Chapter - 6
Environmental Issues and Natural Disaster

6.1 Introduction
The natural environment encompasses all living and non-living things occurring naturally on earth or some region thereof. It is the environment, which encompasses the interaction of all living species. The concept of the natural environment can be distinguished by two components, (a) Complete ecological units that function as natural systems without massive human intervention, including all vegetation, soil, rocks, atmosphere and natural phenomena that occur within their boundaries, (b) Universal natural resources and physical phenomena that lack clear-cut boundaries, such as air, water, and climate, as well as energy, radiation, electric charge, not originating from human activity.

A geographical area is regarded as a natural environment. Of late, the most serious and widely discussed topic all across the globe is the protection of environment for sustainable healthy living and there is a growing consciousness of the ecological problems among the countries in the western world. It is because the ecological imbalance or disharmony is appearing as a great threat to existence of life in this planet. In the past two decades, environmental issues such as famines, droughts, floods, scarcity of fuel, firewood and fodder, pollution of air and water, problems of hazardous chemicals and radiation, depletion of natural resources, extinction of wildlife and dangers to flora and fauna has attracted the attention of decision makers, scientists and even laymen in many parts of the world. People are now aware of the need to protect the natural environmental resources of air, water, soil and plant life that constitute the natural capital on which man depends. The world commission on environment and development (the Brundtland commission) submitted its report titled "our common future" in 1987. This report highlighted and popularized the concept of "sustainable development", which is defined as protecting the environment by meeting the needs of the present generation without compromising the need of future generations.

Climate change poses significant risks to the livelihoods, culture and health of millions of people (Barnett, 2003). Ecological and climatic changes are becoming more frequent, resulting in devastation to livelihood, especially the poor living in precarious environments (Ogata and Sen, 2003). In this respect, human beings are getting more vulnerable day by day. Vulnerability is usually characterized as forms of extent and frequency of exposures, and people's capacity to adapt to these hazards. A hazard may be defined "as a source of danger whose evaluation..."
encompasses three elements: the risk of human harm, such as injury, trauma or death; the risk of property damage; and the acceptability of the level of risk" (Kovach, 1995, 2). This definition suggests that each natural hazard event is unique because of the idiosyncrasies of the event itself as well as the differences in the population. Risk may be defined as the likely consequences (damage, loss, etc.) that may result from the impact of an event on exposures (values at risk) with specific event-related vulnerabilities. Risk assessment defines the nature and severity of the risk problem, and risk evaluation focuses on evaluating what to do about the risk. Natural disaster is one of the outcomes of climate degradation.

A disaster can be defined as a situation or event, which devastates local capacity, demanding a request for external assistance. Disasters commonly refer to particularly acute and extensive stressful situations that may be viewed in terms of the loss of life and the destruction of the natural or built environment. Combining the different views, disasters have been defined on the basis of how well individuals and communities can withstand, respond and recover from environmental stresses, as well as their ability to interfere in people's ability to meet their expectations. Disasters that are caused by nature are called natural disasters, examples of which include earthquakes, floods, cyclones, forest fires, hurricanes, lightning, tornados, tsunamis, and volcanic eruptions.

Lindell and Prater (2003) also outline how the impact of natural disasters should take into account other mechanisms, such as mitigation practices emergency preparedness, assistance to determine the real impact. In addition, Donner (2007), analyzed the effects of tornadoes in the US and found that the effect are not random, because some factors such as environmental, organization, demographic, and technological, have an incidence on the impact of such events. The impacts of a natural disaster cause inequalities. The aftermath of a disaster affects more to the vulnerable groups of the affected society. Moreover, vulnerability to natural disasters is a complex issue, as it is determined by the economic structure, the stage of development, prevailing of social and economic conditions, coping mechanism, risk assessment, frequency and intensity of disasters.

People staying in the coastal areas, by nature of their life and profession, not only live by generations close to the water but also depend on it for their livelihood. The fishermen groups have always been considered to be most vulnerable to the onset of any natural disasters. The marginalized and the economically disadvantaged groups are in general hit by natural disasters for a variety of reasons. The group or the communities often live in particularly vulnerable areas, their access to aid and support after the disaster is mostly restricted.
Odisha is prone to natural and human-made disasters. Due to its sub-tropical coastal location, the state is prone to tropical cyclones, storm surges and tsunamis. Its densely populated coastal plains are the sedimentary deposits of its river systems. The rivers in these areas with heavy load of silt have very little carrying capacity, resulting in frequent floods, only to be compounded by breached embankments. Though a large part of the state comes under Earthquake Risk Zone-II (Low Damage Risk Zone), the Brahmani Mahanadi graben and their deltaic areas come under Earthquake Risk Zone-III (Moderate Damage Risk Zone) covering 43 out of the 103 urban local bodies of the state. Odisha is also vulnerable to cyclones during April-May and September-November. Importantly, Odisha state in 1999 experienced a 'Super Cyclone', its worst catastrophic cyclone in 100 years. Though several UN agencies, NGOs, Civil Society organizations and the state and central Government have implemented number of projects to combat the impact of natural disasters, the results so far have been not up to the mark.

Chilika lagoon is situated along with the Bay of Bengal which is one of the six major cyclone-prone regions of the world. On an average, every year four to five cyclones strike the coastal regions of India (Shanmuga sundaram et al. 2000). In addition to cyclones, floods are common in Chilika lagoon. While various exposures to climate changes in Chilika lagoon have been reviewed through secondary data and research papers, people's perception is also of importance to consider their behavior and responsive actions (Grothmann and Patt, 2005). It is also evident that the lake is facing constant problem in terms of its environmental degradation.

Based on these discussions, this Chapter applied the 'Sustainable Livelihood Approach (SLA)' in an effort to understand impact of environmental degradations and natural disaster at the community level and scale up from the sample communities to the larger representative livelihood region. In order to understand the same, the major indicators which have been studied are, knowledge of fishermen about natural disaster, real time experience about natural disaster, receiving warning message, awareness about Do's and Don'ts during natural disaster, seasonality and its impact, plan of action to fight natural disaster, involvement of NGOs for disaster management and Government's safeguard mechanism.

6.2 Environmental Issues
The International Decade of Natural Disaster Reduction (IDNDR) concluded that "environmental protection, as a component of sustainable development and consistent with poverty alleviation, is imperative in the prevention and mitigation of natural disasters" (ISDR 2002). Planners and practitioners have recognized that the overall objectives of environmental management and mitigation of natural disasters are closely related and both aim to promote sustainable
communities. They also recognize that these problems share some common roots. Initiatives undertaken for environmental management, poverty alleviation and disaster risk management aim to manage the physical environment as well as support sustainable and resilient livelihoods at the community level.

Environmentalism is not only concerned with nature but with the sustainable use of nature (Guha and Gadgil, 1992, 1995, Guha and Alier, 1998). Lake Chilika has its own ecological, cultural, social, economic and physiological balance. Climate, food availability and quality, suitability of shelter, and the presence of predators (including humans) affect the fish populations. Water quality, turbidity, and the presence of pollutants can also affect fish reproductive success, which affects fish populations. Species composition is usually determined by a number of factors including water quality. Fishing has a large impact on fish population and community structure and thus, it has to be regulated to try and maintain a balanced fishery. In short, any human activity that affects water quality and habitat has potential direct effect on the fish population and overall structure.

The major issues, that are affecting the environment of Chilika is studied under the following six parameters.

The first parameter, which was studied during the research, was the views of fishermen about change in the environment of Chilika within the last ten years. The lagoon is divided into four ecological sectors namely, the southern sector, the central sector, the northern sector and the outer channel area. Basically, the northern sector is fresh water dominated zone and central sector is a brackish water zone. The southern sector is a higher saline area. The outer channel is marine in nature with saline water but during monsoon, the water becomes fresh water due to discharge of flood water to the sea. It is considered that most of the tidal flats and sea weed areas in Chilika Lagoon are nursery grounds and spawning grounds of some of target species. Especially, the tidal flats in the region of outer channel and Satapada are good nursery grounds of Bagada, Kantala, and Mud crabs throughout the year. The freshwater weed area off Kalupadaghat is also a good nursery ground of Boraga, Kundala, and Sahala. The juvenile of Khainga is found in the shallow areas all over the Lagoon. The fry of Khainga are available in large quantity at the Lagoon mouth between October and December (Mohanty, 1972 and 1973).

However, it is found that the natural resources in Chilika are under a great threat. Due to the overall deterioration of the Lake, the Nalabana Bird Sanctuary in it, which houses the migratory birds of North Asia beyond the Himalayas (Tibet, Mangolia, Manassarobar, Caspian Seas and Siberia) in the winter, is facing the danger of degradation. It is also true that despite the
honorable Supreme Court's order to abolish the prawn gheris, the cause of degradation of Chilika, no one is ready to execute this order. As the powerful people are either directly or indirectly involved in intensification of shrimp farming activities in Chilika, no laws are strictly enforced till today to stop them and to protect livelihood of poor fishermen.

During the study, the researcher tried to understand, the perception of the fishermen in terms of degradation of environment in Chilika. To support the question, the researcher also tried to understand, what the fishermen understand by environmental degradation in the lake. This will help not only to build a strategy for protecting the environment, but will also bring out the major issues which Chilika is facing now, in terms of environmental degradation.

65% respondents feel that the overall environment of Chilika is affected, whereas 30% feel that the environment has not been affected. Only 5% have no information about the situation.

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<thead>
<tr>
<th>Environment of Chilika been affected</th>
<th>Frequency</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Yes</td>
<td>291</td>
<td>64.8%</td>
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<tr>
<td>No</td>
<td>136</td>
<td>30.2%</td>
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<tr>
<td>No idea</td>
<td>23</td>
<td>5.0%</td>
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<tr>
<td>Total</td>
<td>450</td>
<td>100.0%</td>
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During interaction with the CDA officials, it was informed that due to siltation in the north-east and north-west sectors of the lake, the average depth of Chilika has substantially reduced. A large number of fishermen on the northern shore of the lake use fishing nets of fine mesh because of which prawn, crabs and other types of fish, are not growing rather the number are declining fast. Reduction in salinity is adversely affecting the aquatic life in the lake. A large number of birds visit the lake during winter. But, now the number has declined. This may be due to the fact that they did not find any perching ground.

While discussing with the forest officials, it was informed that the department has taken major steps in the past couple of year to preserve as well as generate new forests. Number of awareness generation programmes has also been undertaken on this subject. However, during the FGD, some of the older fishermen informed that, there were large forest areas both on the coastal side and around the lake, which were covered by casuarina (near the sea shore), eucalyptus and cashew. But the local communities, who entirely depend upon the forest to meet their fuel requirements, are cutting and selling these trees in the local market. Also, the
fishermen cut the bamboo to make fishing tools. The forest department hardly takes any step against this. At the same time it is difficult for the forest guard to manage such a vast area. This fact was further supported and proved during individual discussions and by use of triangulations.

Similarly, farmland, mostly paddy fields, is spread all around the lake and irrigation water with pesticides drain straight into the lake (CDA Report). These also cause potential harm to a variety of aquatic life, including fish. Most importantly the increased use of motorboats in Chilika Lake has affected the lake water. The pollution level has increased due to seepage of oil in the lake. During research it was also informed that due to the massive deforestation in the upper reaches of the Mahanadi and in the Eastern Ghats, it is being silted up rapidly.

As can be seen all the problems are complicated and interrelated and the fishermen are aware of the problem. There are competing economic and social demands on Chilika. The families of local fishermen are poor and mostly depend on Chilika for their livelihood. For them Chilika is bread and butter and thus, its ecology needs to be maintained. Total ban on illegal and unauthorized shrimp culture will increase the level of income source for fishermen of Chilika. At this crucial hour, it is all the more important not to think only the economic considerations but also there is a need to harmonize the social as well as ecological imperatives.

To develop the lake and the beneficiaries around it, the inbuilt balance should be well understood. For this, sustainable development of natural resources and ecological subsistence, its ecosystem must be maintained and conserved. Proper steps should be taken to save its ecology from deterioration and environmental degradation. During the interaction, the fishermen suggested some measures for saving Chilika from degradation and deterioration and consequent improvement in their living conditions

- There are ten rivers and rivulets draining into the lake and feed the wetland with flood water during rainy season. These rivers and rivulets carry a huge quantity of silt to the lake. Siltation in the lake has reached alarming situation causing three noticeable ecological effects, namely shrinkage of the lake area, decline in the lake’s depth and weed growth, which are interlinked with one another. Hence plantation of trees on the banks of rivers should be made more extensively to check soil erosion and silting of Chilika basin.

- To reduce deposition of silt and flushing out of sediments in the Lagoon, some channels such as Magarmukh channel, outer channel and Palur canal need to be dredged and kept free from blockages by fishing nets. The creeks in Parikud islands should be dredged to lead the fish migration and juveniles into Lagoon.
• Abolition of shrimp culture and demolition of shrimp 'gheris' (net enclosures), which disrupt the tidal flushing, reduces the level of salinity, squeeze grazing ground for juveniles and accelerate the process silting of marginal areas of the Lake.

• Digging and dredging at the mouth of Chilika at ‘Arakhakuda’ and ‘Chilika Canal’ as well as in the Lake for proper exchange of water between ‘Bay of Bengal and Chilika to check siltation and to allow free movement of fish and shrimp juveniles.

• Efforts should be made to remove aquatic weeds particularly from the western and northern shore of Chilika and abolish shrimp gheris, which disrupt the tidal flushing and free movement of fishing boats in the lake.

