Centre for Marine Living Resources, Kochi on 21st September, 2019

Oceans and Us:
Marine Environment, Ecology and Sustainability

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Oceans and Us

"How inappropriate to call this planet Earth when it is quite clearly the Ocean"

- Arthur C. Clarke

* 70% Of the Earth's Surface is covered with oceans
* Hold 97% of the earth's water
* Stores thousand times more heat than the atmosphere
* Transports 25-30% of energy received from the sun.

Oceans absorb more CO_2 than atmosphere - almost **24 million tons** every day

Sustainable Development Goals

SDG 13 – Climate Action

To take urgent actions to Combat Climate Change and its Impacts

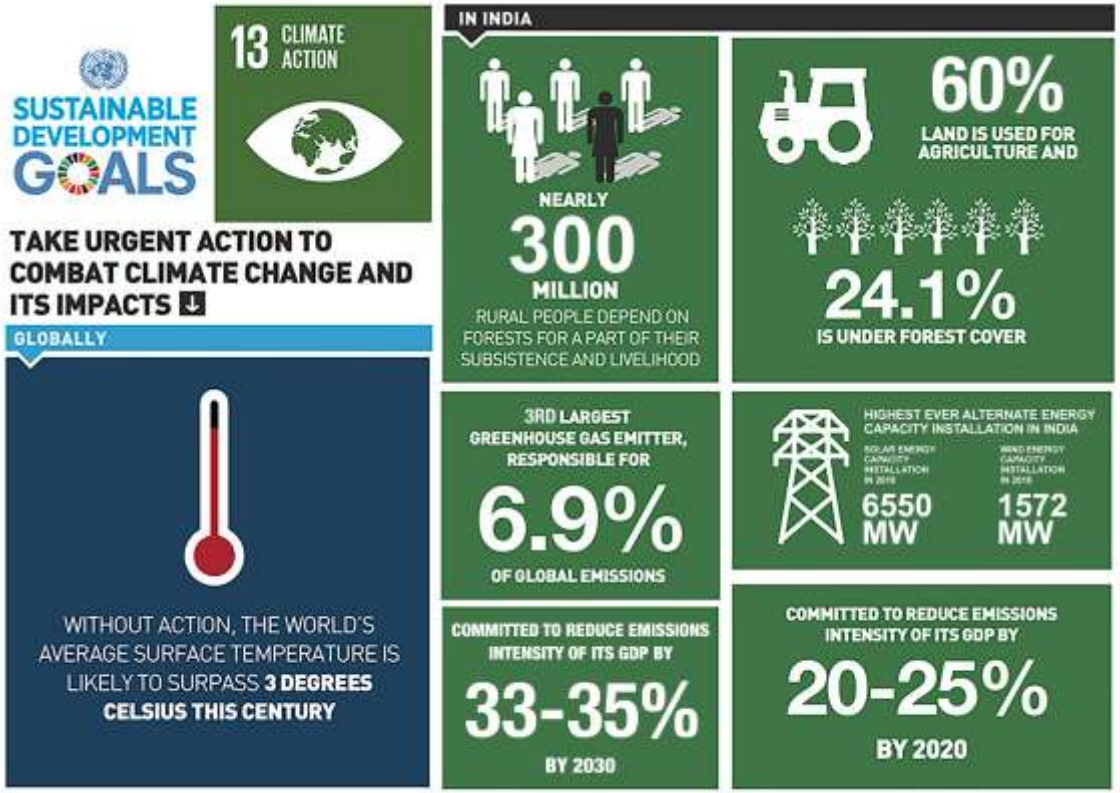
SDG 14 – Life below Water

To conserve and sustainably use the oceans, seas and marine resources for sustainable development.

* 14.1 - By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.
* 14.3 - Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

SDG 13 : Climate Action

Take urgent action to combat climate cahnge and its impacts



- India is the **third largest emitter of carbon-dioxide**, responsible for **6.9%** of **global emission**.
- The **emissions intensity** of India's GDP **reduced by 12%** between **2005** and **2010**
- In **October 2015**, India made a **commitment** to reduce the emissions intensity of its GDP by **20-25%** from its 2005 levels **by 2020** and by **33-35%** by **2030**.

Source : UN India Website

SDG 14: Life Below Water

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

* India has a **long coastline** of about **7,517 km** in length which sustains and provides a source of livelihood to over **250 million people**.
* India is the **second largest producer of fish** in the world.
* Coastal and marine biodiversity protection is a key area of focus for India.
* Launched **Sagarmala Project(the Blue Revolution), National Plan for the Conservation of Aquatic Eco-systems**.

