

MARINE FISHERIES

Options for adaptation, though limited do exist

As the ability to sustain fisheries will rest on a mechanistic understanding of interactions between global change events and localized disturbances, it is important to recognize the regional responses to climate change says **Drs. E. Vivekanandan** Head, Demersal Fisheries Division and **G. Syda Rao**, Director, CMFRI, Kochi, Kerala

Marine capture fisheries have very important roles for food supply, food security and income generation in India. About one million people work directly in this sector, producing 3 million tonnes annually. The value of fish catch at production level is about US \$ 2.8 billion and India earns US \$ 1.8 billion by exporting fish and fishery products.

Being open access to a large extent, there is intense competition among the stakeholders with varied interests to share the limited resources in the coastal waters, which has resulted in overfishing and decline in stocks of a few species. Climate change is projected to exacerbate this situation and act as a depensatory factor on fish populations. Climate change will have strong impact on fisheries with far-reaching consequences for food and livelihood security of a sizeable section of the population.

Climatic and oceanographic parameters

There is now a widely-held consensus among scientists and policy-makers that human activities are increasing the levels of carbon dioxide and other greenhouse gases in the atmosphere, leading to a rise in temperature. This

links in turn to changes in seawater temperature, varying with latitude and topography, and to thermal expansion and melting of ice caps and sea level rise. The world's oceans are affected by changes in precipitation, wind and currents, themselves the result of geographical differences in temperature and humidity of the atmosphere. Thus, important oceanic weather systems such as the El Niño Southern Oscillation (ENSO) and the Indian Ocean monsoon are affected by global warming. These processes will, in turn, affect the abundance and variety of marine organisms.

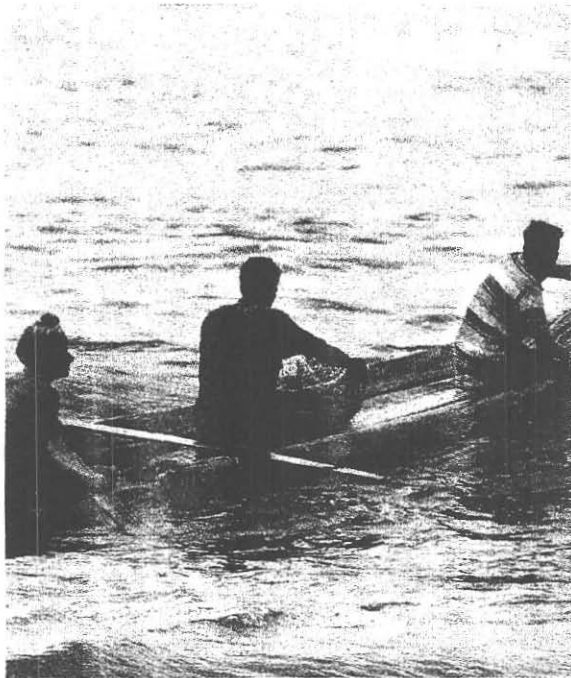
The sea surface temperature (SST) has increased by 0.2°C along the northwest (NW), southwest (SW) and northeast (NE) coasts, and by 0.3°C along the southeast (SE) coast during the 45 year period from 1961 to 2005. It is predicted that the annual average sea surface temperature in the Indian seas would increase by 2.0°C to 3.5°C by 2099.

Unlike most terrestrial animals that constitute the livestock sector, aquatic animal species used for human consumption are poikilothermic, meaning their body temperatures vary according to ambient temperatures. Any change in habitat temperatures (warming or cooling of seawaters in which they live) significantly influence their metabolism, growth rate, productivity, seasonal reproduction, and susceptibility to diseases and toxins. Most fish species have a fairly narrow range of optimum temperatures related both to the species basic metabolism and the availability of food organisms that have their own optimum temperature ranges.

From the investigations carried out by the Central Marine Fisheries Research Institute, the following responses to climate change by different marine organisms are discernible in the Indian seas: (i) Changes in growth, death and species composition of phytoplankton (which form the basic food for marine organisms) at higher temperature; (ii) Extension of distributional boundary of small pelagic (fish living near water surface) such as oil sardine and Indian mackerel; (iii) extension of depth of occurrence; and (iv) phenological changes (changes in the on-set of life parameters such as spawning with changing environmental parameters). These changes in distribution, abundance and phenology will induce significant changes in the structure and function of marine ecosystems.

