

IMPACT OF CLIMATE CHANGE ON SEAFOOD AND THEIR CONSUMPTION

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ABSTRACT: Problems like economic losses caused by fish diseases and infections are the most important issue for the fisheries sector's growth. Current studies concentrate on the use of immunostimulants against fish diseases because of the fact that for a few fish diseases there is still no effective treatment and additional stress for fish are included in the treatments. Climate change is one of the biggest problems the world is facing today. Because of the human activities, greenhouse gases, chemicals and heavy metals have risen and have played a key role in global warming. Hence; level, oxygen content and water salinity have changed, and pathogens, toxic algae have increased globally. Since seafood is sensitive to changes in the aquatic ecosystems, climate change will eventually harm aquaculture and fishery sectors. Climate change will also endanger safety, diversity, quantity, value of seafood and diseases caused by seafood. Therefore, the consumption of seafood will be decreased and the sector of the production of seafood will be negatively affected. In addition to reducing greenhouse gas emissions and promoting environmental technologies, governments need to create collective food safety programs to avoid these negative conditions. Through Hazard Analysis and Critical Control Points (HACCP) programs, the risks that occurred as a result of climate change must be considered.

KEYWORDS: Climate Change, Fish diseases, Fisheries, Global Warming, Immunostimulants, Seafood.

I. INTRODUCTION

Changes in the climate characteristics and averages are referred to as climate change. Climate change is the most significant environmental problem and directly influences the living areas, food chain, biodiversity, economy and human life. Such changes should be measured systematically and last for decades or longer in order to define the changes in climate conditions as “climate change de”[1]. Gradual global warming and related physical changes and increasing frequency of severe weather events are triggering the effects of climate change (FAO, 2008a)[2]. Climate change melting of glaciers, rising seawater levels, diminishing forests and agricultural areas, increasing frequency and intensity of severe weather events, desertification, hurricanes, flooding, irregular rainfall; infectious diseases are increasing. By creating social and economic pressure on natural resources and ecosystems, the adverse conditions that will emerge as a result of climate change will adversely affect the food and livelihoods.

Climate change is expected to increase illnesses such as respiratory tract disorders, heart disease, allergies, nausea and diarrhea; this is believed to be caused by insufficient food resources, which are a significant outcome of climate change. Due to the negative consequences that may pose a threat to the survival of the human race, climate change is one of the biggest problems of our day. Therefore, international organizations are made to understand the causes of climate change and make agreements, strategies and proposals to assess and enforce the steps that can be taken against it [3]. Studies on controlling the quantity of greenhouse gas and developing more environmentally friendly systems and technologies have become increasingly important.

1. Main Impacts of Climate Change

The world's temperature has risen by 0.6°C over the past 30 years. In global warming, it is understood that it has reached the global threat dimension and will be felt significantly in the coming years, especially the rapid increase seen in recent years [4]. Because of the effects of global warming, there are major problems facing

reefs, glaciers and diverse ecosystems. A warm and humid climate in the Arctic nerve layers of the atmosphere will be formed due to the greenhouse effect and warming, cloudlessness will increase and storm seasons will start sooner and last longer. Climate change will have an effect in different geographical regions on large living communities [5]. It is reported that the global warming mainly influences the living life as well as causing destruction of habitat. In this regard, global warming can bring about the ecosystem changes.

i) Pollutants

Industrial development throughout the world has given mankind a lot of convenience and has led to a raise in environmental pollution. Several chemical contaminants are released into the environment as a result of human activity. In particular, these are persistent natural pollutants such as polycyclic aromatic hydrocarbons (PAHs), which are produced or by-products used in industrial or agricultural processes, toxic metals such as mercury, lead, cadmium, copper, zinc, and organic synthetic chemicals [6], [7]. Chemical contaminants enter in an aquatic ecosystem directly via land-based runoff, river-water or pollution, airborne deposition from local or remote sources and ships. Some toxins remain in the soil and live for long periods of time, reaching high concentrations in the food chain's high-level predators, thereby potentially impacting human health [1]. The precipitation level is expected to increase based on climate change and the amount of pollution in the waters will increase. Methyl mercury, however, is the most toxic. Toxic metals in aquatic materials cause tissue damage, loss of ability to regenerate, developmental disorders, damage to genetic material such as DNA, growth and growth changes by influencing various physiological processes of these species. The pesticide toxicity affects the temperature as well as the salinity rise. The magnitude of the effect depends on the organism's life stage as well as chemical pollution. Yes, the combination of increased salinity and temperature has been found to increase the toxic effect of insecticide and fungicide on *Palaemonetes pugio*. Toxicity depends on both the exposed organism's chemical pollutant and the living level [6]. The fact that toxins can be passed to offspring raises the value of their negative effects.