Source : UN India Website

SDG 14.1

- Reduce Marine pollution
- Reduce Ocean deoxygenation
- Conserve Marine Resources
- Achieve Food security

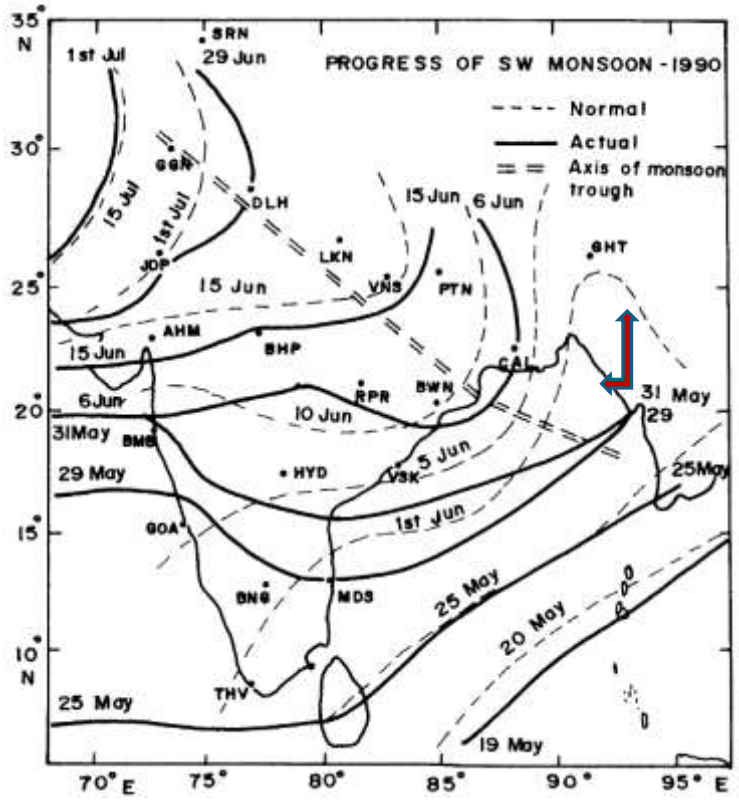
SDG 14.3

- Climate Change Mitigation
- Reduce Ocean Acidification
- Reduce Impact on Reproductive cycle

