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Effects of masks on marine animals

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Abstract. Due to the global pandemic, we are producing a large number of discarded masks every day. At the same time, some of them will find their way into the ocean and affect the Marine ecology. This paper will analyze the damage of waste masks to the ocean, and give solutions for reference. Through case analysis, this paper concludes that waste masks have brought certain impacts on various Marine organisms and destroyed the stability of Marine ecosystems, but there are still some solutions to improve the problem. This article will provide solutions that can be adopted by governments today, as well as some directions and goals that can be developed in the future. In the future, we can better protect the Marine ecology and pay attention to environmental protection although there will be some cost burden for the government. To protect animals while improving the overall environment of the earth on which human live.

Keywords: pandemic, face mask, environment.

1. Introduction

According to statistics, taking China, which has a large population in the world, as an example, the daily use of masks is huge. The discrepancy between mask supply and demand was further alleviated on February 29 when the daily output of masks, comprising common masks, medical masks, and medical N95 masks, reached 110 million and 116 million, or 5.2 times and 12 times that of February 1. They produced 1.96 million and 1.66 million medical N95 masks each day, adequately meeting the protection requirements of front-line healthcare professionals. China's capability for mask production has increased as a result of the expansion of production lines. China has produced more masks overall and at a higher value during the past five years. China produced 5 billion masks in 2019, an increase of 10.13 percent. The COVID-19 outbreak has increased demand for masks in China. With a production capacity of over 16 million masks, 76% of mask firms had resumed operations by February 10, 2020. China has a daily mask production capability of 20 million, including 2.2 million surgical masks and 600,000 N95 masks. Yet, as masks have become more common, poor handling of them has led to a number of social issues, secondary diseases, and environmental contamination [1]. At the same time, another paper reported the same number of masks. In the wake of the COVID-19 outbreak, face masks have become a standard accessory for almost everyone. According to the World Health Organization, worldwide demand for disposable protective masks has increased nearly 100-fold since the outbreak began. Around the world, 129 billion masks are used and disposed of every month. As the use of masks surges, unused masks that are not properly disposed of are polluting the environment, affecting wildlife, and even threatening people themselves [2]. Scientists and environmentalists have warned of

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the waste, especially when large quantities of waste masks containing plastic fibers flow into natural rivers, which can cause serious ecological disasters. There have been cases of turtles, birds and other animals becoming entangled in the plastic cord of the masks, and in severe cases, choking to death. The amount of face mask waste in the UK soared almost 90-fold in the first seven months after the coronavirus outbreak. Many disposable masks on the market were examined by Professor Tharp of Swansea University's Department of Chemical Engineering and his team. The masks leak nanoscale plastic, silicon, and heavy metal particles when submerged in water, which can contaminate the nearby water. According to Tharp, the quantity of harmful particles emitted by these masks is astounding and has an impact on both the human drinking water supply and the food chain in natural waters. It is urgent for countries to deal with the potential plastic waste crisis caused by disposable masks. In addition to government policies, technology and market approaches are also needed. Researchers at the Massachusetts Institute of Technology, for example, are working with a start-up to create N95-rated, multiple-use masks that could reduce the amount of waste caused by disposable masks. The reusable masks will be available in late spring. In addition, it is also important to strengthen waste disposal measures. It is advisable for countries to set up central recycling points for disposable masks so that they can be uniformly disposed of after use.

One effective way to deal with the face mask is by using a public mask processor, or a design of a new recycling device [3-4]. Both of these methods can collect waste masks, and it is best to recycle and destroy them in a unified manner. The masks and other household garbage are mainly treated harmlessly through high-temperature incineration. Also, some of the heat produced by waste incineration will be turned into electric energy and made available as resources. On the other hand, it is also essential to research materials and create quickly biodegradable plastics as raw materials for the manufacture of masks and other plastic products. This will not only help to prevent plastics from harming the environment, organisms, and people, but it will also stop masks from acting as carriers for the novel coronavirus. However, there may have some cost burden for the government. The huge amount of discarded masks not only puts unprecedented pressure on waste disposal but also is more likely to cause plastic pollution, becoming the most serious “aftereffect” after the epidemic. The United Nations Environment Programme (UNEP) warned earlier last year that, based on historical evidence, 75 percent of waste masks would end up in landfills or oceans, causing pollution and an estimated $40bn in economic losses to related industries such as tourism and fishing. Moreover, three types of masks tested were found to have three-layer fibrous structures (Fig. 1a-c). The size of the pores and the porosity of the external and internal layers were greater than those of the intermediate layers as they both provided ventilation. Some fibres have been thermally fused in the outer and inner layers as shown by the yellow dotted rings in Fig. 1. The average diameters of the single fibres for three outer layers were 24 3.6 μm, similar to the internal layers (23-28 μm) [5]. In conclusion, although collecting discarded masks will have some economic losses, the government should not give up the measure since the effect is long-lasting and devastating.

