OCEAN CHANGE FACTSHEET

CLIMATE CHANGE

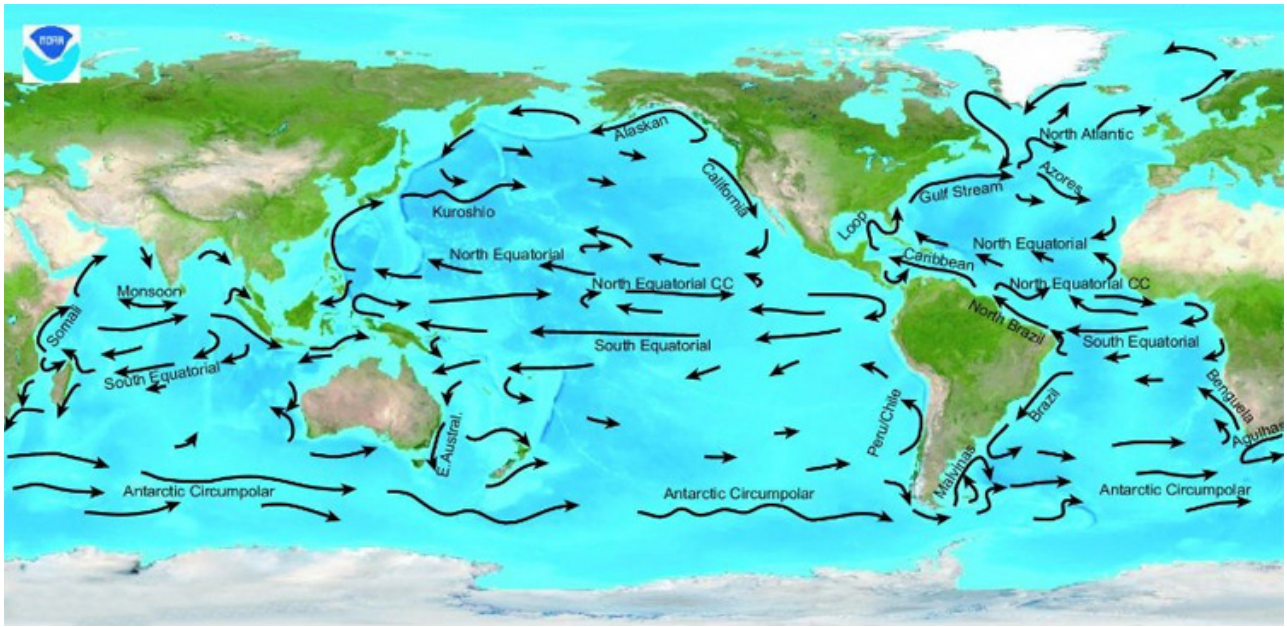
Our ocean is a powerful ally in the fight against climate change, shielding us from the full extent of warming.

Climate change is a change in the pattern of weather, and related changes in oceans, land surfaces and ice sheets, occurring over time scales of decades or longer. It is true that the climate has changed many times in the past; however, the climate change we are experiencing now is believed to be a result of human activity. Rising levels of greenhouse gases – particularly Carbon Dioxide (CO_2) – caused by the burning of fossil fuels, are heating the atmosphere to an extent where the climate is changing.

What has climate change got to do with the oceans?

Oceans play a starring role in the Earth's climate.

Oceans absorb the majority of the heat from the sun, acting as a huge heat-retaining solar panel. It then transfers this heat it back into the atmosphere and distributes it around the world through ever-moving ocean currents. This continual process drives weather patterns around the globe. The image below from NOAA (National Ocean Atmospheric Administration) shows the direction of currents around the world.



Ocean currents end heat toward the chilly polar regions and helping the steamy tropical regions cool down.
Image source: http://oceanexplorer.noaa.gov/facts/climate.html

Ocean currents behave in similar way to conveyer belts, moving warm water and precipitation from the equator toward the poles, and then moving cold water from the poles back to the tropics. In this way, currents regulate the global climate. They help to regulate the uneven distribution of heat from the sun on the Earths surface. If we didn't have currents then temperatures around the world would tend to be more extreme, with very hot temperatures at the equator and very, very cold temperatures towards the north and south poles. The effect of this would be an Earth with far fewer habitable areas.

OCEAN CHANGE FACTSHEET

OCEAN WARMING

Since the industrial revolution – when humans began burning fossil fuels – the ocean has absorbed over 90% of the extra heat trapped by the rising concentrations of atmospheric greenhouse gases. As a result, the world's oceans are warmer now than at any point in the last 50 years. The warming of the oceans has occurred from the surface to a depth of about 700 meters, where most marine life thrives. The image below from Climate Central shows where the areas of the ocean that have experienced the most warming.

