CHAPTER ONE

INTRODUCTION

1.0 OBJECTIVE

The objective of this present endeavour is to study tropical cyclones as natural phenomena in the east coast of India and as hazard stimulating definite patterns of human response on two specific economic activities of fishing and tourism in West Bengal coast.

The objective has two aspects:

i) To observe and analyze the behaviour of selected parameters of tropical cyclones in the east coast of India.

ii) To assess the impacts of cyclones on sea-fishing and beach-tourism in the West Bengal coast.

To meet the first part of our primary objectives, the secondary objective is to focus on the debate on the term 'cyclone' in the Bay of Bengal coast. To be more specific it is our objective also to concentrate on scientific significance of the term and its difference from perceptive reality without which the second part of our objective cannot be fulfilled.

Though for impact analysis our objective is to focus on two activities, one is a primary activity, the other one is a tertiary economic activity within a short time span. But a retrospection into other cyclones occurred in the historical past is imperative as the past helps to understand the present in a better way.

For impact study our objective is also to deal with impacts of cyclones in general in the West Bengal coast.

1.1 RELEVANCE OF THE THEME

Tropical cyclone is an atmospheric phenomenon of the tropics. Climate, as it is understood, is an inseparable element of organic environment and has an influence on human habitation irrespective of the debate relating to climatic
determinism or non-determinism. 'Tropical Cyclone' which is the central question of the present research, must be established as relevant for geographical research on two aspects — one from its theoretical aspect and the other from its empirical implications on human society.

1.1.1 Theoretical relevance

Tropical cyclones demand separate treatment because these are quite intriguing and have special academic value. These are associated with some hazardous parameters often disturbing human society living within their reaches. Tropical cyclones can be considered as the second largest climatic entity of the world, next to the temperate cyclones of the extra-tropical region. These cyclones visit tropical coasts most regularly amongst other natural hazards of the world. Moreover, coastal areas support the highest densities of population in the world despite the facts that the inhabitants are fully aware of the risks (Gopalan, C. 1992, p. 29. Narayan, T.G. 1944, p. 157-58). Inspite of the relatively high speed of onset and the general consequences of loss of life and property associated with tropical cyclones, it cannot be said that the phenomena are totally unexpected because there is some degree of regularity of the visits of tropical cyclones in these coastal areas when seen over a slightly longer spell of time, say a span of a decade or so within which a certain number of tropical cyclones of hazardous magnitude is expected to visit a given area and this expectation is seldom belied. This means that the population living in the tropical coast are aware of the risks of inhabiting the area, yet by conscious choice of indulging into calculated risks involving ventures or without having any option people crowd these hazardous regions of the world. Natural phenomena with high magnitude which are generally regarded as natural hazards from human ecological view points disrupt normal life of the region that suffers a set back in the development process, be it a rich or poor economic zone. United Nations Organization (UNO) declared the decade of the
nineteen nineties as the "International Decade for Natural Disaster Reduction" (IDNDR).

The General trend regarding loss of life and property due to natural hazards all over the world accounts for the following facts:

i) Material loss is increasing everywhere in the world due to general trend of development and more occupancy of the hazard-prone areas.

ii) Apparently, loss of life shows a diminishing trend in the developed countries rather than developing ones, but actually losses of both life and property are increasing due to population pressure over space. It may be true for a few developed countries that over the years annual average loss of life due to natural hazards is decreasing, but it is high in exceptional years when large scale events occur. Burton in a 10 year moving average of deaths and property losses from U.S. tropical cyclones has shown that death is declining but damage is rising in U.S.A. (Burton, et al 1978, p. 12-14). A close view is needed to find out number of death caused by natural hazards during or immediately after the hazards are over and slow, unnoticed death in the affected zone following a considerable period being over because it is quite possible that the loss of property and destitution caused by a particular event may create death after a considerable time has elapsed (Burton, et al. 1978, p. 13). It has not been enumerated how many deaths are caused due to destitution or pauperization. There is quite a possibility that natural hazards used to cause death in the past immediately after the events were over. But now the fatal effects may be staggered over a greater period of time. Therefore, it cannot be said with conviction that the modern technological world has guaranteed greater longevity against such hazards.
In a five year moving average of major internationally reported hazards (excluding drought) for the period between 1947 to 1973, Burton has shown that the reported disasters decline in occurrence and then remain constant, but loss in terms of life and property is increasing (1978, p. 3).

