or FFP3 standard or similar), and aprons composed mostly of single-use plastics are examples of personal protective equipment (PPEs), according to the WHO. Beginning in 2020, the WHO estimated that 89 million medical masks, 76 million pairs of gloves, and
1.6 million pairs of goggles will be needed for the COVID-19 response globally [16]. According to the International Solid Waste Association, use of single-use plastic increased by between 250 to 300% compared to pre-pandemic levels. Today, 65 billion pairs of gloves and 130 billion face masks are used globally each month [17,11]. China produced 116 million masks per day in 2020, or around 12 times as many as were made prior to the pandemic [11,18]. Over 7 billion face masks are reportedly used every day across the globe [19]. Packaging materials and other items (which includes medical equipment) are predicted to increase 44.8 and 13.2%, respectively, as a result of the COVID-19 pandemic's demand for PPEs, food delivery services, and online grocery shopping [19]. The function and significance of plastic during the pandemic also become more obvious when considering hospitals. The majority of life-saving equipment used in hospitals, particularly for COVID-19, is manufactured entirely or in part of plastic [11]. Therefore, during the continuing COVID-19 pandemic, plastic has served as a shield [11,12].

IV.Plastic tsunami during COVID-19 and its harmful impact:

Due to social distance, less people are using the roads and breathing the air, which has considerably improved global air quality. According to projections, carbon emissions will decrease by 4% in 2020 compared to 2019 [10]. The same cannot be true about our oceans, though. In order to avoid spreading COVID 19, we have enhanced our hygiene standards and changed some of our behaviour. Examples include using PPE (personal protective equipment), buying more plastic-wrapped food and goods, and using disposable cutlery. The outbreak has greatly increased the use of PPE by healthcare personnel, which includes gloves, face masks, and gowns. PPE is single-use only and generates a lot of plastic trash [22]. In addition, post-transport disposal of protective gear, such as hoods, masks, gloves, and gowns, worn by medical personnel and infected patients during their transit to healthcare facilities is common [23]. Additionally, the situation is exacerbated by the growing amount of biomedical waste produced by laboratory research and testing, which contains a sizable amount of plastic. In accordance with a WWF assessment, "as many as 10 million masks each month may pollute the environment if just 1% of the masks were disposed of improperly and distributed in nature" [24]. We could cover the whole surface of Switzerland if we stitched together all the masks that have already been made and those that are expected to be produced. Our current waste management system is inadequate and ineffective due to the growing usage of plastic, which could worsen environmental pollution and waste management issues [20]. Due to COVID-19 financial constraints, recycling systems are beginning to fail globally [10]. The problem with gloves and masks getting into our rivers and oceans is that sea turtles like to eat jellyfish, which are readily confused with them. Masks can enhance the risk of entanglement for a number of fish, animals, and birds because of their elastic components. The situation becomes considerably more problematic when considering the sharp increase in single-use plastic brought on by COVID-19.



Fig1. A sea turtle mistakes a plastic bag for food. © Ben J. Hicks / benjhicks.com

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PPE comprises of articles of clothing, additional protective apparel, or equipment that is especially made to shield the wearer from illness or physical harm [33]. We can safeguard ourselves against infectious materials during the COVID-19 crisis by using a variety of PPE, such as disposable gloves and coveralls, N95 respirators, surgical masks, face shields, and safety glasses. PPEs are primarily composite materials constructed of various synthetic non-degradable polymers, similar to the majority of plastic trash [34].

Table1: Composite materials of PPE [31-33]

PPE	**Components**
Disposable Gloves and Coveralls	vinyl, latex or nitrile polypro pylene
N95 Respirator Masks	flexible non-woven polypropylene fiber
Disposable surgical masks	Polypropylene, polystyrene, polycarbonate, polyethylene, or polyester.
Face Shields	polycarbonate, propionate, acetate, polyvinyl chloride and polyethylene terephthalate glycol (PETG).

