Global Aquaculture Advocate

ENVIRONMENTAL & SOCIAL RESPONSIBILITY (/ADVOCATE/CATEGORY/ENVIRONMENTAL-SOCIAL-RESPONSIBILITY)

How will climate change impact seafood production?

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Important perspectives for aquaculture productivity and global food security

Netting surrounding ponds could protect escape of fish during floods.

The theme of the United Nations World Food Day on Oct. 16, 2016 ("Climate is changing, food and agriculture must too") highlighted the links between climate change, sustainable agriculture and food security.

Climate change poses a major threat to global food production – including seafood and aquaculture – and the challenge is how to continue feeding a growing global population in a changing environment. Currently, human population is at around 7.4 billion and is expected to continue growing to around 9.7 billion by 2050.

Global food production will need to increase by about 60 percent in that time. What are the prospects and valid alternatives for increased food production, when every year 5 to 7 million hectares (0.6 percent) of farmland are lost worldwide to industrialization, population growth and urbanization? And when, currently, one in nine people in the world are undernourished? It certainly is ambitious to achieve the Food and Agriculture Organization's (FAO) goal of zero hunger by 2030.

Aquaculture relevance to global food production

According to FAO (http://www.fao.org/fishery/climatechange/en), around 540 million people are mostly dependent on aquaculture and fisheries for income and protein. For a significant majority of these people, seafood is the source of one-half or more of their entire animal protein and dietary minerals intake. Globally, fish provides more than 3.1 billion people with 20 percent of their animal protein intake, with per capita fish consumption increasing from 9.9 kg in the 1960s to 20 kg in 2014.

Aquaculture is the fastest growing food production sector in the world, with an average annual growth rate of 6 percent over the last decade. According to FAO, global aquaculture production increased threefold between 1995 and 2014, and excluding aquatic plants; it reached 74 million tons in 2014, of which Asia accounted for 89 percent. The rapid development of aquaculture has been considered as the blue revolution, an approach to increasing food production to further contribute to human nutrition and food security.

Pond-dike cropping with extension onto pond water could reduce erosion during the rainy season and could provide shade for fish during summer months

The threat of climate change

Climate change can have a variety of effects on oceanic, coastal and freshwater ecosystems (including water flow and quality), all important to seafood production through fisheries and aquaculture activities. It can affect the structure and function of critical ecosystems like mangroves, seagrasses, estuaries and coastal lagoons that are critical for the life-stages of numerous commercial species.

Any significant habitat changes will affect aquaculture productivity and security. In temperate regions, aquaculture productivity could be negatively impacted by the warming of the oceans brought about by climate change. Much work is needed to properly address and prepare for the potential impacts globally on aquatic ecosystems, world fisheries and aquaculture by changing climate patterns.

The **2016 FAO Assessment Report** (http://www.fao.org/3/a-i5707e.pdf) "Climate Change Implications for Fisheries and Aquaculture" presents valuable information to better understand the potential consequences of climate change and ocean acidification on fisheries, aquaculture and dependent communities and economies, and how very important seafood production activities are for food security, cultural identities, human nutrition and livelihoods around the world. It also provides important information on how coastal communities are directly exposed to effects of extreme climate change events like sea level rise, storms, floods and others. The report also discusses potential changes in species ranges and biological processes and how these changes can help explain the different risks and opportunities for food security, food safety, governance issues, and social and economic costs in different regions.

Finally, this FAO report is also a reminder that mismanagement and poor governance of natural resources are still critical impediments to fisheries and aquaculture sustainability, and that the negative consequences of human activities – overfishing, pollution and others – are being magnified by climate change. It also points to the need for better understanding of economic, social and governance risks, context-specific disaster-risk management and vulnerabilities, and for improved adaptation options for fisheries and aquaculture production systems all along their value chains and across governance regimes.

During the dry season, irrigation capability could help aquaculture activities and integrated rice-fish culture in many regions.

As fish demand grows and capture fisheries reach their limits, aquaculture growth should continue at a strong pace. Aquaculture, however, has been affected by anthropogenic climate change, including events like coastal flooding, drought, ocean warming and acidification, changes in rainfall patterns, ocean salinity, sea level rise, storm surges and other events.

Because of climate change, water is becoming increasingly scarce in many regions of the world, which affects aquaculture production by reducing freshwater availability and limiting crop productivity. Rainfall variation has increased the risk of floods and droughts that negatively affect aquaculture. Fish culture is extremely vulnerable to flooding and farmers often loss of total harvest, and floods are becoming more frequent in fish farming communities in many Asian countries.

Drought is one of the key environmental limits to aquaculture as fish cannot grow without water. Droughts often result in short culture period for fish and surviving fish has always been hard due to severe droughts. As a result of global warming, increased water temperature leads to change in the ecosystems of fish ponds. Fish are highly sensitive to ecological conditions and changes in pond ecosystem have severe effects on their survival, growth, and production. Future climate change would have severe consequences for global fish production.

Perspectives

Per the FAO **climate change report** (http://www.fao.org/fishery/climatechange/en) – although accurate projections of the effect climate change could have on seafood production cannot be precisely predicted – these potential effects would certainly affect fisheries and aquaculture through "indirect, wider socio-economic effects (e.g. freshwater use conflicts affect all food production systems, adaptation and mitigation strategies in other sectors impact aquatic systems in general or fisheries and aquaculture directly); through biological and ecological responses to physical changes (e.g. productivity, species abundance, ecosystem stability, stock locations, pathogen levels and impacts); and through direct physical effects (e.g. sea level change, flooding, storm impacts)."

Higher pond-dikes could protect fish culture infrastructure from flooding.

Because of the prospects of climate change affecting seafood production, and the need to continue increasing aquaculture production, adaptation strategies must be further developed and implemented. Integrated freshwater aquaculture can help increase their resilience to climate change. In fact, aquaculture can potentially increase resilience to climate change through diversification and intensification of cultured species with efficient resource use.

The impacts of climate change on integrated aquaculture could be minimal. Planting of vegetables and fruit trees on pond-dikes could reduce erosion during the rainy season. Pond-dike cropping and pond slopes are also used for growing vegetables that can be extended out onto the pond water to provide shade and shelter for fish during times of high water temperatures.

Community based climate change adaptation including flood control (dams, embankments, higher pond-dikes) and irrigation facilities can help climate change adaptation in aquaculture. Technological innovation and efficient use of water in aquaculture can increase productivity and food security. Cutting edge trans-disciplinary research and development work, which rests on strong collaborations, are also needed among key stakeholders include farming communities, funding agencies, research institutes, and government and non-governmental organizations for resilience to climate change.

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