Impacts of natural hazards are not directly related to the magnitude of the events as was thought previously in the “dominant view” of the hazard studies (Hewitt, 1983, p. 5). Rather the impacts are very much tied to the social, economic, administrative and political systems prevailing over the area or areas visited by such phenomena. Where appropriate warning signals, timely evacuation, elaborate life saving structures and techniques are guaranteed by an egalitarian political system backed by enough economic capacity to invest towards the development of such techniques and structures and where the poorer section of the population have the option to choose from a large range of occupational and residential options, the situation may not be associated with high death rates due to natural hazards. On the other hand in different situations where the economic and technological prowess of the government is limited, where the political attitude or ideology is not very high, pushing the poorer section of the population towards the hazard prone areas, natural hazard of lesser magnitude may be associated with a much larger number of deaths and a much greater quantity of property lost. There are innumerable instances from all over the world that the poorer Third World countries have suffered more from the adverse effects of extreme natural events than those which have the facility of ready assistance from their own government or from their developed neighbours. Thus while Bangladesh suffers from floods and cyclones beyond measure, Mexico is fortunate to escape much of the probable damage from similar cause. This reveals the role of man or society in interaction or adjustment pattern with natural hazards determining the types of impacts of the events on the society. Actually better adjustment or better resistance comes from the better economic sectors and the distribution
of these economies is not spatially equitable. It may seem that eradication of this spatial inequality may bring equality in the impacts of cyclones or other hazards. But this is not dependent on the desires and needs of individuals and the availability of resources in the locality only. Rather it depends on the desires of the organized groups of human society as characterized by Lucien Febvre (1950). Daryll Forde also gives emphasis on economy which according to him is largely controlled by physical conditions, acting either as a limiting or stimulating factor for determining the size, density and stability of human settlement, and also the scale of the social and political unit (Forde, 1970 p.463). Lastly, Chakrabarty and Biswas have categorically stated that the spatial inequality of economic distribution is expressed on the basis of "socially validated norms" which are determined by the organised groups of people or pressure groups who have their influence in politico-economic decision making processes (1980,p.91).

The entire problem including the natural characteristics of the phenomena and the social, economic and other human consequences poses some questions which have to be resolved in order to understand the reality of hazards, not only of tropical cyclones, but of all other natural phenomena which are associated with human suffering. These questions involve those relating to the real meaning of interaction between man and environment, the conflict and compromise between scientific appraisal of natural systems and events and their socio-cultural interpretations and probably the unresolved debate concerning determinism and non-determinism.

1.1.2 Empirical Relevance
Impacts of cyclones on the coasts or coastal inhabitants are the result of the joint interactions among the phenomena themselves, the social, cultural and economic status of affected people and the physical environmental characteristics of the region. The former two may be subjected to
changes in any part of the world within historical time span whereas the latter seldom shows any alteration within specified time exerting any change causing impacts of cyclones except in places of great human influence. Variation in coastal topography such as rocky, sandy or muddy, upland or lowland, broken or continuous, bare or covered, mainland or island, protected or unprotected etc. regulate the impacts of cyclones. Impacts of cyclones on the rocky coasts of Philippines must be different from that of the highly dissected deltaic coasts of Bangladesh. Coastal lands are prone to effects from ocean-atmospheric or oceanic phenomena. Thus Norwegian coast is affected by maelstrom. Maelstrom is a whirlpool which results from the turbulence within a tidal current or may develop at a point of convergence of different currents. But the fjord coast of Norway is naturally protected unlike naturally unprotected coast of Bangladesh. So storm surges generated by cyclone easily devastate the Bangladesh coast. Tropical cyclone in India has got a special significance for a number of factors.

(i) It has a long coastline and numerous large and small river corridors, some of which are the most populated parts of the country. The river channels can draw the impacts of tropical cyclones to a more interior area that would not have been possible otherwise. The largest corridor is the Gangetic Delta and it is located very close to the Bay of Bengal where most of the cyclones originate. This part of India has a sizeable population who have to interact with cyclones for subsistence and this is historically valid point because coastal areas are generally occupied by fishermen groups who originated from the Kaibartas and belong to the lower rung of the Brahminical cast hierarchy (O’Malley, 1911, pp. 68-70).

(ii) Annual average number of cyclones of any intensity level originating in the Bay of Bengal is four to five. But high
magnitude cyclones to occur in near or distant future are still now unpredictable. It is just a matter of chance occurrence.