Sea level rise in the Indian seas

The Inter-governmental Panel on Climate Change has projected that the global sea level would rise by 8 to 25 cm by 2050. The historic sea level rise for Cochin is estimated to have been 2 cm in the last one century. However, the rate of increase is accelerating, and it is projected that it



It is mandatory for fishermen to develop knowledge base for climate change and marine fisheries.

— Photo: M. Karunakaran



Worker drying his fish catch at a beach in Blangad near Thrissur in Kerala. — Photo: K.K. Mustafah

may rise at the rate of 5 mm per year in the coming decades. Considering this, it is possible that the sea level may rise by 25 to 30 cm in 50 years.

An increase in mean sea level will affect waves, currents and bottom pressure in the near-shore region. In general, an increase in mean water depth will be accompanied by an increase in mean wave height, resulting in a more severe wave attack on the coast and a greater wave-induced littoral drift. This will result in erosion and inundation of several coastal areas, making the coastal fishing populations vulnerable.

Options for fisheries sector for adaptation

Options for adaptation are limited, but they do exist. The impact of climate change depends on the magnitude of change, and on the sensitivity of particular species or ecosystems.

Develop knowledge base for climate change and marine fisheries

As the ability to sustain fisheries will rest on a mechanistic understanding of interactions between global change events and localized disturbances, it is important to recognize the regional responses to climate change. It is also important to recognize the importance of the changes in these parameters as drivers of change in marine organisms including fish. Initiating a commitment on long-term environmental and ecological monitoring programmes is important as such data cannot be collected retrospectively. Projections on climate change impact on fish populations need to be developed as the first step for future analytical and empirical models, and for planning better management adaptations.

Adopt Code of Conduct for Responsible Fisheries

Fishing and climate change are strongly interrelated pressures on fish production and must be addressed jointly. Reducing fishing mortality in the majority of fisheries, which are currently fully exploited or overexploited, is the principal means of reducing the impacts of climate change. Reduction of fishing effort (i) maximizes sustainable yields, (ii) helps adaptation of fish stocks and marine ecosystems to climate impacts, and (iii) reduces greenhouse gas emission by fishing boats.

Hence, some of the most effective actions which we can take to tackle climate impacts are to deal with the old familiar problems such as overfishing, and adopt Code of Conduct for Responsible Fisheries and Integrated Ecosystem-based Fisheries Management.

The challenge becomes severe considering the high level of poverty prevalent in the coastal communities involved in traditional fishing methods, and the lack of suitable alternate income generating options for them. These factors make these communities highly vulnerable to future changes, as their capacity to accommodate change is very much limited. Effort to reduce dependence on fishing by these vulnerable communities is essential.

Increase awareness on climate change

Specific policy document with reference to the implications of climate change for fisheries needs to be developed. This document should take into account all relevant social, economic and environmental policies and actions including education, training and public awareness related to climate change.

Effort is also required in respect of raising awareness of the impact, vulnerability, adaptation and mitigation



A good catch at Chettuva fishing harbour near Thrissur, Kerala. — Photo: K.K. Mustafah

related to climate change among the decision makers, managers, fishermen and other stakeholders in the fishing sector.

In the context of climate change, the primary challenge to the fisheries and aquaculture sector will be to ensure food supply, enhance nutritional security, improve livelihood and economic output, and ensure ecosystem safety.

These objectives call for identifying and addressing the concerns arising out of climate change; evolve adaptive mechanisms and implement action across all stakeholders at national, regional and international levels. In response to shifting fish population and species, the industry may have to respond with the right types of craft and gear combinations, on-board processing equipments etc.

Governments should consider establishing Weather Watch Groups and decision support systems on a regional basis. Allocating research funds to analyze the impacts and establishing institutional mechanisms to enable the sector are also important. The relevance of active regional and international participation and collaboration to exchange information and ideas is being felt now as never before.

For the fisheries sector, climate change notwithstanding, there are several issues to be addressed. Strategies to promote sustainability and improve the supplies should be in place before the threat of climate change assumes greater proportion. While the fisheries sector contributes little to greenhouse gas emission, it could contribute to reduce the impact by following effective adaptation measures.