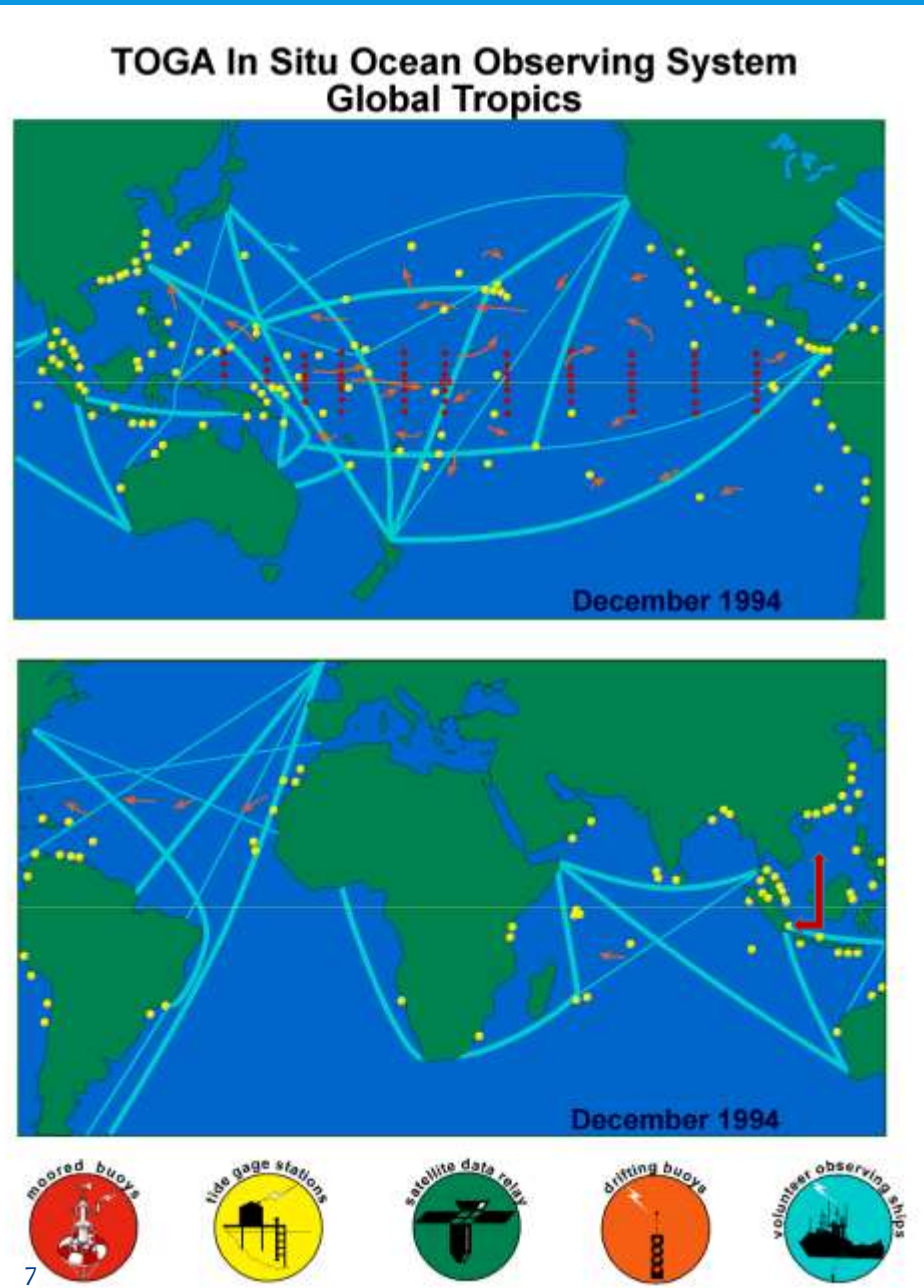
Reproductive Cycl

Marine Environment

MONTBLEX 1990



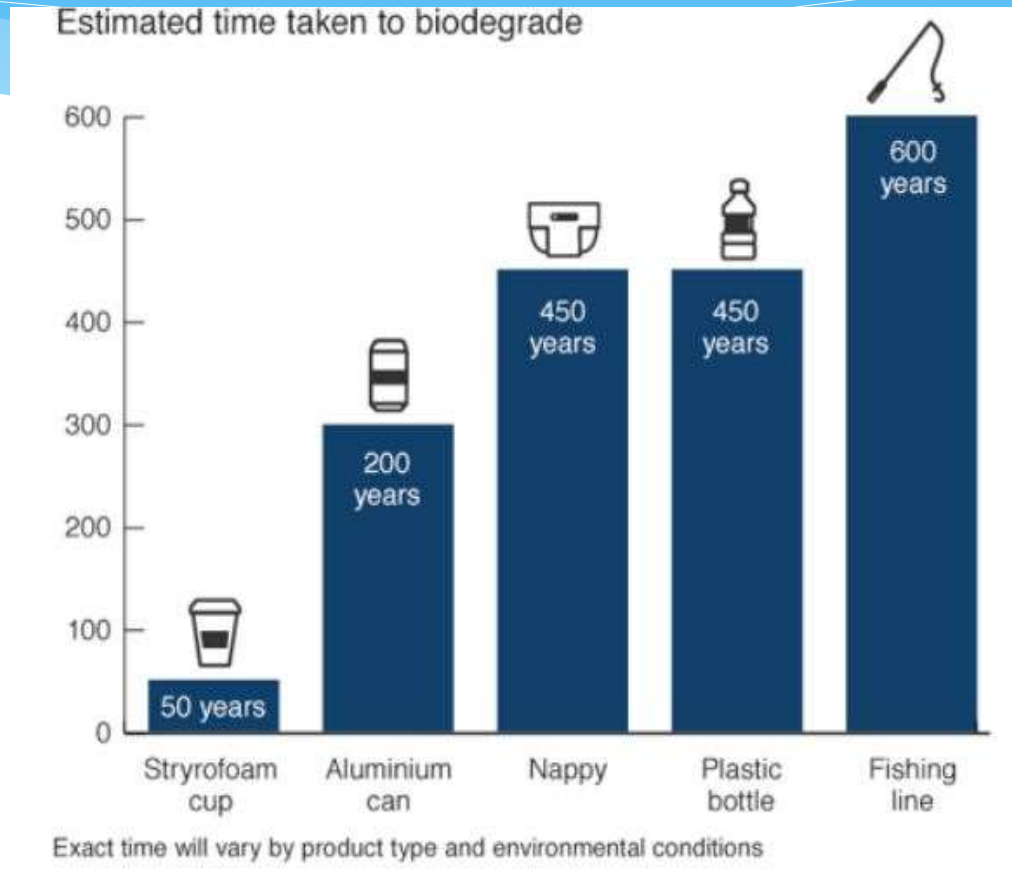
To Understand Monsoon Variability



To Study Impact of ENSO on Climate

Marine Ecology is Getting Affected

* Anthropogenic Land Based Activities
* Plastic Menace
* CO_2 Sequestration
* Ocean Mining
* Maritime Transport
* Stratospheric Ozone Depletion
* Ocean Deoxygenation