(iii) The density of population in the deltaic corridors of the river Ganges, Godavari, Krishna and Kaveri is very high causing more death and destruction.

(iv) Most of the coastal people are economically backward group belonging to the lower rung of the cast hierarchical system.

(v) India is constitutionally a socialistic country. It has provided reservation and special programmes for backward classes. Therefore, reduction of hazards from cyclones is a task before the Government. In 1996, Government of West Bengal and India have taken a special programme on coastal area management (Ghosh, A.K. and Sanyal, P., 1996).

(vi) These hazardous coastal areas are seaside resorts and important religious spots and both attract tourists and pilgrims. Tourism has become an important source of income to many of the local people. Lastly, in consideration to these social and human constituents, tropical cyclones deserve a separate academic treatment. If these phenomena are studied in detail and if proper zones of cyclone hazards can be identified on the basis of the frequency and magnitude of the cyclones then possibly certain measures can be applied to improve the conditions of people suffering from their adverse effects.

1.2. STUDY AREA
Tropical cyclones will be studied as physical phenomena over the Bay of Bengal in general and east coast of India in particular. But impacts of cyclones will be tested on West Bengal coast only.
1.2.1 Eastern Coast of India

It starts from the southern extremity of Tamil Nadu (latitude 8°15'N, longitude 77°33'E) and extends roughly north-north-eastwards in a broad sweep upto Tenali (latitude 15°45'N, longitude 81°E) and then turns north-eastwards till it reaches the extreme south-eastern corner of West Bengal (latitude 21°31'N, longitude 89°E). Of course the land water contact does not follow a uniform course; it has broad swells both land and seawards in terms of geomorphic control. It comprises of states namely Tamil Nadu, Andhra Pradesh, Orissa and West Bengal from south to north. Coastal districts of these states respectively are as follows: Kanyakumari, Tirunelveli, Tuticorin, Ramanathapuram, Pudukottai, Thanjavur, Nagapattinam, Cuddalore, Pondicherry, Villupuram, Kanchipuram, Tiruvallur in Tamil Nadu. Nellore, Guntur, Krishna, West Godavari, East Godavari, Vishakhapatnam, Srikakulam in Andhra Pradesh, parts of Ganjam and Puri. Cuttack and Balasore in Orissa from South to North and Medinipur, South Twenty Four Parganas in West Bengal from West to East directions. The eastern coast of India lies to the west of the Bay of Bengal. So the cyclones originated in this sea, hit the coast, badly affecting the economy and life of the coastal inhabitants. Impacts of cyclones are disastrous because they hit the important riverine plains and deltas along with the small river valleys which because of their agricultural productivity form the backbone of the regional economy. Coastal fishing and specially sea-fishing which mostly suffer from cyclonic occurrences, has become a large economic practice in this region. Moreover this fishing activity generally engages the people from the low-income group. The eastern coastal region of India has been selected as the relevant area for studying tropical cyclones in their totality.

1.2.1.1. West Bengal Coast.

Unlike other states in the eastern coast of India, the West Bengal coast is arranged in the west-east direction, while others trend mostly north-south. Medinipur is the western district and its southern part constitutes
the West Bengal portion of the eastern coast of India. Twenty Four Parganas, South and North are to the east of the Hooghly river and the parts of Ganga Delta which is the largest delta in the world. For the present research however, Medinipur and the western part of the south Twenty Four Parganas coasts have been given emphasis whereas eastern part of the South Twenty Four Parganas has been given least emphasis since these areas are not settled at their southernmost islands. North Twenty Four Parganas is excluded since its southernmost boundary line does not coincide with the northernmost limit of the coastal boundary as demarcated for the present research. West Bengal coast may seem to be a less affected zone in terms of frequency of tropical cyclones compared to the other states in the eastern coast. But the West Bengal coast is the only one mentioned in the historical records as having suffered from repeated cyclonic occurrences. Therefore, in case of West Bengal, historical records are available regarding impacts of cyclones and response of the society. At present, a pressure of population in the coast must be considered as a disadvantageous factor while studying cyclonic impacts (Berz, G.,1994, p.330). Moreover, coasts of different physical characteristics which may be another controlling factor for differential impacts of cyclones are present in West Bengal coast. The coast in these respects is relevant for this research providing opportunity to observe cyclones and their impacts from temporal as well as spatial aspects.

