



Fisheries and Aquaculture in Changing Climate of South Asia

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Purpose

The aim of this policy brief is to:

- alert South Asian countries on the climate change impacts on the contributions of fisheries and aquaculture to food security and livelihoods; and
- identify the adaptations and policies needed to take advantage of the climate change and to reduce the threat.

The significance of fisheries and aquaculture in South Asia

The South Asian Region is the fisheries and aquaculture hub in the world. The two major fish producing countries, India and Bangladesh belong to this region. India is the 2nd largest fish producing country and also ranks 2nd in aquaculture at global level. Bangladesh ranks 4th in fisheries and 5th in aquaculture in the world. The South Asian region contributes 27.3% of the global fish production and more than 34.4 million people are engaged in fisheries and aquaculture, mounting to 57% of the total global fishers and fish farmers. The region hosts 40% of the World's poor and one in every 5 person is undernourished. Based on the USD 1.9 /day poverty line, it is estimated that 12 % of the region's total population is in extreme poverty, higher than that of global average (10%). But if the value of poverty line that's just slightly higher than that USD 1.90 is considered, almost half of the people in South Asia (49 %) are in extreme poverty, if the base line is increased slightly to USD 3.20. Fish accounts for about 17% of the global population's intake of animal protein and the figure is as high as 72 % in some of the SAARC countries.

Climate change impact on fisheries and aquaculture

Worldwide marine and freshwater species and habitats are at risk from climate change impacts. South Asia is recognized as highly vulnerable to climate variability and change. The drivers of climate change include warming of water bodies, sea-level rise, ocean acidification, coral reef bleaching, change of wind speed and direction, change in rainfall, weather pattern changes and extreme weather events like, flood, draught and cyclone. Average annual temperatures throughout South Asia have increased significantly in recent decades. Western Afghanistan, southwestern Pakistan, southeastern India, western Sri Lanka, northern Pakistan, and eastern Nepal have all experienced increases of 1.0°C to 1.5°C (1.8°F to 2.7°F) over a period from 1950 to 2010. These climate change impacts impact aquaculture and fishery, their productivity, and livelihoods and safety of fishing community. The IPCC (Intergovernmental Panel on Climate Change) projected that with 1 m rise in sea level, about 2,500 km² of mangroves in Asia are likely to be lost. However, some opined that sea-level rise could open up of new habitat and flooded coastal agricultural land may provide new areas for mangroves and aquaculture opportunities. In Nepal, the increased temperature and rainfall resulted in more crop production and had significant positive effect on Agricultural GDP and also in national GDP of the country.

Table 1. Fisheries and aquaculture status in South Asia

Attributes	Bangladesh	India	Pakistan	Nepal	Bhutan	Sri Lanka	Maldives
Fish production (mmt)	4.13	11.44	0.48	0.077	150 t	0.53	0.13
Annual growth of fisheries (%)	4.50	4.50	3.20	8.50	-	3.00	-15%
Contribution of fisheries and aquaculture to National GDP (%)	3.65	0.90	0.40	1.32	<1.00	1.30	1.20
Contribution of fisheries and aquaculture to National Agril. GDP	24.41	5.23	-	2.47	-	-	-
Fishers and fish farmers	17.80 m	14.50 m	0.80 m	0.40 m	> 600 family	0.56 m	21,100

mmt = million metric ton; m = million; t = ton

Effect of climate change on aquaculture

Adverse climatic condition reduced fish growth, seasonality, reproductive efficiency and increased susceptibility to diseases. Increased temperature changes hydrology and hydrograph of water bodies. The lack of rainfall during summer months resulted in increased salinity beyond the toleration level in shrimp farms. Similarly, heavy rainfall caused drop in salinity resulting mass mortality of shrimp. Flood caused damage to the infrastructures, erosion of bunds, heavy siltation, introduction of disease and predators to the aquaculture system, which resulted in yield reduction and crop losses. Aquaculture ponds dried up and unexpected flush floods due to glacier melting were observed in upper Himalayan regions of Nepal and Bhutan.

