

Ocean pollution – An Introduction

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(All information presented here are collected from internet)

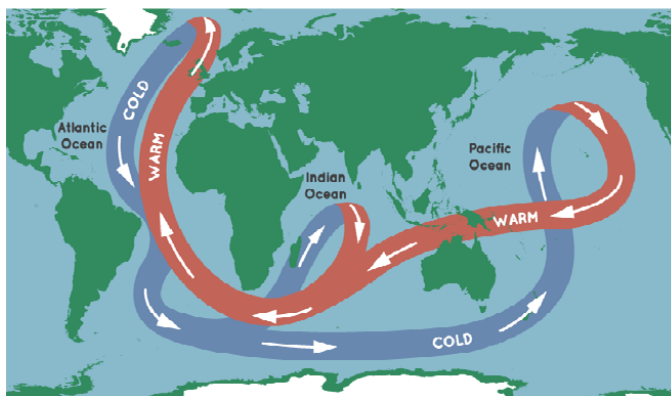
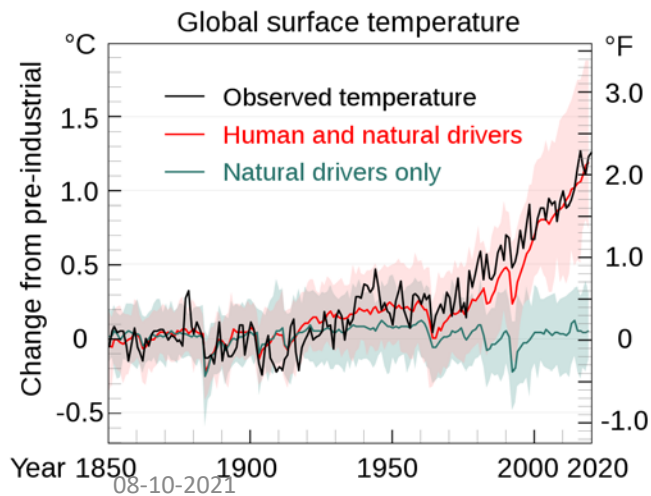
What is Ocean Pollution

- Pollution is addition of any substance (solid, liquid or gas) or energy (heat, sound or radioactivity) to the environment having a negative impact at a rate faster than it can be disposed or made inactive .
- We humans are land animals. Why talk of ocean pollution? Does ocean pollution have a negative impact on our living? Does ocean pollution have a connect with climate change?
- Some of these issues will be addressed today by eminent speakers.

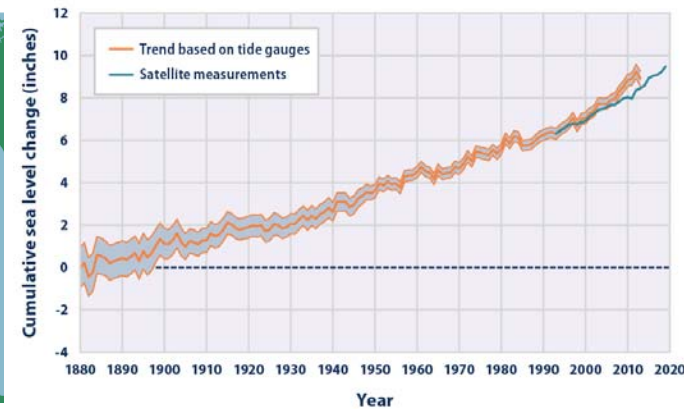
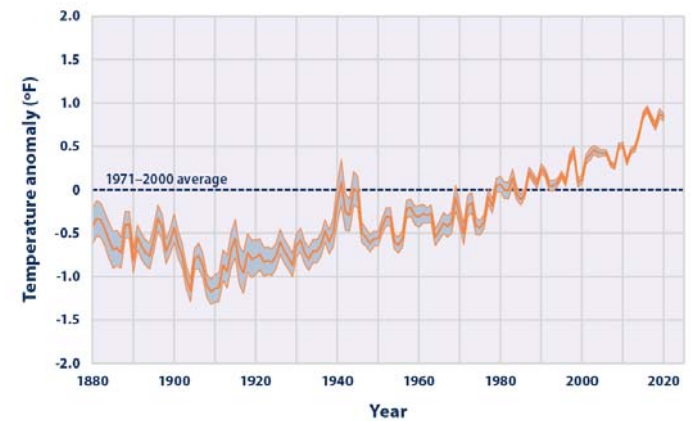
Ocean Pollution Items

