Effects of ocean acidification and global warming

ASSIGN BUSTER

Introduction:

Since the beginning of the industrial revolution, the release of carbon dioxide (CO2) from our industrial and agricultural activities has resulted in increasing atmospheric CO2 concentration. Over a period of less than a decade, the change in seawater chemistry due to rising atmospheric carbon dioxide (CO2) levels becomes one of the most critical and pressing issues, identify as ocean acidification.

The ability of the ocean to absorb additional atmospheric CO2 is decreasing, and more rapid global warming is led by future CO2 emissions. Ocean acidification is also problematic, the negative effects on marine calcifying organisms, resources and services cause by human societies largely depend energy, water, and fisheries. For example, it is predicted that by 2100 around 70% of all cold-water corals, especially those in the higher latitudes, will live in waters undersaturated in carbonate due to ocean acidification. Recent research indicates that ocean acidification might also result in increasing levels of jellyfish in some marine ecosystems. Aside from direct effects, marine and coastal pollution as global change-induced impacts with ocean acidification and the invasive alien species are likely to result in more fragile marine ecosystems. For example, coastal deforestation and wide-scale fisheries making species more vulnerable to other environmental impacts.

The motivation for this research is that although global change and global warming have been topics of intensive research among these years. Potentially profound changes throughout marine ecosystems and in the

environmental that research provide to humankind shows that impacts of ocean acidification may be just as dramatic as those of global warming and the combination of both are likely to led worst consequences.

Natural environment:

For tens of millions of years, acidity level of Earth’s oceans is relatively stable. The life in today’s seas has arisen and flourished because of the steady environment. But research shows that this balance is not keeping anymore and being undone by a recent and rapid drop in surface pH called ocean acidification. It could have devastated global consequences.

Human impact:

At least one-quarter of the carbon dioxide (CO2) released by burning coal, oil and gas doesn’t stay in the air, but instead dissolves into the ocean. Since the beginning of the industrial era, the ocean has absorbed some 525 billion tons of CO2 from the atmosphere, presently around 22 million tons per day.

For 2008, total human CO2 emissions were about 10 billion tons of carbon annually (equivalent to one million tons per hour or, on a per capita basis, ~ 0. 2 kg person-1 h-1; note that 1 billion tons equals 1 Pg or 1 x 1015 g). Of this amount, 8. 7 ± 0. 5 billion tons originates from fossil fuel combustion and cement production and another 1. 2 ± 0. 7 billion tons from deforestation (Le Que Ì re Ì et al., 2009). After the industrial era the amount of human CO2 emissions close to 560 billion tons. It is certainly enough to be of grave concern as a greenhouse gas leading to climate

change, even it is less than half of this anthropogenic CO2 remains in the atmosphere.

At first, scientists thought that what happened after industrial revolution might be a good thing because it avoids more carbon dioxide leaves in the air to warm the planet. But in the past decade, they have realized that it does leaf less CO2 in the atmosphere, but it has come as the cost of changing the ocean's chemistry. When carbon dioxide dissolves in seawater, water (H2O) and CO2 mix, they combine to form carbonic acid (H2CO3). The water becomes more acidic and the ocean's pH value gets lower. Compare to immense ocean, if there has enough carbon dioxide, it can have a major impact. In the past 200 years alone, ocean water has become 30 percent more acidic — faster than any known change in ocean chemistry in the last 50 million years.

Scientists formerly did not worry about this process because they call a stabilizing effect " buffering", which keep the ocean's pH stable by carrying enough dissolved chemicals through rivers from rocks to the ocean. But all the CO2 emission is dissolving into the ocean so quickly that this natural buffering has not been able to keep pH stable, and rapidly dropping pH in surface waters. The entire ocean is affected when surface layers mix into deep water. When the term " ocean acidification" was first coined, scientists have been tracking ocean pH for more than 30 years, even though it really only started in 2003. The current rapid rise in atmospheric CO2 is as much as 30 times faster than natural rates in the geological past, and present levels are higher than at anytime in at least the last 850, 000 years and likely several million years (Kump et al., 2009).

Consequences:

Geologists saw a number of changes about in the time period of 300 million years that share many of the characteristics of today’s human-driven ocean acidification. But the main difference before and nowadays is, CO2 levels are rising at an unprecedented rate, causing endanger situation like the near-disappearance of coral reefs. Also there’s a threat of acidification in human society, includes a decline in commercial fisheries and in the Arctic tourism industry and economy. Commercial fisheries are threatened because acidification harms calcifying organisms destroyed the Arctic food webs, such as pteropods and brittle stars. For example, In Scandinavia, acidic water reduced 15% of species populations and that more species were limited in population or declining. The rapid decrease or disappearance of marine life decrease the economic in coast area, it could also affect the diet of Indigenous peoples.

Branching corals, lives around natural carbon dioxide seeps, as a model for a more acidic future ocean. The reason the can struggle in the acidic water is because of their more fragile structure. For reef-building corals, calcium carbonate forms complex reefs in order raft house by coral animals themselves. Pre-existing coral skeletons can be corroded by acidic seawater, and limit their reproduce. The growth of new ones slows down, so the reefs will be more easily eroding by storm waves or eaten by animals. It’s possible that weaker and healthy coral reefs will all be eroding more quickly than they can rebuild.

Acidification may also effects the eggs and larvae of carols. While they were still in the plankton it’s not easy to get hurt by acidic water. However, as long as larvae is be in acidic water, it harder to find a good place to settle, preventing them from reaching adulthood.

