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MARINE POLLUTION, SOURCES, EFFECT AND MANAGEMENT

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Abstract

Marine pollution is the harmful effect caused by the entry into the **ocean** of chemicals or particles. ... Many particles combine chemically in a manner highly depletive of oxygen, causing estuaries to become anoxic. This article explains the causes, consequences and cure of Marine pollution. Three different kinds of marine pollution have been categorised – caused through land, caused through air and caused by means of transportation. The pollutants from the land like industrial wastes and other wastes are discharged into sewerage and more untreated waters of from fertilizer and pesticide run off from agricultural lands that further is disposed into the waterways. Daily use of plastics is also contributing to the marine pollution. Oil spills and negligent acts of the transporters of the oil have a hazardous impact on marine life. Microorganisms and other animals eat the plastic assuming it as food and die off. There are many different enacted legislations which have provided for the prevention of the environment. This paper shall chalk out the steps to prevent the pollution that has been caused by endless pollutants.

This short review summarizes the present knowledge on pollutant impacts on marine viruses, virus-host systems and their potential ecological implications. Excess nutrients from sewage and river effluents are a primary cause of marine eutrophication and mucilage formation, often related to the development of large viral assemblages. At the same time, hydrocarbons, polychlorinated biphenyl and pesticides alter ecosystem functioning and can determinate changes in the virus-host interactions, thus increasing the potential of viral infection. All these pollutants might have synergistic effects on the virus-host system and are able to induce prophage, thus increasing the impact of viruses on marine ecosystems.

Introduction

Marine pollution occurs when harmful effects result from the entry into the ocean of chemicals, particles, agricultural and residential waste, noise, or the spread of invasive organisms. Eighty percent of marine pollution comes from land. Air pollution is also a contributing factor by carrying off pesticides or dirt into the ocean. Land and air pollution have proven to be harmful to marine life and its habitats.

The pollution often comes from nonpoint sources such as agricultural runoff, wind-blown debris, and dust. Pollution in large bodies of water can be aggravated by physical phenomena like the biological effects of Langmuir circulation. Nutrient pollution, a form of water pollution, refers to contamination by excessive inputs of nutrients. It is a primary cause of eutrophication of surface waters, in which excess nutrients, usually nitrates or phosphates, stimulate algae growth. Many potentially toxic chemicals adhere to tiny particles that are then taken up by plankton and benthic animals, most of which are either deposit feeders or filter feeders. In this way, the toxins are concentrated upward within ocean food chains. Many particles combine chemically in a manner highly depletive of oxygen, causing estuaries to become anoxic.

When pesticides are incorporated into the marine ecosystem, they quickly become absorbed into marine food webs. Once in the food webs, these pesticides can cause mutations, as well as diseases, which can be harmful to humans as well as the entire food web. Toxic metals can also be introduced into marine food webs. These can cause a change to tissue matter, biochemistry, behaviour, reproduction, and suppress growth in marine life. Also, many animal feeds have a high fishmeal or fish hydrolysate content. In this way, marine toxins can be transferred to land animals, and appear later in meat and dairy products.

In order to protect the ocean from marine pollution, policies have been developed internationally. There are different ways for the ocean to get polluted, therefore there have been multiple laws, policies, and treaties put into place throughout history.

Definition

Marine Pollution (UN definition)–

“The introduction by man, directly, or indirectly, of substances or energy to the marine environment resulting in deleterious effects such as: hazards to human health, hindrance to marine activities, impairment of the quality of seawater for various uses and reduction of amenities.” Marine pollution is a combination of chemicals and trash, most of which comes from land sources and is washed or blown into the ocean. This pollution results in damage to the environment, to the health of all organisms, and to economic structures worldwide.

Types of Marine Pollution

Eutrophication

When there is an excess of chemical nutrients mainly nitrates and phosphates in the water, it leads to eutrophication or nutrient pollution. Eutrophication decreases the level of oxygen, reduces the quality of water, makes the water inhabitable for fish, affects the breeding process within the marine life and increases the primary productivity of the marine ecosystem.

