

The Impact of Climate Change on Sustainable Aquaculture Production

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Abstract : Aquaculture sector is the fastest growing food sector with annual growth rate of about 10%. The sustainability of aquaculture production, however, has been debated mainly in relation to the feed ingredients used for farmed fish. The industry has been able to decrease its dependency on marine-based ingredients in line with policies for more sustainable production. As a result, plant-based ingredients have increasingly been incorporated in aquaculture feeds, especially in feeds for popular carnivorous species, salmonids. The effect of these ingredients on salmonids' health and performance has been widely studied. In most cases, plant-based diets are associated with varying degrees of health and performance issues across salmonids, partly depending on inclusion levels of plant ingredients and the species in question. However, aquaculture sector is facing another challenge of concern. Environmental challenges in association with climate change is another issue the aquaculture sector must deal with. Data from trials in salmonids subjected to environmental challenges of various types show adverse physiological responses, partly in relation to stress. To date, there are only a limited number of studies reporting the interactive effects of adverse environmental conditions and dietary regimens on salmonids. These studies have shown that adverse environmental conditions exacerbate the detrimental effect of plant-based diets on digestive function and health in salmonids. This indicates an additional challenge for the aquaculture sector to grow in a sustainable manner. The adverse environmental conditions often studied in farmed fish is the change in certain water quality parameters such as oxygen and/or temperature that are typically altered in response to climate change and, more specifically, global warming. In a challenge study, we observed that the in the fish fed a plant-based diet, the fish's ability to absorb dietary energy was further reduced when reared under low oxygen level. In addition, gut health in these fish was severely impaired. Some other studies also confirm the adverse effect of environmental challenge on fish's gut health. These effects on the digestive function and gut health of salmonids may result in less resistance to diseases and weaker performance with significant economic and ethical implications. Overall, various findings indicate the multidimensional negative effects of climate change, as a major environmental issue, in different sectors, including aquaculture production. Therefore, a comprehensive evaluation of different ways to cope with climate change is essential for planning more sustainable strategies in aquaculture sector.

Keywords : aquaculture, climate change, sustainability, salmonids

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