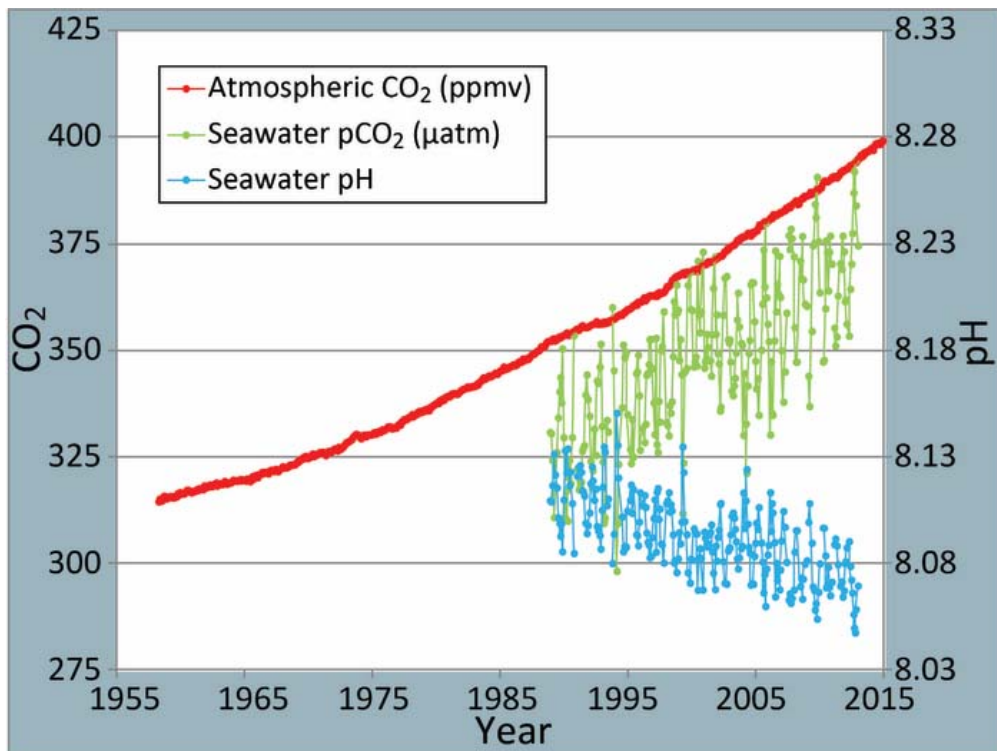
- From atmosphere
 - Heat
 - Carbon dioxide
 - Other green house gases – sulphur oxides, nitrogen oxides, methane etc.
- From rivers, lakes and land
 - Sewage and garbage
 - Industrial waste – chemicals, minerals, radio active material, oil
 - **PLASTICS**
- Human Activities in the ocean
 - Transportation and engineering generated waste gases, liquids and solids
 - Movement of species due to carriage of ballast water and fouling on ship bodies
 - Noise generated due to anthropogenic activities

93% of heat of the atmosphere is absorbed by the ocean. Obvious and visible effects of more heat in the ocean is melting of sea ice near the north pole (opening of the Bering strait all the year round), melting of glaciers in the Antarctica and the snow capped mountains including the Himalayas, sea level rise generating climate migration, loss of habitat of aquatic and polar living species and effect on ocean circulation leading to climate change.