Acidification

Oceans act as a natural reservoir for absorbing the carbon dioxide from the Earth's atmosphere. But, due to rising level of carbon dioxide in the atmosphere, the oceans across the world are becoming acidic in nature, as a consequence, it leads to acidification of oceans. Researches and scientists have not been able to uncover the potential damage ocean acidification may have on the Earth's atmosphere. But, there is a strong concern that acidification might lead to dissolution of calcium carbonate structures, that can affect the shell formation in shellfish and also the corals.

Toxins

There are persistent toxins that do not get dissolved or disintegrate with the marine ecosystem rapidly. Toxins such as pesticides, DDT, PCBs, furans, TBT, radioactive waste, phenols, and dioxins get accumulated in the tissue cells of the marine lifeforms and lead to bioaccumulation hampering the life underwater and sometimes leads to a mutation in aquatic life forms.

Plastics

The ever-growing dependence of human population on plastic has filled the oceans and the land, it consists of 80 percent of the debris found in the oceans. Plastic dumped and found in the oceans are dangerous for the marine life forms and wildlife, as sometimes it strangles and chokes them to death. The rising levels of plastic dumps found in the oceans are suffocating, ingesting, and entangling the life underwater as well as above it.

Types of Oceans

Over time, the number of oceans have evolved from a single water body to something different.

But it really depends where you are from if you recognize that there is a fifth ocean.

Pacific, Atlantic, Indian, Arctic... and the Southern Ocean which is off the coast of Antarctica.

Today, we list the top 5 largest oceans in the world and the evolution of 5 oceans on Earth.

The Pacific Ocean is the largest ocean covering more than 30% of the Earth. This is close to half of the water on Earth.

It touches the west coast border of the Americas along with east Asia and Australia.

The equator divides the Pacific Ocean into two separate parts – North Pacific Ocean and South Pacific Ocean.

Pacific means “peaceful” in Latin. It has the deepest trenches with an average depth of 3800m.

2. Atlantic Ocean

The Atlantic Ocean is situated between the Americas and European/African continents. Atlantic Ocean is the second largest and saltiest ocean in the world.

It resembles an S-shape between the Americas, Europe and Africa. “Atlantic” originated from the Greek god “Atlas” who carried the sky for eternity.

The ocean bottom is composed of mid-Atlantic Ridge. This submarine mountain range extends all the



way from Iceland to 58 degrees South latitude. It's part of the longest mountain range in the world.

The Vikings, Portuguese and Christopher Columbus have extensively explored the Atlantic Ocean. Similarly to this day, it's being used for trade routes such as the transatlantic trade route.

3. Indian Ocean

Indian Ocean is the third largest ocean surrounding a densely populated region. It contains additional 20% of water on Earth's surface.

It borders India at the North, East Africa, Australia and the Southern Ocean. Because of higher water temperature, it has limited marine life.

Since about 800 A.D. the Indian Ocean has played an important role in trading. For centuries, navigators have sailed along major ocean currents for shipment routes.

It is bounded by 4 tectonic plate boundaries and may include an additional plate boundary. It is the geologically youngest of the 5 oceans with spreading ridges at divergent plate boundaries.



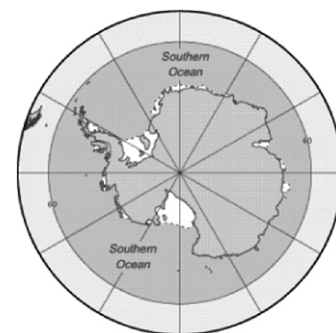
4. Southern Ocean

In 2000, the Southern Ocean is the newest ocean recognized by the International Hydrographic Organization. It borders Antarctica in its entirety.

In terms of size, it's the fourth largest at 20,327,000 square kilometers. It extends out to 60 degrees South latitude.

It's an extreme environment and is the least understood of the 5 oceans. This is because it is unexplored, far from populated areas and has a severe climate.

Despite the Southern Ocean being unexplored, about 80% of all oceans in the world are unexplored. There's still a lot of work to do for ocean exploration.