Depending on their properties, PPE items may sink or have varied fates once they enter the maritime environment. Common PPE is made up of a variety of materials, and because of these materials' non-degradability and environmental persistence, it is reasonable to assume that their fate will depend on these qualities. Some PPE items are anticipated to persist in the environment for an extended amount of time, likely subject to surface oceanic currents, while others may become buried in sediments and eventually end up in the geological record, as has been seen with other forms of plastic pollution [3].



Fig.2 (a–d). Littering of PPE kits has become a new nuisance to already existing worst marine litter (Masks found washed up on the beach during the pandemic at Soko Islands, Hong Kong during an environmental survey carried out by Marine conservationist NGO group- Oceans Asia; Photo credits: Naomi Brannan) [21].

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V.Effect of marine plastic pollution on human and marine health:

An estimated 80% of marine pollution is made up of plastic garbage. The oceans receive about 10 million metric tonnes of plastic trash annually. Plastic degrades into tiny particles known as microplastics (particles smaller than 5 mm) or nanoplastics under the effect of solar UV radiation, currents, wind and other natural causes (particles smaller than 100 nm). They are easily accidentally consumed by aquatic creatures due to their small size [28]. The health of our world and all its inhabitants would suffer greatly as a result of microplastics, which are microscopic pieces of plastic that can be consumed by marine animals and end up in their bodies and tissues [9]. Pesticides and hazardous metals are only a few of the pollutants that microplastics are capable of absorbing off the water's surface. These chemically packed particles are swallowed by fish and shellfish, afterwards they are transferred to humans who eat seafood [27]. Plastic pollution is a significant problem that harms the marine ecosystem. It poses a threat to the wellbeing of the ocean, marine life, human health, coastal tourism, food safety and quality, and climate change [28]. The ingestion, asphyxia, and entanglement of several marine animals are the effects of plastic trash that are most readily apparent. Seabirds, fish, whales and other marine animals mistake plastic debris for food; as a result, the majority of them starve to death because their stomachs are so full of plastic. Additionally, they experience internal injuries, lacerations, infections, and decreased swimming capacity. Additionally, floating plastics aid in the spread of invasive marine organisms, endangering marine biodiversity and the food chain [28]. In addition to being recognised to be endocrine disruptors and carcinogens, a number of the chemicals employed in the manufacture of plastic products also cause reproductive, developmental, immunological and neurological issues in both people and wildlife. Microplastics have recently been discovered in human placentas, but additional investigation is required to determine whether this is a prevalent issue.

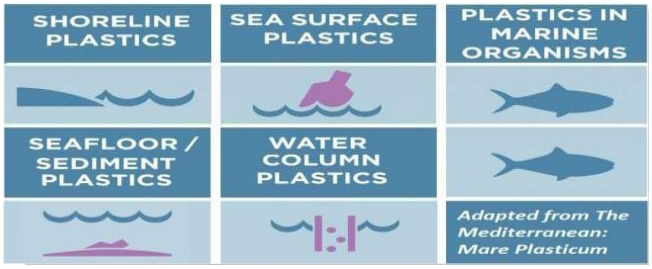

Fig3. Plastic pollution is found in all areas of the ocean and in marine organisms. © IUCN

VI.Solutions for Sustainable Future:

How can we stop plastic waste from damaging delicate marine ecosystems is the question that now needs to be answered? In a perfect world, trash made of plastic would be collected before it becomes microplastics or sinks to the ocean floor. Litter collection on land is significantly simpler than collecting floating ocean trash. In this situation we may consider the following solutions for sustainable future.