Environmental degradation is hampering the livelihood of the fishermen of Chilika as it has a direct linkage with the flora and fauna of the Lake. The environment of Chilika is unique and its impact tends to be felt far beyond the immediate circle. While for the local fishermen, it is primarily a question of livelihood, at the national and international level it has become an issue of ecosystem of unparalleled importance. Thus its local, national and international importance should be realized.

The second parameter under environmental degradation, which was studied through interview schedule, was conservation or protection of the environment in Chilika. Conservation of natural resources or their sustainable use has often been regarded as a characteristic of traditional Asian cultures (Kalland and Persoon, 1998). The environmental destruction has destroyed the conditions of production of peasants, fisher-folk, hunters and gatherers in many parts of Asia in many ways; it has also affected their production itself, not merely the quality of their daily lives (Omvedt, 1993). Chilika has been under constant threats from both natural as well as artificial problems. The most important problem is that the overall ecological degradation of the Lake has brought about the socio-economic deterioration of a large chunk of traditional fishing community dependent on the Lake.

Most of the resources in the lake are renewable resources. Renewable resources are those that can be replaced such as plants, animals and water. But if collected or hunted faster than they cannot reproduce and they will completely extinct from the earth. However, as in number of cases, Chilika is experiencing fast decrease of resources, which is putting a huge pressure on the fishing community, who solely depends on the lake for their bread and butter. It is these fishing communities, which have been experiencing so many problems like deprivation, marginalization, alienation, migration, and many others. Ironically all these problems increased due to the environmental problems in the Lake. In a substantial sense, they have been
associated with the larger environmental problems of the Lake as these people live a life embedded in nature and derive their sustenance from this environment (natural resources) for their survival (Conservation of Environment and Protection of Marginalized Fishing Communities of Lake Chilika in Odisha, India, Sarmistha Pattanaik). However at the same time Government of Odisha has been claiming to do a lot of activities to conserve the environment in Chilika.

Conservation of environment in Chilika is not only the responsibility of CDA, but various other state departments are responsible for it. However, as per Resolution No. EE-82/91.1619/F&E., dated 24th January, 1992, the objectives of other department in the part of resource management is "to survey, plan and prepare the project proposal for Integrated Resource Management for overall development in and around Chilika" but not implementation. Various national and international agencies are keeping a track on the environment of Chilika. The Lake was added to the Ramsar List of Wetlands of International Importance in 1981. In 2002, the Chilika Development Authority (CDA) received the Ramsar Award for its impressive work in restoring the Chilika Lake. The Ramsar Wetland Conservation Award was established in 1996 in order to recognise and honour the contributions of individuals, organisations, and governments around the world towards promoting the conservation and wise use of wetlands. This restoration has been carried out based on the principles of wise use and integrated management, and with a major emphasis on the participation of the local population and their shared decision-making, as well as capacity building. Similarly CDA was conferred with the prestigious Indira Gandhi Paryavaran Award 2002 for the outstanding contribution by way of successful conservation and restoration of the eco-system of Chilika lagoon. However, even after all the efforts, it is observed that the ecological balance of Chilika is still under threat and at the same time the external environment of Chilika is in the process of fast depletion.

The researcher therefore wanted to find out, whether enough efforts are being made to protect the Chilika from the environmental degradation from the point of view of the respondents. This will help to understand the fishermen’s opinion on environmental conservation and will also help to prepare a plan of action for environmental restoration in the lake.

The above table distributes the respondents into two categories on the basis of their views and on the efforts made to conserve and protect the Chilika environment. Out of 450 respondents 11.8% said that proper steps are being taken to protect the Chilika environment and 88.2% replied negative.

This proves that the efforts made by the government of Odisha for the conservation and protection of the Chilika environment are still insufficient. This is generating the biggest threat to
the life, and livelihood of not only the fishermen living on the Chilika Lake but also the people inhabiting in the region. This situation is putting challenge to the Human rights guaranteed under the United Nation's Universal Declaration of Human Rights, 1948 and right to life guaranteed under Article 21 of the constitution of India.

During the initial discussions, the officials from the CDA informed that the government has taken major steps in terms of environment protection. This has resulted in increase of bird migration during winter, which is one of the major attractions for the tourists. However, while interacting with the fishermen the researcher got to know that the ecological change of Chilika is affecting the avifauna of the lake. More than a million of birds congregate in every winter here, but the numbers are falling because of weed growth near Nalabana - the bird sanctuary and because of the decline in the quantity and variety of fishes on which these birds depend upon. This needs immediate attention. This was further confirmed during the FGDs. Here the researcher used the triangulation method during the research to come to the conclusion.

The decline in salinity, due to siltation and sedimentation is contributing to excessive weed growth in the lake. De-forestation and bird poaching in the Chilika-basin are also the contributing factors. The decline in avifauna has led to a substantial decline in eco-tourism and fall in arrival of international tourists, resulting in economic loss for the locals who are dependent upon tourism economy. The spread of shrimp culture ponds and shrimp gheris since mid-1980s all around Chilika has contributed to the influx of nutrients facilitating weed growth and this act as a breeding ground for mosquitoes.

It is therefore recommended that CDA should work in coordination with other departments for implementation of the plans and projects. Therefore, collaboration mechanism with Department of Fisheries and Animal Resource Development and Department, Environment Department and Agriculture Department need to be strengthened for planning and implementing environmental protection schemes. This will also lead to fishery resource management for improving livelihood of fishers.

Fishermen's perception about awareness programmes in managing environments was the third key component, which was studied during the research. The enhanced pace of development activities and rapid changes in the society have resulted in stress on natural resources and quality of life. The trend of increasing pollution in various environmental media is evident from the deteriorating air and water quality, higher noise levels, increasing vehicular emission. While
meeting the ever-growing needs, we put pressure on the environment. When the pressure exceeds the carrying capacity of the environment to repair or replace itself, it creates a serious problem of environmental degradation. If we use any environmental resource such as groundwater beyond its limit of replacement, we may lose it forever. Therefore, there is a need to create 'awareness' about environmental protection. While efforts are being made at the national and international level to protect our environment, it is also the responsibility of every citizen to use our environmental resources with care and protect them from degradation.

Environmental education, awareness and training plays a significant role in encouraging and enhancing people's participation in activities aimed at conservation, protection and management of the environment, essential for achieving sustainable development.

The environmental degradation in Chilika poses a great danger to fishermen's own survival. It should be realized, sooner than later, that conservation and improvement of the environment are vital for the survival, and wellbeing of fishermen and all other depending on Chilika. Natural resources like water, land, plants and fish have to be used wisely to ensure a healthy environment for the present and future generations. Fishers' social networks and their awareness of the larger world are extremely weak. They frequently fall victim to frauds of various kinds. Effective participation of communities is dependent upon the people's awareness of the programmes and the government functionaries' interest in involving people. CDA along with several NGOs and international organisations have carried out massive awareness programme in the fishing villages of Chilika. Several other organisations having interest in the environment have also carried out awareness programmes on different subjects.

The researcher therefore tried to understand, whether the awareness programme help the fishermen to change their mind about any specific issue. This will also help to suggest the kind of awareness programme that should be taken up to address the challenges that Chilika is currently facing.

66% respondents feel that awareness programme help in managing environment and 34% feel that awareness programme does not help in managing environment.

Chilika being a hot spot from environmental point of view, it is quite visible that fishermen are aware of the training and awareness programmes. This clearly shows the importance of awareness programme already undertaken in the region by various agencies and its impact on the fishermen.
The study therefore suggest that massive awareness programmes for the fishers, local NGOs, school children, village level government functionaries and village women on the sustainable and wise use of natural resources of Chilika Lagoon needs to be implemented in a sustained manner. Environment Education Programme for school children with special references to Chilika eco-system should be continued to orient the young minds on conservation and cultural importance of Chilika Lagoon. The main objectives of environmental awareness programme should be to:

1. Improve the overall quality of Chilika environment
2. Create awareness among the fishermen as well as others who have direct or indirect relation with the lake on a daily basis on environmental problems and conservation
3. Create an atmosphere so that the fishermen find themselves fit enough to participate in decision making so that developmental programme are presented after evaluation.

Several non-government organizations, educational and training institutions, professional associations, scientific bodies, community organizations, and also a whole range of other agencies should be brought together to participate in the campaign mode awareness programme. These bodies individually or in partnership with other organizations can organize programmes for creating environmental awareness followed by field action at the village level.

All development activities in the lake may involve some amount of environmental degradation. It is important to take into account the damage to environment as a result of development, and strike a balance between development and environmental protection. The aim should be to achieve sustainable levels of fishermen’s welfare and development.

The fourth component, which was studied under environmental degradation, was fishermen’s awareness on legal provisions for protection environment. Every person has equal right over natural resources and also duty or obligation to conserve it. There are several laws which have been enacted in India on protection of environment and more particularly for protecting the environment of the water bodies. Two international conferences on environment and development one at Stockholm in 1972 and another at Rio de Janerio in 1992 have influenced environmental policies in most countries, including India.

However most of the people in India are unaware of environmental laws and also unaware of harmful effects of environmental degradation. Article 48 A of constitution of India says that “the state shall endeavor to protect and improve the environment and to safeguards the forests and wildlife of the country.” Part IV A of the Constitution directs fundamental duties for every citizen
of India. According to clause 'g' of Article 51 (A) "it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures". Article 253 of constitution empowers Parliament to legislate on any matter for implementing the international obligations and decisions taken at international conferences. Accordingly Parliament passed many laws such as implementing decisions of Stockholm's Conference, 1972, Water (Prevention and Control of Pollution) Act, 1974. List III of Concurrent list of schedule VII also provides power to both state legislature and Indian parliament on various aspects related to environment. Article 21 of Indian Constitution provides right to life which is interpreted by Supreme Court in number of cases. The Water Prevention and Control of Pollution Act, 1974, Municipal Solid Wastes (Management and Handling) Rules, 2003 are some of the major acts which regulate the huge water bodies. Similarly Ramsar Convention on wetlands, first intergovernmental treaty between nations, signed in Ramsar, Iran entered into force in 1975 is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands. 156 countries and 1676 sites are designated under this convention as Ramsar sites of international importance. This convention emphasizes on conservation along with wise use of wetlands. The definition of wise use is given in Article 3.1 of the convention i.e. "Wise use of wetlands is the maintenance of the ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development." According to which every contracting party should adopt national wetland policies and developing programmes such as research, training, public awareness, review of existing legislation and institutional measures for dealing with conservation of wetlands. Ramsar secretariat also assists the contracting parties by providing them expertise, guidelines for wise use of wetlands and conservation measures and funding for implementation of such measures. Chilika Development Authority (CDA) has been constituted as a state government organisation and has not been empowered legally to enforce measures for conservation and protection of the resources of the lagoon and to apprehend violators of the rules and regulations applicable. During the study the researcher tried to assess the knowledge of fishermen community on the laws and regulations that govern the environment of the lake. The study reflects that only 14% respondents have basic knowledge about the legal provisions on environment protection, where as 86% do not have the knowledge about the legal provisions about environmental protection. It is therefore quite clear that there is a lack of knowledge and awareness on the part of fishermen about the legal provisions for environment protection and
this leads to environmental degradation. As already been discussed, environmental degradation leads to livelihood insecurity.

It was also revealed that through the FGD that the environment of the lake gets affected by the tourists. The local CDA office viewed that the local administration keeps a close eye on the tourist and ensures environmental safety even during the high tourist season. However, some of the boat operators during interaction informed that the tourists, who visit the lake, come just to enjoy the scenic beauty of lake and thus most of them pollute the lake by throwing harmful substances in the lake such as polythene bags and harmful wastes. This is really difficult to manage, unless the local concerned authority try to make people aware of the harmful effects of these acts and make laws prohibiting such things near to lake. Contribution of the local people also is very important to manage the environment safety. This was contradictory finding against the information given by the CDA officials. This was further clarified during the interview. Here the researcher used the triangulation method to reach the conclusion, which was rather revealing.

While making the environmental policy equity should be considered as an important parameter. When the distribution of income is highly skewed and about one-third of the fishermen live below the poverty line, intergenerational equity must be of concern. The reason is that the poor fishermen are the victims of environmental degradation near the lake even though their contribution in environmental degradation is proportionately less. Further, the poor do not have the means to undertake averting expenditures to protect them from various environmental hazards. Therefore while it is important to make them understand about the policies and acts on environmental law, it is more important to ensure that the rules and guidelines are followed by the people who are aware of it. This will create a sense of satisfaction among the poor fishermen and they will further try to protect the environment.

At the same time the government should also provide an enabling environment to community based organizations in the area to contribute in the management of local fishermen and in the enforcement of environmental laws and rules. The government must make a transparent and conscious assessment of the tradeoff between efficiency and equity in the matter of environmental policy.

Strict enforcement of the Odisha Marine Fishing Regulation Act, applicable to Chilika needs to be ensured by the Fishery Department. Operational framework/guidelines to establish interagency co-ordination and working relationships should be put in place to ensure that management objectives are coordinated and mutually supportive. An overall policy that will
provide a long-term vision and support for the future use, conservation and development of the lagoon is also necessary.

Similarly awareness about the illegal poaching (birds) was also studied during the research. Chilika is one of the hotspot of biodiversity in the country, and some rare, vulnerable and endangered species listed in the IUCN Red List of threatened Animals inhabit in the lagoon for at least part of their life cycle. More importantly the lake is temporary habitat for some of the largest congregations of migratory birds in the country. Every year, about a million migratory birds come to the lake in October and return in March. According to the census conducted in 2010, 9.04 lakh water birds of 114 species, from both local and long distance migratory birds visited Chilika during the last winter.

