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Why Plastic Pollution is the Biggest Threat Marine Birds Face

There are almost 350 species of birds that depend on marine environments for part of their lifecycle (BirdLife International, 2012). These birds have adapted for an ever-changing life by the sea and are considered marine birds or seabirds. These birds generally have dense, waterproof feathers; layers of fat; and are able to remove excess salt through a desalination system (Audubon, n.d.). Even though these birds are so well adapted for their environment, they, as with any organism, are not able to adapt fast enough to the human impacts on their habitats. Some of these threats include oil spills, human interactions near nesting sites, and habitat destruction from urbanization and fisheries (NOAA, 2022). Because of this, marine birds are the most threatened group of bird species and almost half of them are known or suspected to be experiencing a population decline (BirdLife International, 2012). Another threat marine birds face is plastic pollution; ocean plastic pollution is often ingested by birds and has become a bigger problem over the years. In the 1960s, less than 5% of birds were found with plastic in their stomach. 20 years later 80% of birds had plastic in their stomachs, and by 2050 it is projected that 99% of seabirds will be ingesting plastic (Broholm, n.d.). While marine birds are at risk from many human induced threats, plastic pollution is the biggest threat these birds face.

In the world's oceans there is an estimated 15-51 trillion pieces of plastic (Broholm, n.d.). Plastic can end up in the oceans through a variety of ways. When plastic is dropped or left behind, it can be carried away by wind and rain into drainage systems or rivers (Young, 2017). Fishing gear is also a frequent polluter due to it being lost to sea by accident, through industrial losses, or due to illegal dumping (Young, 2017). The plastic has continued to accumulate over the years because it never breaks down. This plastic can be found along coasts, on the ocean floor, and on the surface, and much of it will accumulate into what are known as 'garbage patches.' Garbage patches form at ocean gyres, which are rotating ocean currents that can pull in debris. When the gyres pull in a lot of debris they can create 'patches' of garbage. These patches

can cause wildlife to get entangled, ingest the plastic, or even allow for the transportation of invasive species (NOAA, 2022). Plastic comes in many shapes and sizes, the most prevalent forms found in the ocean are bags, bottle caps, and plastic fibers from synthetic clothes (CSIRO Australia, 2015). This plastic does not decompose and will either float or break down into microplastics (NOAA, 2022).

Microplastics are a type of plastic that have recently been the cause of concern to scientists. Microplastics are defined as plastics less than 5 mm and can be classified as primary or secondary microplastics (Ha and Yeo, 2018). Primary microplastics were originally manufactured to be small, while secondary microplastics originate from larger plastics that have broken down due to weathering (Lehtiniemi et al, 2018). It is currently estimated that there are 24 trillion and counting of these microplastics in the ocean (Kyushu University, 2021). Most of these are secondary microplastics, as they are much more prevalent than primary in the environment (Lehtiniemi, 2018). Microplastics can be more easily consumed by marine animals than larger pieces of plastic and have been detected in marine organisms as small as plankton and as large as whales (National Geographic Society, 2022).

Many marine birds rely on the ocean to provide a source of food for them; they either get their food by surface feeding or forage diving (PAWS, n.d.). When they feed though, many of them are eating more than just food. Both microplastics and larger plastics are unintentionally either ingested by seabirds due to their proximity to actual food, or ingested as the birds mistake the colorful pieces of plastic for prey. While both surface feeding and forage diving seabirds have been found with plastic in their stomachs, surface feeding seabirds are more likely to ingest plastic when feeding (Broholm, n.d.). This can happen when these birds, such as albatrosses, eat fish eggs floating on debris and also consume the plastic floating with their food (Broholm, n.d.). Colorful pieces of plastic are also often mistaken for food by these birds, and they ingest the plastic believing it is actually food. Overtime, the plastic they eat accumulates in the GI tract and stomach of the bird, the plastic takes the place of food which constricts the bird's stomach capacity (Jue, 2020). This ingested plastic reduces the volume of the stomach and leads to the bird starving even though their stomach is full (Broholm, n.d.).