2. Analyze of real-world cases and examples

Demand for masks has surged due to global pandemics. It is estimated that the daily consumption of masks in the world reaches a peak of 1 billion masks. If only 1% of all masks are disposed of inappropriately, that could be 10 million discarded masks a day, which would pose an environmental threat [6]. Since masks are mainly made of non-naturally degradable plastic, when masks are used and abandoned in the environment such as oceans, rivers, cities and other places, they can have a huge impact on the local ecological environment. In addition, according to a new report by the conservation group Oceans Asia an estimated 52 billion masks were produced in 2020 all around the world, with at least 1.56 billion entering the oceans. Since the outbreak began, countless masks have made their way into the ocean along rivers, causing great harm to Marine life and ecological impact. The surging demand for and use of masks has also posed a serious threat to Marine ecology. Not only have octopuses been found hiding under discarded masks, but penguins have also mistakenly swallowed N95 masks, resulting in malnutrition, and many Marine creatures have died after becoming entangled

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in the ear bands on the left and right of the masks. As the use of masks surges, discarded masks that have not been properly disposed of are polluting the environment, affecting the survival of wildlife and even threatening humans themselves. Dead penguins wash ashore on the coast of Brazil in September 2020. After dissecting one of them, people were surprised to find that it had a black N95 mask in its stomach [7]. Not only large Marine animals, such as whales and sharks, will swallow waste masks by mistake when hunting, but also small animals, such as turtles, seabirds and penguins, who do not know that waste masks cannot be used as food, will also eat them by mistake.

In December 2020, a marine conservation agency, released a report that found many marine creatures had died from being carelessly discarded and becoming entangled in the ear straps on the left and right sides of the masks. In addition, penguins have died from eating the masks, unable to digest and eat, and seagulls have been found to be unable to move due to swollen joints caught on their feet by the slings of the masks. The ability of masks to absorb impurities in the ocean has gone from an advantage to a concern. The masks absorb and accumulate toxic substances in the ocean, which can block the esophagus and starve to death when eaten by Marine creatures such as jellyfish, or they can slowly be poisoned to death.

The dangers of discarded masks are not just visible to the naked eye. Disposable masks are divided into three layers, the inner and outer layers are non-woven fabric, and the middle layer is melt-blown cloth, which is mainly composed of plastic and belongs to non-degradable materials. Compared with other materials, melt-blown fabrics and non-woven fabrics have very small fiber diameters, which further exacerbates mechanical wear between the fibers during mask use, leading to the formation of more microplastics. The study showed that the average amount of microplastics released from unused masks ranged from 71 to 308 per mask, but increased to 682 to 1918 per mask after use. These microplastics are easily eaten by fish, which can then enter the food chain and eventually enter the human body. The masks are made of polypropylene, which can take up to 400 years to degrade in the environment, a process that also directly impacts Marine ecosystems. The Marine environment has long been polluted by plastic waste before the outbreak, and the new coronavirus has dealt a blow to the environment. “As a result of this pandemic, 129 billion masks and 65 billion plastic gloves are being released into the environment every month,” said Doug Kress, deputy administrator of the US Marine Conservation Service. “And much of it is scattered in the ocean due to improper disposal.” Coral reefs are hardest hit by Marine pollution. The world-famous Great Barrier Reef in Australia has experienced widespread coral bleaching, causing a lot of concern. While the Great Barrier Reef is well known, Britain’s Pitcairn Islands are relatively unknown to the public. But this little-known archipelago is home to an amazing natural ecosystem. In 2015, the UK government also officially declared the Pitcairn Islands and the surrounding waters as one of the largest and most important Marine ecological reserves. Divers and environmental observers have captured footage of the ocean floor, and as the pandemic continues around the world, more and more waste are being found floating on the ocean floor, damaging wildlife and even “surfing” coastlines. The Pitcairn Islands are located in the south-central Pacific Ocean. They are the last British territory in the Pacific. Only Pitcairn is inhabited. The largest of the Pitcairn Islands, Henderson Island, is recognized as a World Heritage Site for its extensive biodiversity. But a severe dilemma currently confronts the island. Henderson's geographic location causes the South Pacific Gyre to slam all marine debris into Henderson's beaches. Henderson Island is currently the largest Pacific Ocean garbage dump with more than 18 tons of plastic rubbish piling up there. It is because of a large amount of plastic accumulation, resulting in the Pitcairn Islands. The Marine ecosystem has been seriously damaged, causing a large degree of pollution. During an underwater survey in September 2017, researchers documented a mass coral bleaching. While researchers say the bleaching was caused by cold temperatures at the time, the plastic debris that made its way across the Pitcairn Islands could also have contributed to the severe bleaching, given that many pollution factors could have exacerbated coral bleaching.