With a view to getting estranged from severe cold in winter and also in search of food, birds travelling thousands of miles from the remote lands like Saiberia, Mongolia, Caspian Lake, Baikal Lake, Ladakh and the Himalayas foothills visit to the wet-lands in India. In comparison to other wetlands in India, maximum numbers of migratory birds are seen in Chilika lagoon. Notable places for Bird lovers in the lagoon are Nalabana, Birds Island and Mangalajodi. Nalabana is a marshy island covered with reeds famous for feeding & roosting of large-range of migratory birds during winters. Birds Island is heaven for resident and migratory birds. Here one can watch birds in their natural habitat. Mangalajodi has also become potential feeding and roosting ground of migratory water birds especially duck species and waders.

However the migratory birds are under constant threat in Chilika. First of all the poachers have always stood as a major threat since time immemorial. Similarly Prawn-gheries in shore areas of the lagoon pose threat for shore birds as they are prevented from feeding and roosting. Thus the birds can't enjoy the natural shore habitats of the lagoon. The increasing numbers of diesel boats also play a major role in disturbing the tranquility of the lagoon.

As per the Wildlife (Protection) Act, 1972 (amended in 2006) poaching of birds is strictly prohibited. The State Wildlife Organisation in collaboration with the Chilika Development Authority (CDA) has taken several steps for protection and conservation of the local and long distant migratory birds. Protection camps and watches towers have been installed in strategic locations of Chilika and round the clock patrolling is being carried out to check out the poaching of birds. Bird hunters are also being vigilantly watched. However, despite of several security measures, poaching is the biggest threat to the migratory birds here, which is a major concern for wildlife officials. The researcher therefore tried to ascertain whether the illegal bird poaching is still an issue in Chilika, as it supports an easy income.
The study shows that 58% respondents still feel that there is an illegal poaching in the area, whereas 42% feel that illegal poaching is not common now a day. During the study the researcher was informed that in the year 1997, the Prevention of Poaching of Waterfowl in Chilika Lake with Community Participation Program was launched which veered towards the menace of large scale poaching of migratory and non-migratory waterfowl in Chilika Lake.

It is proved that illegal poaching of migratory birds is still common in Chilika. However several interventions including the one taken by CDA has ensured the decrease of bird poaching.

The CDA needs to address the issue of illegal bird hunting by working with local NGOs and CBOs and the wildlife wing of the Forest Department of Odisha. It is suggested that in addition to 'Bird Protection Committees', which has assisted in developing alternative economic activities through soft loans, number of small "bird protect committees" should be formed in a cooperative model. This will require specialized knowledge, which currently may be a scarcity in CDA. However, this can be done by going through similar best practices from across the country. It is important for the NGOs to spend time with the locals and discuss with them the problems of waterfowl poaching. Poachers need to be identified, and their modus operandi needs to be studied.

The last component under this indicator was environmental degradation impacting the livelihood of fishermen. Environmental degradation means the reduction of the capacity of the environment to meet social and ecological objectives, and needs. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards. With the threat of global climate change, the environment has moved from unexpected concern to the forefront of the international agenda. The scale of change is so high that appropriate measure to address the challenges of adapting an altered environment should be taken, while at the same time there is an urgent need to make firm efforts to prevent further damage. Climate change is caused by the anthropogenic emission of greenhouse gases and leads to modifications in global climate patterns with shifts in local rainfall, temperature and weather patterns. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will stress critical ecosystems and lead to water and food shortages this century.

At the same time human societies cannot be dissociated from the environment that they shape and which in turn influence their development and livelihoods. Together they form a comprehensive system with intrinsic levels of vulnerability and inherent coping mechanisms. The less degraded the environmental component will be, the lower is its overall vulnerability and the higher is its coping capacity.
During the recent years, climate uncertainty and environmental degradation in the form of salt intrusion and increased sediment loads have affected the hydrological regime and the balance between coastal and freshwater, threatening livelihood security and posing a considerable flood risk, particularly during the monsoon for the fishermen in Chilika. The researcher has therefore tried to ascertain, whether the fishermen are aware of the bad consequence of environmental degradation and more particularly its possible impact on their livelihood. This was primarily done through Focus Group Discussion. During the discussions, fishermen revealed that environment degradation has a direct impact on the livelihood. As they primarily depend on fishing, which come from nature, environmental degradation can severely affect their livelihood. Similarly environmental degradation can have a direct impact on the health system of fishermen, which in turn can affect their livelihoods.

People who live in marginal or environmentally degraded areas often struggle on a daily basis to survive and are unable to cope with any additional stress factors. Limited livelihood alternatives, competition over scarce resources, weak governance structures and lack of access to healthcare and other services can compromise a community’s ability to respond to and recover from a hazard event. In order to support capacity-building and training programmes, and to facilitate the design and implementation of environmentally sound solutions to the challenges posed by hazards, there is a need to effectively communicate the strategic issues which have strong environmental dimensions.

Current poverty level of fishermen contributes to both environmental degradation and vulnerability to hazards and should be addressed accordingly. Environmental management and community based resource management can promote more resilient communities through supporting sustainable livelihoods, conflict prevention and strengthening cooperation for good governance. At the same time regulatory frameworks need to be enforced at the Chilika region, and the political will to balance competing interests and bring about the many changes that may be necessary must be continually reaffirmed.

6.3 Ecological Issues

Chilika is also getting affected by illegal encroachment of its shoreline as well as constant siltation. An Illegal encroachment of shoreline not only affects the livelihood of poor local fishers, but also has an adverse effect on fish spawning and mullet fishery. Similarly, siltation has a major impact on the decrease of fish catch. Both these issues have further been studied during the research.
The first component, which was studied under the ecological issues, was about demarcation of the shore line of Chilika Lagoon. A shore or shoreline is the peripheral of land at the edge of a large body of water, such as an ocean, sea, or lake. The shoreline is one of the rapidly changing linear features of the coastal zone which is dynamic in nature. Shores are influenced by the topography of the surrounding landscape, as well as by water induced erosion, such as waves. However, the issue of shoreline changes due to sea level rise during the last few years has increasingly become a major social, economic and environmental concern to a large number of countries along the coast, where it poses a serious problem to the environment and human habitation. Shoreline recession as a result of rising sea level has been recognized as a potential near future hazard by a number of countries which includes the states in India along the coast.

Shoreline is a boundary between land and water body. The term is considered synonymous with coastline but is actually different so the precise definition of shoreline given by (CERC; 1984), shoreline is defined as the line contacting between the mean high water line and the shore. An idealized definition of shoreline is that it coincides with the physical interface of land and water (Dolan et al., 1980). Accurate demarcation and monitoring of shoreline changes are necessary for understanding and deciphering the coastal processes operating in an area. Today the issue of shoreline changes due to sea level rise which is caused by Globe warming has increasingly become a major issue in terms of its impact on the population along the coastal area.

The lake's north shoreline comes under Khordha district while the western coast is the part of Ganjam district. Highly productive and sensitive shoreline ecosystem of the lake is altered due to artificial enclosure. The researcher therefore tried to find out whether the fishermen think that demarcating the shoreline of Chilika can help in protecting the lake and increase in fish catch.

47% respondents feel that demarcation of the shoreline will help, whereas 34% respondents feel that demarcation of shoreline will not help in protecting the lake's ecology. The study thus proves that the lake’s fishery is adversely affected due to destructive fishery practices like encroachment of shoreline for shrimp culture.

It is therefore suggested that the shore line of Chilika Lagoon should be clearly demarcated and efforts should be made to make these areas free from ghery with active participation of local fishers. Illegal encroachments of shoreline not only affect the livelihood of poor local fishers, but also adversely affect fish spawning and mullet fishery. A task force needs to be created with local fishers and eviction drives should be done continuously throughout the year. Enforcement of eviction drives needs the involvement of representatives from local fisher's co-operatives, village committees, and PRI representatives with the constituted task force for the purpose. The
integration of latest techniques of remote sensing with geographical information system (GIS) has been proven to be an extremely useful approach for the shoreline changes studies and therefore CDA should try the latest technology for the same.

Similarly the issue about siltation was studied to understand the problem fishermen are facing in terms of siltation and how it is affecting the fishing. The pear-shaped lagoon is about 64.5 km long and its width varies from 18 km to 5 km (Das and Samal 1988). The lagoon is connected to sea by a 32 km long, channel with several shoals restricting the flow and head loss. About 1.5 km wide, the channel runs parallel to the Bay of Bengal and is separated from it by a narrow spit whose width very between 100m to several kilometers. The channel opens to the sea near village Motto which is extremely narrow. Recently a new mouth was opened by CDA which is only 14 Kms away from the lagoon as per the recommendation of the CWPRS, Pune. The drainage basin of Chilika covers an area of over 4,300 sq. km (Das and Samal 1988), including about 1,100 sq. km of the lagoon itself.

For the last many years Chilika has been facing the problem of siltation. The reason for siltation is the sedimentation. The sediments flush to Chilika Lagoon through soil erosion from bald hills, eroded lands, and degraded forestlands of catchment area through different rivers and rivulets. The important factors that contribute to the soil erosion from catchment area are over grazing, illicit felling and ruthless cutting, cultivation and clearance of vegetation for various purposes. It is quite apparent that high sediment loads are contributing by tributaries on the west side and the Mahanadi tributaries for the major sources of rapid sedimentation in the lagoon which is creating increased flood damages in the Daya and Bhargavi rivers. As per survey carried out by CDA (2000), during the monsoon 3,65,500 tonnes of sediment are discharged into the lagoon. While the distributaries of the Mahanadi contribute 75% (2,75,297 tonnes), the rivers/ streams from the western catchments are responsible for only 25% (90,203 tonnes) of the silt load in to the lagoon. It is apparent that the high sediment loads contributed by the distributaries of Mahanadi are creating rapid sedimentation in the North western part of the lagoon and the inlet channel. Siltation has led to a gradual reduction in the size of the lagoon, and this process has particularly taken hold over the past few decades. Dean and Saaltink (1991), have reported that the lake may have shrunk by 10-15 % by 1990 during the dry season. Landsat imagery indicates the mouth of the Daya River was about 30 km north of its present position following stabilization of sea levels (ORSAC per. Comm.)

Due to excessive soil erosion the water layer of the villages are affected and the water layer of wells, tanks, ponds have decreased and dried. The top soil erosion by the rain disturbed the bio-
chemic nutrition of the land. Hence, the productivity of the land for the last few years has been reduced dramatically. Due to decrease in surface moisture, the water layer is rapidly decreasing. Degradation of green forest and soil erosion caused draught situation in these villages. In addition, to soil erosion and in capability of the lands to conserve moisture is a major problematic area. The grazing land and forestland are continuously decreasing since decades, for which the villagers experience lack of firewood and grazing lands for domestic animal.

The researcher made an attempt to understand whether sedimentation is an issue for the fishermen and whether they take it seriously. This will help to solve this issue in a better way with community mobilization and by using more scientific methodologies.

66% respondents feel that siltation is a major issue, which is affecting Chilika’s ecology, whereas 30% replied that it is not an issue. At the same time only 4% informed that they have no idea about this and siltation really does not matter.

Thus the study reflects that siltation in the lake has reached alarming situation. This has caused three noticeable ecological effects, namely shrinkage of the lake area, decline in the lake’s depth and weed growth, which are interlinked with one another.

Hence extensive plantation of trees should be done on the banks of rivers to check soil erosion and silting of Chilika basin. Due care also must be taken to reduce this load by watershed development programme in the catchment areas. A detailed study is required to be taken up for identifying critical issues. Due to the decrease in salinity and the excess nutrients (from the silt) weeds have spread over approximately one fourth of the lake. Opening of an artificial mouth on September 2000 reduced the length of inlet channel, by 18 km. The lake can be restored by integrated watershed management with active participation of local community and non-governmental organisations on a micro watershed basis and improvements of socio-economic conditions of the local communities, shared decision making, and improvement of communication network, wetland research and training center. Awareness programme should be conducted to caution the fishermen about the possible hazard due to siltation. Digging and dredging at the mouth of Chilika at ‘Arakhakuda’ and ‘Chilika Canal’ should be done for proper exchange of water between ‘Bay of Bengal and Chilika to check siltation and to allow free movement of fish and shrimp juveniles.

6.4 Knowledge about natural disaster (Hazards)
A natural disaster is the effect of the earth’s natural hazards, for example flood, tornado, hurricane, volcanic eruption, earthquake, heat wave, or landslide. They can lead to financial,
environmental or human losses. The resulting loss depends on the vulnerability of the affected population to resist the hazard, also called their resilience. This understanding is concentrated in the formulation: "disasters occur when hazards meet vulnerability". Thus a natural hazard will not result in a natural disaster in areas without vulnerability, e.g. strong earthquakes in uninhabited areas.

Awareness of communities on risk communications is the process through which the community members living in hazard-prone areas realize and understand the risk associated in the areas they live in and know the specific dangers that they are exposed to. Understanding natural disaster and its possible effects and accordingly work on hazard mapping and risk assessment can provide tools to the fishermen to understand and address the effects of natural hazards. To be really self-reliant in coping with a disaster, the fishing communities need to understand what natural disaster is all about. Without having the basic understanding, a fisherman cannot prepare its coping mechanism. Therefore through this study an attempt has been made to know if the fishermen have the basic idea about the natural disaster.

