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FISHERS' PERCEPTIONS ABOUT CLIMATE CHANGE AND FISHERIES



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ABSTRACT:

The climatic change needs to be understood as a process already at work, although not always visible because it is covered under a welter of other concerns. In fact, in the fisheries sector, climate change is probably not a new problem at all; fishers have been experiencing its impacts since before the term itself acquired popular currency. Consequently, it is not often possible to differentiate climate-change issues from wider processes affecting fisheries, and it is probably just as well because climate change

itself is the cumulative outcome of several such actions and processes at different levels within and beyond the fisheries sector.

KEYWORDS

Fishers' Perceptions , fishing communities, literature review .

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INTRODUCTION

There is need to curb the tendency to ascribe every change in fisheries to climate change, as appears increasingly to be the case, ignoring the other factors that need equal attention. Given the prevailing situation in fisheries, climate change will need to be understood as one more layer in a complex web of factors affecting fisheries and fishing communities. While several changes in the sector could possibly link up with climate change, the cause-and-effect relationships are seldom linear or clear, and are frequently overlapping or interchanging. Under the circumstances, ascribing every change directly or solely to climate change would call for abundant caution.

KEY CLIMATE-CHANGE FACTORS AFFECTING FISHERIES

Based on the literature review and the scoping workshop, a set of issues relating to climate change and climate variability was identified as having significant impacts (real and potential) upon Indian fisheries. In this section, a summary of the key changes relating to each climate-change/variability issue is provided from the fishers' perspectives.

SEA-LEVEL RISE

Sea-level rise is considered to be an important manifestation of global warming. In field interactions, sea-level rise did not come up as an issue in any of the study villages. Obviously, a 2-mm increase in sea level is rather difficult to perceive unless one is particularly watching for it. But that is a rather simplistic understanding of the issue; the increase in sea level is reported to manifest itself in a number of ways, affecting waves, currents and bottom pressure in the near shore regions². As the following sections will show, such manifestations of sea-level rise are being felt by the fishers, although the link between the different phenomena needs to be conclusively established. More recent work by CMFRI in Maharashtra indicates that some 75 coastal villages are vulnerable to inundation due to a projected 1-m rise in sea level, expected to happen over 20-50 years (Dr VV Singh, pers.com).

SEA-SURFACE TEMPERATURE

Sea-surface temperature is considered to be an indicator of ocean variability as well as more complex ocean processes. As with sea-level rise, the fishers are unable to perceive a rise in sea temperature as a result of climate change. In Maharashtra and Andhra Pradesh, it is reported that temperatures have increased both at the surface and even more at the bottom, but this is attributed to intensive drilling, industrial discharges (especially the atomic power plant discharges in Maharashtra), chemical effluents and urban wastes. Not only are these sources more immediate, but the heat generated by these activities is so much greater than the natural global-warming process that the latter remains mostly hidden. One possible impact of rising sea-surface temperature being felt by the fishers might relate to the changing fish composition in their catches. The small-scale gillnet fishers of Andhra Pradesh have reported that the depth of the surface gillnets, which was four fathoms in the 1980s, has now gone up to nine fathoms; the fishers contend that the pelagic species have descended to the lower layers from the surface due to variation in surface-water temperature.

SEA-SURFACE SALINITY

Sea-level rise could mean incursion of sea water into the coastal and upstream areas, making groundwater more saline, harming freshwater fisheries, aquaculture and agriculture, and limiting industrial and domestic water uses. There is much evidence of increased salinity in the near shore seawater, in the creeks and rivers, and in the groundwater in certain locations. However, the critical factor which contributes to the increased Salinization of the coastal areas is not so much the sea-level rise as the drastic reduction in freshwater flows from the upstream. In all States, there is a strong perception that freshwater inflows into the sea have decreased considerably. In Andhra Pradesh, the sinking of bore wells for aquaculture in the 1990s has reportedly salinised the groundwater table, while in West Bengal, the construction of the Farakka Barrage and increased upstream demand for freshwater are reported to have reduced freshwater flows into the lower reaches of the coast. With weakened flows from the upstream, the seawater intrudes higher up in the creeks and rivers, and stays longer in the absence of a strong push from above. This affects the local ecological and biological conditions; however—except in some places in Andhra Pradesh—there is as yet limited evidence of salinisation of groundwater resources in the coastal areas.

