Man made causes of losing aquatic biodiversity

Human activities affect marine life and marine habitats through overfishing, habitat loss, the introduction of invasive species, ocean pollution, ocean acidification and ocean warming. These impact marine ecosystems and food webs and may result in consequences as yet unrecognised for the biodiversity and continuation of marine life forms.

Overfishing:

Overfishing is occurring in one third of world fish stocks, according to a 2018 report by the Food and Agriculture Organization of the United Nations In addition, industry observers believe illegal, unreported and unregulated fishing occurs in most fisheries, and accounts for up to 30% of total catches in some important fisheries. In a phenomenon called fishing down the foodweb, the mean trophic level of world fisheries has declined because of overfishing high trophic level fish

Habitat Loss:

Coastal ecosystems are being particularly damaged by humans. Significant habitat loss is occurring particularly in seagrass meadows, mangrove forests and coral reefs, all of which are in global decline due to human disturbances.

Coral reefs are among the more productive and diverse ecosystems on the planet, but one-fifth of them have been lost in recent years due to anthropogenic disturbances. Coral reefs are microbially driven ecosystems that rely on marine microorganisms to retain and recycle nutrients in order to thrive in oligotrophic waters. However, these same microorganisms can also trigger feedback loops that intensify declines in coral reefs, with cascading effects across biogeochemical cycles and marine food webs. A better understanding is needed of the complex microbial interactions within coral reefs if reef conservation has a chance of success in the future.

Seagrass meadows have lost 30,000 km^2 (12,000 sq mi) during recent decades. Seagrass ecosystem services, currently worth about $US1.9 trillion per year, include nutrient cycling, the provision of food and habitats for many marine animals, including the endangered dugongs, manatee and green turtles, and major facilitations for coral reef fish.

One-fifth of the world's mangrove forests have also been lost since 1980.The most pressing threat to kelp forests may be the overfishing of coastal ecosystems, which by removing higher trophic levels facilitates their shift to depauperate urchin barrens.

An invasive species is a species not native to a particular location which can spread to a degree that causes damage to the environment, human economy or human health. In 2008, Molnar et al. documented the pathways of hundreds of marine invasive species and found shipping was the dominant mechanism for the transfer of invasive species in the ocean. The two main maritime mechanisms of transporting marine organisms to other ocean environments are via hull fouling and the transfer of ballast water.

Ballast water taken up at sea and released in port is a major source of unwanted exotic marine life. The invasive freshwater zebra mussels, native to the Black, Caspian, and Azov seas, were probably transported to the Great Lakes via ballast water from a transoceanic vessel. Meinesz believes that one of the worst cases of a single invasive species causing harm to an ecosystem can be attributed to a seemingly harmless jellyfish. *Mnemiopsis leidyi*, a species of comb jellyfish that spread so it now inhabits estuaries in many parts of the world, was first introduced in 1982, and thought to have been transported to the Black Sea in a ship's ballast water. The population of the jellyfish grew exponentially and, by 1988, it was wreaking havoc upon the local fishing industry. "The anchovy catch fell from 204,000 tons in 1984 to 200 tons in 1993; sprat from 24,600 tons in 1984 to 12,000 tons in 1993; horse mackerel from 4,000 tons in 1984 to zero in 1993." Now that the jellyfish have exhausted the zooplankton, including fish larvae, their numbers have fallen dramatically, yet they continue to maintain a stranglehold on the ecosystem.

Invasive species can take over once occupied areas, facilitate the spread of new diseases, introduce new genetic material, alter underwater seascapes, and jeopardize the ability of native species to obtain food. Invasive species are responsible for about $138 billion annually in lost revenue and management costs in the US alone.

Marine pollution:

Marine pollution occurs when substances used or spread by humans, such as industrial, agricultural and residential waste, particles, noise, excess carbon dioxide or invasive organisms enter the ocean and cause harmful effects there. The majority of this waste (80%) comes from land-based activity, although marine transportation significantly contributes as well. Since most inputs come from land, either via the rivers, sewage or the atmosphere, it means that continental shelves are more vulnerable to pollution. Air pollution is also a contributing factor by carrying off iron, carbonic acid, nitrogen, silicon, sulfur, pesticides or dust particles into the ocean. The pollution often comes from nonpoint sources such as agricultural runoff, wind-blown debris, and dust. These nonpoint sources are largely due to runoff that enters the ocean through rivers, but wind-blown debris and dust can also play a role, as these pollutants can settle into waterways and oceans. Pathways of

pollution include direct discharge, land runoff, ship pollution, atmospheric pollution and, potentially, deep sea mining.