The study distributes the respondents into two categories on the basis of their awareness on natural disasters. Out of the total 450 respondents 76% are aware of natural disasters and the remaining 23.6% are unaware of natural disasters. So most of the fishermen living in and around the Chilika have knowledge on natural disasters and the least of them do not.

The data proves that the fishermen of Chilika are well aware of the natural hazards to which they are prone to frequently face natural hazards and thus they are aware of the natural disaster they may face. It is also true that followed by the Odisha super cyclone, people of Odisha including the fishermen have become more aware of the natural disaster. This also proves that fishing occupations are subject to strong restriction of natural forces combined with climate variability. The fishing population's livelihood primarily has to adjust with these climate factors.

The adverse impacts of hazards often cannot be prevented fully, but their scale or impact can substantially be reduced by various precautionary actions. Awareness about natural disaster has a positive impact on mitigating natural disaster. While most of the natural disasters are unavoidable, awareness about the natural disaster can minimize the impact to a great extent. Thus the population, who are prone to such climatic disasters but are not aware of it, should be trained in this regard. Government agencies as well as the NGOs need to play a more active role in this sector. Adaptation at the community level is of crucial importance in enabling them to respond to the direct and indirect effects of natural calamities. However among all it is important in placing people and the priorities they define firmly at the centre of analysis and objective-
setting. While making the fishermen aware about the natural disaster and their coping mechanisms, focus should be made on understanding climate change adaptation at the community level and scaling it up into the policy perspective through application of Livelihood Approach.

6.5 Real time experience about Natural Disaster

A disaster is "the occurrence of a sudden or major misfortune which disrupts the basic fabric and normal functioning of a life. An event or a series of events which give rise to casualties and/or damage or loss of property, infrastructure, essential services or means of livelihood on a scale which is beyond the normal capacity of the affected communities to cope with unaided" (FAO, 1998). Natural phenomena, such as earthquakes, floods and cyclones – referred to as natural hazards – are not disasters in themselves. A natural or other hazard only becomes a disaster when people are affected or costs are incurred. Combined with increased vulnerabilities resulting from changing socio-economic, technological and demographic conditions, both natural and man-made disasters continue to threaten populations all over the world, jeopardizing the sustainable development of developing countries (ISDR, 2005).

As already established, the fishermen groups have always been considered to be most vulnerable to the onset of any natural disasters. The relegated and the economically underprivileged clusters are in general hit by natural disasters for a variety of reasons. Therefore the researcher has tried to identify the key areas under the theme “real time experience”, including about common hazards, the fishermen face while fishing, worst disaster faced, disaster faced during fishing and damage caused by Disasters.

Common hazards, which the fishermen face while fishing, was one of the major component, which was studied during the research. Irrespective of the scale of the disaster, be it major or minor, of national or local proportion, it is the people at the community or village level who suffer its adverse effects. Moreover, vulnerability to natural disasters is a complex issue, as it is determined by the economic structure, the stage of development, prevailing of social and economic conditions, coping mechanism, risk assessment, frequency and the intensity of disasters.

While the fishermen of Chilika mostly catch fish inside the lake, some of them also venture into the sea for fishing. Many of them also catch fish close to the mouth. They rarely take safety equipment when they go out for fishing. Thus they are more vulnerable to the disasters, both natural and unnatural. The common such disasters apprehended to be faced by them, was
assessed and an attempt was made to locate which are the disasters faced by the fishermen in and around the Chilika while on fishing.

The data reflects that 43.9% fishermen face High speed wind, 1.1% Flood, 3.3% Heavy rain, 0.7% Lack of drinking water, 0.4 Tide, 2.2% Lack of fish, 17.8% Both high speed wind and flood, 1.1% Both high speed wind and rain, 1.1% Both wave and lightning and 0.4% face Flood, rain & wind. Thus mostly the fishermen are facing high speed wind.

This means the fishermen of Chilika are constant victim of the natural disasters and suffer by one or the other natural disaster. The growing incidence of natural disasters is highly correlated to the increasing vulnerability of fishermen communities, as previous socioeconomic vulnerabilities may exacerbate the impact of a natural disaster. Thus, the impact of such events could result in an immediate increase in poverty and deprivation. Department of fisheries and Animal Husbandries as well as Chilika Development Authority are the government bodies dealing with fisheries management in Chilika. They normally focus on the fisher source and very seldom consider safety for fishermen. However they need to realize that safety for fishermen is directly or indirectly integrated with fisheries management.

It is therefore important that government organizations like Odisha State Disaster Management Authority (OSDMA) should make a hazard mapping specific to the fishermen of Chilika fishermen. Hazard mapping and risk assessment will provide tools to help those in authority understand and address the effects of natural and human hazards on fishermen communities’ vision for the future. They are also essential to understand and address risks that can impact the fishermen community’s ability to sustain. Based on the information provided through the hazard mapping and risk assessment processes, one can: (1) identify risk management strategies (doing the right things to manage risk consistent with the fishermen community; (2) identify operating strategies (doing the right things in the right way to control risk); (3) identify financial strategies (providing funds in the amounts and at the right times); and (4) evaluate the effectiveness of the comprehensive community risk management program. It is also suggested for supporting systematic analysis of livelihood issues from natural disaster point of view which is more realistic, manageable, and which synthesizes issues across sectors and levels. This will ensure that the concept of sustainable livelihood is integrated along with natural disaster and produce even a better result in a longer run.

The second key areas, which was studied was the worst disaster faced, while fishing. The two very common natural disasters, which affect the fishermen, are flood and high speed wind. Odisha belongs to a cyclonic zone as most of the time the late monsoon symptoms cumulate to
cyclonic developments in the Bay of Bengal. Among the others, the severity of the Super Cyclone of 29 October, 1999 was comparatively more devastating. It had affected about 97 blocks of 12 districts of the state besides affecting approx 125.9 lakh people. Apart from this, in the recent past, tsunami has taken a heavy toll of life. This study attempts to find out which of the following disasters is/are causing worst consequences for the fishermen in the Chilika.

Out of 450 respondents, 9.3% viewed that flood brings them the worst consequences, 63.7 said cyclone, 1.3% heavy rain, 4.4% both flood & cyclone 21.3% said that none of these disasters bring them the worst consequences. Thus mostly cyclone is treated as the worst disaster by the fishermen in the Chilika and heavy rain is mostly not treated as the worst disaster.

**Figure 6.1: Worst Disaster gone through**

![Worst Disaster Faced (%)](chart)

The annual cyclone from the Bay of Bengal normally occurs in the months of April to May and October to November. The lagoon is also situated along with the Bay of Bengal which is one of the six major cyclone-prone regions of the world and therefore it is natural that the fishermen face heavy wind and cyclone on regular intervals. The study also proves that the fishermen are generally aware of the risks involved in fisheries, but not often accept them. Thus they are the ones who suffer the most from cyclones and flood.

It is therefore essential to mobilize the entire community in disaster preparedness, which could include, setting up village-level committees, training and awareness raising, establishing safer places and providing food and medicine supply to cope with emergencies. Safety of fishermen and their families should receive special attention when implementing disaster preparedness. The impacts of cyclone cover multifaceted aspects of fishermen’s livelihoods, thus there is a major challenge in understanding the broad relevance to livelihood contexts and their linkage.
with natural disaster like cyclones. Practical ways of bringing together existing concepts and lessons, along with newer ideas about the nature of livelihood and fishermen's vulnerability to cyclone and how best to address this condition at the large scale require policy advocacy.

While it was important to understand the idea of fishermen about the common disaster the fishermen face, inorder to understand the real time experience, disaster faced during fishing was studied during the research.

The annual cyclone season along the Bay of Bengal normally occurs in the months of April to May and October to November. Increasing warm sea temperatures (approximately 26.51°C) in the Bay of Bengal induce cyclones to become more intense as they get close to the coastal areas of India (Gupta & Sharma, 2000). Coastal districts of Odisha state have been hit by 11 severe cyclones and 55 cyclone storms, with a probable maximum storm surge height between 3.2 and 5.5m in the last 120 years (Gupta & Sharma, 2000).

There are different risk perceptions in response to natural hazards between inland and coastal areas of Chilika lagoon. The fishermen communities, who spend most of their time inside the lake, are thought to face the natural hazards while in the lake. Thus it is attempted to find out if they are facing the disasters while in the lake.

Based on the data it was observed that out of 450 respondents 62.2% viewed that they are facing it while fishing and the remaining 37.8% denied.

The study therefore reflects that most of the fishermen are facing disasters while in the lake for fishing and few of them don't. The disaster which is mostly experienced at the time of fishing is cyclone. It is because Chilika Lagoon, which covers Khurda, Puri, and Ganjam districts, is classified to be a “very high damage risk zone (50 m/s)” in terms of wind and cyclones. The lagoon is also situated along the Bay of Bengal, which is one of the six major cyclone-prone regions of the world.

It is therefore suggested that a mitigation plan should be developed, which can reflect an emphasis on pre-disaster activities to manage risk and reduce the impact of disasters and more importantly the effects of cyclone. Grassroots mitigation plans developed with the involvement of non-governmental organizations and community-based organizations will benefit from public involvement and support, particularly useful in mitigation efforts that involve public awareness.

It is evident that impact of natural disasters is higher on those with lower income and low socio-economic indicators and therefore to reduce such impacts public policies must be more focused on those fishermen who are under the poverty lines.
Similarly damage caused by disasters was studied to understand fishermen's vulnerability. Vulnerability to natural disasters is a complex issue, as it is determined by the economic structure, the stage of development, prevailing of social and economic conditions, coping mechanism, risk assessment, frequency and intensity of disasters.

Disasters affect the fisheries sector in many different ways. The loss of lives is the most dramatic impact, affecting not only surviving household members but also potentially upsetting economic and social activities and systems outside the immediate family. The long-term effects may also be considerable but sometimes difficult to appreciate, especially since the immediate impact is overwhelmingly visible (FAO technical paper - Fisheries sector characteristics and vulnerability context). Any loss due to natural disaster has direct consequences on the incomes of the affected communities that in turn may influence other aspects of their livelihoods such as employment, health and education. Thus the researcher has attempted to know if any damage is being caused by the disasters for the fishermen.

The findings explore the views of the fishermen on if disasters cause any damage to the fishermen. Out of 450 respondents, 67.8% said that the disasters are causing damage to fishing and the remaining 32.2% denied. As they said in informal, natural disasters that strike suddenly, without warning, cause tangible losses such as loss of boats, gear, fish cages, and other productive assets; destruction of infrastructure such as landing and fish processing facilities; loss of production and sometimes lives also.

The incidence of natural disasters is directly correlated to the increasing vulnerability of fishing households and communities in Chilika. The impact of natural disasters is not only on occupational activities but also the multiple dimensions of fishermen’s livelihoods that have secondary effects and determine their capacity to handle future stress.

Impact of natural disasters takes into account several other mechanisms, such as mitigation practices emergency preparedness, assistance. The impacts of natural disaster cover multifaceted aspects of fishermen’s livelihoods so that there is an urgent need in looking into the broad relevance to livelihood contexts and their linkage with natural disasters with particular context to fishermen of Chilika. As fishermen suffer most due to natural disasters, conditional cash transfers facility during or before disaster can serve as a safety net for those exposed to the disasters.
6.6 Warning Message on the onset of disaster

Countries have long been concerned about the huge impacts that natural disasters have on the society. Unfortunately, communities have not adapted their frameworks of development to the natural environment surrounding them and the losses and costs associated with disasters of natural origin. The UN International Decade on Natural Disaster Reduction (IDNDR) Conference on Early Warning Systems for Reduction of Natural Disasters (held in Potsdam, Germany in September 1998) declared that the successful application of early warning is the most practical and effective measure for disaster prevention.

In the event of any disaster, effective early warning not only can save a lot of lives, but also can save the assets, which is otherwise the life and livelihood of fishermen. As early warning is considered as one of the important mechanism for safety and security of the fishermen, the researcher have tried to study some of the components under this head including ways of predicting natural disaster, prior warnings provided on disasters, sources of early warning from, accurate source of information during natural disaster and awareness about the port signals under this study.

How does the fishermen predict natural disaster, was the first component, which was studied by the researcher, under this indicator. Reports from around the Indian Ocean rim after the December 26 tsunami, such as from fishing communities in Thailand, tribal communities on India's remote Andaman and Nicobar islands (Perez, F.Y.L., 2005, *Survival Tactics of Indigenous People*), and even tourist resorts powerfully demonstrate that knowledge gained from experience or from education are critical to reducing disasters. The power of knowledge was also demonstrated at a tourist resort near Phuket, Thailand, where a young British schoolgirl recognised that the turbulent sea and loud noise of the waves meant a tsunami was coming (Clinton, B., *Transcript of Remarks to UN Economic and Social Council (ECOSOC)*, July 14th 2005). She alerted her parents and other people present of the danger, which possibly resulted in saving of 100 lives.

Education, whether of formal or informal type, empowers people by developing their capacity to understand a situation and take appropriate action. Traditional indigenous knowledge has over the years played a significant role in solving several major social-ecological problems including those related to climate change and variability. People living close to nature often observe the circumstances around them and are the often the first to identify and adapt any changes.

The study shows that the fishermen have developed their own coping mechanism to predict the natural disaster. Almost 69% respondents can predict the natural disaster by seeing the colour
of the sky, whereas 10% respondents can predict the natural disaster by seeing the water. At the same time 5% respondents depends on the birds to predict the natural disaster and 2% can predict it by seeing the water and colour of the sky. 14% respondents cannot predict it. During interaction, some of the old aged fishermen informed that this is an age-old system and they have learned it from their forefather. This proves that it is inherent in every human being the instinct for survival and the fishermen of Chilika have developed it in the course of time.