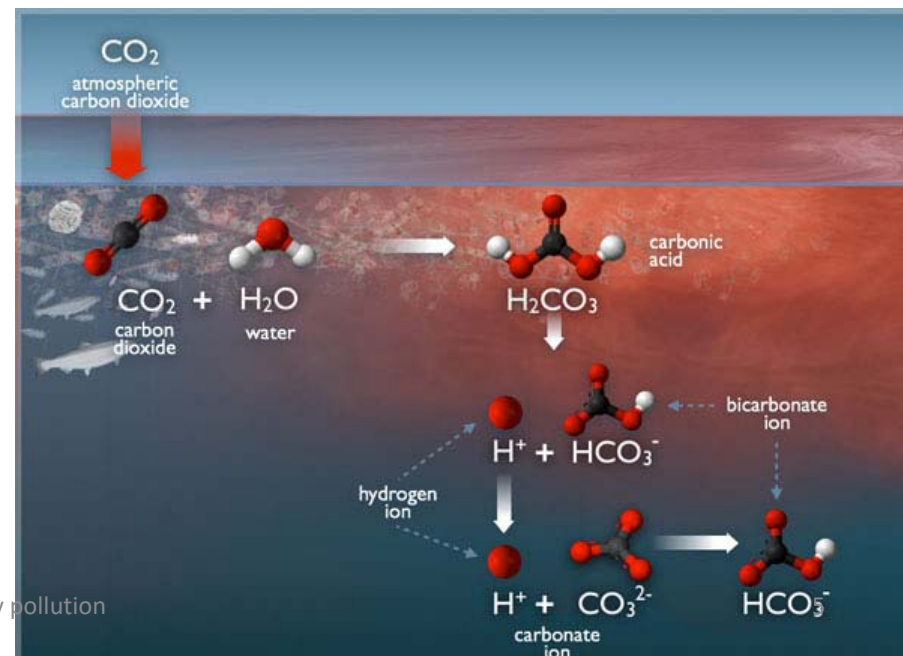
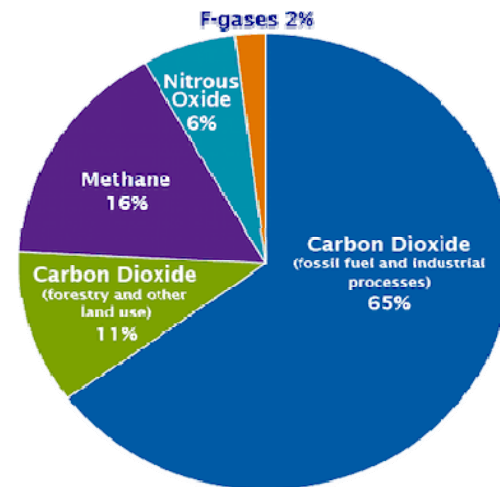


webinar on water body pollution





This graph shows the correlation between rising levels of carbon dioxide (CO₂) in the atmosphere at Mauna Loa with rising CO₂ levels in the nearby ocean at Station Aloha. As more CO₂ accumulates in the ocean, the pH of the ocean decreases. (modified after R. A. Feely, Bulletin of the American Meteorological Society, July 2008).



Ocean absorbs about 93% of atmospheric CO₂.

Estimated 34 billion (giga) metric tons of CO₂ has gone to the Ocean between 1994 and 2007. This makes an average of 2.7 giga tons of CO₂ per annum. Increased CO₂ in sea water makes the surface water acidic. The pH level of surface sea water has reduced from 8.2 to 8.1 already.

Other gases such as nitrogen oxides, sulphur oxides and ammonia breathed out from land based industrial activity and from ships at sea, cause acid rain and on the coastal zone they also cause acidic surface water. Slowly deep waters also become acidic due to ocean circulation. Ocean acidification reduces formation of calcium carbonates, building block of shells.

Untreated and treated sewage, fertiliser run-offs, animal waste, and wastes from aquaculture find their way to coastal waters and ultimately to the oceans.

Due to warming, increased nutrients and carbon dioxide there is increased photosynthesis on the ocean surface – algae bloom (Eutrophication).

Algae, spread across the ocean surface, blocks sunlight. Due to warming of water oxygen is depleted from water. Also there is more demand of oxygen by aquatic species and there is deoxygenation. Acidification makes living difficult for many types of marine species. Algae die and bacteria form which demand more oxygen.

Ocean food cycle is disturbed. Coral bleaching occur. Small species like krill die and so food source for fish, whales, orca, seals and penguins reduces.