While the ingestion of plastics causes a threat to seabirds on its own, when birds ingest plastic they can be exposed to chemicals that will leach into their bodies. When seabirds ingest plastic, the chemicals from plastic build up in the birds' liver and fatty tissues at levels thousands

of times higher than normal (Briggs, 2020). Along with chemical exposure from ingesting plastic, particulate plastics are also spread at colonies through regurgitation and guano deposition which increases concentrations of chemical contaminants near colonies (Wang, 2021). Chemical exposure can also occur through the food chain in a process known as biomagnification (Center for Biological Diversity, 2012). When biomagnification occurs in the food chain, chemical concentrations progressively increase along with the increase of an animal's trophic status (Drouillard, 2008). For bird species higher up on the food chain, this means they are experiencing more chemical contamination if their food sources are being exposed to these chemicals. A study found that chemicals such as PCB, DDT, and Bisphenol A could be correlated to a multitude of issues. These include impared kidney function, high cholesterol, and low BMI in adults. As well as a shorter head, bill, and wing length in shearwater fledglings and could also cause early mortality (Jue, 2020). Seabirds that have consumed plastic that survived to adulthood are also smaller, have shorter wings and bills, and have a smaller body mass (Broholm, n.d.). Research has also revealed another concerning effect of plastic consumption. A study on Laysan Albatrosses and Bonin Petrels from the Midway Atoll found that there was a correlation between the high levels plastic they ingested and the increased levels of chlorine, iron, lead, manganese, and rubidium in their feathers (Lavers and Bond, 2016). Increased levels of heavy metals such as lead can also affect the behavior and physiology of a bird as well as lower their survival (Lavers and Bond, 2016). Increased levels of lead, mercury, and cadmium in birds can also cause reduced body condition, and could also lower juvenile survival (Lavers and Bond, 2016).

It could be argued that other threats marine birds face put them more at risk than plastic. A study published in Science Magazine found that 40% of the world's oceans are heavily impacted by human activities, but there is no place that is completely unaffected by humans (NOAA, 2010). Much of this human activity involves oil spills, human interactions near nesting sites, and habitat destruction, along with plastic pollution (NOAA, 2022).While these are all detrimental, plastic is so abundant in marine environments that seabirds come into contact with it much more frequently than other threats. Policy changes such as establishing marine preserves to protect waters where seabirds feed from overfishing, vessel traffic, and energy extraction can be used to limit the risks seabirds face (Urton, 2021). Plastic pollution, on the other hand, is much harder to prevent than these threats.

Marine birds face a multitude of issues associated with plastic pollution, and every year more than 1 million of seabird deaths are caused by it (MBRC the Ocean, n.d.). The main threats plastic poses on these birds are the consumption of plastics and microplastics leading to starvation and chemical exposure. The chemicals these birds are exposed to can cause birth defects, impairment of bodily functions, and early mortality. Since the 1950's, monitored seabird populations have dropped 70% (University of British Columbia, 2015). Efforts need to be made to protect these species, and one of the best ways this can be done is to clean up plastic already in the oceans, along with preventing more from entering marine environments. Policies are an important role in protecting any aspect of the environment and will be vital in saving our waterways and the organisms living in them. The Center for Biological Diversity has been advocating to regulate plastic as a pollutant under the Clean Water Act, citing the Act's objective "to restore and maintain the chemical, physical, biological integrity of the Nation's waters (cited in (US Congress, 1972)" (Lueders and Nomanim, 2012). While this alone won't prevent plastic from entering waterways, initiatives like it are what will be needed to make a noticeable difference. While updating recycling infrastructure can also help reduce pollution in the environment, 400 million tons of plastic waste are produced every year (UNEP, n.d.). The biggest difference will be seen in producing less plastic, and stopping this problem at its source.