The fishermen of Chilika living in one of most disaster prone areas have evolved a system of preparedness and mitigation, regarding hazard events as part of natural cycle of life. They have over the period of time developed coping mechanisms, which has become a distinct part of their capacity. This can be considered as their natural coping mechanism to natural disasters. These are collective mechanisms derived from internal social systems and structures present in a community, and strategies adopted by them to deal with the hazards. This must be considered as one of the most vital component of social and economic development, survival of the fishing community of Chilika and prevalent in all stages of life. The natural environment is constantly changing, and the threat posed by various natural hazards is constantly changing. The research shows that the community is the best to judge on the onset of natural disaster and react accordingly.

It is suggested that this form of institutional arrangement to identify natural disasters for mitigating the impact may be established and further strengthened through the legal framework. However, there is a need to further study the instinct of fishermen in identifying the natural disaster from a more scientific angle, so that it can further guide others. The disaster management authorities need to ensure that keeping the fishermen and the specific needs of their locality as the focus the disaster management authorities should develop strategies risk avoidance action during natural disasters. The traditional knowledge of the local communities with regard to coping with natural disasters should also be incorporated in the warning message.

The second variable, which was studied through interview, was whether the fishermen get prior warnings on Disasters.

Mitigation efforts are attempts to prevent hazards from developing into disasters or even to reduce the effects of disasters. Policies, legislation, and institutional arrangements for disaster mitigation are specific to countries and localities within them. "Mitigation" is described by Webster as making less intense or severe (from the Latin mitis or mild). Mitigation policy, then, is designed to lessen or minimize the effects or impacts of a hazard event, such as an earthquake.
The primary goal is life protection (saving lives). Mitigation policy deals primarily with the four basic elements of hazard, risk, vulnerability, and disaster (Drabek, 1991). Disaster mitigation policies may focus on a number of approaches to ensure the reduction of disaster risk, including use of technology for forecasting and warning. A sound scientific basis warning system is required for predicting potentially disastrous events. Constant monitoring of possible disaster precursors is necessary to forecast accurate warnings on time. Approaches that can address multiple hazards and involves various monitoring agencies are most effective. Followed by the identification of possible disaster clear, easy to understand warnings messages should reach those at risk. For people to understand the warning alerts should contain clear, useful information that ensures proper responses.

Different channels are in use for disaster warning. The brief accounts of such channels used are as follows:

1. **Television & Radio**: These are most effectively used channel in disaster warnings because there will be good availability of radio & TV sets in all fishermen communities.

2. **Telephone (Fixed & Mobile)**: It plays an important role for giving the warning of disaster. In a very short time, it reaches too many people.

3. **Short Message Service**: It is useful to give warning of disaster when there is a problem of communicating through fixed telephones. The use of SMS was very widely done during the 2005 Hurricane Katrina disaster in the US.

4. **Satellite Radio**: It is the digital radio that receives the signals from communication satellites which cover much larger geographic area than terrestrial radio. It can be of help when the transmission towers of normal radio stations are damaged in disaster. This is however is very rare for the fishermen and more common for the government agencies, handling natural disasters.

It has been attempted in this study, if the fishermen are being informed of the occurrence of disaster beforehand.

Current study has tried to give a picture on the prior awareness of the respondents about the occurrence of the disasters they are vulnerable to. Out of 450 respondents 35.56% viewed that they get warning on the occurrence of disasters and 64.44% denied.
The study proves that the fishermen in the Chilika are vulnerable to natural disasters as they seldom get timely alerts on the occurrence of the disasters beforehand. This makes them the victims of the disasters in the form of facing damages.

There should be a more robust early warning system which can alert the fishermen of the expected bad weather information in a timely manner. Early warning information should be shared through a combination of formal and informal systems. While the formal information can be provided through government mechanisms, the informal message can be delivered through community based networks.

More importantly the sources of early warning were also studied to understand the already established early warning system.

During a natural disaster, some material loss are unavoidable, especially in the case of severe and rare hazards, in few cases the loss of human lives can be avoided if proper precautions and measures are put in place. Though many government at different levels and other related disaster management organizations throughout Asia have already initiated Early Warning Systems; yet, the systems varies widely in their capacity to produce and communicate effective warnings.

The traditional framework of early warning systems is composed of three phases: monitoring of precursors, forecasting of a probable event, and the notification of a warning or an alert of catastrophic proportions take place. An improved four-step framework being promoted by national emergency agencies and risk management institutions includes the additional fourth phase: the onset of emergency response activities once the warning has been issued. The purpose of this fourth element is to recognize the fact that there should be a response to the warning, where the initial responsibility relies on emergency response agencies. Early warning is one of the most important responses to the likelihood of natural disaster.

Effective early warning systems require strong technical foundations and good knowledge of the risks. They must be strongly “people centered” with clear messages, dissemination systems that reach those at risk, and practiced and knowledgeable responses by risk managers and the public. Public awareness and education are critical; in addition, other partners must be involved. Effective early warning systems must be embedded in an understandable manner and relevant to the communities which they serve (UNISDR: 2006).

There should be an early warning system from which fishermen can get timely forecast of the anticipated bad weather. Fishermen become most vulnerable during the natural disaster, as
they stay, venture in and around the vast water areas. Government plays a vital role in disseminating information, as early warning on the onset of any natural disaster. They use various print and electronic media for disseminating the information. Most of the times, the information is shared through radios and televisions. Apart from this the fishermen have their own channel of getting information, which they consider stronger than the government sources.

The researcher has tried to understand the source through which, the fishermen get the early warning messages. This was important to understand, whether the early warning message reach them properly and whether they act on the basis of the warning message.

Out of 160 respondents, who informed that they receive early warning 35% said that they get early warning from radios, 14.38% get it from televisions, 12.5% get the information from other government sources. Similarly 38.13% get the early warning from neighbours.

This proves that fishermen receive the early warning from their neighbours. This is largely because the fishermen spend most of their time outside their family and thus society becomes the source of information for them. The close proximity between the HHs makes it easier to disseminate the information between the fishermen in a short span of time.

It is observed that curtailing a trip can lead to loss of income and drive fishermen into debt, but ignoring a signal of risk can endanger their lives. More advance warning can help them avoid such dilemmas. Radio broadcast is the most relieved means to get updates and information, but fishermen are mostly at work and do not carry radio, this can increase the risk chances due to lack of timely information. Therefore local government should be more equipped to disseminate accurate weather forecasts in a timely way through an effective and accessible channel.

Successful climate forecast depend on the technically skilled forecasts that are designed and disseminated in consideration of the decision makers. Thus, assessment of forecasts for effective vulnerability reduction for the fishermen of Chilika should be done keeping in consideration the users’ vulnerability, capacity and needs. The five general components of effective early warning systems, which the government should consider while developing such a system should include risk Assessment, including hazard assessment and vulnerability analysis, hazard detection and prediction, formulation of warning messages, dissemination of warning message and community response. This will give the government a much clear idea of how the warning message should be disseminated and in turn can reduce the nature of vulnerability to a great extent. A key element to effective warning message is to establish and sustain institutional mechanisms for dialogue between the fishermen and the government machinery, more
importantly the officials of Indian Metrological Department on climate information. Not only should government officials understand the potential applications of their work but the fishermen should also have the opportunity to learn how to interpret forecast, to understand the assumptions upon which they are premised and the limitations to their application. Dialogue between these two groups on early warning can create an opportunity for joint problem solving in which the relationship between science and decision making can be strengthened.

From where do the fishermen get the accurate source of information during natural disaster, was one of the key indicator, which was studied during the research.

The preparedness and mitigation measures with respect to the various natural disasters involve several activities, of which one major activity is communicating timely warning messages to the population at risk. The process of dissemination of warning and risk avoidance action depends crucially on the people in the disaster-prone areas. However in most of the cases, government plays an active role in disseminating the early warning message. The traditional or indigenous knowledge of the people regarding getting early warning and its use for disaster management varies according to their place of living their traditional pursuits and their occupations. Indigenous knowledge or traditional knowledge refers to the methods and practices developed by a group of people from an advanced understanding of the local environment, which is formed over multiple generations of habitation. This knowledge contains several other important characteristics which distinguish it from other types of knowledge. These include originating within the community, maintaining a non-formal means of dissemination, collectively owned, developed over several generations and subject to adaptation, and imbedded in the community's lifestyle as a means of survival. For the fisherman, the most common signs which provide early warnings of disasters are related to animal behavior (mostly domestic animals), appearance of the sky, clouds, moon, sun, nature of sea/lake water.

Even before the governments and several technical agencies came up with high technology based early warning systems, or standard operating procedures, number of local communities worldwide have prepared, operated and acted, to natural disasters using indigenous methods passed on from one generation to the other. The United Nations already considers indigenous knowledge as a priority as one of the key activities identified under this priority action focuses on the importance of information management and exchange, and highlights the use of “relevant traditional and indigenous knowledge and cultural heritage” to be shared with and adapted to different target audiences.
Success and the sustainability of interventions at the community level depends on a number of factors, which include, on the availability of relevant local culture, knowledge and indigenous practices that can combine with new ideas to generate innovation. The importance of indigenous knowledge contributes not only to the success of intervention, but more importantly to its sustainability in the longer term. In order to fulfill this objective, it is important to understand, acknowledge and respect indigenous knowledge as a valuable source of information and as a key contributor to reduce risk for the fishermen of Chilika. This will also help to identify key areas, which need to be further strengthened, so that early warning can further be disseminated in a better way, using the local channels.

Maximum numbers of respondents i.e. 68% consider that traditional way of identifying natural disaster gives them more accurate information, whereas only 11% believe that government provides more accurate information. However, the educated mass of these villages do believe that government warning message is much more effective than these things. However, it takes time to receive the message from the government source, and hence these people use their traditional knowledge for identifying the high wind or cyclone.

**Table 6.2: Source of Early Warning before disaster**

<table>
<thead>
<tr>
<th>Accurate source of information on natural disaster</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government</td>
<td>49</td>
<td>10.9</td>
</tr>
<tr>
<td>Traditional way (indigenous knowledge)</td>
<td>307</td>
<td>68.2</td>
</tr>
<tr>
<td>Any other</td>
<td>16</td>
<td>3.6</td>
</tr>
<tr>
<td>NA</td>
<td>76</td>
<td>16.9</td>
</tr>
</tbody>
</table>

This proves that the indigenous technical knowledge within the fishing communities in Chilika is an amalgamation of strategies, skills and techniques gained through shared interactions to live and survive the natural way of life. The fishermen have been confronted with changing environments and have developed a wide array of coping mechanisms. Their traditional knowledge and practices provide an important basis for facing the even greater challenges of natural disaster.

Since it is the fishermen who directly bear the impact of disaster, the traditional way of receiving early warning systems need to be tailored for local use and they need to be generated on site. It is true that many a times it is not possible to afford the expensive scientific technologies for disaster reduction that are used in the developed nations for the fishermen. Hence the ‘bottom up’ approach to risk reduction involving local fishermen communities can be quite useful during...
natural disaster. The government should further study these techniques and make it a formal one. Small resources can be earmarked for further disseminating these messages, after scientific validation. A group of volunteers can be designated the task to disseminate these information.

This indigenous practice and strategy embedded in the knowledge, which prove valuable against natural disasters, can be transferred and adapted to other fishermen communities in similar situations. Government of Odisha should also try to incorporate the indigenous knowledge in existing practices and policies and encourage the participation of the affected community and empower the members of the fishermen community of Chilika to take the leading role in all disaster risk reduction activities in the area.

Similarly, awareness about the port signals meant for the fisherman was studied to understand their current level of knowledge and their vulnerability.

In accordance with international procedure, ports are warned and advised to raise "Signals" whenever adverse weather is expected over the ports for the oceanic areas, in which it is located due to the tropical cyclone. On receipt of the warning telegrams, the port officers hoist appropriate visual signals prominently on signal posts so that they are visible from a distance. Mariners and other sea-faring people, including fishermen who may not be literate, are generally aware of the meaning of these signals. At some ports, the meanings of the signals are displayed in English as well as in the local languages prominently on a notice board. While the India Meteorological Department is responsible for issuing the warnings, the port authorities arrange the display of signals. In addition to hoisting the signals, the port officers have, in most cases, made arrangements for disseminating the warnings received by them, to country craft and sailing vessels in the harbors. (Port Warnings Regional Specialised Meteorological Centre (RSMC) - Tropical Cyclones, New Delhi, Cyclone Warning Division, India Meteorological Department). Most of the time, the light house provides the signals for the fishermen. Danger signals are hoisted when the storm is of slight or moderate intensity and Great Danger Signals when the storm is severe. The prominences of the signals refer to the intensity of the storm at and about its centre and not to the intensity or severity of the weather in different parts of the cyclone.

Many of the fishermen from Ganjam district, who depends on Chilika, also venture into the sea for fishing. For them it is important to identify the signal given by the Chatrapur port located in Ganjam district. During the research it was tried to ascertain whether the fishermen are aware of the port signals, so that they identify the cyclone or storm beforehand and ensure their safety.
99.5% respondents responded that they are not aware of the port signal and its meaning. Only about 5% respondents informed that they are aware of the signals. This reflects that the fishermen are not aware of the port signals and in turn can become the victims of the cyclone or storm.