WIND PATTERNS

In all four States, it has been reported that there have been significant changes in intensity and directional stability of winds over the last 20 years. The most critical change, with implications on fishing activities, has been the uncertainties in the direction of wind flows. Three broad trends are discernible:

- The seasonal wind patterns have changed; winds that should arrive at particular periods of the year do not appear on time, which leads to an overall disturbance in fishing conditions.
- The stability of wind flows in particular directions is very uncertain; a wind flows in a particular direction for a short duration before it changes and flows in a different direction. Sometimes, the change in direction takes only 15 minutes to happen.
- Some unusual winds have gained strength, while favorable winds have become sluggish.

Overall wind velocities have reportedly decreased, especially in the near shore waters. While generally conceded to be a natural phenomenon, the construction of high-rise buildings on the coast is suggested in Maharashtra as one possible reason for this. The decrease in wind velocities is reported to have impacted upon the currents, upwelling processes, fish movements, navigation and fishing effort.

At the same time, freak occurrences of very intense winds—causing tremendous losses within a very short time—are increasing.

SEASONALITY AND SEASONAL PATTERNS

The fishers are as dependent on the monsoons as the farming communities, and the consequences of a poor or delayed monsoon are just as hard for them. Their timely arrival of monsoons, especially the southwest monsoon, remains the most critical requirement for productive

fisheries. Increasingly, the monsoons have become quite irregular; even when they arrive on time; they seem less consistent in their behavior. Staggered monsoons playing hide-and-seek and staying on much longer than usual (the southwest monsoon remaining active into November), and shifting and shrinking trends in the onset of the northeast monsoon (from October-December to November-December) have been reported as becoming the norm. With changing seasonal patterns, fish availability has been affected, and some important seasonal fish species have reportedly declined in catches. In Andhra Pradesh, there is a reduction in intensity and duration of the southeast and east-southeast day winds during summer, affecting the arrival of small pelagic shoals. Unseasonal events are reportedly on the rise, which include heavy rains during the peak summer, and high temperatures (above 35 degrees Centigrade) during September-October. Such changes are reported to have an impact on the behaviour, breeding and migratory patterns of fish, especially in the Sundarbans and in the Coringa mangroves of Andhra Pradesh. In West Bengal, where culture fisheries and agriculture are important livelihood activities for fishers, this is reported to lead to mass mortalities, stunted growth and spread of diseases in culture operations, and severe upsets in seasonal cycles in agriculture.

RAINFALL

There have been some critical trends in rainfall patterns from year to year and within each year. Heavy downpours in certain years are followed by near-drought conditions in the following years, both being equally disastrous for fishing and other activities. Even within a year, rainfall is not spread evenly through a season; the entire annual rainfall occurs within a very short period, creating problems, both immediate (swamping) and long-term (reduced upwelling). Thus, while the total annual rainfall may remain constant, its distribution being not uniform through the season means a severe upset of fishing and other activities.

Sudden rains

Sudden and intense downpours are a rising phenomenon that has had catastrophic effects on fish-drying operations in Maharashtra and Andhra Pradesh, effectively wiping out the business investments of a sizeable number of women. In both these States, the heavy, short-term, rainfall swamps the coastal villages and leads to water logging for extended periods of time, especially where natural water outlets have been extensively built over. Yet another hazard from short, intensive, downpours has been the flushing away of large quantities of land pollutants (near industrial areas) all of a sudden into the sea, leading to mass kills of near shore fish. The showers that signalled the onset of the southwest monsoon and that persisted for two or more weeks at a stretch (a phenomenon that in most States has a specific name and carries special economic, social and cultural connotations) have become rare. This seasonal downpour helped to churn the coastal waters and ensured upwelling, while also facilitating copious flows of freshwater into the system, which enabled fish breeding.

NATURAL DISASTERS

Ocean warming plays a major role in sea-level rise, intensified cyclone activity and heightened storm surges. For the fishers, especially those in Andhra Pradesh and Kerala, the unique—but

devastating—tsunami of 2004 is a major indicator of climate change. Apart from the direct loss of lives and livelihood assets, the tsunami also left behind several other long-lasting impacts—biological, geographical/

geological, economic and social—and still remains a largely inexplicable and terrifying phenomenon for the fishers. The fishers observed that there have been changes relating to the location, frequency, direction and intensity of cyclones. In general, there is a relative decline in the number of cyclones and low-pressure areas along the coast. Contrary to the general perception of the cyclone as a destructive force, the fishers contend that it also has a more benign aspect in that it helped churn the sea, ensuring up welling of nutrients from the deep, and helping the rapid transport of plankton masses from one area to another. The last major cyclone to have hit the central zone of Andhra Pradesh was the one in November 1996, a full 15 years ago. That it struck an unusual spot (the relatively safer Godavari delta) not only affected the response time, but is also taken as an indication of change in the usual cyclonic patterns.

