CHAPTER THREE

LITERATURE REVIEW AND CONCEPTUAL BACKGROUND

3.0 LITERATURE REVIEW: INTRODUCTION

The present research problem is framed into a disaster study. Disaster may be taken as a combination of consequence of hazardous natural or social (man-made) phenomenon and environmental condition at the place of occurrence. For the natural, tropical cyclones and for the ‘social’ two different types of occupations, viz. fishing and tourism, as these are affected by the former in the coastal West Bengal, are the centres of interests. To that end, the present study develops a human ecological approach standing at the interface of the physical and the social aspects. Some old literatures describing cyclones in relation to their disastrous consequence in the study area or in other parts of India and Bangladesh (part of erstwhile Bengal) can be found. But most of these are either in the form of Government or newspaper reports and articles or as a part of autobiographies. There is rarely any study along the guideline followed in the present research which emphasizes not only the characteristic features of tropical cyclones in West Bengal as well as on the Bay of Bengal coast but examines two of the most important coastal economies also in the selected study area. Literature related to the present study are, for that reason, categorized in the following heads:

Literature related to:

(i) Cyclones as physical phenomena in the study area.
(ii) Cyclones as hazardous phenomena in the study area.
(iii) Fishing as affected by cyclones in the study area.
(iv) Tourism as affected by cyclones in the study area.

Literature relating to the theme of the research will be reviewed on the above points successively.
3.1 LITERATURE REVIEW ON THE CHARACTERISTICS OF CYCLONES IN THE BAY OF BENGAL.

It is truism to mention the name of Henry Piddington first while revealing the characteristics of cyclones in the study area. Henry Piddington is the pioneer in cyclone research in the Bay of Bengal and Arabian Sea and also in the China Sea though Colonel Capper (1801, cited in Piddington, 1851, p.2) did a few investigations in the 18th century with a little outcome. Colonel James Capper, an employee in the East India Company published his work in 1801 on winds and monsoons. He mainly worked on some hurricanes which hit the coromandel coast. Colonel Reid was interested and busy in finding out the physics and mechanism of cyclones in the tropical latitudes following his employment to reestablish the buildings destroyed in the cyclones in the Barbadoes, discussed and mentioned Capper's writings in his book (Reid, 1841, pp. 284-93). Two cyclones were mainly investigated by Capper—one in Pondicherry in 1760 and another in Madras in 1773. Capper was mainly engaged with the whirling nature of cyclones.

We are also to mention the name of Robert Orme who in his History of the British Nation in Indostan (1763), recorded a good number of cyclones in the Bay of Bengal whether they hit or not the southern coast of Coromandel or other southern parts on the eastern coast of India during the period of 1746 to 1755. His note about the reverse currents of winds due to monsoon and also the seasonality of cyclones may be regarded much as the work of a man of other fields. In consideration of the period of initiation, India may well deserve its position as contemporaneous to the countries in other parts of the world.

In India it was associated with the beginning and execution of a detailed and thorough-going research on the cyclones originating in and travelling through the Bay of Bengal, Arabian and China seas by Piddington. His twenty-five memoirs on 'Law of Storms' (Piddington, 1839-1859) are important contributions not only in India, but also in the world history of cyclone research.
He is also credited internationally for the first hand-book for the sailors The Sailor’s Hornbook (Piddington, 1851). In this book, he made a detailed and analytical discussion on Indian Cyclones regarding (i) place of origin, (ii) most probable storm tracks, (iii) rate of travelling on different tracks, (iv) stationary as well as contemporary cyclones, (v) size of cyclones etc., in addition to his effective contributions on defining different terms associated with cyclone and more specifically introducing the term ‘cyclone’ with justified explanations and thoughtful analysis and attempt for generalizations about the origin and mechanism of cyclones. All these ordinarily related to the physical characteristics of the phenomenon were directed to understand in particular the location and movement of cyclones in favour of the international trade routes on the oceans. Though the shipping hazards were at the centre of research (since these generated interest amongst the people connected to marine trade and also those who had little training in meteorology as such), other associated criteria creating coastal hazards were not overlooked by Piddington. Consequently, the parameters like storm-wave, storm current, inundation by storm wave, size of the central place or lull, electricity and earthquakes along with swell at great distances or across seas experienced in cyclones were evaluated in his discussion. It must be mentioned in this connection that West Bengal coast was not given any special emphasis, rather it received attention like other parts of the Indian coast when cyclones made inroads with disastrous consequences. Only the first (1839) seventh (1842), eighteenth (1849), twentieth (1852) and twenty-fourth (1856) memoires are on Bengal cyclones of which the eighteenth is on Chittagong (now in Bangladesh) cyclone. With the meteorological readings on barometer, sympiosometer and thermometer and details about wind direction and wind velocity, Piddington indentified the probable tracks followed by these cyclones. He was inspired by the works of Colonel Reid of London on the Law of Storms, which appeared in the Calcutta Papers and Edinburgh Review (Piddington, 1839 p. 559). In his The Sailor’s Hornbook, Piddington produced a map showing the most probable storm tracks which were followed by the cyclones in the Indian Seas.
during 1839-1859. It is the first map of cyclones in India. Thus it was he who initiated scientific and systematic research on Indian cyclones.