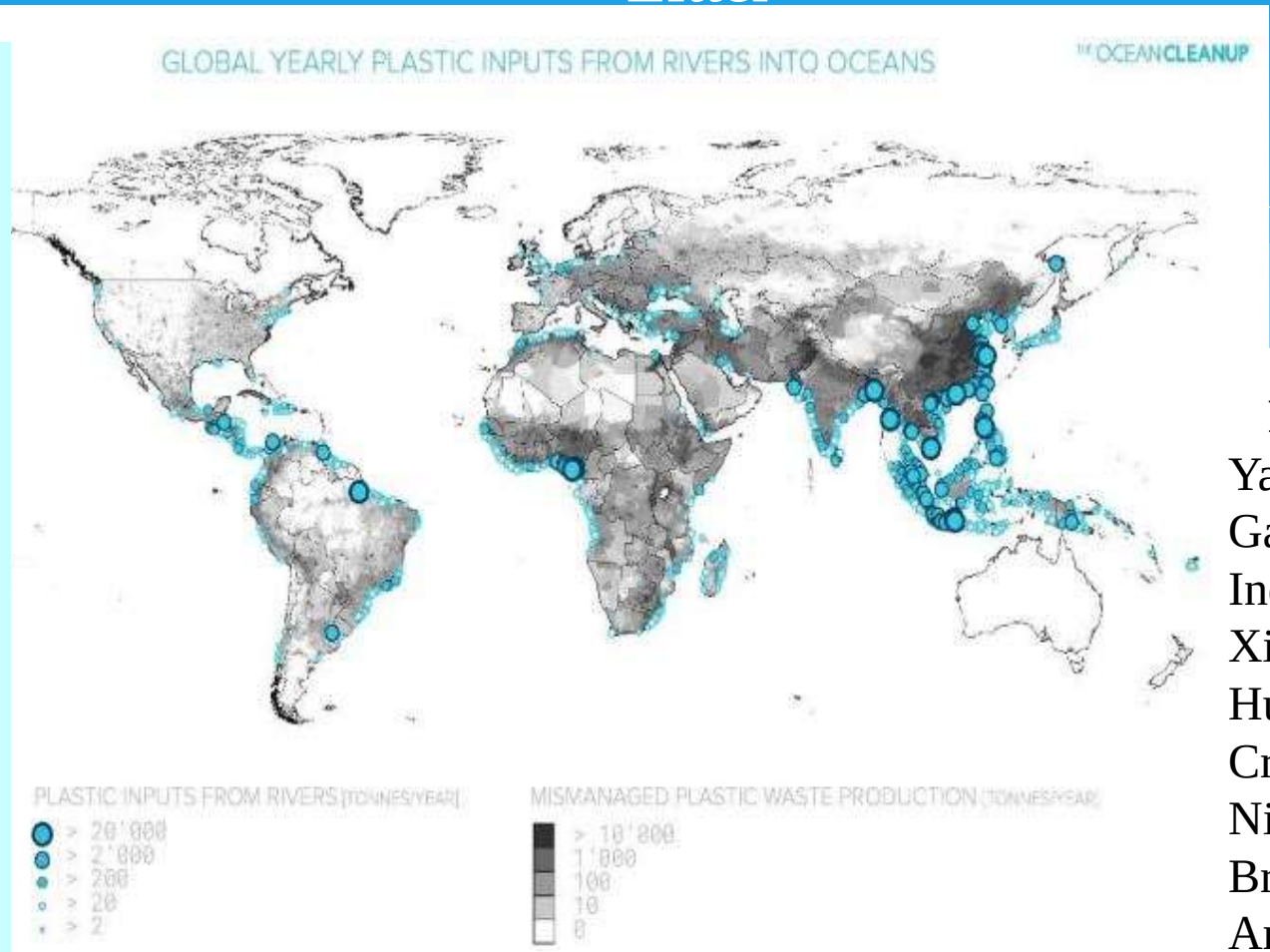


Source: NOAA Woods Hole Sea Grant

Plastic Pollution

Top Rivers at the origin of Marine Litter

Scientists in Helmholtz Centre for Environmental Research surveyed 57 river systems in the world and found that 10 rivers transport more than 90% of river-based plastic to oceans. All the river surveyed, have two common traits; a high population living in the surrounding region and inadequate waste management systems and infrastructure.