1.3. TIME SPAN AND RATIONALE OF PERIODIZATION

The first recorded and oft quoted cyclone in the Bay of Bengal affecting the eastern coast of India dates back to the year 1737 of the month of October (Blanford, H.F., 1877; Nash,J.R.,1976,p.748).

This Bengal cyclone has been considered as the starting point for the present research work. So the time span stretches from 1737 up to the present and the
total length of time span accounts for more than two hundred and fifty years. This total period of time has been divided into five separate periods due to some convenient reasons.

This periodization is not related to any temporal change in the nature of the phenomenon itself. Tropical cyclones in all probability have maintained their characteristics over the centuries concerned. Basically it is a periodization related to variations over time in the nature of the data available. But this is relevant here because the varying nature and quantity of information available at different periods have certainly influenced the treatment by the researcher dealing with the tropical cyclones hitting the Eastern Coast of India during different periods. It also carries the reflections of the changing attitude of the scientific community and the decision makers of the Indian society towards tropical cyclones and associated hazards. Different periods and their distinguishing characteristics are given chronologically in the following paragraphs.

1.3.1 1737-1838

Very few information about the cyclones of this period are made available to the researcher in detail and those are not so scientific. So this period has been dealt with separately from the period of scientific research on tropical cyclones. Cyclones of this period have been recorded just as report of the events.

1.3.2 1839-1859

This is the period of meteorological research organised by Piddington who is the pioneer in this field in India. Being inspired by Colonel Redfield of America and assisted by the Asiatic Society of Bengal in India, Piddington executed uninterrupted laborious investigation on the physical characteristics, mechanism, causes of formation of cyclones and various other aspects
relating to cyclones such as, terminology of the event and its phases, distribution and delimitation of the phenomena over the earth, storm surges during cyclones etc. along with the application of these knowledge in preventing shipping hazards in the sea.

Thus his ventures can also be considered to be the first attempt towards applied meteorology in India. Piddington had no special emphasis on the impacts of cyclones on the coastal economies or coastal inhabitants. But those came inevitably in his writings since he wanted to see the phenomena in their totality.

1.3.3. 1860-1874

A close observation on each and every depression formed in the Indian and China seas by the trading ships as far as it was possible and publication of analytical notes and data of the important ones regardless of their striking on coast virtually came to an end after Piddington. The mutiny of 1857 also had a profound effect on such systematized scientific studies. Nonetheless little interest was shown in meteorological studies after the period of Piddington was over until and unless twin disasters in successive months of October and November of 1864 occurred respectively in Bengal and Andhra Pradesh taking a heavy toll. A sudden onslaught of the dreadful cyclones in 1864 without any prior notice accompanied by irresistible disastrous consequences brought a realisation among the administrative personnels about the necessity of observatories for meteorological data with an objective of prognosticating hazardous weather events. These two cyclones, specially the Calcutta one revived the necessity of meteorological research on cyclones from its silence. Persons like Gastrell and Blanford came enthusiastically. They not only reinforced, but extended the field of meteorological observation connecting monsoon rainfall with agricultural prosperity and with occurrence of flood or drought. But in case of cyclonic phenomena their emphasis was shifted on special events. They did not follow Piddington in toto in terms of regular collection and interpretation along with recording of data. The India
Meteorological Department however was set up in 1875. In this period, the 1864 cyclone was the only to place itself at the centre of interest from all corners of the society.

1.3.4 1875-1941

In 1875, India Meteorological Department (IMD) was established with an objective to carry on day to day observation on atmospheric phenomena to understand physical laws specially of monsoon in order to forecast the timing of monsoon rains since Indian agriculture was the plaything in the hands of monsoon. Daily weather maps began to be prepared. Tropical cyclones were being studied from purely physical aspects on the basis of particular events. Therefore very few relevant information regarding impacts of cyclones have been made available during this period. Both Blanford and Eliot were eminent meteorologists of this time. Eliot worked on the Madras cyclone of 1877 and the Medinipur cyclone of 1874 (Eliot 1879). Eliot's observation did not overlook the cyclone in Andaman and Nicobar Islands (Eliot, 1893). But his important contribution in the cyclone research is *Handbook of Cyclonic Storms in the Bay of Bengal* (Eliot, 1901) and *Climatological Atlas of India*. He prepared twenty five plates on different aspects of weather including cyclone tracks in India and adjacent countries (Eliot 1893). Mapping techniques and information put in the maps prepared by IMD altered repeatedly. Eliot, like Piddington and Blanford took much interest in discovering the physical principles or laws governing the initiation, growth, movement, dissipation, even recurvature of cyclones specially in the Bay of Bengal and in Arabian sea. Details of his investigation have been discussed in the section of literature review. Eliot held the post of Meteorological Reporter after Blanford who was the first incumbent of the post. Since the period of Blanford, IMD started publishing meteorological memoirs consisting of various research papers on different climatological aspects giving special importance on individual cyclones of any season and of any intensity. But like the cyclone reports of the earlier period viz. cyclones of 1823,'33 or '64, these were mostly excluded from description about hazards rendered to the society.
Apart from the research worked out by Blanford and Eliot, most of the first half of the 20th century remains less significant in consideration to the system of study and recording and the objective of the present thesis.