3.1.1 HENRY PIDDINGTON

In Piddington’s descriptions, “strong gust of wind” “with uncommon heavy rain” were felt at Kedgereee i.e. present day Khejuri on the 5th to the 7th June, 1839. Though it was a high speed wind, yet it did not always reach the coast and it was not as disastrous as the May cyclone of 1833 (Piddington, 1839, pp. 630-50). The seventh memoir describes a tremendous hurricane affecting again Khejuri on the 3rd and the 4th June of 1842. This cyclone travelled up to Dinajpur, Purulia, Munger and Purulia (Piddington, 1842, pp. 971-1094).

April Cyclone of 1850 in between 23rd to 28th affected Medinipur hitting at Digha in “Beercool Pargunnah” Division. It originated near the Nicobar Islands and travelled upto Mushidabad covering a distance of about thousand miles (Piddington, 1852, pp. 13-61 & 195-207). The cyclone of 14th–15th May, 1852 followed from Madras before hitting the Sundarban (Piddington, 1856, pp. 397-461).

Different Parameters like rise of temperature, fall of pressure, wind direction and speed, sea conditions etc., were observed by different ships in as much detail as possible in the midst of cyclonic situations and with low quality technical equipments for data recording. On land he mainly depended on empirical observations for wind direction and speed along with instrumental recordings taken in some other administrative centres. But with insufficient data he analysed each phenomenon very carefully to understand their nature and preserved those data both in tabular and textual forms.

Piddington was concerned also about the nature and causes of storm waves. In a letter issued to the Governor General of India, he made an elaborate discussion on some points about the causes related to the height and extent of storm waves. These, in brief, are the followings: (i) friction of land, (ii) rising
of land, (iii) release of pressure from ‘other waters’ and its spread to right and left, (iv) height of storm wave determined by track of cyclone (Piddington, 1853, p.15). Piddington, nevertheless, made a valuable statement about the pattern of frequency of cyclones that it might come within five years or at the gap of twenty years or could come in coming October. He also pointed out the irregular occurrence of severe cyclones which was also supported by his followers like Blanford or Eliot (Piddington, 1853; p.16). In later years Ponandikar (1926, p.16) believed the same about infrequent occurrence of greater storm waves in the years of 1822, 1854 and 1876.

3.1.2 GASTRELL AND BLanford
Gastrell and Blanford are the next to revive the trend of cyclone research by Piddington after some years of gap due to his death. The names of Gastrell and Blanford deserve special attention by a detailed coverage of the October cyclone of 1864 in Calcutta (Gastrell and Blanford, 1866). They admitted that they were not in a position to generalize on any aspect of cyclone characteristics due to poor and unsatisfactory data in hand. In fact they had much hesitations and apprehensions to formulate any theory.

Yet they made some important attempts to find out certain characteristics of the Bay of Bengal cyclones, such as periodicity, place of origin and relations between originating place and tracks followed by the cyclones. It is to be said that most of the statements made by them till now are the accepted facts and also have little difference with the findings of the present research. They also marked certain circumstances which they observed as usually essential for or related to the cyclone generation.