Source : Lebreton et al, 2017
Schmidt et al,2017

Rivers:
Yangtze
Ganges
Indus
Xi
Huangpu
Cross
Nile
Brantas
Amazon
Pasig
Niger
Mekong
Irrawaddy
Solo

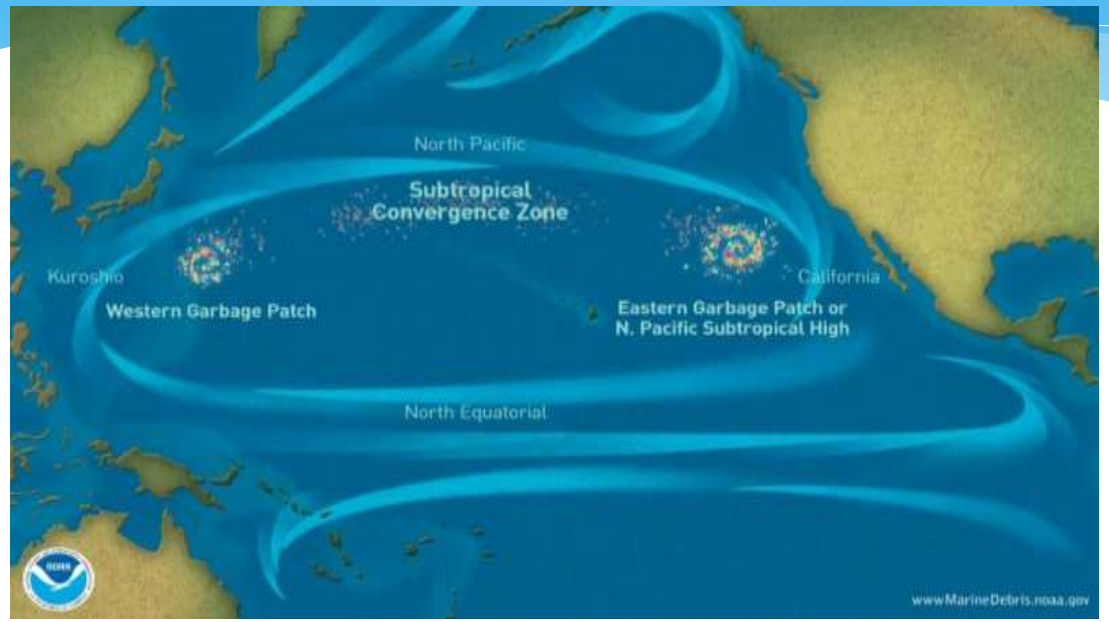
How Plastic Pollution is Impacting Marine Ecology?

- Tiny pieces of plastic detected in sea creatures that humans like to eat such as fish, shrimp, mussels, and oysters.
- Plastic bags resemble jellyfish, a common food for sea turtles, while some seabirds eat plastic because it releases a chemical that makes it smell like its natural food.
- Scientists found plastic fibers in corals in the Atlantic Ocean and that the corals readily ate plastic over food.
- Dying marine mammals, washing up on shore, also contain plastic inside their stomachs.
- Small organisms feed on tiny bits of broken-down plastic, called microplastic, and absorb the chemicals from the plastic into their

Dead Albatross with plastic in itrs stomach

A team works to disentangle a right whale from fishing gear.

Magnitude of Plastic Menace



The currents of the North Pacific gyre collect trash—mostly bits of microscopic plastic collected as "garbage patches." (NOAA Marine Debris Program)

A Spam Container part of Marine Debris, found on the deep-sea floor of the Marianas Trench. (NOAA Okeanos Explorer Program, 2016)

Ocean Acidification

* In the late 1700s, the oceans had equilibrated to be slightly alkaline, with a pH of about 7.1.
* The Oceans tries to maintain slightly basic pH under normal conditions.
* When carbon dioxide (CO_2) is absorbed by seawater, chemical reactions occur that reduce seawater pH, carbonate ion concentration, and saturation states of biologically important calcium carbonate minerals.
* Estimates of future carbon dioxide levels, based on the scenario that nothing changes, show that by the end of this century the surface waters of the ocean could be approximately 150 percent more acidic than they have ever been in human existence.
* The current rate of acidification is over 10 times faster than at any time in the last 55 million years.