Some types of coral use bicarbonate to build their skeletons, so they have more ways to survive in an acidifying ocean. Some can handle a wider pH range instead of survive without a skeleton after the pH value back to normal. Area that affected by natural carbon dioxide seeps, like on reefs in Papua New Guinea, big boulder colonies have taken over. Probably because this dedicatedly branching has thin branches, it’s more attackable to dissolving. From this change, many thousands of organisms that live among the coral can be affected. Nevertheless those fish and people eat. Acidification is not the only reason for corals suffer, also warming water, pollution, and overfishing that caused by human also affect them.

In general, shelled animals such as mussels, clams, urchins and starfish, are going to face the same problem like the corals. They have trouble building their shells by themselves in more acidic water. From the study we expected that, by the end of the century, Mussels and oysters will grow less shell by 25 percent and 10 percent individually. Urchins and starfish are not as well studied, but they have more weaker shelled that build by calcite, a type of calcium carbonate that dissolves more quicker that coral’s does. This study shows that the chance of being crushed or eaten of shelled animals will increase because of their weaker “ acidic affected” shelled.

Due to the burning of fossil fuels, people produce excess carbon dioxide that cause CO2 bubbles out of volcanic vents in the reef of the coast of Papua New Guinea. Also excess CO2 dissolves into the surrounding seawater, making water more acidic. There are places scattered throughout, lowering the pH in surrounding waters. Scientists study these unusual communities for clues to what an acidified ocean will look like.

Plants and many make their energy to survive from combining sunlight and carbon dioxide, it shows that more carbon dioxide in the water is helpful for them, doesn’t hurt them at all. As nurseries and home for many larger fish and thousand different organisms in the shallow-water area along coasts, seagrasses in more acidic water area were able to reproduce better, grow healthier. However, the pollution flowing into ocean and other reasons cause the seagrasses in decline, even the help of acidic seawater can’t replace the lost of other pollution cause.

Coralline algae, which build calcium carbonate skeletons more soluble than regular calcite form. It strengthened coral reefs. It makes space for other types of non-calcifying algae, so it can damage coral reefs about 92 percent less area in acidifying conditions. As we known coralline algae provide a ecosystem for coral before they leave the plankton stage, so it is a terrible situation for carol survive before start a new life on carol reefs.

There’s an exception called the coccolithophores, one major group of algae, they also grew weak shells. But in nearly 100 years, this algae was able to adapt the acidic water by growing stronger shells. This evidence shows that

they just needed more time to adapt, through the population is growing and changing, they will be more adopted to new environment.

To have a overview of the how ocean acidification be like, researchers compared the ability of 79 species of bottom-dwelling invertebrates settled in different areas of the Italian coast. For most species, including worms, mollusks, and crustaceans, the closer more acidic water, the fewer number could survive. Sea grass and brown algae dominated algae and animals that need massive calcium-carbonate. The polychaete worm Syllis prolifers, as the only one species that was more abundant in lower pH water. In some areas, they are replacing corals entirely with large boulder corals, sand, rubble and algae beds.

Although fish don’t have shells, the effects of acidification can also reflect on them. In humans, for instance, a drop in blood pH of 0. 2-0. 3 can cause seizures, comas, and even death. A fish is also sensitive to pH as human. To keep the pH value balance, it will burn extra energy to excrete the excess acid out of its blood through its gills, kidneys and intestines. Through the process it can also slow fishes growth.

Even slightly more acidic water may also affects fishes’ minds. In more acidic water, clownfish cannot identify threatening noise and flee from danger. There are unpredictable changes in animal behavior under acidification from the study. Because acidification, they cannot smell there way back. The changes of pH of a fish’s body and brain could change how the brain processes information and send the message to react. The more acidic seawater could shift the fish species. It could have major impacts on the food

web and on human fisheries. Altogether the ocean’s various habitats will no longer provide the diversity we depend on.

Restoration:

The most realistic way to lower the CO2 level and keep it from getting even higher, would be burning less fossil fuels and finding more area to restore carbon, such as seagrass beds, and marshes, known as blue carbon. If we did, even it won’t change immediately, but after hundreds of years, carbon dioxide in the atmosphere and ocean would back to normal and comfort for species to live again.

Many organization already started to let more people noticed what is ocean acidification and how it is related to our life. United Nations Framework Convention on Climate Change (UNFCCC) adopted the Limiting global warming in surface ocean pH of 0. 16 from pre-industrial levels. This represents the limit of surface ocean pH.

At the same time, organizations have fund raise in order to develop technologies that under the title of “ geoengineering.” Developing engines that reduce carbon dioxide and stable the biosphere. Some idea is 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, then absorb carbon dioxide from the atmosphere, and then, after death, sink down and trap it in the deep sea. However, it’s unknown the effect of this action, maybe seawater will become more acidic.

Conclusion:

Both ocean acidification and global warming are caused by anthropogenic CO2 emissions.

Ocean acidification is not just happened yesterday, it will continue to get worst if we do not pay attention in our biosphere and tracking global CO2 emissions. The ocean acidification is not only impact on biology, but also affect human society and economy, especially with ocean warming, the biosphere various will decrease and the environment is not stable anymore.

Generally, the pH of the ocean changes in a natural way, and some ocean organisms are well-adapted to live and reproduce in the changes. It may be hard for different marine species to adapt the more extreme changes, like ocean acidification, in resulting there will likely be extinctions. We don’t know the exact number, but there were mass extinctions around 55 million years ago. It happened during the last great acidification event, including deep sea invertebrates were extinct. At the time ocean acidification is intensify, we should aware and learn from the past.