The types of marine pollution can be grouped as pollution from marine debris, plastic pollution, including microplastics, ocean acidification, nutrient pollution, toxins and underwater noise. Plastic pollution in the ocean is a type of marine pollution by plastics, ranging in size from large original material such as bottles and bags, down to microplastics formed from the fragmentation of plastic material. Marine debris is mainly discarded human rubbish which floats on, or is suspended in the ocean. Plastic pollution is harmful to marine life.

Another concern is the runoff of nutrients (nitrogen and phosphorus) from intensive agriculture, and the disposal of untreated or partially treated sewage to rivers and subsequently oceans. These nitrogen and phosphorus nutrients (which are also contained in fertilizers) stimulate phytoplankton and macroalgal growth, which can lead to harmful algal blooms (eutrophication) which can be harmful to humans as well as marine creatures. Excessive algal growth can also smother sensitive coral reefs and lead to loss of biodiversity and coral health. A second major concern is that the degradation of algal blooms can lead to consumption of oxygen in coastal waters, a situation that may worsen with climate change as warming reduces vertical mixing of the water column

Nutrient pollution:

Nutrient pollution is a primary cause of eutrophication of surface waters, in which excess nutrients, usually nitrates or phosphates, stimulate algae growth. This algae then dies, sinks, and is decomposed by bacteria in the water. This decomposition process consumes oxygen, depleting the supply for other marine life and creating what is referred to as a "dead zone." Dead zones are hypoxic, meaning the water has very low levels of dissolved oxygen. This kills off marine life or forces it to leave the area, removing life from the area and giving it the name dead zone. Hypoxic zones or dead zones can occur naturally, but nutrient pollution from human activity has turned this natural process into an environmental problem.

There are five main sources of nutrient pollution. The most common source of nutrient runoff is municipal sewage. This sewage can reach waterways through storm water, leaks, or direct dumping of human sewage into bodies of water. The next biggest sources come from agricultural practices. Chemical fertilizers used in farming can seep into ground water or be washed away in rainwater, entering water ways and introducing excess nitrogen and phosphorus to these environments. Livestock waste can also enter waterways and introduce excess nutrients. Nutrient pollution from animal manure is most intense from industrial animal agriculture operations, in which hundreds or thousands of animals are raised in one concentrated area. Stormwater

drainage is another source of nutrient pollution. Nutrients and fertilizers from residential properties and impervious surfaces can be picked up in stormwater, which then runs into nearby rivers and streams that eventually lead to the ocean. The fifth main source of nutrient runoff is aquaculture, in which aquatic organisms are cultivated under controlled conditions. The excrement, excess food, and other organic wastes created by these operations introduces excess nutrients into the surrounding water.[

Toxic chemicals:

Toxic chemicals can adhere to tiny particles which are then taken up by plankton and benthic animals, most of which are either deposit feeders or filter feeders. In this way, toxins are concentrated upward within ocean food chains. Many particles combine chemically in a manner which depletes oxygen, causing estuaries to become anoxic. Pesticides and toxic metals are similarly incorporated into marine food webs, harming the biological health of marine life. Many animal feeds have a high fish meal or fish hydrolysate content. In this way, marine toxins are transferred back to farmed land animals, and then to humans.

Phytoplankton concentrations have increased over the last century in coastal waters, and more recently have declined in the open ocean. Increases in nutrient runoff from land may explain the rise in coastal phytoplankton, while warming surface temperatures in the open ocean may have strengthened stratification in the water column, reducing the flow of nutrients from the deep that open ocean phytoplankton find useful.