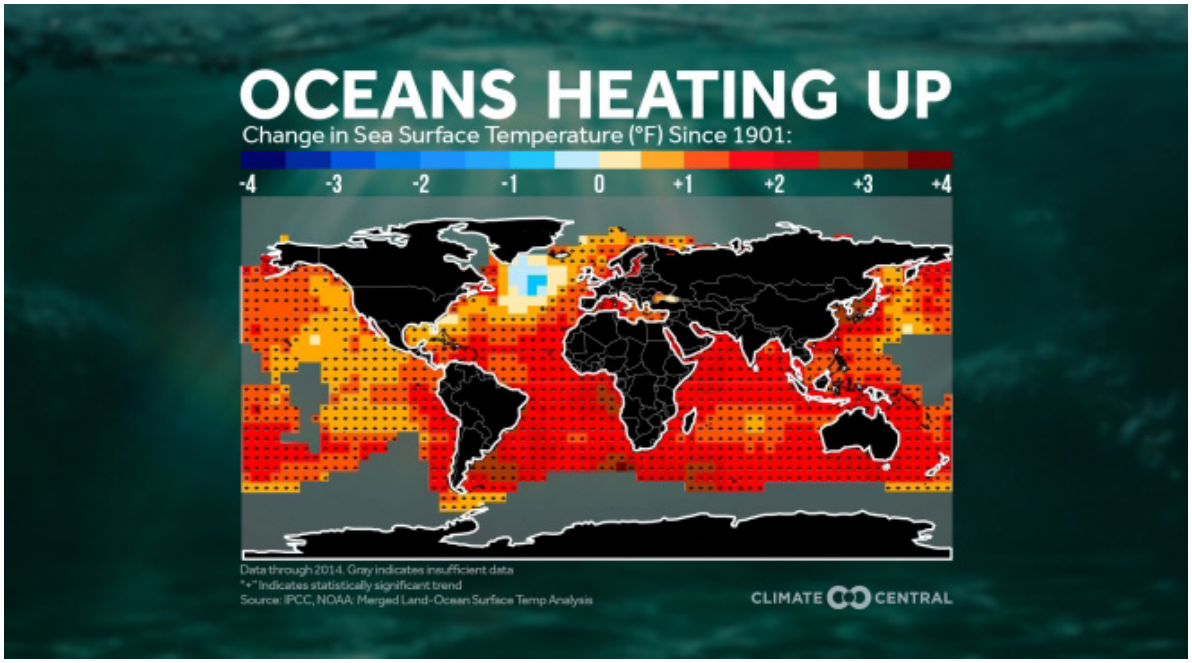


Image source: http://www.climatecentral.org/gallery/maps/el-nino-impacts-on-ocean-warming

Some of the organisms most vulnerable to warming ocean temperatures include:

- **Corals:** Corals are probably the most vulnerable. Even the slightest warming of ocean waters can cause corals to eject their symbiotic algae, resulting in coral bleaching. Bleaching slows coral growth and can make them susceptible to disease, and in some cases, can lead to large scale die-off.

- **Krill:** Krill are an extremely important link at the bottom of the ocean food chain. Research shows that ocean warming affects krill by causing them to reproduce in much lower numbers than they normally would. This causes a ripple effect up the food chain, first affecting krill eaters like seals, penguins and whales, but then also affecting those animals whose prey includes the krill eaters.

Atmospheric CO_2 levels are believed to be higher and rising faster than any time in the last 20 million years, and if current rates of temperature rise continue, the ocean will become too warm for coral reefs by 2050. In addition, the Arctic Ocean is projected to become nearly ice-free in summer within this century, likely within the next 30 to 40 years.

OCEAN CHANGE FACTSHEET

OCEAN ACIDIFICATION

In addition to absorbing heat, ocean waters also absorb vast amounts of CO_2 (about a quarter of the CO_2 we release each year), and over the last 200 years, the ocean has absorbed around a third of the CO_2 produced by human activities. While this has been good news for humans because it has slowed the pace of climate change, it has been bad news for the oceans.

The absorption of CO_2 by the oceans is resulting in chemical changes, with the ocean becoming more acidic. This in known as ocean acidification, although at this stage the oceans are still technically alkaline. Ocean acidification is estimated to have caused a decrease in oceanic pH of 0.1. The alkalinity of the ocean is very important in maintaining a delicate balance needed for animals such as shellfish, which will not be able to make strong shells if the water becomes too acidic. Corals may also be affected because their skeletons are made of the same shell-like material. The image below from the Climate Commission shows the cause and effect of ocean acidification.