Objective of their study was to identify the pre-conditions for the formation of cyclones so that the generating and incoming cyclones can be identified before their formation or reaching the coast. It is worth mentioning in this connection that twin cyclone disasters in 1864, one in October in Bengal and another in November in Andhra Pradesh brought a realization in the administrative
sector for the establishment of an independent department which can administer meteorological investigation themselves and facilitate advance forecasting of phenomena like cyclones to reduce the damage and destruction on the coast. Gastrell and Blanford made a detailed survey on temperature and wind direction at different places occurred in the 1864 cyclone commencing from the formation of the phenomenon through its progress and up to the dissipating stage. A separate account produced in the report on storm waves as an associated cyclone parameter deserves special attention. They explained the causes of storm waves and collected data on height of storm waves above embankment or the ground surface at different places. Blanford carried on meteorological investigation into various aspects in the capacity of the Meteorological Registrar after the India Meteorological Department was established in 1875. On October 25, 1886 Blanford issued a note from Simla about the occurrences and characteristics (intensity, trajectory and place of hitting) of cyclones of the Bay of Bengal. The information was placed in the form of a monthly list of cyclones. Also, a note furnished as an advertisement to the publication of "Weather charts of the Bay of Bengal and adjacent sea north of the Equator" (Blanford, 1866), was the first of their kind in India.

3.1.3 THE 1864 CYCLONE
The 1864 cyclone which could easily be referred to as the disaster of the century, received attention from various corners, both Government and non-Government. Lieutenant colonel J.P. Beadle who was the Chief Engineer, Bengal to the Secretary to the Government of Bengal at that time, prepared a note not only on the progress of cyclones at different places of coastal West Bengal, but also prepared a comparative discussion on different theories of cyclone characteristics by Maury, Alexander Thom, and of course Piddington taking this cyclone as an object for investigation. This report was published in the Calcutta Gazette (Calcutta Gazette, 1864 No. 31 pp. 366-68). First, he examined the general patterns of the whirling motion of wind in cyclonic circulation and then concentrated on specific cyclones regarding their origin and track, passing of lull through different places at different times along with
dissipation. Hunter acknowledged “Official documents published in 1866” and “the Bengal Administration Report for 1864-65” (1876, p.220) for preparing his account on the 1864 cyclone. He also described the phenomenon with its origin and track almost in a similar manner as did Blanford in his report.

3.1.4 JOHN ELIOT

John Eliot succeeded both Blanford and Piddington in conducting meteorological observation on cyclonic events. Eliot worked as Meteorological Registrar in the India Meteorological Department after Blandford. Like Piddington he also prepared maps showing the tracks of cyclones. His Atlas is the first cyclone Atlas in India. Eliot studied three cyclones in detail—one in Medinipur in 1874, one in Bakharganj in 1876 and another in Madras (present Chennai) in 1877. He investigated mainly the causes of origin and the tracks followed by cyclones.

Eliot critically examined various theories connected with the origin of cyclones. He, however, supported the theories of Meldrum (Mauritius) and Reverend W. Clement Lay which held rainfall as a guiding factor of cyclone. Apparently he was against Dr. Hann’s theory in which sunspot cycle was taken as the cause of occurrence and frequency of cyclones. Later on, he himself connected rainfall to sunspot cycle and cyclonic phenomena. But yet he was apprehensive of accepting the rainfall related cause due to the apparent absence of cyclones during the monsoon. Nevertheless, ultimately he was able to identify numerous monsoon depressions as cyclonic phenomena. He came to a definite conclusion that cyclones during the monsoon occur in frequent number but with low intensity and differ from those which are occasional but much severe in occurrence during the periods of change from monsoon to non-monsoon season and from non-monsoon to monsoon. Eliot was partially successful in finding out the factors determining cyclone paths and in identifying the preconditions for cyclone generation. Nevertheless, he has done a lot in advanced research on different aspects of cyclones of the Bay
of Bengal. He enlisted fifteen points on different characteristics of cyclones, most of which are still proved valid. He rightly observed that there is a (i) relationship between periodicity and intensity of cyclones and periodicity and place of origin of cyclones (ii) October cyclones are more intense and extensive, (iii) cyclones of April and October form in the south Bay of Bengal and proceed towards the Coromandel Coast, (iv) cyclones of late April and the greater part of October usually originate in the east central part of the Bay of Bengal near the Andaman Sea and hit Andhra Pradesh, Orissa or Bengal (West Bengal and Bangladesh), (v) intense cyclones occur at the period of minimum sun-spot frequency, (vi) at least one cyclone must originate in the minimum sun-spot period, (vii) the progress of cyclone is determined by antecedent conditions over the sea, (viii) place of hitting can be guessed from low barometric pressure of the region in comparison to surrounding areas on the coast, (ix) cyclones at sea advance more or less in a straight line, (x) cyclone tracks in pre-and-post monsoon seasons are almost similar, (xi) the intensity is confined to the lower strata, plane of saturation does not take a great height, (xii) essential conditions for cyclone formation are (a) uniform pressure over a large area, (b) light variable winds over the central area of the Bay, (c) normally no rainfall occurs for some time previous to the cyclone formation, (xiii) winds in cyclonic circulation is converging type and lines of air movement form a spiral. Elliot analysed a south-west monsoon storm occurring from 18th to 24th September 1878 from different angles to reveal the characteristics of south-west monsoon storms and the memoir was published under the direction of Blanford (Blanford, 1882).