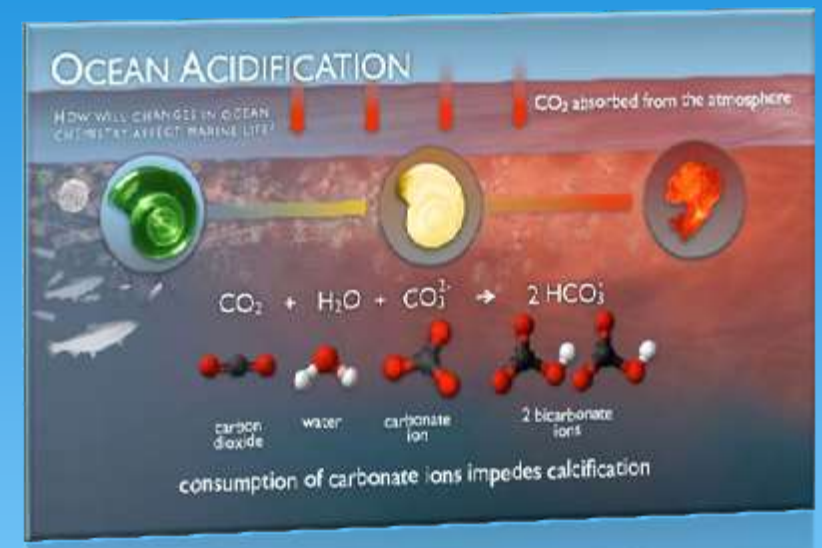
Ocean Acidification – Causes and Consequences

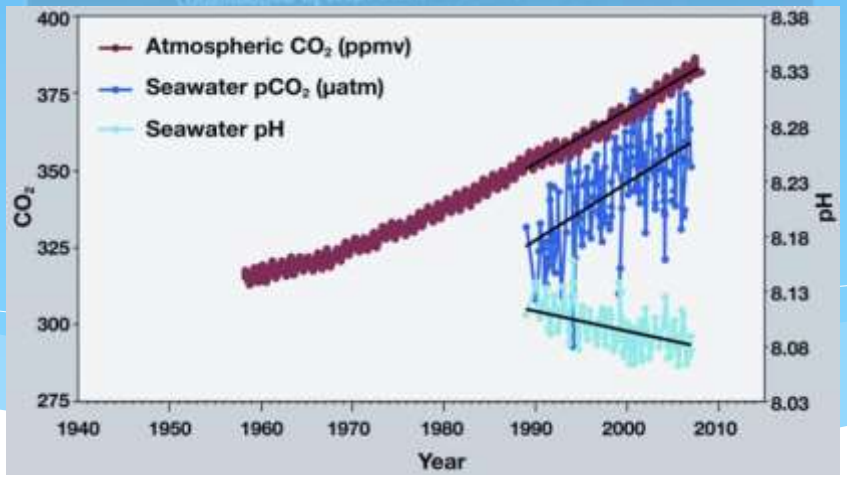
* **Stratospheric ozone depletion** alters intensity of solar UV-B radiation on earth and causes changes in the biogeochemical cycling of carbon and other chemical elements.
* The pH scale is logarithmic and this change represents approximately a 30 percent increase in acidity.
* **CO2 Injection in Oceans for Sequestration** can lead to Ocean acidification
* While photosynthetic algae and sea grasses may benefit from higher CO_2 conditions in the ocean, the species like Oysters, clams, sea urchins, shallow water corals, deep sea corals, and calcareous plankton as well as any other shelled organism are at risk, threatening food security for millions of people.
* Mussels and oysters are expected to grow less shell by 25% and 10% respectively by the end of the century. Corals are affected.

Ocean Acidification?

