



i-LEARN
Gateway to knowledge

Ocean



Acidification

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- ❖ Introduction to Ocean Acidification
- ❖ Ocean Acidification process
- ❖ CO_2 cycle in ocean
- ❖ Timeline on Ocean Acidification
- ❖ Impact of Ocean Acidification
- ❖ What's our response to this?

Introduction

- ❖ Oceans have maintained a relatively stable acidity level for millions of years
- ❖ But now, it's been undone by a rapid drop in surface pH
- ❖ After the industrial revolution becomes, the fossil fuel powered vehicle enters into the market
- ❖ It leads to emission of billions of tons of CO_2 into the Atmosphere
- ❖ Atmospheric CO_2 has increased from 280 ppm to 400 ppm
- ❖ Mean global temperature has increased by 0.8°C since 1870
- ❖ Ocean temperature higher by 0.7°C

Ocean Acidification-Intro

- ❖ Scientists now know that almost half of this man-made, CO₂ has been soaked up over time by the oceans. 1
- ❖ An estimated 30–40% of the carbon dioxide released by humans into the atmosphere dissolves into oceans, rivers and lakes.
- ❖ So, it slows down the climate change problem, But it`s lead to some other problem...



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What is Ocean Acidification

Why we need to think of it

Where it's occurring





What is Ocean Acidification?

“

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. These chemical reactions are termed "ocean acidification" or "OA" for short

2

”



Why it's so important?

- ◆ Calcium carbonate minerals are the building blocks for the skeletons and shells of many marine organisms.
- ◆ It will wipe out these living creatures
- ◆ So food chain will be affected
- ◆ Similarly, increasing acidity can interfere with basic bodily function for all marine animals, shelled or not.

Where it`s occurring?

- ◆ Air pollution is a mother of Ocean Acidification
- ◆ Air pollution is a Global Problem
- ◆ So, Ocean Acidification also a **Global Problem**
- ◆ Don`t imagine that it will only affect coral ecosystems
- ◆ Due to its substantial influence in the planetary ecosystem, it will hit the whole Earth

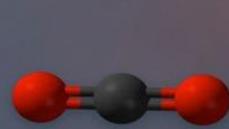


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Ocean Acidification process

HOW WILL CHANGES IN OCEAN CHEMISTRY AFFECT MARINE LIFE?