5. Arctic Ocean

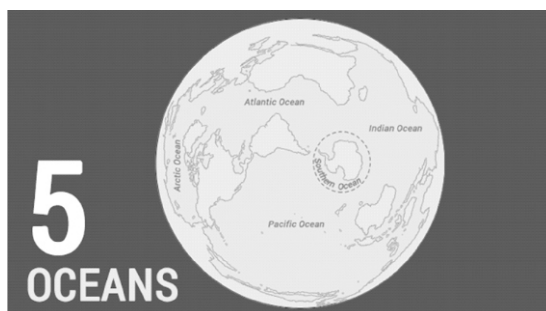
Arctic Ocean is the world's smallest and shallowest ocean of all 5 oceans. Further to this, it is the coldest and least salty ocean.

In size, the Arctic Ocean is about the size of Russia. Because it's located at the North Pole, the Arctic Ocean has polar ice. But over the years, glaciers have melted threatening sea levels to rise.

Despite the IHO recognizing it as the "Arctic Ocean", some oceanographers still call it the "Arctic Sea".

The Arctic Ocean is the most diverse in terms of fish species. It has a wide variety of marine species including whales, jellyfish, etc.

But because of its frigid temperatures, it has little plant life. This makes it one of the most fragile ecosystems on the planet.



Sources of Marine Pollution

Marine pollution is a growing problem in today's world. Our ocean is being flooded with two main types of pollution: chemicals and trash.

Chemical contamination, or nutrient pollution, is concerning for health, environmental, and economic reasons. This type of pollution occurs when human activities, notably the use of fertilizer on farms, lead to the runoff of chemicals into waterways that ultimately flow into the ocean. The increased concentration of chemicals, such as nitrogen and phosphorus, in the coastal ocean promotes the growth of algal blooms, which can be toxic to wildlife and harmful to humans. The negative effects on health and the environment caused by algal blooms that hurt local fishing and tourism industries.

Marine trash encompasses all manufactured products—most of them plastic—that end up in the ocean. Littering, storm winds, and poor waste management all contribute to the accumulation of this debris, 80 percent of which comes from sources on land. Common types of marine debris include various plastic items like shopping bags and beverage bottles, along with cigarette butts, bottle caps, food wrappers, and fishing gear. Plastic waste is particularly problematic as a pollutant because it is so long lasting. Plastic items can take hundreds of years to decompose.

This trash poses dangers to both humans and animals. Fish become tangled and injured in the debris, and some animals mistake items like plastic bags for food and eat them. Small organisms feed on tiny bits of broken-down plastic, called microplastic, and absorb the chemicals from the plastic into their tissues. Microplastics are less than five millimeters (0.2 inches) in diameter and have been detected in a range of marine species, including plankton and whales. When larger animals eat small organisms that consume microplastics, the toxic chemicals then become part of their tissues. In this way, the microplastic pollution migrates up the food chain, eventually becoming part of the food that humans eat.

Solutions for marine pollution include prevention and cleanup. Disposable and single-use plastic is abundantly used in today's society, from shopping bags to shipping packaging to plastic bottles. Changing society's approach to plastic use will be a long and economically challenging process. Cleanup, in contrast, may be impossible for some items. Many types of debris (including some plastics) do not float, so they are lost deep in the ocean. Plastics that do float tend to collect in large “patches” in ocean gyres. The Pacific Garbage Patch is one example of such a collection, with plastics and microplastics floating on and below the surface of swirling ocean currents between California and Hawaii in an area of about 1.6 million square kilometers (617,763 square miles), although its size is not fixed. These patches are less like islands of trash and, as the National Oceanic and Atmospheric Administration says, more like flecks of microplastic pepper swirling around an ocean soup. Even some promising solutions are inadequate for combating marine pollution. So-called “biodegradable” plastics often break down only at temperatures higher than will ever be reached in the ocean.

Nonetheless, many countries are taking action. According to a 2018 report from the United Nations, more than sixty countries have enacted regulations to limit or ban the use of disposable plastic items.

Pollutants are dumped into the ocean. This waste affects the daily life of fish and other marine creatures.