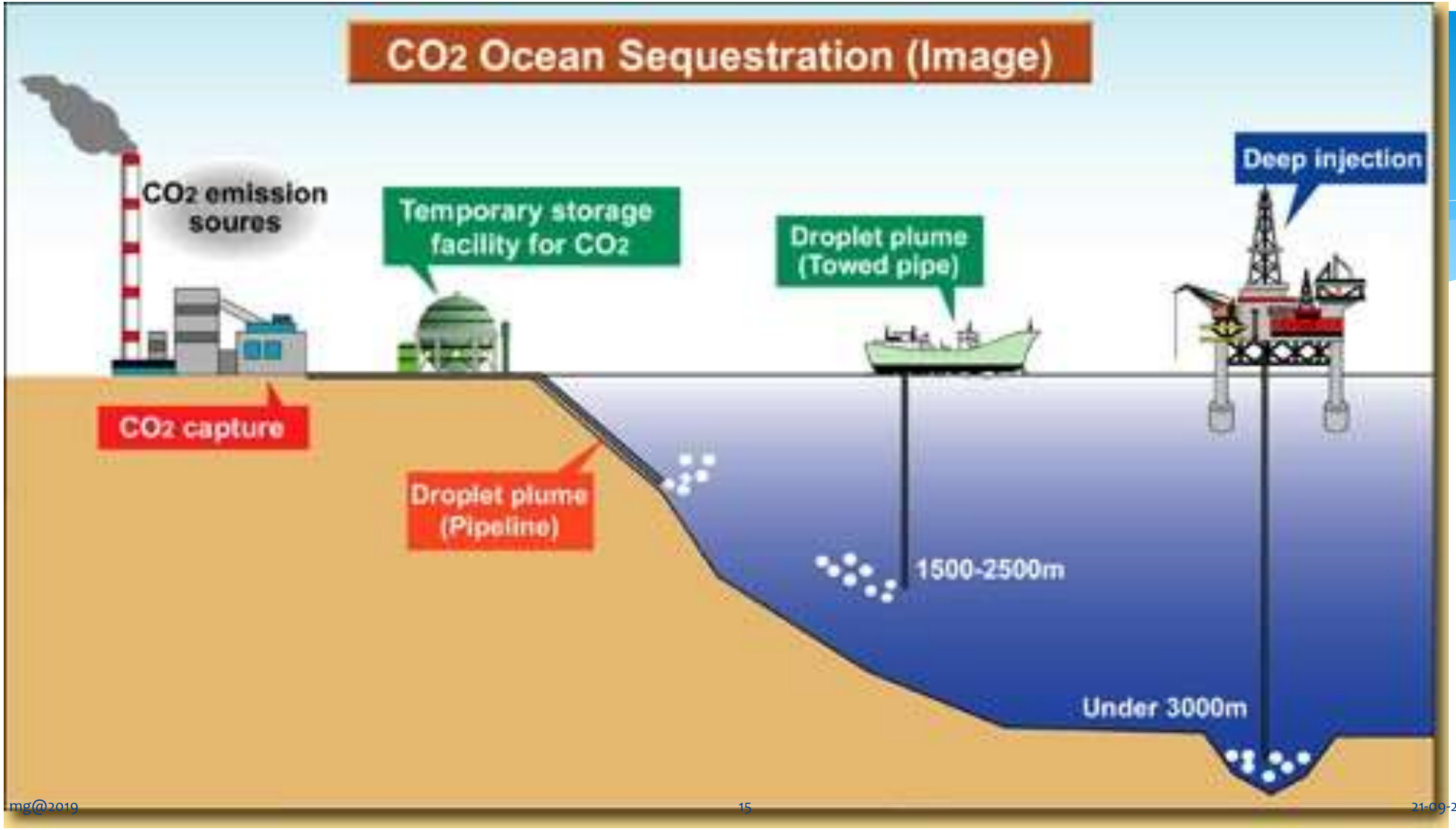
Climate Change's equally evil twin

- **Ocean acidification is** happening in parallel with other climate-related stressors, including **ocean warming and deoxygenation**.
- Three climate change pressures on the marine environment – **heat, acidity and oxygen loss** often referred to as the **'deadly trio'**
- Continued ocean acidification is causing many parts of the ocean to become under saturated with calcium carbonate minerals, affecting the ability of Marine organisms to produce and maintain their shells.





NOAA PMEL Carbon Program)


CO2 Ocean Sequestration (Image)
CO2 emission soures
Temporary storage facility for CO2
Droplet plume (Towed pipe)
Deep injection
CO2 capture
Droplet plume (Pipeline)
1500-2500m
Under 3000m

Implementing SDG 14

* To reduce our carbon emissions by burning less fossil fuels and finding more carbon sinks, such as regrowing mangroves, seagrass beds, and marshes, known as blue carbon.
* To remove carbon dioxide from the atmosphere by growing more of the organisms that use it up: **phytoplankton**. Adding iron or other fertilizers to the ocean could cause man-made phytoplankton blooms. This phytoplankton then would absorb carbon dioxide from the atmosphere, and then, after death, sink down and trap it in the deep sea.
* However, it's unknown how this would affect marine food webs that depend on phytoplankton, or whether this would just cause the deep sea to become more acidic itself.
* Ocean Seeding is another way.