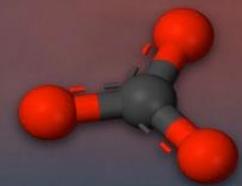
CO₂ absorbed from the atmosphere



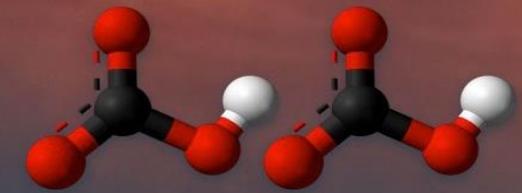
carbon dioxide



water



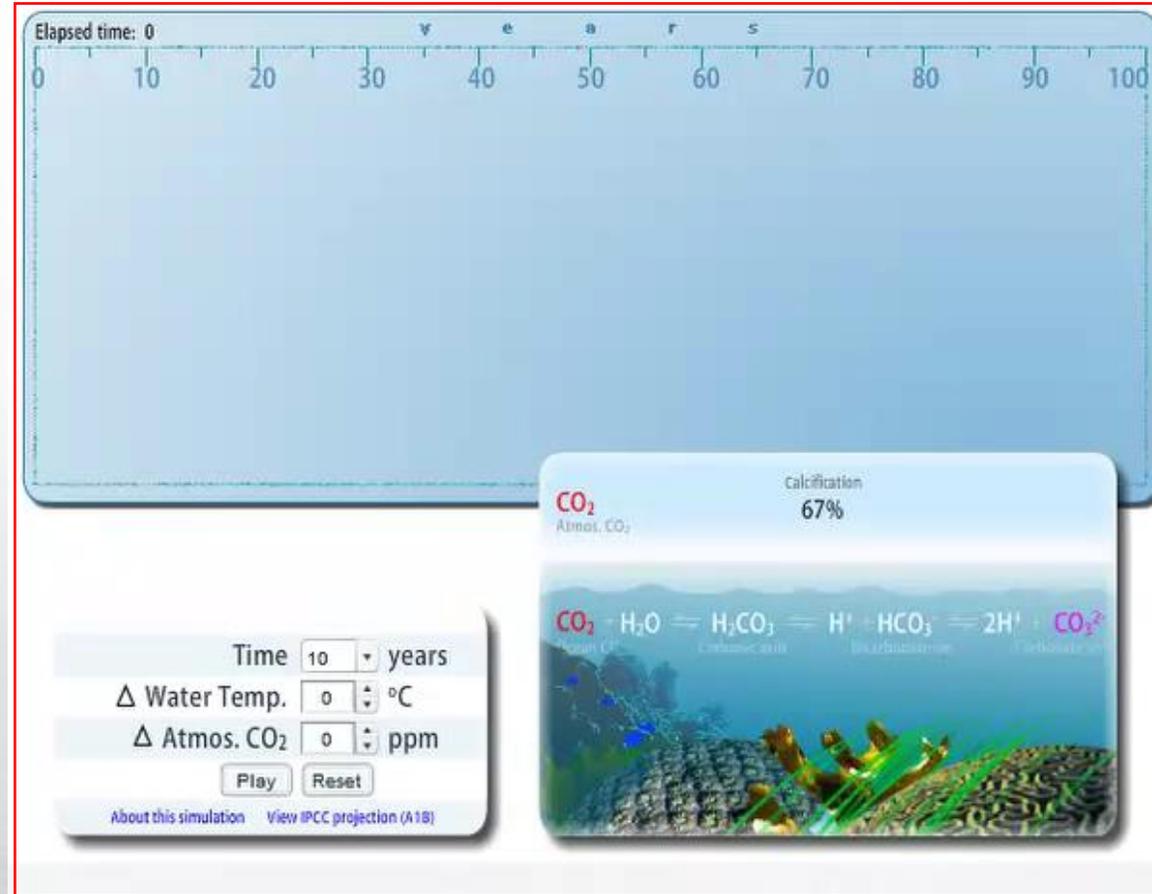
carbonate ion



2 bicarbonate ions

consumption of carbonate ions impedes calcification

Co₂ cycle in ocean



Elapsed time: 0

0 10 20 30 40 50 60 70 80 90 100

years

Time years

Δ Water Temp. °C

Δ Atmos. CO₂ ppm

[About this simulation](#) [View IPCC projection \(A1B\)](#)