Even though plastic pollution is the biggest threat to marine birds and more efforts need to be made to protect these birds from plastic pollution, this does not diminish the gravity of other threats still affecting marine birds. To save sea birds though the focus needs to be placed on the issue of plastic in our oceans, because it is the most prevalent and pressing issue. Seabirds are strong indicators of marine environment health, as they adapt quickly to environmental changes and their colonies can be an indicator for a variety of potential abiotic threats (Rajpar et al, 2018). It is important to protect marine birds, because the health of these species is a reflection on the health of marine environments. Marine birds are not the only group of species suffering from plastic pollution, but the threat of plastic pollution to them reflects the overall threat of plastic to the oceans.

Bibliography

Audubon. n.d. “What’s a Seabird?” *Audubon California*. Visited November 29, 2022. https://ca.audubon.org/what-s-seabird

BirdLife International. 2012. “Spotlight on Seabirds.” *BirdLife International.* 2012. http://datazone.birdlife.org/sowb/spotseabirds

Briggs, Helen. 2020. “Plastic Pollution: ‘Hidden’ Chemicals Build Up in Seabirds.” *BBC News.* January 31, 2020. https://www.bbc.com/news/science-environment-51285103

Broholm, Tessa. n.d. “The Effects of Plastic Pollution on Seabirds.” *Ocean Blue Project*. Vitised November 29, 2022. https://oceanblueproject.org/the-effects-of-plastic-p-on-seabirds/#:~:text=Adult%20birds%20return%20to%20nests,are%20full%20of%20plastic%20waste

Center for Biological Diversity. n.d. “Ocean Plastics Pollution.” *Center for Biological Diversity.* Visited November 30, 2022. https://www.biologicaldiversity.org/campaigns/ocean_plastics/

CSIRO Australia. 2015. “Plastic in 99 Percent of Seabirds by 2050.” *ScienceDaily*. August 31, 2015. https://www.sciencedaily.com/releases/2015/08/150831163739.htm

Drouillard, K.G. 2008. “Biomagnification” In *Encyclopedia of Ecology.* Edited by Brian Fath. Elsevier B.V. 2019. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/biomagnification

Ha, Jiwon and Min-Keyeong Yeo. 2018. “The Environmental Effects of Microplastics on Aquatic Ecosystems.” *Molecular and Cellular Toxicology* 14, no. 4 August 31, 2018. https://www.researchgate.net/publication/327870293_The_environmental_effects_of_microplastics_on_aquatic_ecosystems

Jue, Matthew. 2020. “Effects of Plastic Ingestion on Marine Birds.” *Richardson Bay Audubon News.* July 20, 2020. https://richardsonbay.audubon.org/news/effects-plastic-ingestion-marine-birds#:~:text=The%20more%20plastic%20that%20is,both%20birds%20and%20their%20prey

Kyushu University. 2021. “Twenty-four Trillion Pieces of Microplastics in the Ocean and Counting.” *ScienceDaily*. October 27, 2021. https://www.sciencedaily.com/releases/2021/10/211027122120.htm

Lavers, Jennifer and Alexander Bond. 2016. “Ingested Plastic as a Route for Trace Metals in Laysan Albatross (*Phoebastria immutabilis*) and Bonin Petrel (*Pterodroma hypoleuca*) from Midway Atoll.” *Marine Pollution Bulletin* 110, no. 1 August 9, 2016. https://www.sciencedirect.com/science/article/pii/S0025326X16304052?via%3Dihub

Lehtiniemi, Maiju, Samuel Hartikainen, Pinja Nakki, Jonna Engstrom-Ost, Arto Koistinen, and Outi Setala. 2018. “Size Matters More than Shape: Ingestion of Primary and Secondary Microplastics by Small Predators.” *Food Webs* 17. December 2018. https://www.sciencedirect.com/science/article/pii/S2352249618300326