ii) Salinity

Higher sea level due to climate change will increase the arrival of salt water into the underground water basins, and increased salinity in the groundwater and brackish waters will affect human drinking water, agricultural and coastal habitats [2], [3]. Because of the increase in salinity in drinking waters due to the rise in sea level due to climate change, millions of poor people living in developing countries will have to use water limitedly. On the other hand, changes in precipitation level in these regions will affect salinity and living things by changing the amount of streams entering the coastal waters and mouths of the river [8]. Because salinity is a critical factor affecting species distribution and physiology, exposure to changes in salinity of valuable and important human products in terms of food chain and human consumption is important in terms of consumption and fishing as well as economic and ecological aspects.

2. Effect of climate change on seafood

Based on climate change, changes are likely to adversely affect the abundance, amount and value of seafood in marine and freshwater environments. The effects of global warming can be described as follows on various types of fish farming. Impacts on small inland areas: Many fish species act as heavier, deeper, or deeper waters when environmental factors change. As higher water temperatures occur, cold water fishing will decrease, while temperature sensitivity will increase, resulting in an unbalanced and unidirectional population in these waters. Wide inland areas and impacts on coastal fishing: those that breed and live in coastal wetlands are the most endangered species to be impacted in these regions [9]. The lagoons and swamps on the shores are the growing areas of crabs, karides and many fish species of economic importance. Most of the reproduction activities take place in the open area of this type at depths of 15-30 m and if the water raises more, the characteristics of these environments will be lost. Because of the increase of water, sound species such as mussels and oysters in the coastal areas will be exposed to predator attack [1]. Increasing water levels and rising water temperatures and reducing levels of oxygen in bays can result in fish death. Additionally to these species, tuna, lily, mackerel, etc. are found in shelf.

Impacts on the ocean fishing: Climate change frequency is estimated to have a lesser impact on deep-sea fishing than fish in other environments. But global warming, ocean scientists, creates fluctuations in the fishing, El

Nino, and so on. Since general biological activity at high temperatures is higher, high temperatures in many areas are likely to enrich fisheries. In this regard, since the medium contains a high amount of nutrients, it will be faster to grow the fish and achieve their sexual maturity [1], [6].

In general, the effects of climate change on aquaculture are summarized below;

- Rising sea water temperatures are likely to influence the distribution of many populations of fisheries. Some species may adapt to high temperatures and die as a result of warming due to climate change or may need to relocate to areas with more favorable conditions. The fish species residing in the southern hemisphere are estimated to be pushed towards the northern hemisphere due to the effect of environmental conditions that are affected by global warming [9].
- As aquaculture is highly sensitive to environmental influences during larval and embryological stages of development, changes in the environment due to climate change can lead to mutations, deformations, and survival effects.
- Higher water temperatures in the atmosphere can cause physiological stress to organisms by decreasing dissolved water oxygen and increasing the diversity of species.
- The transfer of nutrients from the soil to the surface in the water column may be reduced or eliminated due to the short winter and high water temperatures. This can lead to a steady stratification that reduces the productivity of the food chain in the oceans.
- Coastal fish are likely to be impacted by chemicals transported to the marine environment as a result of increasing seawater levels.
- Changes in freshwater flow and lake levels due to changes in precipitation will have an adverse effect on living and reproductive activity in these areas.
- It is expected that the distribution of stocks and the amount of catchable fish will be negatively affected in small rivers and lakes in regions where temperature and precipitation changes are high. Fishing operations will then be affected in large rivers and lakes, lagoon fishing and offshore fishing. Climate change poses a threat to fisheries conservation (FAO, 2008a).