CO₂ Atmos. CO₂

Calcification 67%

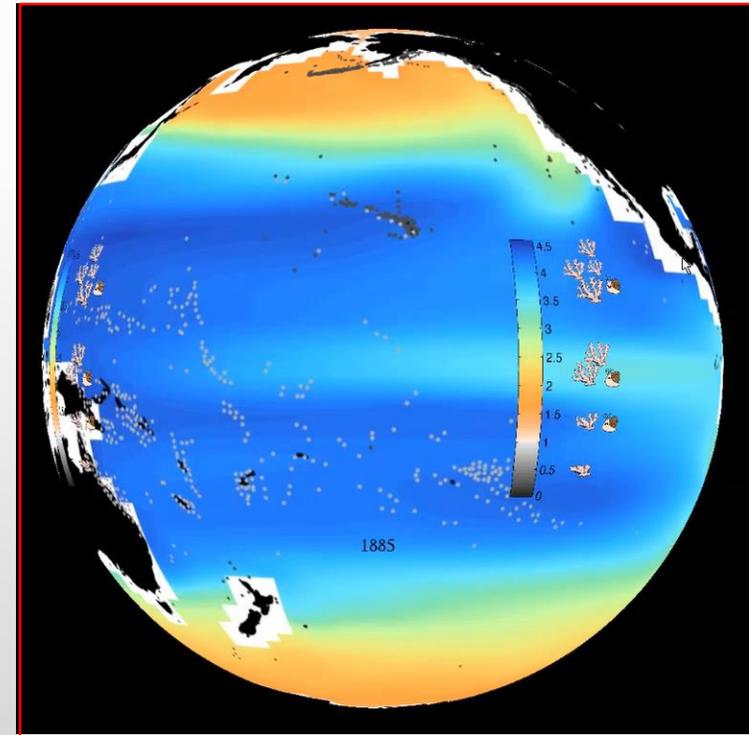
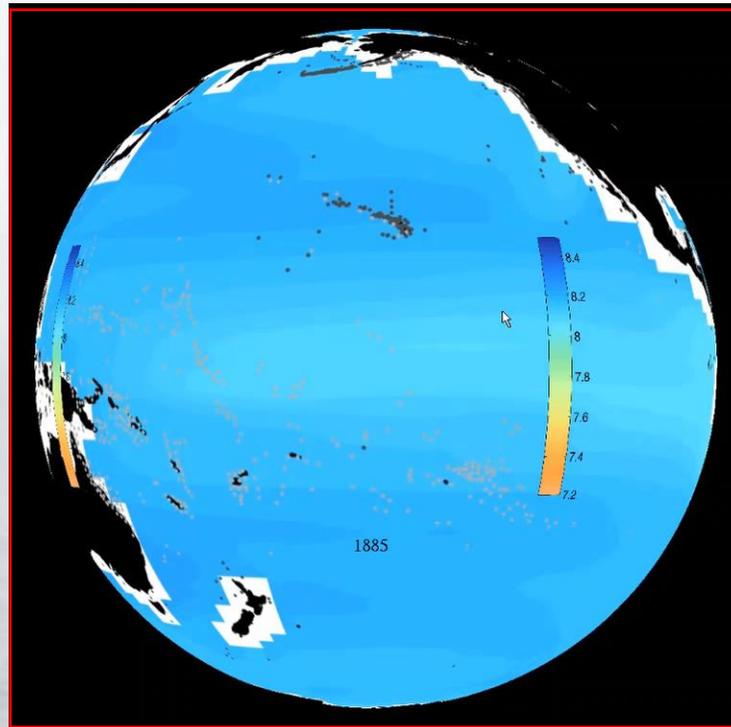
$$\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 \rightleftharpoons \text{H}^+ + \text{HCO}_3^- \rightleftharpoons 2\text{H}^+ + \text{CO}_3^{2-}$$

Atmos. CO₂ Carbonic acid Bicarbonate Carbonate

Timeline on Ocean Acidification

pH variation
(1885 to 2094)

Ocean pH and aragonite
saturation state (1885 to 2094)



pH variation over the time period



Time	pH	pH change relative to pre-industrial	H ⁺ concentration change relative to pre-industrial
Pre-industrial (18th century)	8.179		
Recent past (1990s)	8.104	-0.075	+ 18.9%
Present levels	~8.069	-0.110	+ 28.8%
2050 (2×CO ₂ = 560 ppm)	7.949	-0.230	+ 69.8%
2100 (IS92a)	7.824	-0.355	+ 126.5%

Table 1.1 pH variation over the time period at Ocean

24 million

The number of tonnes of CO₂ the ocean absorbs every day

10 times

The current rate of acidification is over 10 times faster than any time in the last 55 million years

26%

The increase in ocean acidity from preindustrial levels to today

40%

The increase in atmospheric carbon dioxide (CO₂) levels since the start of the industrial revolution

170%

The projected increase in ocean acidity by 2100 compared with preindustrial levels if high CO₂ emissions continue (RCP* 8.5)



If

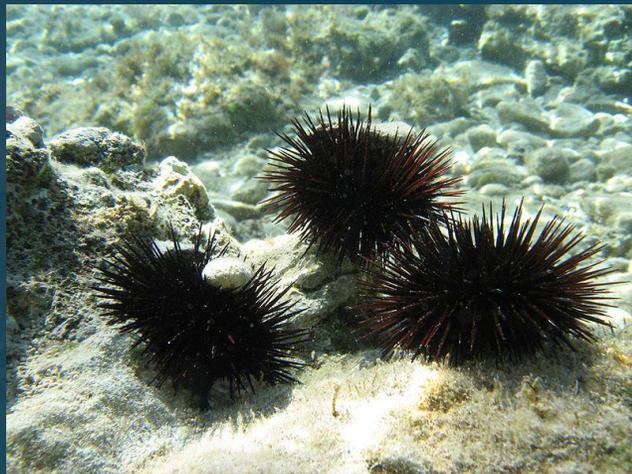
Dissolving CO_2 reach saturation limit,
then

What will happen?