1.3.5. 1942 to the present.

Though 1942 cyclone had no such significant impact upon meteorological treatment either to this cyclone or on later events, yet this is important because this is till now considered as the most disastrous cyclone of last century in west Bengal coast. The introduction of weather satellites has improved the forecasting of tropical cyclones many times. But forecasting well in advance or about exact location of cyclone tracks are not yet possible. So the trend of the research in tropical cyclones of the time is to build forecasting models. Therefore meteorological work in that sense does not bother about impacts of tropical cyclones as was dealt in the previous studies like Piddington and his fellow researchers, although the ultimate objective of the present research is to relate forecasting to human societies.

1.4 TARGET SECTORS

Extreme natural events or commonly the natural hazards affect human society mainly crippling their economy. Tropical cyclone is a phenomenon which does not remain confined within a particular area of the coast. Therefore the whole east coast of India has been taken into consideration. Again, it is very difficult for a single researcher to study all types of impacts due to cyclone over such a large area within a short period of time. So two economic sectors dependent on coastal environment viz. fishing and tourism have been selected for giving special emphasis while studying impacts of the phenomena.
1.4.1 Fishing

The fishing economy is broadly divided into two as inland and sea-fishing. Sea-fishing specially is location specific. Fishing is a collective economic activity and it is an economic process which is prevailing both at its primitive stage as well as under the process of rapid mechanization. The character of sea-fishing can be considered as close to that of an industry because it involves quite a large number of workers and several steps starting from netting to its ultimate export which require industry-like vertical integration of process. But whatever may be the stage of mechanization and modernization in collection and storage, sea-fishing is always a primary extractive activity. Sea-fishing is now a common and growing economy in the coastal areas throughout the world. In the countries of developed economy like U.K. or Japan, sea-fishing continues to serve as one of the main basis of the country's economies (Guha & Chatteraj, 1980, pp.249-51). At present the trend has spread in other countries and in tropical cyclone prone areas also. The significant characteristics of fishing which attract all, is its collective attitude. Fishing is such an economy which has maintained its existence since man's primitive age to the present day though in varied forms depending on the characteristics of space and time and of the people involved. (Becht & Belzung, 1975, pp.135-36). Fishing seldom requires significant investment in that sense and even the poor may have the opportunities to practise fishing on a small scale. Notwithstanding, since fishing is regarded as primary activity due to its gathering character, fishermen can be considered as the producer groups in the human food chain. In tropical countries where general warm climate and poverty act as retarding factors for intake of animal protein, fishing specially sea-fishing provides a cheap and chief source of protein. Specificity of coastal location in case of sea-fishing, indulges every chance of being affected by the occurrences of tropical cyclones. Any adverse effect on this fishing must have a negative impact on the other secondary consumer groups of human ecosystem. So sea-fishing in which fishermen are forced to venture to the sea, has been chosen as a target sector to observe impacts of cyclones.
1.4.2 Tourism

As fishing is a location specific activity, tourism stands for specificity of time. Tourism has a positive correlation with the fair weather condition. Tourist centres may be on the hill, in forest, in historical places or on the coast. Unlike other places, tourist centres when are placed on tropical coasts, carry the risks of temporal losses during cyclones. On the other hand tourism is considered as an industry or is placed in an antipodal position of primary activity in the seral stages in the development of human civilization. Tourism industry basically depends on the urban people. So tourism and fishing stand in two different points from the human ecological viewpoint.