While there has been a general weakening in the seasonal cyclones that occurred at specific times during the year (May and November, in the case of Andhra Pradesh), the few cyclones that have hit the coast during the last 15 years have been far more catastrophic than the previous ones. The cyclone of 1996 in Andhra Pradesh, the 'super cyclone' of Orissa in 1998, and Cyclone Aila of 2009 in West Bengal are considered to be the most grievous of their kind to have hit the respective coasts. These cyclones were not only more intense, but also covered a more extensive area further inshore than ever before. Thousands of houses were partially or fully destroyed, and millions left homeless. In all these cases, the influx of seawater deep into the inland led to salinisation of the land and groundwater resources, making them unfit for agriculture for long periods, and creating drinking-water scarcity in the areas. The transformation of cyclones from seasonal occurrences to irregular happenings has also resulted in inadequate preparedness of the coastal communities and government agencies to cope with them when they do occur. Thus, for instance, in Andhra Pradesh, three years of no—or minor—cyclones prior to 2010 was followed in that year by as many as four cyclone threats, leading to serious disarray within the administrative machinery.

Apart from the cyclones, the other serious natural disaster that the fishers faced earlier was the annual floods of the major river systems like the Ganga and the Godavari. Apart from their disastrous consequences for fish habitats, they also had a positive impact in terms of allowing a good mix of fresh and saline waters, cleaning up the rivers and creeks, flushing out the siltation from the river mouths, rejuvenating the coastal freshwater aquifers, and helping in the survival of mangroves. With uncertain rainfall year on year, and with the construction of dams across the major rivers, the annual floods have given way to more irregular, frequently man-made, events, which are far more catastrophic. Moreover, the steps taken to control floods have had their own implications. The bunds built in the Sundarbans to protect the human habitation from flooding have been counterproductive on at least two counts: (i) the process of flooding would help in depositing silt outside. (With the construction of bunds, this process has been disrupted—the silt remains in the river, elevating the river bed. Thus, the river is often seen to be flowing much above the land lying on the other side of the bund. This makes the bunds very prone to bursting and spilling.); (ii) the soft, unsettled soil makes the base of the bunds very unstable, putting them at risk of being swept away by the pressure of tidal or flood waters.

LOCALIZED DISASTERS

Alongside such large-scale occurrences as the 2004 Indian Ocean tsunami and Cyclone Aila, there is an impression that the nature and scope of disasters has also become more 'localized', and their implications are more diffuse.

Examples include:

- freak waves hitting one or a few boats at sea (Andhra Pradesh); individual villages (or specific households within a village) suffering from sudden swamping (Maharashtra and Andhra Pradesh);
- the coastline getting eroded in a particular area, making the surf crossing more difficult and leading to frequent capsizing of boats (Andhra Pradesh);
- erosion leading to total loss of beaches in a few locations, wiping out the local beach-seine fisheries, reducing space for local fish landing, boat berthing, net mending and fish trade (Andhra Pradesh);
- a river course changing overnight to swamp or engulf a Sundarbans village (West Bengal);
- sudden downpours wiping out the investments of a section of the fishing communities (Andhra Pradesh and Maharashtra); and
- unpredictable upwelling causing accidents in Kerala.

WAVES AND CURRENTS

In most places, it was seen that the intensification of waves in one area is complemented by a weakening of the same in the neighborhood. The cyclical Pattern that characterized the movement of waves to the coast appears to be broken; rogue waves keep intruding into the cycle. The wave action in the coastal waters has become weaker as a result of weakening near shore winds and increased siltation around river mouths. There is a perception that there has been a reduction in wave height, frequency and intensity. At the same time, wave action is much stronger in places where:

- beaches have been eroded and/or built over extensively;
- reclamation of land has taken place in the neighborhood;
- natural barriers like mangroves have declined; and
- new barriers to water movement (like jetties and harbours) have come up.