From Land

80% of non-biological marine pollution comes from land based activities

Most obvious inputs via pipes discharging directly into marine water (sewage, industrial, chemical and food processing wastes)

Riverine flows into the sea carry pollutants from the entire catchment area.

From Air

Global atmospheric inputs to the sea from air discharges .

Sources of Pollution cont'd.

Maritime

Oily discharges from ballast water and bilge water) during routine ship operations and illegal dumping of solid waste

Designated dumping grounds at sea (dredged spoil, old munitions, sewage sludge, fly ash, oil based drilling muds)

Accidental spills from Ships carrying hazardous substances, oil, gas etc.

Marine Pollutants

Worldwide

10 billion tonnes of ballast water with invasives.

Est. 10,000 million gallons of sewage annually

- 3.25 million metric tonnes of oil annually
- Millions of tonnes of Solid waste

Major Marine Pollutants - Metals

Introduced dangerous metals include mercury, lead, and copper

Heavy Metals are a great concern because they enter the food chain

Fuel combustion, electric utilities, steel and iron manufacturing, fuel oils, fuel additives and incineration of urban refuse are the major sources of oceanic and atmospheric contamination by heavy metals

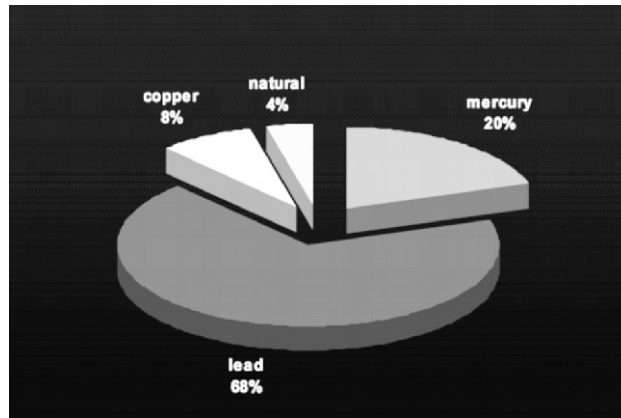
Copper is dangerous to marine organisms and has been used in marine anti-fouling paints

Mercury and lead poisoning cause brain damage and behavioral disturbances in children

Contaminated land runoff, rain of pollutants from the air, and fallout from shipwrecks pollute the ocean with dangerous metals

Human activities release 5 times as much mercury and 17 times as much lead as is derived from natural sources.

Heavy Metals Entering Oceans



Major Marine Pollutants - Solid Waste

A large portion and great danger is non- biodegradable plastic

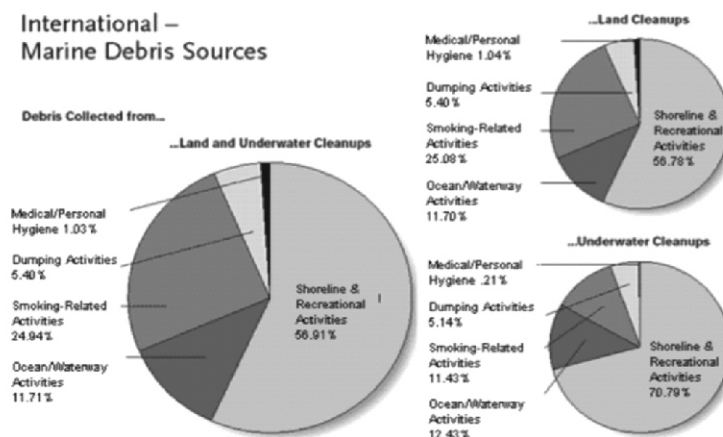
46,000 pieces of floating plastic/sq. mile of ocean surface off the N.E U.S. coast.

Sea turtles mistake plastic bags for jellyfish and die from internal blockages.