(a)Oil skimming technology: Norway, on the other hand, develops effective techniques for sanitising the ocean and clearing plastic waste from the water's surface [35]. For instance, the business Spill Tech specialises in solutions for responding to oil spills. It created the PortBin robot, PortBin fixed, and TrashTrawl product lines to gather floating maritime debris using its expertise in oil skimming technology. The machinery collects floating waste from the rivers, ports and other small bodies of water. The Clean Sea Robot has been created by Clean Sea Solutions in the interim. Using computer vision and remote sensing, an autonomous electric aqua drone "sweeps up" plastic debris from the ocean's surface [35]. When it is full, the device goes back to a specific docking station where it can be emptied and recharged for the next trip. The collected trash is stored on board. A model that can operate below the surface for more thorough ocean cleaning is also being developed by the company.



Fig4. The PortBin from SpillTech collects floating waste [35]

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(b)Recycling plastic garbage: By 2035, the European Commission wants to see a total of 65% of waste materials reused or recycled, including plastics [35]. This will benefit the environment in two ways: it will use less resources to make items and generate a lot less waste, especially in terms of plastic pollution and ocean litter. A startling 95% of all plastic bottles are returned in Norway thanks to a national bottle deposit programme [35]. By giving people a financial incentive to collect and distribute plastic debris, it helps to reduce plastic pollution as well as poverty.
(c)Adopt green chemistry practices: This means banning the use of dubious chemicals like phthalates, forbidding the use of hard-to-manage materials like expanded polystyrene, and fostering materials research. If plastics do end up in the water, the harm they do might be lessened by developing substitute materials, such as true biodegradables, that offer the same performance benefits as plastics without the disadvantages.
(d)Improving wastewater management: The amount of plastic that ends up in the ocean can be reduced by improving wastewater management, which will help reduce nutrient pollution, which is good for fisheries and coral reefs. This shows that while the focus is on plastic pollution, there may be an opportunity to address many ocean pollutants at once [36].
(e)Coastal zone improvements: Limiting aquaculture in open waterways is one way to do this. A variety of contaminants related to coastal aquaculture, such as plastic pollution from lost or discarded gear and untreated waste with high levels of nitrogen and phosphorus, could be reduced by switching to sustainable land-based aquaculture systems.
(f)Biodegradable fishing nets: About 13,000 fishing nets are abandoned at sea each year and end up in the water as plastic waste [35]. Therefore, in order to replace plastic nets and lessen ocean plastic waste, researchers are looking into the usage of biodegradable materials in gillnets. The outcomes so far are encouraging.
(g)Improve storm water management: Storm water and storm drain filters, as well as waste collection at river mouths, can aid the issue. By doing this, it may be possible to stop the flow of wastes from the roads—such as plastics, chemicals and microplastics—into rivers and eventually the ocean.
(h)Use extreme resource efficiency: To do this, levies on single-use plastics must be implemented, voluntary industry standards must be promoted to reduce the usage of plastics made from fossil fuels, and social attitudes around waste generation, consumption, and recycling must be altered. For instance, the UK implemented carrier bag fees in 2015, which resulted in an 80% decrease in the use of plastic bags there. Since then, 9 billion fewer plastic bags have been used [36].

VII.Conclusion:

There is a need for sophisticated solutions to the plastic issue, including improved regulation, enhanced recycling, and incentives to encourage a decrease in the production of virgin plastic. The existing international legal frameworks that address marine plastic pollution should be adhered to and strengthened. The 1972 London Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter, the 1978 Protocol to the International Convention for the Prevention of Pollution from Ships and the 1996 London Protocol to the London Convention are the three most significant ones (MARPOL). It is important to follow and strengthen the current international legislative frameworks that address marine plastic pollution. Federal and regional governments should research national legal systems for extended producer accountability. Along with policies that support circular economies, these are emerging as creative, economical alternatives. To reduce the amount of microplastic trash produced by pellets, synthetic textiles, and tyres, governments, research organisations, and companies must collaborate to redesign goods and reconsider their usage and disposal. Both consumers and society must change their consuming habits. More funding should be made available for research and innovation in order to provide businesses, governments, and consumers with the information they need to adopt technological, behavioural, and legal solutions to stop the pollution of the oceans with plastic.

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