Thus tourism and fishing are activities at the two different poles of the axis of human development in terms of space or time specificity, proximity to or alienation from uncontrolled nature, nature of commodities and services produced and the workforce and clientele involved and also in terms of risk involvement. We must clear the methods of enquiry in solving our problems in the present research work.

1.5 METHODOLOGICAL ISSUES

The task of the researcher as implied by the objective of the research concerned, is to delve into the penetrating effects caused by the cyclonic phenomena on the society which are exposed to these. In order to have a comprehensive realization of the objective, the research has to be organized into some convenient working steps.

The first and foremost of these is to have a deep understanding of the phenomenon called cyclone. Cyclones are to be examined in the direction of whether these have any particular features of their own in the study area.
The second thing is to develop an acquaintance with the study area relating to its physical condition, the nature of population and their activities.

A thorough literature survey is a pre-requisite for understanding both the steps. The literatures relating to cyclones, cyclone as a physical phenomenon as well as hazard in social interpretation, and impacts of cyclones on fishing and tourism are the areas of particular interest in making a literature review for the present study. The review must progress starting from the epistemology of the problem to the particularity of the region.

From the literature review develops an approach which tends to highlight the effects of cyclones on society and the examination of physical character of cyclones becomes only incidental to the central thrust. As a consequence, the investigation into the negative impacts of cyclones becomes the principal responsibility of the methods. A question may be raised as to how the effects would be evaluated whether in terms of the measurable quantities, or in terms of the different types of afflictions. The fact is that the question of measurability or estimate building can never come first until and unless a total coverage of types of afflictions is obtained. Therefore emphasis is placed on the types of hazardous effects faced by people. In order to achieve this objective or to get a full coverage about the types of afflictions, it becomes inevitable to go through the past documents written in the form of reports since it is not always very easy to recall a recent past event unless these are recorded. Newspaper reports may also be considered as documents though every chance is there for exaggeration or under estimation of facts.

In the first phase of field observation, both individual and group interviews are held about the types of cyclone afflictions faced by them. From the first shot of field observations and interviews of affected people, an idea about further line of investigation for the second shot of survey develops. With an overview on the cyclone affected problems, our task is to reduce the problems in terms of specific economic activities, specific groups of people in specific areas and
in specific periods of the year also in consideration to specific events of the past. Two things are worth to note – one of them is related to space, while the other is associated with time. In case of space, we are moving from general to particular. Likewise, as time is considered, clarity reduces as we go backward into past. In terms of space, the eastern coast of India is taken as an area for a general discussion from where the emphasis is gradually shifted on to the West Bengal coast and later placed on specific study areas. Similarly the exactitude of data loses precision as we move from the present to the past. Notwithstanding equal amount of emphasis should be given on understanding the phenomenon as on understanding its effects.

In the second phase, cyclones are studied as natural phenomena in the study areas. To understand their nature or to reveal any pattern of these, cyclones are viewed from different angles which will also include characteristics of the cyclones under scrutiny. Emphasis is given on wind speed of the cyclones specially at the time of onset, distance from the coast where the stage of severity is reached, periodization of places of origin, places reaching the cyclonic stage, places reaching the severe cyclonic stage and also the places of hitting.

In order to examine these, maps become the primary tools showing the cyclones occurred in the past. Data are generated from the maps and systematically tabulated. Another tool is the reports with descriptions of cyclones in the past. The data generated from these reports cannot be expressed in tabular form. So the expression is textual. Maps of cyclones from their origin to dissipation are the tools having a different kind of expression.

In the third phase, we have to go to the field again, but this time with a structured questionnaire. The purpose of the interview is to gauge perception of the target groups in the field. The questions are simple, open-ended, but these are always directed towards the effects of cyclones on fishing and fishermen and in case of tourism, the questions are addressed to the persons connected with tourism industry. The statements which are evolved from
these, have been verified further with the help of other data such as the number of fishermen operating in each type of fishing vehicle in different modes of sea-fishing, number of tourists gathered annually or periodically. The data concerned have been collected mainly from fields and offices.