3. Effects on seafood as food

The effects of climate change on the consumption of seafood and the manufacturing of seafood can be summed up as follows [1]:

- Climate change would have a detrimental impact on sectors such as aquaculture and health, fisheries, food trade, meat and feed production and processing. Such impacts can have economic, cultural, and environmental impacts, as well as public health impacts.
- Climate change has a negative impact on food safety, resulting in the processing and harvesting of unhealthier fishery items as they increase food waste and food borne diseases. Because this condition may adversely affect the perception of seafood by the customer, it may contribute to the avoidance of consumption of seafood.
- Parasite development at higher temperatures will also result in problems with aquaculture consumption and processing, which will include them more.
- Rising toxins such as pesticides and heavy metals in water will also be a major obstacle to healthy seafood consumption.
- As the fisheries and aquaculture industries are adversely affected by increasing environmental factors as a result of climate change, the food stocks and the diversity that humans will eat will decrease.
- Calcification may decrease as a result of acidification, resulting in shellfish not developing, developing and becoming invisible on the tables.
- As the increase in temperature and precipitation increases the frequency and incidence of bacteria, viruses, parasites and fungi, food-borne diseases will increase.

- Climate change will alter some seasonal biological processes and the marine and freshwater food chain, leading to an increase in invasive species and transport-related diseases.

4. Prevent climate change and reduce impacts

Today, most parts of the world host international climate change conferences every year and the necessary measures are decided by debating what is being achieved and what can be done about it. Global warming and climate change pose a major threat to Earth's life. This issue should be brought to worldwide awareness and scientific research and preventive measures should be taken as soon as possible [7]. Reducing emissions of carbon dioxide is of great importance in minimizing global warming caused by the change in climate. A primary strategy to prevent global warming should be to reduce the release of greenhouse gases into the atmosphere. An early and powerful step in reducing greenhouse gas emissions in the next 10-20 years should be taken. In order to reduce global warming and the changes it will cause, it has been estimated that global CO₂ emissions need to be reduced by 20-50%. [7], [9] Approximately 70% of anthropogenic CO₂ emissions are associated with the use of fossil fuels and this pollution will be offset by energy efficiency, energy conservation, and alternative energy sources such as wind energy, geothermal energy, and solar energy planning.

Increasing the fossil fuel tax, promoting public transport, minimizing the use of automobiles, using technology that consume less energy, construction, destructing forests is another reason for the high level of CO₂ in the atmosphere and forest burning to open agricultural areas is responsible for about 20 percent of human-generated carbon emissions in the atmosphere. Therefore, it will reduce the threat of global warming to protect forests [10]. The fact that climate change increases the incidence of harmful algae bursts and that the eruption-causing algae can create a maritime environment requires governments to grow shell and micro-algae monitoring programs and take regular and planned action to generate full toxicological data. The effects of warming and ocean acidity on bioaccumulation, structure and distribution of pollutants in aquatic organisms require additional research on the physical, biochemical and geological distribution of aquatic organisms.

There are very few studies examining the impact of future climate change on aquatic biota, and how aquatic production will occur in the future, what nutrient supply will be in the future, how the water temperature will respond to increased temperature, CO₂, pollutant, toxic algae, disease, low oxygen environment [3], [8]. The impact of climate change on public health and food safety should be addressed more broadly with these interdisciplinary studies. Countries will strengthen directed FAO / WHO food safety management systems in coordination and management, supervision, legal framework, evaluation, experimental and monitoring facilities, education, information and communication [11]. The frequency and prevalence of chemical and microbiological hazards that are affected by climate change and other factors need to be better understood when incorporating good hygiene practices in HACCP plans. It is essential that seafood processing sector be more careful and aware of the fishery products that are exposed to pesticides, toxic algae and heavy metal contamination when buying raw materials from regions where effects of climate change are more evident.

II. CONCLUSIONS

Climate change will have a major impact on the aquaculture, hunting and marketing industries as well as the manufacturing sector; general and special steps should be taken by all countries to minimize the factors that make up this, as it may be an obstacle to the safe production and consumption of seafood. It is important to analyse the ecological problems faced and to provide their impacts and studies on the protection of fishery resources. The impact of climate change on reliability and quality of seafood to be consumed should be researched and investigated to decrease these impacts, considering these determinants in the procurement of raw material, the hazards which can arise in the HACCP plans of processing sector should be considered.

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