It is important to ensure that the fishermen read, understand, and follow all of the port instructions. They need to be sensitized and trained by the government.

6.7 Awareness about Do's and Don'ts during a Natural Disaster?
Floods, droughts, heat waves, and cyclones are common features in Odisha. However, for the fishermen the most common natural disasters are cyclone and flood.

Cyclones are caused by atmospheric disturbances around a low-pressure area distinguished by swift and often destructive air circulation. They are usually accompanied by violent storms and bad weather.

<table>
<thead>
<tr>
<th>Date/Year</th>
<th>Category of Cyclone</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-5 October, 1864</td>
<td>Very Severe Cyclonic Storm</td>
</tr>
<tr>
<td>1-2 November, 1864</td>
<td>Very Severe Cyclonic Storm</td>
</tr>
<tr>
<td>22 September, 1885</td>
<td>Super Cyclone</td>
</tr>
<tr>
<td>14-16 October, 1942</td>
<td>Very Severe Cyclonic Storm</td>
</tr>
<tr>
<td>8-11 October, 1967</td>
<td>Very Severe Cyclonic Storm</td>
</tr>
<tr>
<td>26-30 October, 1971</td>
<td>Very Severe Cyclonic Storm</td>
</tr>
<tr>
<td>14-20 November, 1977</td>
<td>Super Cyclone</td>
</tr>
<tr>
<td>4-11 May, 1990</td>
<td>Super Cyclone</td>
</tr>
<tr>
<td>5-6 November, 1996</td>
<td>Very Severe Cyclonic Storm</td>
</tr>
<tr>
<td>25-31 October, 1999</td>
<td>Super Cyclone</td>
</tr>
</tbody>
</table>

Odisha happens to be one of the few Indian states that are subjected to the devastating cyclones and tornadoes. The cyclones originate from the Bay of Bengal and usually cross across the East Coast from Paradeep to Chandbali and continue with their journey towards the northwest terrains. The cyclone arrives and nearly splits apart the coastal belts in a short spell the peak seasons are between
May to July, and between October to November, prior to the arrival of winter. The cyclonic zone of Odisha is depicted in the map:

As can be seen from the map, three of the district adjacent to Chilika, Puri, Khurda and Ganjam comes under the very high risk damage zone. In 1999, Odisha state experienced a “super cyclone,” its worst disastrous cyclone in 100 years. The super cyclone brushed the entire Odisha coastal area, causing 9,893 deaths, and damaging 1,661,683 houses. Fortunately, Chilika Lagoon avoided much of the possible loss of human life, though the cyclone caused tremendous damage to fishing equipment and houses in and around the lagoon. Cyclones have a short-term as well as long-term impact on fishery livelihoods in terms of damages to vital infrastructures. Those losses were evident in the Chilika Lagoon after the 1999 super cyclone, which led to traumatic perceptions for fishing communities.

Flood can be defined as an overflow of water that submerges land. Flood may result from the volume of water within a body of water, such as a river or lake, which overflows or breaks levees, with the result that some of the water escapes its usual boundaries. In Odisha, rivers such as the Mahanadi, Subarnarekha, Brahmani, Baitarani, Rushikulya, Vansadhara and their many tributaries and branches flowing through the State expose vast areas to floods. The flat coastal belt with poor drainage, high degree of siltation of the rivers, soil erosion, breaching of the embankments and spilling of floodwaters over them, causes severe floods in the river basin and delta areas. The flood zone of Odisha can be seen from the map. As can be seen from the map, most of the fishing villages of Puri and Khurda come under the flood zone. Though some of the villages of Ganjam also come under flood zones, they are not fishing villages. Floods are also common in the Chilika Lagoon. The majority of the annual rainfall occurs from June to November. The southwest monsoon brings much rainfall from June to September, while the northeast monsoon brings some rain in October and

Figure 6.3: Flood zones of Orissa
November. The highly concentrated rainfall in July and August provokes flood in the major streams. Chilika Lagoon receives fresh water from 52 channels, especially two principal streams (that is, Daya and Bhargavi Rivers), which are sub-branches of the Mahanadi River system that is prone to be affected by extreme floods.

Lightning or thunder stroke is a natural phenomenon and prevention of its occurrence is beyond human control. A good number of people, nearly 300 people succumb to death due to lightning in Odisha every year. The death toll due to lightning in the State since 2001 is shown in the graph:

**Figure 6.4: Human Causality due to lightning in Odisha**

Fishermen are vulnerable to cyclone, flood and thunder strokes as they venture out for fishing in the open areas. It is important for them to know what to do when they get the warning. Unless they react to the warning their lives and livelihood can be adversely affected. Through this research, an attempt was made to understand, whether the fishermen are aware of the dos and don’ts before the common natural disasters.

The study reflects that 49% fishermen are not aware about what to do before cyclone and at the same time 49% don’t know what to do before flood and 51% do not know what to do before possibility of thunder stroke.

This reflects that the fishermen are most vulnerable to cyclone, storm and flood. This is due to their limited knowledge about the same. This might be because they have never been trained on this aspect or might be because they have never put so much of importance to results of natural calamities compared to their income.

It is therefore suggested that the fishermen should be trained on various aspects of the know how before natural disaster. Some aspects of behavior change will help in ensuring that the
fishermen give importance to the hazard. More importantly they must be trained to check the house, secure loose tiles, carry out repair works for doors and windows, remove dead woods or dying trees close to the house, anchor removable objects loose tin sheds, loose bricks, signboards etc. which can fly in strong winds, keep a hurricane lantern filled with kerosene, battery operated torches and enough dry cells before the cyclonic season. They should also demolish condemned buildings; keep some dry non-perishable food; always ready for emergency use. Similarly during cyclone they should keep monitoring the warnings and pass information to others, apart from taking other recovery measures. Similarly before the declaration of the flood the fishermen should avoid going in the lake and should ensure safety and security of the family members. They should try to migrate to a safer place leaving behind the home. Thunder storm is common before heavy rain and the fishermen should take all precaution to return to the shores and remain in a safe place before such situation. While none of the disasters are avoidable, precautions can ensure safety and security of fishermen.

It is also suggested that the government should ensure that information on dos and don'ts in response to on the different disasters are disseminated to the fishermen. This will ensure their safety and security.

6.8 Impact of rainy season

Like most of the eastern states of India, Odisha has a tropical monsoon climate. In Odisha, almost 80% of the annual rainfall is concentrated over a short monsoon period of three months starting from July to September (Managing disaster in Odisha, OSDMA, Page: 1). While monsoon brings with it the much-awaited relief from summer, it also brings with it concerns.

- The first concern is spread of diseases. Diseases that are spread during monsoon in Odisha are basically water borne and gastrointestinal infections. Increase in water level in water bodies and even on the roads promotes the growth of the mosquitoes causing malaria and dengue. Eye flu and infections of the foot are also observed in this season. Also diseases like dryness, spasmodic pain, high blood pressure, gas formation and gastric disturbances occur frequently. Also one comes across cases of viral attacks and coughs and colds.

- By August, the monsoon floods start and in September the salinity conditions in Chilika become absolutely different. The flood waters of the branches of the Mahanadi enter the Lake at its north-east end and push out saline water from the main area replacing it completely with fresh or almost fresh water in due course of time. Direction of winds plays an important role and is responsible for local changes in the salinity. At times this also results in decrease of fish catch during monsoon.
• Because of the strong wind the fishermen become more careful and don't go inside the lake. During this time the fishermen opt to go off fishing and concentrate on household work or agriculture.

The researcher tried to gather information on the perception of the fishermen on the impact of monsoon in their life at the domestic and professional front. This will enable the researcher to identify the most important impact of rainy season on the fishermen and their profession.

44% respondents viewed that there is a fear of spreading diseases during rainy season. 34% informed that there is a possibility of decrease in fish catch during the monsoon. 21% responded that, during monsoon, it is sometime difficult to go inside the lake and thus it can affect the fishermen.

The study reveals that the monsoon brings with it a host of illnesses for the fishermen which are a matter of concern. Spread of Malaria, Cholera, Typhoid, Diarrhea, Jaundice and even Hepatitis A are common during monsoon in the region. Some water borne diseases are also common for the fishermen.

It is therefore suggested that the government takes adequate steps to control these diseases and makes necessary provisions to supply drugs for the fishermen. One way to control the diseases is to increase awareness and make use of existing best practices. Understanding issues of rights, power, governance and institutions is critical for all involved in the whole process.

6.9 Plan of Action to fight natural disaster

Preparedness to face disasters is required at all levels right from the Household to the state Government to minimize the impact of Disasters. Whether a disaster is major or minor, of national or local proportion, it is the people at the community or village level who suffer its adverse effects. The community is the first responder of any disaster and develops some traditional coping mechanisms to reduce their vulnerabilities. Community can be defined as a group of individuals and households living in the same location and having the same hazard exposure, who can share the same objectives and goals in disaster risk reduction.

In this research, the community referred to are the fishermen of Chilika. The researcher has studied three key issues, including community specific action plan to fight natural disaster, effectiveness of the action plan and availability of HH specific plan on natural disasters.

Community based disaster preparedness is a list of activities a community decides to follow to prevent loss of life, livelihoods and property in case of a disaster. It also identifies well in advance, actions to be taken by individuals in the community so that each one is aware of
his/her responsibilities when an emergency warning is received. The plans involve providing training to the community people to make them aware and responsible to protect themselves during and post disasters.

Community based disaster preparedness and mitigation activities are found to be the most effective ways of reducing disaster vulnerability. Individual and community ownership, commitment and concerted actions in disaster mitigation produce a wide range of appropriate, innovative and doable mitigation solutions, which are cost-effective and sustainable. The first line of disaster response is at the local level, where simple planning and preparedness measures can substantially reduce the impacts of natural hazards.

In fact the destructions caused by the disasters are almost unrecoverable and unmanageable till a very long time for the fishermen. The reasons behind such severe results are unawareness and ignorance. It is also due to lack of preparedness. During the research an attempt was made to understand whether the fishermen communities have a specific disaster management plan, and whether they are aware of it.

Maximum number of respondents, i.e. 71.33% informed that they are not aware of any community based plan or even if it is there, they are not aware of it. Only a small portion of respondents i.e. 28.67% know that there is a community based disaster plan. This implies that, in the absence of community based disaster plan, the fishermen can suffer even during a small disaster. This may affect both the lives and livelihood of fishermen.

Preparedness for the fishermen should involve setting up the systems for early warning, coordinative and institutional arrangements, evacuation and emergency operations management, awareness about natural disaster, and stockpiling of different emergency materials. Emergency response plan should include search and rescue, immediate repair and restoration of critical facilities and utilities, food and non-food relief assistance for the most vulnerable families, medical assistance, evacuation center management; and networking. This should be prepared with support of the NGOs and government agencies that are specialized in this sector. Odisha State Disaster Management Authority (OSDMA) should play a more active role in this regard. Resources must be mobilized to sustain community involvement and participation. It is important to link the interventions to livelihood options and choices for the communities.

Having the action plan does not alone solve the purpose; it is most important that, the community participates in monitoring the plan and make it effective. Community action plan can
be sustained and can be considered effective, if it responds to the immediate need of the community. Mock drill or in real case natural disaster are two most effective ways of trying the community based action plan. Therefore effectiveness of the action plan (mock drill or in real case) was studied through interviews, during the research.

Mock drill is a practice done by the community or a group of persons, acting to respond as in an actual disaster situation. It is done in order to check the preparedness of various agencies to respond to disasters. Usually they are considered to be an integrated part of disaster preparedness during the drill it is actually intended to prepare the person to face the hazard both mentally and physically. During the drill the pre-designed plan is obeyed and carried out so that each and every person in the group follows the plan and acts as per the requirement and also ensure to help others safely evacuate. Basically during the drill, it is ensured whether the plan, which is in place, is proper and the people are aware and ready to face the disaster. This helps to practically face the disaster and be ready for it in advance.

During the research, it was tried to assess if the fishermen have ever practiced the mock drill or in real cases have seen the natural disaster and have verified the effectiveness of community action plan. This helped clarify if the fishermen are trained enough for the real time natural disaster and whether the external agencies like CDA and OSDMA are facilitating such activities as per their mandate.

Out of the total respondents, maximum number of respondents, i.e. 95.6% informed that though they are aware of the availability of the action plan, yet, they have never gone through any mock drill or real time situation and thus they have no knowledge about the effectiveness of the plan. Whereas only 4.4% respondents have experienced the real time a natural disaster or have gone through mock drill and felt that the plan is effective.

This proves that almost 96% respondents, who have the knowledge of community based action plan have never got a scope to try it, either in real time case or through a mock drill. These respondents also informed that the action plans were prepared with the help of NGOs. However, they were never updated neither tried. However, while these action plans were prepared, they had taken active part in it and had also put a lot of effort to understand it. This makes them even more vulnerable and put a question mark on the effectiveness of the action plan, as without any pre-testing the action plan may have many loopholes.

Therefore it is suggested that mock drill should be conducted on regular interval to educate and train the fishermen to respond to any unforeseen emergency situations like cyclone, flood, and
high wind. Mock exercises and evacuation can help in building up courage and confidence of fishermen to avoid panic situation and take correct action on time. This will also help the fishermen about the life saving and rescue techniques. This will also help the fishermen to make necessary correction in the community action plan. Proper disaster preparedness plan can not only reduce the requirement for relief and rehabilitation but also improve the rescue and relief activities significantly.