The approach taken by the researcher is human ecological. Here cyclone is considered as a causally related phenomenon in the environment of the people in the target sectors. Hence the concept of marginalisation and marginalised people, social justice (amount of return or remuneration against the capital of risk), concept of environment, social interpretation of hazard, human ecology and question of perception connect the objective and representation of the research. The primary objective of the research is to assess the impacts of cyclones. Therefore, the task of the researcher is to find out the parameters of the physical phenomena which are related to the social phenomena even if he or she is trained in the field of meteorology, climatology or environment or else. As for example, monsoon rainfall is not important, rather the amount of rainfall in the expected periods, variations in rainfall, particular places of rainfall are more important. A correct identification about the parameters of the physical phenomena bringing negative impacts on different aspects of the social phenomena is a pre-requisite since one of the objectives of the present research aims at hazards reduction. Prior to this, we must know the exact meaning of disaster reduction in the modern world. Any physical phenomenon becomes a disaster when it is related to the loss of life and property in the short term as well as in the long run. Therefore, disaster reduction means the reduction in the loss of life and property. At this juncture, the geographer’s viewpoint should be different from that of the geologists, meteorologists, botanists, zoologists or other streams in physical sciences and the view points of various social sciences like the economics, cultural and social anthropology, sociology etc. Physical sciences mainly emphasize the reasons behind the origin and development of the physical phenomena concerned and concentrate upon correct and advance forecasting of the occurrences. On the other hand, social sciences centre their interest on different aspects of social phenomena
experiencing disastrous consequences. Thus the work is different from other disciplines because here the problem is examined from a holistic viewpoint and everything must be proved scientifically with the help of data and other statistical or mathematical tools or logical statements. The whole problem has been arranged in the shape of a report, the contents of which help one understand the logic behind the arrangement of the theme of research.

1.6 DATA BASE

In consideration of the objective taken and the methodology followed in the research, we require three sets of information. (1) Data related to cyclones i.e. the place and nature, time of occurrences including their effects, (2) Details about the study areas – about physical as well as human environment, (3) Details about the impacts of cyclones at present on the sea-fishing and the activities associated with tourism.

For the first sector, data base may be divided into two (i) Old records in the form of newspapers and magazines, books, articles in journals and government reports, (ii) Reports and data on cyclones in the past prior to the formation of India Meteorological Department (IMD) and Atlas prepared by IMD.

For the second part, maps are the elementary source to know the physical environment. Toposheets are considered as the basic sources. In case of West Bengal coast, old toposheets and old maps prepared in the 19th and 20th centuries have been considered in order to investigate about changes in the physical environment due to cyclones or any other reasons. Satellite imageries also have been considered for this purpose. Cyclone reports in textual form are the source in this respect. Human environment including the economic practices are retrieved from census reports and other government reports. For the details and current information, field observation is the main data base.
The third component is the study of inflictions due to cyclones entirely based on field data. It has two facets – one is the geographer’s approach of field observation and its interpretation to understand the mode of human interaction with the habitats. The second involves perception surveys with the help of a structured questionnaire schedules, given in Appendices. Data collected from various offices are also supportive evidences. To evaluate the problems in the present research, chapters have been organized in the following manner.

1.7 CHAPTER ORGANISATON
The First Chapter is an introductory chapter. The chapter begins with objectives and theoretical and empirical relevance of the objectives. Basis for selection of study area and target groups are discussed and clarified. Methodological issues and data base have been focused in association with other introductory notes.

The Second Chapter introduces the east coast of India with special emphasis on the West Bengal coast. Cyclone, fishing and tourism related books, journals, records, reports etc, have been reviewed in the Third Chapter. This chapter also discusses some concepts to be used for the analysis of observations and findings.

There is a plethora of articles on defining the term 'cyclone'. The Fourth Chapter, therefore, deals with the scientific terminological problems and perceptive reality of 'cyclones'.

The Fifth Chapter concentrates on the selected parameters of cyclones in the east coast of India. The chapter gives emphasis on the behaviour of cyclones in the West Bengal coast.

The Sixth Chapter deals with the operational definition of the term 'impacts' and probable and realized impacts of cyclones in general.

From the Seventh Chapter we enter into the empirical investigation. Sea-fishing and impacts of cyclones on sea-fishing are discussed in details.
Similarly the *Eight Chapter* concentrates on the linkage between cyclones, beach-tourism and tourism based economic activities.

The *Ninth Chapter* is an abstract of previous four chapters with concluding remarks.

The *Tenth Chapter* is the final chapter which states the main theses.

### 1.8 CONCLUSION

With the help of the active and passive data, diagrams, charts and maps have been prepared. Photographs were taken to give a visual impression of empirical investigation. All documents and findings have been organized in a theses format.