Elliot further advanced the study by investigating and analysing particular characteristics of cyclones of the Bay of Bengal distributed over time. In previous research he identified the months of occurrence of cyclonic phenomena. Therefore, he started with the month of April. He considered the cyclones investigated and recorded by Piddington, Blanford and by himself. Thus he tried to understand the specific and changing characteristics of
cyclones in different months with respect to their places of origin, most probable tracks along with the place of hitting. Eliot, however, gave his opinion that there is least chance of the Bengal coast to be affected by cyclones in the months of April and May although the months of May and October were identified as the months of strong and severe cyclones originating in the Bay of Bengal. Further, October cyclones were found to be irregular in their movement and might hit any place on the coast. December to March were taken as cyclone-free months.

Eliot also made a comparative study on the cyclone of Medinipur in 1851 and in Madras (present Chennai) in 1877, regarding their places of origin, tracks followed, acquired antecedent conditions and other meteorological characteristics. Eliot prepared another handbook for the sailors. It certainly carried more information for the sailors in the sea as well as for detecting characteristic features of Bay of Bengal cyclones more clearly. He not only identified different months of the year with significant characteristics about frequency and intensity of cyclones, places of origin, tracks of cyclones, places most likely to be hit by cyclones in different months, but also found out the destructive effect of the phenomenon in its course dividing it into four quadrants. Many instructions are there in his hand-book as to how to detect and avoid cyclones in the midst of the sea by investigating the appearances and paths of movement along with understanding the nature of cyclones and the fearful quadrants. He also pointed out the question of recurvature and observed that northward moving cyclones in the months of May, October and November had the highest probability to recurve inevitably to the east. Eliot critically examined the place of origin, tracks along with other meteorological phenomena on a south-west monsoon storm and three Bay of Bengal and Arabian Sea cyclones specially the Port Blair cyclone in November, 1891.
Eliot put information on the map of Bay of Bengal (divided into grids) about places of origin and tracks of cyclones in different cyclone months of May, June, September, October and November for different periods of 1877-‘87, 1882-‘99, 1888-‘99 etc., and produced valuable plates. He also drew graphs on barometric pressure on the October (4th to 6th) cyclone of 1864 in Midnapur, October (14th to 16th) cyclone of 1874 in Midnapur and September (21st to 22nd) cyclone in 1885 in False point. In the cyclone memoir published in 1893, he prepared twenty five plates producing pressure distribution and departure from the normal cyclone tracks and also weather chart of India and the adjacent region. Eliot’s contribution to cyclone research is much valuable since it advanced the work a great deal in the right direction.

Both Blanford and Eliot made separate attempts to distinguish between the cyclones in the pre-monsoon and post-monsoon seasons and those of the monsoon period by using different nomenclature. Cyclones of the transition period were named as ‘cyclones’ by Blanford and ‘large’ storms by Eliot indicating high velocity and of disastrous nature. The monsoon cyclones, on the contrary, were referred to as ‘cyclonic storms’ and ‘small’ storms respectively with a meaning of low intensity storms. (Blanford, 1889, pp. 84-88).

3.1.5 BALFOUR

Balfour (1976, pp. 866-68) accounts a brief history of cyclone research all over the world. He mentioned the name of Redfield and Espy of America, Dr. Thorn of Mauritius, Colonel Capper, Messrs Bousquet, Hare, Dove, Colonel Reid, Piddington of Calcutta, Professor Taylor, Sir John Herschel, Blanford of Calcutta, Meldrum of Mauritius, Willson, George Buist, Fergusson, Franklin and Gastrell of Calcutta with their respective contributions.
3.1.6 OTHERS IN OLD ACCOUNTS

W.G. Willson searched for the antecedent weather conditions previous to the formation of the storm during 28th June and 1st July, 1872 (Willson, 1872). S.A. Hill in an article in Meteorological Memoirs (1876-1881) accounted for a general discussion on all types of storms in Bengal. He compared local disturbances in Allahabad to that in Bengal. Hill also considered a cyclonic activity near Vishakhapatnam as comparable to that of the Bengal cyclones (Blanford, 1881). Hill was the Meteorological Reporter of the North West Province and while he had been informing J. Eliot, the memoir was published under the direction of Blanford.