More importantly whether the fishing HH have Household specific plan on natural disaster was studied through the interview schedule to understand the preparedness measure in place.

Just as accidents happen, so do natural disasters and while it is possible that a person never actually face the disaster, it is always advisable to have a HH or family action plan in the event. The first step during any natural disaster is gathering the information of everyone in the household. Each family member needs to know exactly what to do since emergencies can strike with little or no warning. How well someone manages the aftermath of disaster depends a great deal on his or her level of preparedness for natural disaster strikes. It is always important to know how to shut off the utilities, safely keeping copies of important documents, taking care of those with special needs, First Aid, CPR, etc.

For the fishermen, who spends maximum of their time in the lake, understand the plan is very important. While in many parts, external resource agencies support in terms of making the HH plan, in few cases the fisherman do it themselves, as a practice. It is not mandatory to have a written plan, but there should be a common understanding amongst the family members on the individual roles and responsibilities.

Though there are recommendations for household disaster preparedness for the fishermen, yet very little is known about the actual level of household disaster preparedness, source of information which can be used during a disaster. Therefore it is intended to understand whether there is any HH specific plan that exists for the fishermen. This will help to decide the possible impact of the natural disaster on the fishermen.

The study observes that maximum numbers of respondents i.e. 92% do not have any family or HH specific plan, whereas a very small portion of respondents i.e. 8% have a family based action plan for natural disaster.

This means the fishermen are prone to vulnerability and on the onset of a natural disaster, without having a proper plan in place; they may have to lose their valuables as well as basic livelihood resources. The efficiency with which the fishermen conduct their transactions is
governed by number of complex factors functioning at various levels. These can be grouped as risks, vulnerabilities, and access to other assets including health, education, nutrition or even new technology. These factors adversely affect the poorer fishermen by dragging the transaction cost on their livelihoods. If these factors do not constrain the transaction costs the fishermen will have multiple options and can effectively pursue their livelihood goals. Therefore each fisherman’s families are vulnerable in terms of the transaction cost in the absence of a HH livelihood plan.

Thus it is proposed that the fishermen need to conduct a hazard mapping for their family to identify hazards in the area and in the home. Followed by this they should prepare an action plan to correct each problem. However, some experts need to help them in this regard. This should be done by the NGOs active in the area. The most important aspect of the plan should be to ensure basic livelihood during any disaster. Facilitating and supporting processes that works towards this outcome will be a key challenge for all stakeholders. However, there should be a core focus on process and finding the most appropriate ways to work. Key issues should include, engaging all the stakeholders, building capacity to prepare plan, developing a vision, and focusing on finding the best ways to ensure sustainable livelihood for the fishermen during any hazard or natural disaster.

Involvement of NGOs in disaster management has a lot of importance in terms of disaster mitigation. In India, the essential responsibility for disaster management lies with the State Government where disaster has occurred, and the Central Government may be required to supplement the State Government’s efforts.

However the states further requires development of strong participatory and collaborative ties between the civil society and authorities at national and local levels, involving all development sectors for academic, scientific and technical support organizations. NGOs have the potential to play a vital role in disaster management. Over last few decades, NGOs have become important players in the development process across the globe, engaged in wide range of activities like community development through training, policy research, and advocacy. Their organizational flexibility, informal work style, and close engagement with grassroots communities enable them to deliver services to the beneficiaries is at lower costs. After the Super cyclone in Odisha, NGOs have been played a key role in disaster management. They have worked in the sectors or communities to support disaster preparedness by actively working with the local communities. The main activity of the NGOs includes developing capacities of fishermen to manage natural disasters.
In this regard capacity building can be defined to be a tool to develop, expand, and improve the existing capabilities and coping mechanisms of fishermen community. It is a process of strengthening their capacities to meet the adversity that confronts them, through a strategic guiding principle of sustainable human and resource development. This also focuses on socio-economic impartiality that leads to empowerment and flexibility of communities.

Thus the researcher has made an attempt to know if the NGOs working in Odissa in and around Chilika region are working for managing the disasters faced by the fishermen of the region.

The study helped in getting the opinion of the respondents on the involvement of the NGOs in the disaster management in the Chilika region. Out of 450 respondents 17.8% said that the NGOs are being involved to manage disaster in this region and the remaining 82.2% replied negative.

While enquiring about their roles in managing natural disaster by the local NGOs, informed that they have supported in preparing the disaster action plans at the village level and the villagers actively follow the plans. However, the local villagers informed that the action plans which were prepared with the help of NGOs, were never updated; neither tried. Though the villagers and fishermen confirmed that, they had actively participated while developing these action plans and also made a lot of effort to understand it; but without updating and practice, the plan does not carry any value. This was further discussed with the NGO Officials for its correctness and found to correct. This fact could be found out because of the use of triangulation method.

The data indicates that NGOs are not involved in mitigating disaster in the region. This reflects that the role of NGOs in the regions have different focus. This may be because no such natural disaster has occurred during the last few years, or may be due to shortage of funds for the NGOs to work in this sector. It may also have happened due to shift of focus from disaster preparedness to more of socio-economic activities in the regions for the NGOs.

In the absence of good number of NGOs, there is an urgent challenge in linking the change with developmental processes. CDA should ensure that more number of NGOs is involved in the whole process of capacity building exercise. The NGOs need to follow number of approaches in building capacities, starting from training, public awareness, policy advocacy, community organizing, institutional networking, income generating projects, health, and emergency response for fishermen. It is important to integrate all the approaches in the capacity building framework starting from socio-economic activities to natural disaster to have a comprehensive platform.
6.10 Government’s safeguard mechanism during the natural disaster

The entire process of disaster management can be classified in two distinct phases, viz. Pre-disaster Phase, and Post-disaster Phase. The Pre-disaster Phase consists of measures relating to disaster preparedness, prevention and mitigation, while the Post-disaster Phase involves response, rehabilitation and recovery. In India, the primary responsibility for undertaking rescue, relief and rehabilitation measures in the event of natural disasters is that of the concerned State government. The role of the Central Government has only been supportive, in terms of physical and financial resources and complementary measures in sectors such as transport, warning and inter-State movement of food grains (Public Policy towards Natural Disasters in India, Disconnect between Resolutions and Reality, Centre for Budget and Governance Accountability, 2005). "Policy" is defined as a "course of action adopted by a government, business, individual, etc." (Pocket Oxford Dictionary) It has also been described as an authoritative statement which typically is intended as a decision rule to guide action, i.e. a statement that outlines desired means to achieve desired results. It is authoritative in that it comes from a party or parties with sufficient legitimacy to speak on behalf of its constituents on the matter. A policy may consist of or include an allocation or reallocation of resources applied toward the desired end state or set of outcomes, and a policy may focus on input, process, or output values (Alesch, 2001).

The plan, programme and policies of the Fishery Sector are carried out through the Directorate of Fisheries, Odisha. It is basically a service sector and extension oriented technical Department, which promotes scientific aquaculture in the state and looks after the welfare of fishing community. CDA does not have the specialization/capacity to provide welfare aid to the fishermen at the onset of any natural calamities. Safeguard mechanisms include government welfare schemes for fishermen before or during natural disaster. It is important to understand that the fishermen’s livelihood is dependent on the fish catch and thus restricting them from fishing during a particular period can make an adverse effect on the livelihood in a major way. In such situations the government's welfare schemes play a vital role for safeguarding their livelihood. These safeguard mechanism helps to ensure that the fishermen do not fall into the debt trap and live a normal life.

Questions were put to the respondents to understand the impact of government welfare schemes in the lives of fishermen before or during the natural disaster. This also gave a clear understanding of where the loopholes are and how to mitigate them. The study reflects that the government plays very limited role in terms of safeguarding the fishermen before or during.
natural disasters. 89% feel that the government does not take any step in safeguarding the fishermen before or during natural disasters, whereas only 11% feel that the government takes step to safeguard their interest.

During or before any natural disaster, without government support the poor fishermen become even more vulnerable. In most of the cases it has been seen that the poor become poorer and without any support mechanism in place, they end up selling their property. Sustainable livelihood can be achieved even during the time of natural disaster if external support including the government agencies provide their support to the fishermen, understand the differences between groups of people and works with them in a way that is consistent with their current livelihood strategies, social environment and ability to adopt.

Government exists to protect the rights and welfare of their citizens and to address common societal and economic issues. They must generate public policies in the interest of the public’s good and ensure promotion and implementation of those policies. Their primary function is to ensure the safety and wellbeing of society. Disaster management is a core function of government and should be explicitly recognized as such. Governments at every level have special obligations toward the citizens they represent with regard to disaster risk. Governments must provide leadership in safeguarding lives, institutions, the physical infrastructure and the environment from disasters.

It is therefore proposed to have a central agency with responsibility for coordination of mitigation efforts. Other agencies with similar roles may legally involve and made responsible to carry out specific roles or activities. This should also include, the human resources, funding, equipment and supplies, leadership, effectiveness, and the communication links between and among organizations. In the design of effective safeguard, government should think about total risk management and how to coordinate with the development process, rather than relying on the response and relief paradigm. Actual participation by various sectors is also important. The safeguard mechanisms should be in line with the interest of fishermen. Loans for the boats, wage earning mechanisms (in addition to Mahatma Gandhi National Rural Employment Guarantee Scheme), support for women SHGs, and special ration for fishermen can be of great help.

In Odisha, Sustainable Livelihood approach has been used jointly by DFID and Govt of Odisha with considerable success for understanding the effects and livelihood implications of the devastating cyclone of October 1999 and responding appropriately. The holistic approach was valuable in understanding how people react to a disaster, since disasters affect all aspects of
people's lives. The Livelihood framework was used to interpret livelihood scenarios in three stages just before the cyclone, immediately after the cyclone and 3-9 months later. Comparing these scenarios helped in identifying priorities for action. Therefore it is also important to look into the whole issue from sustainable livelihood point of view.

6.11 Insurance coverage

A fishing boat is used to catch fish in the sea, lake or river. Different kinds of boats are used in commercial, artisanal and recreational fishing. Small boats are also used in the ponds for fishing. For fishermen in Chilika, boat is the most important necessity. Though many of them do not own a boat, and also do not know to row, their livelihood completely depends on boats. Therefore boat rowing is an important indicator for understating the livelihood issue of fishermen. Using boat and not knowing to row also decides the lives of fishermen, as during high speed wind, one has to be careful enough to save his life.

Insurance is a form of security, but for fishers who spend a large portion of their lives away from house, it also provides an important source of comfort. Lack of insurance can spell destitution for fisher families that lose their wage-earners. And thus Insurance is a form of risk management primarily used to evade against the risk of a contingent, uncertain loss. Insurance is defined as the equitable transfer of the risk of a loss, from one entity to another, in exchange for payment. An insurer is a company selling the insurance; the insured, or policyholder, is the person or entity buying the insurance policy. The amount to be charged for a certain amount of insurance coverage is called the premium. Risk management, the practice of appraising and controlling risk, has evolved as a discrete field of study and practice. The transaction involves the insured assuming a guaranteed and known relatively small loss in the form of payment to the insurer in exchange for the insurer's promise to compensate the insured in the case of a financial (personal) loss. The insured receives an agreement, called the insurance policy, which details the conditions and circumstances under which the insured will be financially compensated.

Fishers' access to insurance is limited to government-sponsored group insurance programmes. There are a lot of possibilities of unexpected events that could occur in the lake, such as storms, fire, sinking, colliding with another boat and capsizing. There could be severe damages to other watercrafts, docks and even lives. Boat insurance not only takes care of all this damage but also pays for liability and medical claims for the injured up to the coverage amount purchased. At the same time thefts often happen on the shore. Boat insurance not only pays for the boat but also for the equipment lost. Furthermore, fishermen will not have to pay the bank loan for a boat that
he no longer has. Therefore boat insurance is most important for any of the fishermen. Property insurance provides protection against risks to property, such as fire, theft or weather damage. Marine insurance and marine cargo insurance covers the loss or damage of vessels at sea or on inland waterways, and of cargo in transit, regardless of the method of transit. When the owner of the cargo and the carrier are separate corporations, marine cargo insurance typically compensates the owner of cargo for losses sustained from fire, shipwreck, but excludes losses that can be recovered from the carrier or the carrier's insurance.

During the study, the researcher was informed about Assistant Registrar of Cooperative Societies, Chilika Circle, Balugaon, Khurda. The main objectives of the Organisation are to promote Socio economic Condition of the poor fishermen of the locality of Chilika Area. The organization is also trying to bring the lease rights of the Fishery sairats of Chilika Lake through the Chilika Fishermen Central Co-op. Society Ltd. to protect the primary Fishermen Co-op. Societies from the clutch of the Odisha state Fishermen Co-op. Federation Ltd., Bhubaneswar. It is also actively involved in initiating trainings for the Fishermen by the sister organizations like CDA /FISHCOFED & N.F.D.B. to create awareness for Insurance and Fisheries activities among the Fishermen and ensure to the compensation towards.

The Indian Marine Insurance Act, 1963 is imbibed from the Marine Insurance Act, 1906. Though the Marine Insurance Act is deep in its insurance coverage, it does not provide for losses that occur while the ship is sailing in the water. This has led to the introduction of another insurance called the Marine Cargo Insurance, which provides for losses to cargo while the ship is sailing in the water. Insurance for boats in the lake is of same importance as the marine. The study reflects that boats in Chilika are used for mainly two reasons, fishing and carrying tourists. Apart from this boats are used for transportation also. Boats are lives and livelihood for the fishermen and therefore their insurance is vital for them. The researcher therefore tried to ascertain, whether the fishermen hold license for the fishermen. However, the only issue which was encountered was, as half of the respondents have been working from other's boat, they were not sure about the exact situation and therefore the opinion was taken through FGD and personal discussion.