As can be seen from the data in the table, sea turtles have a considerable amount of plastic in their bodies due to accidental swallowing of masks [8]. On July 15, 2017, a sea turtle was found stranded in Sanya City, Hainan Province, southern China. Local rescuers brought it back to Sanya Haichang

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Biological Conservation Center for treatment. Nearly 3kg of plastic bags, fishing nets, masks and string were found inside the animal Rescue teams operated on the turtle, but it was found without vital signs on August 26. An autopsy of the turtle revealed that the immediate cause of death was that the turtle had swallowed a large number of foreign bodies, including plastic bags, fishing nets, masks, strings, and fishhooks, resulting in intestinal obstruction and necrosis. When plastic enters the ocean, algae and microbes clump together, releasing volatile compounds that make it smell like turtle feed. Most people used to think that sea turtles were not threatened with extinction because they live a long time, have a long reproductive life and can lay hundreds of eggs at a time. How could they be in danger? But few know that it takes more than 20 years for turtles to become sexually mature. For every thousand sea turtle eggs laid, only about one turtle reaches adult life because of natural predators and other obstacles. Those who face many human threats such as facial masks coming into the ocean.

Another case was in Essex, England, where a baby gull was unable to free itself after it got caught in a discarded face mask [9]. The seabird caught in the mask kept struggling on the beach but was unable to free itself from the mask, and because the seabird was entangled, it was likely to be attacked by other creatures during the struggle. This seagull, on the other hand, was lucky that when it was found rescued and had been entangled in the rope for as long as a week. It could not move feet. Although the rope was untied, its legs would have become swollen and deformed due to the prolonged bondage. A dead puffer fish Is strangled by a mask strap in the waters off Miami, the United States [10]. In the United States, puffer fish have been killed by masks off the coast of Miami. According to a video taken by a netizen, an inflatable dead puffer fish is being tightly strangled by a mask strap. Pufferfish usually inflate when they encounter enemy damage. It instinctively wants to escape the danger through expansion, but did not expect this will only make the mask tighter and tighter. Combined with the shape of the gloves, which are largely transparent and have five fingers, they look very much like jellyfish and other sea creatures. Turtles, seabirds and other Marine mammals are more likely to mistake medical waste for food. Once swallowed, gloves are likely to block an animal esophagus or permanently accumulate in the stomach. Combined with the shape of the gloves, which are largely transparent and have five fingers, they look very much like jellyfish and other sea creatures.

Figure 1. A sea bird being trapped by a face mask.

3. Conclusion

Since the outbreak of the novel coronavirus, masks have become a daily necessity, and the number of discarded masks has increased rapidly, which has had an immeasurable impact on the ecological

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environment. At least 1.56 billion masks end up in the ocean each year because of poor treatment, and some of the waste masks invade wildlife habitats, which can take more than 450 years to degrade. A large number of discarded masks will directly affect Marine life, birds, fisheries, aquaculture and may lead to a larger scale of subsequent disasters. Quite a few Marine creatures have been killed by becoming entangled in the ear bands on the left and right sides of the masks. In addition, penguins have died from eating the masks, unable to digest and eat, and seagulls have been found to be unable to move due to swollen joints caught on their feet by the slings of the masks. Through the case analysis of marine animals, this paper found the impact of masks on Marine organisms and the overall ecology of the sea. At the same time, a related survey found that the amount of waste masks entering the ocean is huge. There is, though, an economic burden on governments to use policies and introduce new approaches. But in the long run, protecting the ocean in terms of output control can effectively improve the Marine environment, thereby protecting marine ecology and animals. At the same time, there is also a need to explore more feasible ways to remove the waste now entering the ocean or to make masks from other environmentally friendly materials to reduce their harm. The hope is that in the next 500 years, masks will no longer cause any harm to Marine ecology.

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