Effect of climate change on fisheries

Climate change increased ocean acidification leading to inhibit shell building in crustaceans. Coral bleaching are recorded in India, Sri Lanka and Maldives, which severely damaged the reef ecosystem. Seawater warming caused cyclones over the time in the region. Sea level rise has been estimated as 1.29 mm per year in South Asian region, threatening low-lying Bangladesh and the Maldives. Sea level rise and inflow of surface changes the physico-chemical characteristic of coastal water. Shifting in spawning period and distribution pattern of fishes has been reported due to rise of sea surface temperature (SST) in Indian coasts. However, the rising SST up to a point may increase the production in mariculture, but this benefit is likely suppressed by adverse effect of temperature on fish growth. The change of stream flow in the rivers caused floods in South Asian region. Water temperature rise resulted in decreased lake size, invasion of aquatic species and plants. Many aquatic species became vulnerable and in the verge of extinction.

Implications for food security and livelihood

Climate change impacts resulted in decreased coastal area due to erosion, which represents a significant loss of income and livelihood of the coastal communities. Areas with large number of creeks and backwaters are likely at a higher risk of inundation due to easier influx of water into vulnerable areas. Extreme climate events cause severe loss to the coastal communities by preventing fishing operations as well as causing infrastructural damage for fishing. The small-scale fishers, comprising of artisanal and subsistence fishers, are the most affected group. Coastal erosion resulted in loss of beach and landscape quality, damaged the houses and business infrastructures and destructed the prized tourism sites in Sri Lanka. Risk assessment based on consequence and livelihood, the seasonal variation caused 20-40 % loss in production and extreme weather events resulted in 50-100% loss in production, though the events are not very common.

Adaptation to climate change impacts

The implications of climate change are far reaching and there is a need to develop and implement management plans to mitigate the impacts.

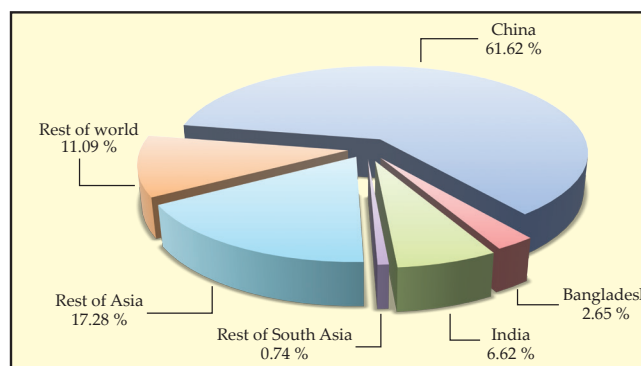


Fig.1. Contribution of South Asian fish production to the global fish production. Derived from FAO 2016.

Mapping of aquatic habitats

Regional or zone wise mapping and spatial representation of aquatic habitats and their linkage with eco-system services may be identified as a prospective adaptation option for better conservation, management and sustainable utilization of aquatic resources.

Restoration of Mangroves

Mapping of mangrove ecosystem, their conservation and restoration may be identified as an adaptation option to enhance coastal resilience. Mangrove planting in shallow extensive and semi-intensive aquaculture ponds may abate stress originating from temperature rise. Mangrove wetlands mitigate the adverse impact of storms, cyclones and Tsunami in coastal areas, reduce coastal erosion and on the other hand gains land by accreting sea and adjacent coastal water bodies.

Species prioritization and conservation

Highly vulnerable species may be identified and prioritized for conservation and management strategies. The conservation strategy should specially include seasonal ban, gear restriction, limiting number of fishers by licensing, species restriction, earmarking some part of the wetland areas as fish sanctuaries and complete ban on fishing in these areas. Conservation and fishing protocols based on species stock vulnerability could also be developed so as to enhance the sustainability. Regulation of fishing (fleet size, mesh size, spatiotemporal closure) could be ensured for sustainable fisheries stock utilization.