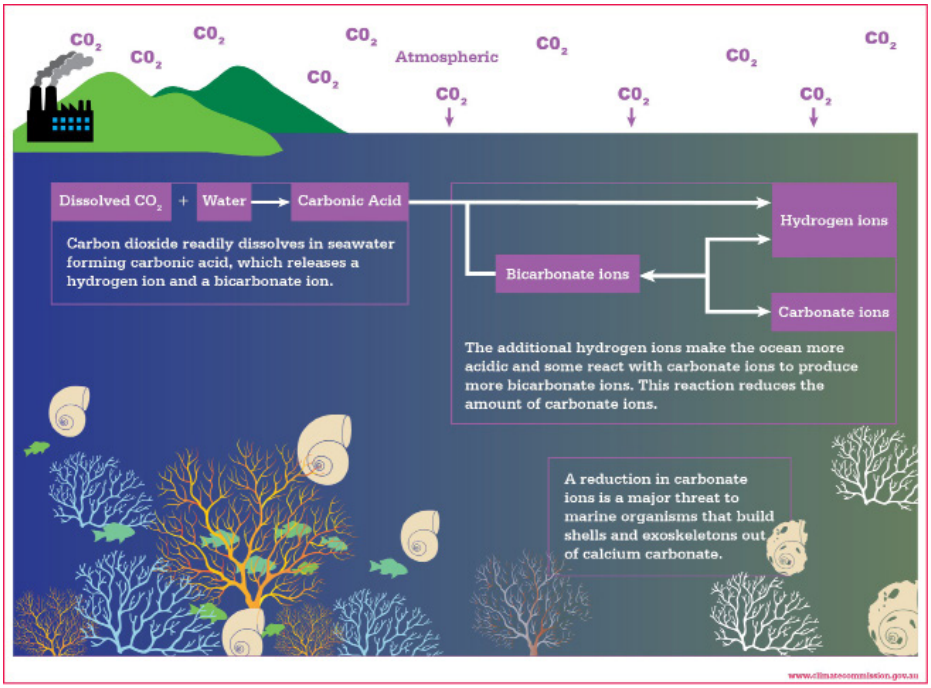


Image source: Climate Commission

THE SOLUTION

The only way to address rising ocean temperatures and ocean acidification is to dramatically cut our greenhouse gas emissions. While it is true that this requires governments and big businesses to take the biggest steps, there are steps we can all take. You can try increasing your energy efficiency by switching off your lights when you don't need them, choosing energy efficient appliances, and taking the bus instead of the car. You could also try shifting to renewable energy sources (like solar, wind and hydropower).

OCEAN CHANGE FACTSHEET

BECOME AN OCEAN GUARDIAN AND JOIN THE GLOBAL MOVEMENT NOW!

Go to the Blue website to become an ocean guardian and take action for our ocean (https://bluethefilm.org/take-action/)

REFERENCE LIST:

- Ocean Overview - http://ocean.nationalgeographic.com/ocean/explore/ocean-overview/
- Ocean Explorer Facts - http://oceanexplorer.noaa.gov/facts/climate.html
- Gattuso, J.-P., Magnan, A., Billé, R., Cheung, W.W.L., Howes, E.L., Joos, F., Allemand, D., Bopp, L., Cooley, S.R., Eakin, C.M., Hoegh-Guldberg, O., Kelly, R.P., Pörtner, H.-O., Rogers, A.D., Baxter, J.M., Laffoley, D., Osborn, D., Rankovic, A., Rochette, J., Sumaila, U.R., Treyer, S. and C. Turley. 2015. Contrasting futures for ocean and society from different anthropogenic CO2 emissions scenarios. Science 349 (6243): aac4722 [DOI:10.1126/science.aac4722].
- A student's guide to global climate change - https://www3.epa.gov/climatechange//kids/index.html
- Sea Temperature Rise - http://ocean.nationalgeographic.com/ocean/explore/pristine-seas/critical-issues-sea-temperature-rise/
- Impacts of Climate Change on Marine Organisms and Ecosystems. Brierley, Andrews S. et al. Current Biology, Volume 19, Issue 14, R602-R614
- Overland, J. E. and Wang, M. 2013. When will the summer Arctic be nearly sea ice free? Geophysical Research Letters 40(10): 2097-2101.
- Ocean Acidification: The Other Carbon Dioxide Problem - https://www.pmel.noaa.gov/co2/story/Ocean+Acidification
- Impacts of ocean acidification on the Reef - http://www.gbrmpa.gov.au/managing-the-reef/threats-to-the-reef/climate-change/how-climate-change-can-affect-the-reef/ocean-acidification
- Explore the issues - https://bluethefilm.org/explore/

"WE OURSELVES FEEL THAT WHAT WE ARE DOING IS JUST A DROP IN THE OCEAN. BUT THE OCEAN WOULD BE LESS BECAUSE OF THAT MISSING DROP" – MOTHER TERESA