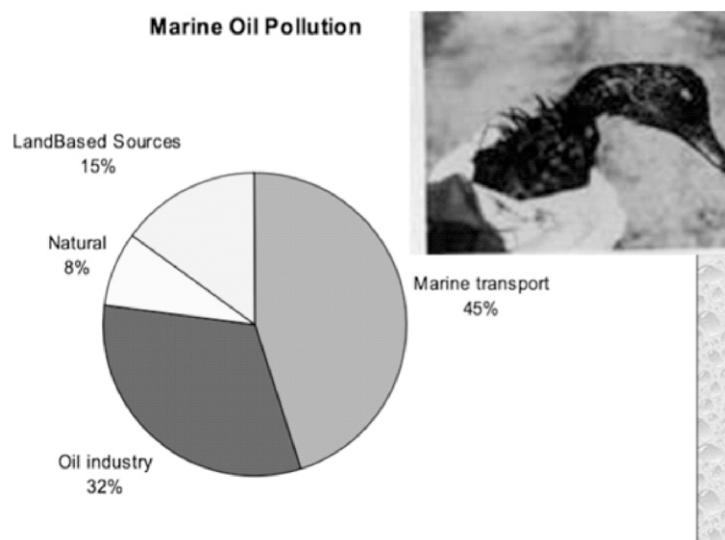
Seals and sea lions starve after being entangled by nets or muzzled by six-pack rings (decomposition time 400 years).

Plastic debris kills 100,000 marine mammals and 2 million sea birds die annually .

International – Marine Debris Sources



Major Marine Pollutants - Oil



Major Marine Pollutants - Biological

International Maritime Organization top ten: Cholera, Cladocera Water Flea, Mitten Crab, toxic algae (R,G,B tides), Round Goby, European Green Crab, Asian kelp, Zebra Mussel, North Pacific Sea star, North American Comb Jelly.

Spreading infestation of Jamaican waters by a Green mussel .

Impacts of Marine Pollution

Generally marine pollution affects ecosystem health, public health, recreational water quality and economic viability in the following ways:

- Mechanical
- Eutrophication
- Saprogenic
- Toxicity
- Mutagenic and Carcinogenic

Cost of Marine Pollution

3.25million metric tons of foil wasted vs. 3.4million tons used by Jamaica annually

100,000 mammal and 2million bird deaths annually

Reduction of GDP by decreasing fishery resource (11.9k tonnes – 7.7k landed 1960-97) and decreased tourism earnings

Loss of bio-diversity and potential lifesaving medicines (for AIDS & Cancer)

Solutions to Pollution

Two main methods

- Correction – costly and time intensive
- Prevention – requires attitude changes

Coastal Scientists believe that prevention is better than cure since the effects of marine pollution may be irreversible and we may therefore be creating everlasting damage to the marine ecosystem.

“An ounce of prevention is worth a pound of cure”

Marine Pollution Conventions

There are no less than 6 international marine pollution conventions. Some are listed below:

Convention for the Prevention of Marine Pollution by Dumping from Ships and Air craft (1972) The Oslo Convention

Convention for the prevention of pollution from ships (1973) MARPOL

Convention for the Prevention of Marine Pollution from Land-based Sources (1974) The Paris Convention
Convention for the Protection of the Marine Environment of the North-East Atlantic (1992) The OSPAR Convention

Conclusion

Although the ocean-and the resources within-seem limitless, there is clear evidence that human impacts such as overfishing, habitat destruction, and pollution disrupt marine ecosystems and threaten the long-term productivity of the seas. Declining yields in many fisheries and decay of treasured marine habitats, such as coral reefs, has heightened interest in establishing a comprehensive system of marine protected areas (MPAs)-areas designated for special protection to enhance the management of marine resources. Therefore, there is an urgent need to evaluate how MPAs can be employed in the United States and internationally as tools to support specific conservation needs of marine and coastal waters.

Marine Protected Areas compares conventional management of marine resources with proposals to augment these management strategies with a system of protected areas. The volume argues that implementation of MPAs should be incremental and adaptive, through the design of areas not only to conserve resources, but also to help us learn how to manage marine species more effectively.

References

1. <http://www.mcsuk.org/marineworld/pollution.html>
2. -http://www.worldstats.org/general_world/principal_environmental_treaties.html
3. <http://www.cmc-ocean.org> -<http://www.oceanlink.island.net/ask/pollution.html>
4. -WIKIPEDIA
5. -nationalgeographic.org