Energy efficient fisheries operation and monitoring of GHGs

Suitable modifications to the diesel engines, speed of operation and to craft and propeller design need to be carried out to reduce the energy consumption and subsequent emissions. Fuel used for fishing contributed more than half of the total impacts in eight of the ten environmental impact categories analysed. Continuous measurement of GHGs directly from the aquaculture ponds provides meaningful information on gases emission trends and help to combat climate change.

Capacity development

Fishermen folks, self-help groups and other stakeholders need to be trained and empowered to augment fish production and fish catching. Community participation in the management of aquatic ecosystem needs to be strengthened.

Management of extreme events

In case of extreme events, adaptation strategies viz., minimizing investment by harvesting fish at a smaller size and farming of species that require short culture periods and minimal inputs can substantially reduce the losses. The aquaculture technologies for harvesting from seasonal waters are equally essential to increase livelihood resilience in flood prone areas.

Aquaculture diversification

Diversification of aquaculture by introduction of new species and technologies provide the scope for natural selection and adaptation. Zone-wise commercially valuable stress tolerant species could be identified and cultured for better adaptation. Expansion of the farming of low trophic level fish with high feed conversion, zero water exchange systems, closed breeding cycle, domestication of specific pathogen free (SPF) and specific pathogen resistant (SPR) strains are beneficial to adapt to the changing climate. Large scale seaweed cultivation for carbon sequestration, reducing ocean acidification and coastal pollution abatement, co-farming of mussels, oysters and fishes, marine product development and coastal livelihood supplementation could enhance the adaptability to climate change impacts. The integration of aquaculture, fisheries, agriculture and other productive or ecosystem management activities has an integral role to play for the future of the aquaculture industry.

Suggested supporting policy actions

- Identification of problems and vulnerable fishery and aquaculture.
- Identification and scale-up of fisheries and aquaculture Disaster Risk Reduction (DRR) & Climate Change Adaptation (CCA) best practices.
- Use Representative Concentration Pathway (RCP) scenarios (in 2030, 2050 and 2080) developed by the IPCC in concert with predictive modelling techniques to gauge the intensity of future changes likely to occur in the marine fisheries sector.
- Introduction of saline, high temperature tolerant and fast-growing fish species for coastal as well as inland aquaculture.
- Expansion of cage farming and pen culture in feasible water-bodies.
- Practice of aquaculture in seasonal water bodies.
- Develop low cost fish farming technologies in tune with climate variability.
- Develop alternate energy and fuel sources for inland and marine capture fisheries.
- Farming of potential carbon sequestering species such as seaweeds and integrating with multi trophic aquaculture (IMTA).

- Breeding and propagation of endangered/threatened fish species and setting up of common gene bank for vulnerable species.
- Establishment of fish sanctuary in potential water-bodies.
- Framing of wetland conservation policies to manage coastal ecosystem/ adaptation strategy framework for marine fisheries sector.
- Developing restoration strategies for ecologically sensitive habitats, mangroves, corals and wetlands.
- Strategies for utilizing e-commerce ventures and Information Communication Technology (ICT) for social and livelihood security of fishers and fish farmers.
- Upgrading and modernizing the fishing industry related infrastructure and allied facilities and setting 'standards' for fishing practices.
- Community based fisheries and aquaculture management.
- Human Resource Development (through education and training) in SAARC member countries and exchange programs supporting member countries including visits, project support and resource sharing.
- Strengthening institutional capacity and developing collaborative and comprehensive researches to address climate vulnerabilities.
- Awareness programs on GHG emissions reduction and adverse impacts of climate change on fisheries and aquaculture.
- Commission of SAARC level task-force to document climate change induced events, their impacts on fisheries in the region and preparation of strategies to adapt/mitigate climate change impacts.

Where has this come from?

The policy brief is prepared from the outcome of the SAARC regional consultation meeting on 'Climate change impact on coastal fisheries and aquaculture', conducted by the SAARC Agriculture Centre in 2016. The SAARC member countries nominated their expert representatives to the consultative meeting to discuss country status and future needs to adopt to the climate change events in fisheries and aquaculture in the South Asian region.

Resources

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