39.5% respondents informed that the boats do not have any insurance, whereas 37.3% have license for their boats. 23% respondents have no idea, whether the boat have the license. This group of respondents is mainly fishermen who are working as crew and operate from other's vessel. This shows that the fishing boats do not have license and more importantly a good number of fishermen have no information about the importance of license and thus not aware of
the situation. This can lead to a disaster, as the boats which are not covered under insurance, if ever destroyed, the owner will not get any compensations and this will lead the fishermen to a more difficult situation.

During FGD in Satapada village, initially the fishermen informed that there is an existing monitoring system in place to monitor the movement of boats in the lake. However, towards the end of the discussion, Mr. Maran, of the village complained that there is no monitoring of the movements of fishing boats and fleets, neither is there any mechanism in place to monitor whether the boats are under insurance coverage. Many of the fishermen supported his view. Some of them suggested that there is a need to log in details everyday about the boats that have gone fishing, the directions that they are headed and number of days they have gone for fishing. These need to be monitored not only for security reasons, but also for fishermen's safety. However, this point came only when there was a discussion around the safety and security of the fishermen started. This view was further supported by the PRI members and NGOs. Here the researcher used the triangulation method for cross verification and reaching conclusion.

Storm disaster warnings often do not filter down to everybody and the fishermen usually rely on our own knowledge of the weather. A separate section should operate within the fishery department to look into the issue, so that all the boats can be brought under the purview of insurance.

The fishermen of Chilika are vulnerable to poverty. In addition, their physical capital is so low that it will be easily damaged or lost when disastrous events happen in Chilika Lagoon. On this account, promotion of natural calamity insurance supported by Department of Fisheries and Animal Resources Development needs to be implemented. The insurance scheme enables all people, including the poor, to mitigate sudden shocks from climate variability and extreme events. Taking into account the increased intensity and frequency of natural disasters in Odisha state, the initiatives will play a greater role in responding to the direct and indirect effects of climate change in the long run.

Apart from the boat insurance, a programme called Janashree Bima Yojna is jointly implemented by the Government of India and the General Insurance Corporation in most coastal areas to insure the lives of poor people. Many fishers have joined this programme as a result of the extensive work done by NGOs and DOF, and because of the fears evoked by the 1999 cyclone. However, CDA should take step to bring more number of fishermen under this programme.
6.12 Overview

To develop the Lake and the beneficiaries around it, the required inbuilt balance need to be well understood. For the sustainable development of natural resources and ecological subsistence, its ecosystem must be maintained and conserved. Environmental degradation and constant threat from natural disaster is hampering the livelihood of the fishermen as it has a direct linkage with the flora and fauna of Chilika Lake. Inspite of the efforts made by the government of Odisha the efforts for the conservation and protection of the Chilika environment is still insufficient.

The study reflects that only 14% respondents have basic knowledge about the legal provisions on environment protection. Therefore it reflects that there is a lack of knowledge and awareness at the part of fishermen about the legal provisions for environmental protections and this leads to environmental degradation. Strict enforcement of the Odisha Marine Fishing Regulation Act, applicable to Chilika needs to be ensured by the Fishery Department. Most importantly it should be ensured that the fishermen are aware of the existing policies and guidelines on environment protection, so that they can ensure their implementation. Further massive awareness programmes for the fishers, local NGOs, school children, village level Government functionaries and village women on the sustainable and wise use of natural resources of Chilika Lagoon needs to be implemented in a sustained manner. CDA should collaborate with Department of Fisheries and Animal Resource Development and Department, environment Department and Agriculture Department to strengthen planning and implementing environmental protection schemes. It is also quite visible that illegal poaching of migratory bird is still common in Chilika. CDA therefore needs to address this issue by working with local NGOs and CBOs and the wildlife wing of the Forest Department of Odisha. It is important for the NGOs to spend time with the locals and discuss with them the problems of waterfowl poaching.

Two other important things which are affecting the lake environment are siltation and non-demarcation of shore line. Therefore the shore line of the Lagoon should be clearly demarcated and efforts should be made to make these areas free from Ghery with active participation of local fishers. Illegal encroachments of shoreline do not only affect the livelihood of poor local fishers, but also adversely affects fish spawning and mullet fishery. The Siltation in the lake also has reached an alarming situation causing noticeable ecological effects; Plantation of trees on the banks of rivers should be done more extensively to check soil erosion and silting of Chilika basin. Recommendations of experts to raise the salinity levels must be implemented with a view to sustain several fish species that grow in saline water. Abolition of shrimp culture and demolition of shrimp ‘gheris’ (net enclosures) which disrupt the tidal flushing, reduces the level
of salinity, squeeze grazing ground for juveniles and accelerate the process sitting of marginal areas of the Lake should also be seriously considered.

The adverse impacts of hazards often cannot be prevented fully, but their scale or severity can substantially be reduced by implementation of various strategies and actions. Awareness about natural disaster has a positive impact on mitigating natural disaster. While making the fishermen aware about the natural disaster and their coping mechanisms, focus should be made on understanding climate change adaptation at the community level and scaling it up into the policy perspective through application of Livelihood Approach. Hazard mapping and risk assessment will provide tools to help those in authority to understand and address the effects of natural and human hazards on fishermen communities' vision for the future. It is suggested that for supporting systematic analysis of livelihood issues from natural disaster point of view, the plans should be made in a way that is holistic, more realistic and at the same time manageable. More importantly the fishermen must be trained to check the house, ensure proper maintenance and at the same time ensure their lives and property is saved. Similarly during cyclone the fishermen should keep monitoring the warnings and pass information to others, apart from taking other recovery measures and before flood they should avoid going in the lake and should ensure safety and security of the family members. While none of the disasters are avoidable, precautions can ensure safety and security of fishermen.

It is evident that, impact of natural disaster is higher for those with lower income and low socio-economic indicators and therefore to weaken such impacts public policies should be more focused on those fishermen who are under the poverty lines. The study also reflects that the incidence of natural disasters is highly correlated to the increasing vulnerability of fishing households and communities in Chilika. The impacts of natural disasters affect not only occupational activities but also the multiple dimensions of fishermen's livelihoods that have secondary effects and determine their capacity to handle future stress. Grassroots mitigation plans developed through involvement of non-governmental organizations and community-based organizations will benefit fishermen. This will have more value from public involvement and support. It is also essential to mobilize the entire community in disaster preparedness, which could include, setting up village-level committees, training and awareness raising, establishing safer places and providing food and medicine supply to cope with emergencies. Safety of fishermen and their families should be given special attention when implementing disaster preparedness. At the same time, the impacts of cyclone cover multifaceted aspects of fishermen's livelihoods, so that there is an urgent challenge in understanding the broad
relevance to livelihood contexts and their linkage with natural disaster like cyclones. As fishermen suffer the most due to natural disasters, conditional cash transfers facility during or before disaster can serve as a safety net for those exposed to the disasters.

In terms of getting early warning, the study reflects that the fishermen fishing in Chilika are vulnerable to natural disasters, as they seldom get timely and accurate information on the occurrence of the disasters beforehand. At the same time it is proved that the fishermen receive timely early warning from their neighbours within the community. The close proximity between the HHs makes it easier to disseminate the information between the fishermen within couple of hours. The fishermen also rely on radios for getting early warning. However, radio broadcasts being the major source of information on which fishermen rely, thousands of fishermen, who sometimes do not carry radios, are deprived of getting timely information and thus, get trapped in trouble.

Preparation of forecasts for effective vulnerability reduction for the fishermen of Chilika should begin with an assessment of users' vulnerability, capacity and needs. There should be a more robust early warning system, from which fishermen can get timely weather forecast. Early warning information should be shared through a combination of formal and informal systems. While the formal information can be provided through government mechanisms, the informal message can be delivered through community based networks. A key element to effective warning message is to establish and sustain institutional mechanisms for dialogue between the fishermen and the government machinery, more importantly the officials of Indian Meteorological Department on climate information. Not only should government officials understand the potential applications of their work but the fishermen should also have the opportunity to learn how to interpret forecast; to understand the assumptions upon which they are premised and the limitations to their application.

It is also interesting to see that the fishing communities of Chilika have evolved a system of preparedness and mitigation, regarding hazard events as part of natural cycle of life. The indigenous technical knowledge within fishing communities in Chilika is an amalgamation of strategies, skills and techniques gained through shared interactions to live and survive the natural way of life. The fishermen have been confronted with changing environments and have developed a wide array of coping strategies and their traditional knowledge and practices provide an important basis for facing even greater challenges of natural disaster. This can be considered as their natural coping mechanism to natural disasters.
However, there is a need to further study the instinct of fishermen in identifying the natural disaster from a more scientific angle, so that it can further guide others. The disaster management authorities need to ensure that traditional knowledge of the local communities with regard to coping with natural disasters is incorporated in the warning message.

More importantly the study reflects the fishermen are not aware of the port signals and in turn can become the victims of the cyclone or storm. It is important to ensure that the fishermen should be trained to read, understand, and follow all of the port instructions. The study also reveals that the monsoon brings with it a host of illnesses for the fisherman which is a matter of concern. Spread of Malaria, Cholera, Typhoid, Diarrhea, Jaundice, water borne diseases and even Hepatitis A are common during monsoon in the region and therefore government should take adequate step to control these diseases and make necessary provisions to supply drugs for the fishermen. One way of increasing our understanding of this situation is to spread awareness of and make better use of existing best practices to control the diseases.

The finding shows that government has not established any safeguard mechanisms during or post disaster period and without government support the poor fishermen become even more vulnerable. Sustainable livelihood can be maintained even during the time of natural disaster only if external support focuses on what matters to fishermen, understands the differences between groups of people and works with them in a way that is consistent with their current livelihood strategies, social environment and ability to adapt. The research proves that NGOs are playing no such role in mitigating disaster in the region. This may be due to no such natural disaster happened during the last few years, or may be due to shortage of funds for the NGOs to work in this sector. In the absence of good number of NGOs, there is an urgent challenge in linking the change with developmental processes. Therefore CDA should ensure that more number of NGOs is involved in the whole process of capacity building exercise and overall development process in the area. There should also be a central agency with overall responsibility for coordination of mitigation efforts other than CDA. Other agencies with similar roles may be made legally responsible to carry out specific roles or activities. Loans for the boats, wage earning mechanisms (in addition to Mahatma Gandhi National Rural Employment Guarantee Scheme), support for women SHGs, and special ration for fishermen can be of great help. In the State of Odisha, Sustainable Livelihood approach has already been used with considerable success for understanding the effects and livelihood implications of the devastating cyclone of October 1999 and responding appropriately. Therefore it is also important to look into the whole issue from sustainable livelihood point of view.
There is no such community based or household specific action plan in place for the fishermen community and in the absence of such plan, the fishermen can be at the receiving end even during a small disaster. This may affect both the lives and livelihood of fishermen. It is also true that 96% respondents, who have knowledge of community based action plan, have never had scope to try it, either in real time or through a mock drill. Preparedness for the fishermen should involve setting up the systems or putting in place a plan for early warning, coordinative and institutional arrangements, evacuation and emergency operations management, and awareness about natural disaster, and stockpiling of different emergency materials. This should be prepared with support of the NGOs and government agencies that are specialized in this sector. It is also important to link the interventions to livelihood and choices for the communities. Facilitating and supporting processes, which work towards this outcome, will be a key challenge for all stakeholders. However, there should be a core focus on process and finding the most appropriate ways to work. It is also suggested that mock drill should be conducted on a regular interval to educate and train the fishermen to react for any unforeseen emergency situations like cyclone, flood, and high wind. Proper disaster preparedness plan can not only reduce the requirement for relief and rehabilitation but also improve the rescue and relief activities significantly. The study reflects that most of the fishing boats do not have insurance for the boats and as the boats which are not covered under insurance, if ever destroyed, the owner will not get any compensations and this will lead the fishermen to a more difficult situation. The insurance scheme will enable all people, including the poor, to mitigate sudden shocks from climate variability and extreme events.

The UN Millennium Declaration and the Millennium Development Goals reaffirm the basic rights of all human beings to participate in the economic, social, and political processes of society. This means their right to freely, actively, and effectively participate in shaping society, take part in decision-making processes, and share in the fruits that development brings. Therefore the overall interventions for the fishermen in Chilika should take into account the following framework to ensure that the fishing populations have a protection environment before any natural disaster.

The framework summarises the findings from the chapter. It reflects that, in order to deal with the natural disaster and environmental degradation, the fishermen should have the Coping, Adaptability, Mitigation and Preparedness (CAMP) skills in their hand. This will help in strengthening the Human, Economic and Political capabilities as well as the existing systems in place. All these things will lead to Environmental Sustainability through change in the attitudes...
Figure 6.5: Environment and Natural Disaster Framework

Implementation including system strengthening and capacity building

Planning & Policy discourse

Environmental Issues and Natural Disaster

CAMP

Management Decisions

Understanding

Improved

Evaluation

System strengthening to address the vulnerability

Political capabilities to ensure basic rights are protected

Disaster Risk Reduction through strengthening capacities and system strengthening

Environmental through change in the attitudes and perceptions

Sustainable Livelihood

Monitoring

Economic capabilities to alternate livelihood

Human capabilities based on identifying risk and mitigating it

Variety of Adaptability – Preparedness)