Lueders, Jesse and Daniel Nomanim. 2012. “Petition for Water Quality Criteria for Plastic Pollution Under the Clean Water Act, 33 U.S.C. § 1314.” Petition to the EPA. August 22, 2012. https://www.biologicaldiversity.org/campaigns/ocean_plastics/pdfs/Petition_Plastic_WQC_08-22-2012.pdf

MBRC the Ocean. n.d. “Shocking Plastic Statistics.” *MBRC the Ocean*. Visited December 5, 2022. https://www.mbrctheocean.com/pages/shocking-plastic-statistics#:~:text=More%20than%201%20million%20seabirds,from%20plastic%20pollution%20every%20year.&text=100%25%20of%20baby%20sea%20turtles%20have%20plastic%20in%20their%20stomachs.&text=There%20is%20now%205.25%20trillion,weighing%20up%20to%20269%2C000%20tonnes.

National Geographic Society. 2022. “Microplastics.” *National Geographic Society.* May 20, 2022. https://education.nationalgeographic.org/resource/microplastics

NOAA. 2022. “A Guide to Plastic in the Ocean.” *National Oceanic and Atmospheric Administration.* January 27, 2022. https://oceanservice.noaa.gov/hazards/marinedebris/plastics-in-the-ocean.html

NOAA. 2010. “Human Influences on Marine Ecosystems.” *National Oceanic and Atmospheric Administration.* January 1, 2010. https://sos.noaa.gov/catalog/datasets/human-influences-on-marine-ecosystems/#:~:text=In%20addition%20to%20finding%20that,impact%2C%20especially%20near%20the%20poles.

NOAA. 2022. “What Threats do Seabirds Face?” *National Oceanic and Atmospheric Administration.* January 4, 2022. https://oceanservice.noaa.gov/facts/seabird-threats.html#:~:text=Seabirds%20are%20impacted%20by%20a,%2C%20disturbances%2C%20and%20habitat%20destruction

OR&R’s Marine Debris Program. 2022. “Garbage Patches.” *National Oceanic and Atmospheric Administration*. December 7, 2022. https://marinedebris.noaa.gov/info/patch.html

PAWS. n.d. “Seabirds.” *Progressive Animal Welfare Society.* Visited December 5, 2022. https://www.paws.org/resources/seabirds/#:~:text=Seabirds%20are%20either%20surface%20feeders,dipping%20their%20head%20while%20swimming.

Rajpar, Muhammad, Ibrahim Ozdemir, Mohamed Zakaria, Shazia Sheryar, and Abdu Rab. 2018. “Seabirds as Bioindicators of Marine Ecosystems.” In *Seabirds*, edited by Heimo Mikkola. London, United Kingdom: IntechOpen, September 5, 2018. https://www.intechopen.com/chapters/59950

UNEP. n.d. “Visual Feature - Beat Plastic Pollution.” *United Nations Environment Programme.* Visited December 8, 2022. https://www.unep.org/interactives/beat-plastic-pollution/

University of British Columbia. 2015. “Global Trends Show Seabird Populations Dropped 70% Since the 1950s.” *ScienceDaily*. July 9, 2015. https://www.sciencedaily.com/releases/2015/07/150709102850.htm

Urton, James. 2021. “Seabirds Face Dire Threats from Climate Change, Human Activity-Especially in Northern Hemisphere.” *University of Washington News.* May 27, 2021.

Wang, Limin, Ghulam Nabi, Liyun Yin, Yanqin Wang, Shuxin Li, Zhaung Hao, and Dongming Li. 2021. “Birds and Plastic Pollution: Recent Advances.” *Avian Research* 12, no. 59 November 2, 2021. https://avianres.biomedcentral.com/articles/10.1186/s40657-021-00293-2

Young, Nick. 2017. “How does Plastic get into the Ocean?” *Greenpeace International.* August 23, 2017. https://www.greenpeace.org/aotearoa/story/how-does-plastic-end-up-in-the-ocean/