CLIMATE CHANGE AND FISHERIES

The stronger wave action in these areas is reported to (i) destroy homes and other structures closer to the coast, and (ii) capsize boats as they near the coast and occasionally destroy them by dashing them against the shore. In the offshore or deep-sea waters, where the mechanized boats of Maharashtra, Kerala and West Bengal are increasingly operating, the waves are reported to have become stronger, leading to more pitching and rolling than previously. In West Bengal, the problem of increased pitching and rolling was highlighted as a major issue. Currents in the nearshore waters have changed course for various reasons, both natural and man-made. Construction of harbours has been

reported to contribute to significant changes in water currents in the nearby areas. Offshore, water currents may have changed course in areas where oil rigs and shipping movements prevail. Sudden and strong currents have been noted to be on the increase in Kerala and Andhra Pradesh waters, while the southern currents (thekkan neeru) that favoured the fishermen in Kerala have weakened. There is a reported weakening of currents in the creeks in both Sundarbans and in Coringa (Andhra Pradesh). Siltation is reported to have reduced water currents in the creeks of Vasai and Versova in Maharashtra.

TIDAL ACTION

Changes in tidal action are felt particularly in the estuarine regions, and evidence of both increase and decrease in tidal amplitude has been reported in the four States. An important (natural) phenomenon appears to be the fluctuations in tidal cycles based on the lunar phases. This is reflected in changes in fish availability in the creeks, where the operations are largely influenced by the tidal cycle. Increase in tidal influx from the sea is said to be caused due to less freshwater flows from upstream, and contributes to increased salinity along the upper reaches. Erosion of beaches has led to increased inundation of fishers' houses during the high-tide period in Maharashtra and Andhra Pradesh. Islands like Gosaba in the Sundarbans also suffer periodical inundation of the bunds and incursion of waters into the village as a result of higher tidal amplitude in the area. Coastal constructions, siltation at the river mouths and along the creeks, and construction of tidal locks/bunds upstream reportedly decreased tidal action in several areas. As a consequence, the backwaters and tidal pools receive less tidal waters, and this reduces the breeding and nursery grounds for several estuary in species. Reduced tidal amplitude in the creeks also affects crab populations and aquaculture operations. It also makes the boats' passage through some creeks, and usage of some berthing places, impossible, requiring longer detours and berthing of boats away from the villages, all of which have attendant problems.

Vembanad Lake, Kerala

With the construction of the Thanneermukkam barrage, the tidal influx into Vembanad Lake in Kerala has stopped during months when the shutters are down. Prawns and other fishes that used to reach the lake for breeding have disappeared. Fish catches in the lake have reduced and have become unpredictable (with respect to the lunar cycle). Reduced interaction between the backwaters and the sea has led to changes in the local ecosystem.

MUD FLOWS AND TURBIDITY

Mud flows from upstream, which carried soil and nutrients to the lower reaches of the rivers, have declined in all States, mainly on account of reduced water flows, but also due to sand mining further upstream. Reduced mud flows decrease the nutrient content in the coastal waters, with consequences on fish breeding and nursery grounds. However, turbidity—which used to be mainly an outcome of mud flows—has increased due to effluent discharges upstream as well as directly into the coastal/estuarine waters.

SHORELINE CHANGES

Erosion and sedimentation are the most significant factors affecting the coastal areas and fisheries. Erosion, which is reported to affect 23 per cent of the shore line along the Indian mainland (Vivekanandan, 2011:11), is a major threat faced by many fishing communities in all four States. Most villages—including major fishing centres like Vasai in Maharashtra and Uppada in Andhra Pradesh—no longer have a beach in which to berth the boats, land and trade the catches, dry the fish, and mend the nets. Even as many houses have been lost to the sea, space available for housing itself has been reduced in erosion-prone areas. Erosion has been the main reason for the loss of beaches; while diverse human actions are contributing to the increased erosion, natural processes like the change in wave patterns, and increased ferocity of cyclones and winds are perceived to be significant too.

With erosion of the coast, the shoreline does not slope gently into the sea, allowing the tides and waves to play out their energies before reaching the beach; it drops abruptly into the sea, causing the waves to be more intense and damaging when they hit the shoreline. Seawater intrusion into the villages is a perennial problem of increasing intensity in places like Satpaty and Vasai in Maharashtra and Uppada in Andhra Pradesh.

CONCLUSION

Situations where there is need to diversify from fisheries-related activities, it is best to draw on the options and choices already being explored by fishing communities, rather than imposing externally driven, and frequently inappropriate, options. Communities' own strategies have the unique advantage of building upon their strengths at least taking cognizance of their weaknesses, and hence strengthening the positive aspects of their strategies would yield better benefits in the long term.

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