Climate Change and its effect on Ocean Life

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“Climate change is happening, humans are causing it, and I think perhaps the most serious environmental issue facing us”- Bill Nye. Carbon dioxide concentration is expected to exceed 500 parts per million as well as global temperatures to rise by at least 2°C by 2050 to 2100, values that considerably exceed those of at least the past 420,000 years during which most extant marine organisms evolved (Hoegh-Guldberg, et al., 2007 ). Climate change is not a surprising topic as it's been discussed on TV and written about in numerous articles. Many scientists have been fighting the issue for decades and have been looking for ways to eradicate any future damage. Climate change affects different parts of the environment including ocean life. Effects like emission of greenhouse gasses, acidification, and deoxygenation impact ocean life and through that are affecting humans. What is needed to know is how global warming impacts ocean life and what are the consequences that affect humans.

Greenhouse gas is a gas that contributes to the greenhouse effect by absorbing inferred radiation (Merriam-Webster's collegiate dictionary, 1999). The most common on earth are water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Greenhouse gases change the earth’s climate by absorbing energy in the lower atmosphere and re-emitting it (Montzka, Dlugokencky, & Butler, 2011, p. 43). The influence of greenhouse gases is projected from its ability to absorb infrared radiation and persistence in the atmosphere. The ocean, however, is impacted by carbon emissions especially CO2 being the most common. According to Montzka’s data anthropogenic emissions of CO2 (ff + lu) increased rapidly from 1980 to 2010. During the 1980s non-CO2 greenhouse gas emissions are comparable to emissions from fossil fuel combustion. Unfortunately, the effect of greenhouse gases has increased over the past century and unless something is done, the emission of CO2 will only increase. What greenhouse gases are doing are increasing the oceans temperatures and contribute to effects like ocean acidification that effect human consumption of ocean life.

Ocean acidification is the decrease in the pH of the earth’s oceans that is caused by the uptake of CO2 from the atmosphere. This is when the ocean’s pH shifts toward neutral conditions rather than acidic conditions. One part of the ocean most affected by acidification is coral reefs. Coral reefs are a small part of the ocean yet hold a big amount of its biodiversity. More than 450 million people from 10 countries live near coral reefs that provide sources of ecosystem goods and services (Pandolfi, Connolly, Marshall, & Cohen, 2011, p. 418). Pandolfi explains that coral reefs are sensitive to increasing temperatures because scleractinian corals suffer a breakdown in their symbiosis with zooxanthellae when temperatures are high (p. 419). This breakdown is termed “coral bleaching” because the corals become white when zooxanthellae are lost which reduces the performance of its ecosystem. Unfortunately, most coral recovery can take a decade, although there have been observations of thermally resistant strains after bleaching but can take several years because of a trade-off between resistance and productivity (Pandolfi, Connolly, Marshall, & Cohen, 2011, p. 419). With coral reefs, the main concern is CO2 induced ocean acidification influence on rates of biogenic calcium carbonate production. It has been shown that enhanced CO2 has potential to influence the competitive abilities of subdominant species of mat-forming algae with an increase in resource availability that can cause shifts in species dominance and community structure that affect persistence and stability of the ecosystem (Godbold & Calosi, 2013, p. 2). Munday found that coral reef fish appear to be sensitive to both increasing ocean temperatures and higher CO2 levels. Most species he tested showed decrements to aerobic scope, declines in growth, reproductive output, swimming ability and sometimes survival. (Munday, McCormick, & Nilsson, 2012, p. 3871). Fish are very sensitive to temperature which causes temperature change to affect fish in different ways. Trout and salmon do not thrive in warm water because dissolved oxygen drops in warmer water that causes the fish to become less active. Fish like bass and catfish thrive in temperatures over 70°F although the warmer temperatures allow for parasites and infections. Unfortunately, what this means Is that fisheries are then catching contaminated fish for commercial purposes which then will be delivered to restaurants and consumed by customers.

Fisheries are a place where fish are harvested for commercial purposes. As previously stated above, many things contribute to negative effects on ocean life like deoxygenation which is anticipated to expand more over the decades. Deoxygenation is the removal of oxygen atoms from a molecule in a chemical reaction (Merriam-Webster's collegiate dictionary, 1999). Deoxygenation can cause negative effects on growth, reproduction, availability to harvest, and survival. “These effects on individuals and in localized areas can lead to responses at the population and food web levels which in turn, can change the harvestable stock abundance, body sizes and quality of the tissues of harvested individuals, and where harvestable individuals are vulnerable and feasible to be caught” (Rose, et al., 2017, p. 523). Growth affects the composition of the tissues that also affects their price and nutritional value. There are two main ways that deoxygenations affect fisheries: on the individual fish that result in population changes, and fisher’s behavior dynamics that affect location and pressure (Rose, et al., 2017, p. 523). Fisheries management is under intense analysis about whether it is appropriately effective, adequately protective of the resource (sustainability), and equitable (Rose, et al., 2017, p. 538). There has been, however, pressure for ecosystem-based fisheries, so hopefully, in the future, we will see more of those.

Climate change has contributed to changing patterns of temperature fluctuations, from different parts of the environment like the ocean. While it’s is clear that climate change is affecting ocean life through effects like emission of greenhouse gasses, acidification, and deoxygenation, the human-human effect needs to be further tested. That being said, fish seem to be the most affected by the temperature increase. It affects their growth, reproduction, and survival. For that reason alone, it affects humans because if their growth becomes minimal, then there is less sustenance for humans to live off of. While our understanding of climate change is still developing, there is evidence that does suggest the decrease in temperature is affecting ocean life particularly fish and coral reefs. “Science is the key to our future, and if you don’t believe in science, then you’re holding everybody back”- Bill Nye.

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