Deoxygenation, in severe form, can generate dead water. The number of identified dead zones have increased from 10 in 1960 to 169 in 2007.



Garbage and Plastics

- Oil and chemicals discharged from land based industries and ocean activities such as petroleum production and shipping accidents.
- Garbage such as **Plastics**, paper, wood, metal and other man-made materials find their way to the oceans from land, rivers and coastal waters.
- A cruise ship generates 3.5kg of waste per person per day. 20% of total garbage is generated by ships and other marine sources.
- 60 to 80% of these is only plastics. Approx. 8 million metric tons of plastics are dumped to sea each year and the total plastics in the oceans could be of the order of 5.25 trillion metric tons.

Plastics

- Due to action of wind and waves, plastic disintegrate and become small in size. Plastics of dimension less than 5mm are known as microplastics. It is estimated that out of 8 million tons of plastic, 236000 tons are microplastics. Plastics are non-biodegradable.
- There are five large ocean circulation rings called gyres – north and south Pacific sub-tropical, north and south Atlantic sub-tropical and Indian Ocean sub-tropical gyres. Plastics get circulated by these gyres and accumulate at their centres which are known as ***garbage patch***.
- Aquatic species, big and small, get affected by swallowing plastic – entanglement and starvation. Their organs get affected leading to body damage and death.

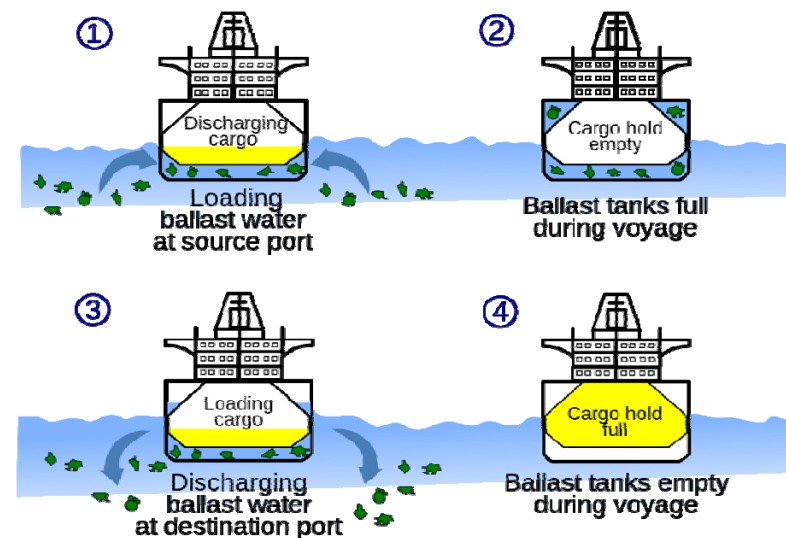


Engineering activities in the Ocean

- Transportation, fossil fuel exploration and production at sea (Oil and NG), new activities such as ocean mining.
- Generation of solid wastes – sewage and garbage, non-removal of old structures at sea such as oil rig platforms, ship dismantling generated waste etc.
- Generation of liquid wastes – mainly oil - voluntary and accidental
- Generation of gaseous pollutants – CO₂, SO_x and NO_x generation due to burning of heavy fuel oil, methane from LNG storage and use at sea.
- Pollution due to the above is under the scrutiny of IMO and well regulated now. I hope the next speakers will elaborate on this.

Movement of Invasive Species

- About 10 million tons of ballast water are exchanged across the seas annually moving about 7000 species each hour from one location to another.
- Fouling on ships' hull moves barnacles, algae and marine species housed in the fouled surface across large distances.
- This could create ecological disaster by moving invasive species which may harm the local marine flora and fauna
- IMO has examined this aspect and regulatory mechanism has been set up to avoid movement of invasive species.



NOISE

- Anthropogenic activities such as ships' propeller movement, sonar deployment, under water activities, energy exploration and production create underwater noise .
- Aquatic animals communicate with sound which travels long distance in water.
- Anthropogenic noise disturbs the ocean acoustic environment causing harm, even death, to large and small aquatic species.
- We should hear more about this later today.



Thank you