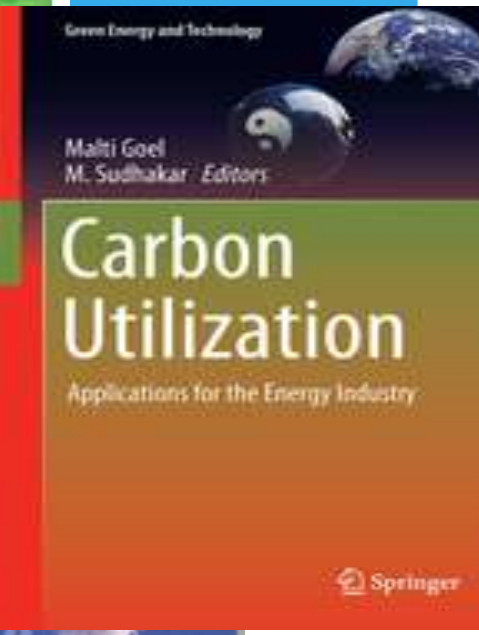
Implementing SDG 14

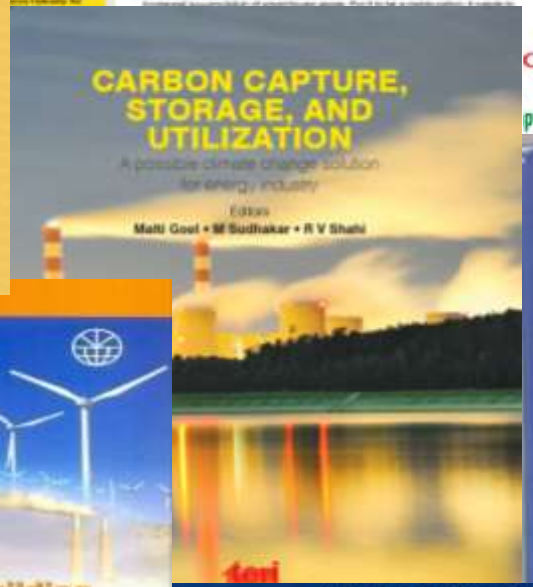
* Fisheries experts have suggested that individual governments set quotas based on stock levels in their local waters as well as on input from local stakeholders.
* Ensuring that the local fishermen have a hand in the regulation of the fish they harvest gives them a vested interest in restoring and maintaining stocks.
* Overfishing, poor fishing practices and poor regulations are most certainly a large part of the problem; and yet, improved regulation and practices have had no marked effect on the health of fish population. Fishing in a sustainable manners might help, by setting up few limits.

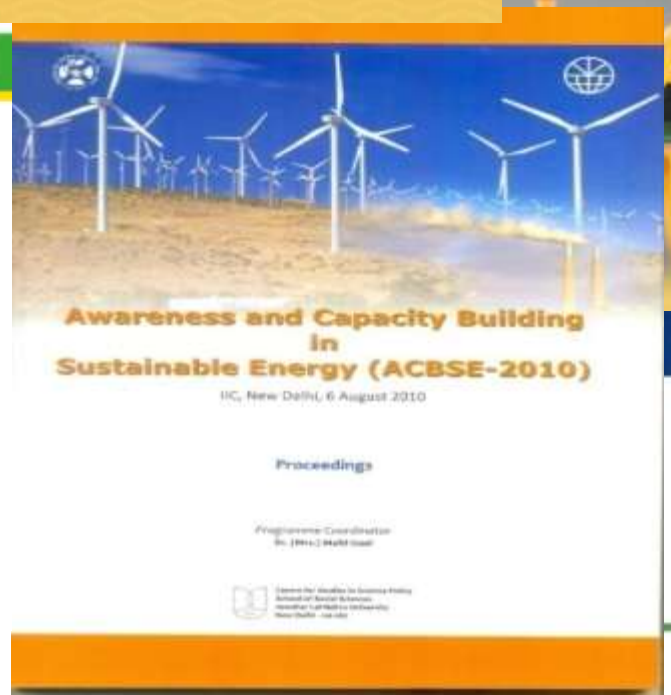
Implementing SDG 14

* **Trim Down Trash-**Ditch the disposable lifestyle, make a point to use reusable bags, beverage cups, and food containers. Garbage patrol: Never litter (inland, on the beach, or from a boat) and Prevent **SINGLE-USE** Plastic
* **Be Fish Friendly**- Demand sustainable seafood at the supermarket and in your favorite restaurants. Avoid eating certain kinds of fish and shellfish that are fished using unsustainable methods.
* **Recreate Responsibly-** Don't litter when in and around the water bodies. Leave the place the way you want to see it again.
* **Be Water Wise**-All water on Earth is connected. Even if you don't live near the coast, water that goes down your drain or runs off from your yard can eventually make its way into the ocean.
* Reduce your carbon footprint

Our Publications







Thank you for your attention