Impacts

- It affects oceanic calcifying organisms
- Organisms may suffer adverse effects, either indirectly through negative impacts on food resources 
- It may alter the acoustic properties of seawater (increasing ocean noise)
- Its decline the commercial fisheries
- After it`s saturation limit, climate change will boost up without restriction
- And, More number of impacts where possible





Sea Urchins



Corals



Plankton

Animals suffer due to Ocean Acidification



Clown Fish



Turtle

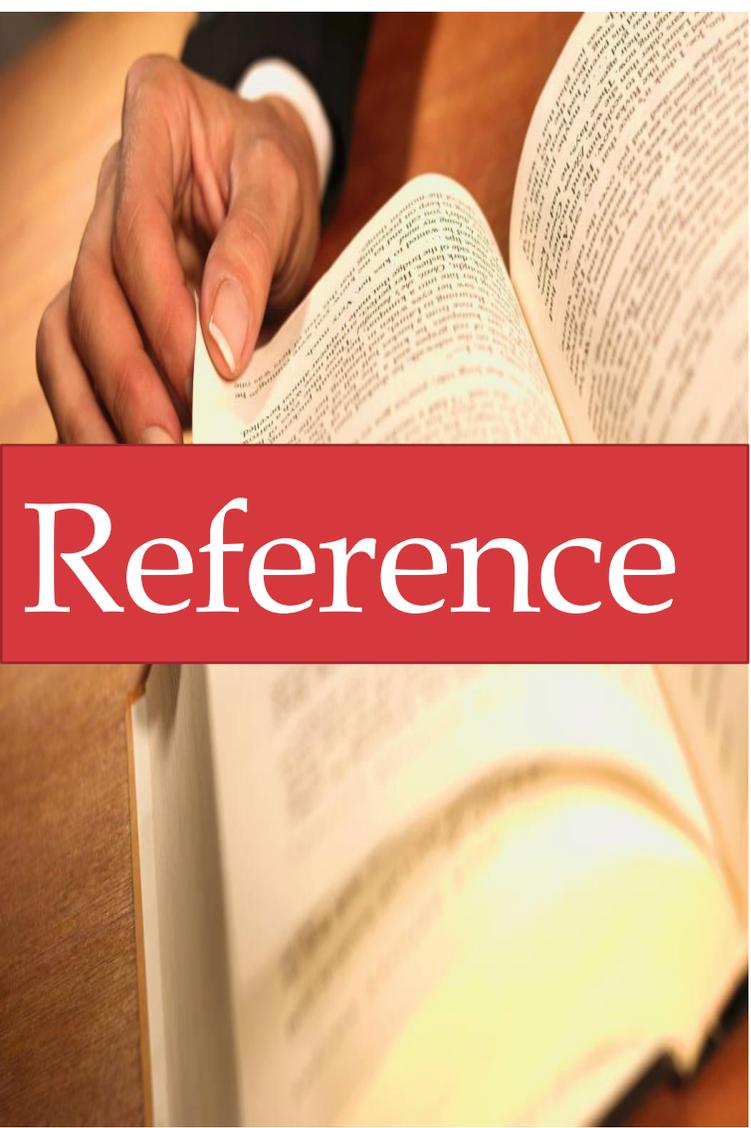


Shellfish

What`s our response???

- ✓ Reduce CO₂ emissions by possible way
- ✓ Make awareness to the people
- ✓ A lot of research is required
- ✓ Carbonic acid can be extracted from seawater as carbon dioxide for use in producing synthetic fuel.
- ✓ Iron fertilization of ocean would increase photosynthesis in phytoplankton, which convert dissolved co₂ into carbohydrate and oxygen gas





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Thank you!

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world back



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