Plastic pollution:

Over 300 million tons of plastic are produced every year, half of which are used in single-use products like cups, bags, and packaging. At least 8 million tons of plastic enter the oceans every year. It is impossible to know for sure, but it is estimated that about 150 million metric tons of plastic exists in our oceans. Plastic pollution makes up 80% of all marine debris from surface waters to deep-sea sediments. Because plastics are light, much of this pollution is seen in and around the ocean surface, but plastic trash and particles are now found in most marine and terrestrial habitats, including the deep sea, Great Lakes, coral reefs, beaches, rivers, and estuaries. The most eye-catching evidence of the ocean plastic problem are the garbage patches that accumulate in gyre regions. A gyre is a circular ocean current formed by the Earth's wind patterns and the forces created by the rotation of the planet. There are five main ocean gyres: the North and South Pacific Subtropical Gyres, the North and South Atlantic Subtropical Gyres, and the Indian Ocean Subtropical Gyre. There are significant garbage patches in each of these.

arger plastic waste can be ingested by marine species, filling their stomachs and leading them to believe they are full when in fact they have taken in nothing of nutritional value. This can bring seabirds, whales, fish, and turtles to die of starvation with plastic-filled stomachs. Marine species can also be suffocated or entangled in plastic garbage.

The biggest threat of ocean plastic pollution comes from microplastics. These are small fragments of plastic debris, some of which were produced to be this small such as microbeads. Other microplastics come from the weathering of larger plastic waste. Once larger pieces of plastic waste enter the ocean, or any waterway, the sunlight exposure, temperature, humidity, waves, and wind begin to break the plastic down into pieces smaller than five millimeters long. Plastics can also be broken down by smaller organisms who will eat plastic debris, breaking it down into small pieces, and either excrete these microplastics or spit them out. In lab tests, it was found that amphipods of the species *Orchestia gammarellus* could quickly devour pieces of plastic bags, shredding a single bag into 1.75 million microscopic fragments. Although the plastic is broken down, it is still a man-made material that does not biodegrade. It is estimated that approximately 90% of the plastics in the pelagic marine environment are microplastics. These microplastics are frequently consumed by marine organisms at the base of the food chain, like plankton and fish larvae, which leads to a concentration of ingested plastic up the food chain. Plastics are produced with toxic chemicals which then enter the marine food chain, including the fish that some humans eat.

Noise pollution:

There is a natural soundscape to the ocean that organisms have evolved around for tens of thousands of years. However, human activity has disrupted this soundscape, largely drowning out sounds organisms depend on for mating, warding off predators, and travel. Ship and boat propellers and engines, industrial fishing, coastal construction, oil drilling, seismic surveys, warfare, sea-bed mining and sonar-based navigation have all introduced noise pollution to ocean environments. Shipping alone has contributed an estimated 32-fold increase of low-frequency noise along major shipping routes in the past 50 years, driving marine animals away from vital breeding and feeding grounds. Sound is the sensory cue that travels the farthest through the ocean, and anthropogenic noise pollution disrupts organisms' ability to utilize sound. This creates stress for the organisms that can affect their overall health, disrupting their behavior, physiology, and reproduction, and even causing mortality. Sound blasts from seismic surveys can damage the ears of marine animals and cause serious injury. Noise pollution is especially damaging for marine mammals that rely on echolocation, such as whales and dolphins. These animals use echolocation to communicate, navigate, feed, and find mates, but excess sound interferes with their ability to use echolocation and, therefore, perform these vital tasks.

Human induced disease:

Rapid change to ocean environments allows disease to flourish. Disease-causing microbes can change and adapt to new ocean conditions much more quickly than other marine life, giving them an advantage in ocean ecosystems. This group of organisms includes viruses, bacteria, fungi, and protozoans. While these pathogenic organisms can quickly adapt, other marine life is weakened by rapid changes to their environment. In addition, microbes are becoming more abundant due to aquaculture, the farming of aquatic life, and human waste polluting the ocean. These practices introduce new pathogens and excess nutrients into the ocean, further encouraging the survival of microbes.

Some of these microbes have wide host ranges and are referred to as multi-host pathogens. This means that the pathogen can infect, multiply, and be transmitted from different, unrelated species. Multi-host pathogens are especially dangerous because they can infect many organisms, but may not be deadly to all them. This means the microbes can exist in species that are more resistant and use these organisms as vessels for continuously infecting a susceptible species. In this case, the pathogen can completely wipe out the susceptible species while maintaining a supply of host organisms.

Conclusion:

Biodiversity is an issue that affects everyone and therefore everyone should be aware of their effect on biodiversity. As biodiversity decreases on earth, so do the chances of human survival. Therefore, it is important to educate people on living in equilibrium with the environment. It is also important to make sure that the government is making laws that will ensure biodiversity for the future and not focus on shortsighted economics. If humans become extinct, it will likely be a result of their own action or lack of action. Hopefully humans will realize this before it is too late.