The Imperial Gazetteer of India (vol. 1, Descriptive 1907, pp. 134-43) describes October cyclones as “most intense tropical storms” (1907, vol. 1, pp. 134-143) usually of smaller extent, being not more than 200 miles in diameter. The diameter of the ‘eye’ is 10 to 20 or 30 miles. These storms are reportedly accompanied by storm waves to such an extent as to inundate the coastal lands “even 30’ above tidal high water level” (Imp. Gaz. Ind. Vol. 1, 1907, p. 135).

The frequency of disastrous cyclones as mentioned in the Gazetteer (p. 135) is not more than one on average in a span of five years. But the annual average number of storms with moderate to considerable intensity during the period from June to September which mostly traverse the Northern India is eight. Incessant rainfall is an invariable attribute of these cyclones. The cyclones in late October and November-December mostly move towards the Circars and Coromandel coasts are a definite source of early winter rainfall in the Deccan and the Madras coast. India Meteorological Department published a book in the pre-independence India in 1942 on Winds, weather and currents on the coasts of India and the Laws of Storms for Indian seamen to study the storm laws, prevailing winds, weather and currents in Indian Waters. (Normand, 1942, Preface). Though the emphasis was on understanding the different characteristics of Indian cyclones yet effort was given also to realise the fundamental climatological features of the Indian seas and coasts. Attention
was given mainly to safeguard the ships in the ocean and along the coast. Collection of synoptic meteorological data, broadcasting wireless weather information, elaborating visual storm warning signals added by an alphabetical glossary of meteorological terms are some of the important features of this book (India Meteorological Department, 1942). A severe storm which hit Sagar Island between 22\textsuperscript{nd} and 27\textsuperscript{th} May, 1936 was discussed with place of origin, trajectory and associated atmospheric conditions.

3.1.7 CONTRIBUTION OF THE LATER HALF OF THE 20TH CENTURY
Rai Sircar (1958) made a valuable work on the monthwise formation, movement and dissipation of cyclones and depressions and their distribution per one degree graticules in the Bay of Bengal for 1890-1950. The study shows a close relationship between places of origin and tracks followed especially during the pre-monsoon and post-monsoon periods. Sircar undertook an important task of probability test of cyclones in connection to hitting place and the place of origin in different seasons.

Fred Chambers investigated the relationships between sun spot cycles and the recurrences of cyclones (1881, PP. 73-78). Rao, Director General of Observations in the World Meteorological Organisation (WMO) placed the article of Chambers in the Marine Climatological Summaries, Vol. 1, 1961 (1976). He himself emphasized that India was one of the nine countries to have the responsibility to collect and process the meteorological data which were standardised under WMO’s Voluntary Observing Float (VOF) Scheme.

3.1.8 ROLE OF INDIA METEOROLOGICAL DEPARTMENT (IMD)
India Meteorological Department had been carrying on various types of investigations on cyclones and also continuing publications of memoirs or scientific notes. In 1931, a scientific note was published on the work of Raghunathan and Banerjee (IMD 1931). Two pre-monsoon storms – one in May, 10-15 and another in June, 1-5 1929 were the subjects of enquiry. In this study, the authors supported the frontal theory as the causes of cyclones in the
tropical region too, types of fronts differing with change of seasons. In the pre­
monsoon season, warm dry air spreads over cold moist air whereas in the post­
monsoon season, warm moist air ascends over cold dry air.

Pramanik, Sengupta and Chakrabarty (IMD, 1948, pp. 59-74) dealt with the
relationship between microseism and different types of storms. It was revealed
in the discussion that the gusty wind, monsoon wind – both in the Arabian Sea
and in the Bay of Bengal and land depressions or even the land and sea
breezes might generate or not microseisms of varying types in the coastal
situation.

After independence IMD began to publish the Indian Journal of Meteorology
and Geophysics (IJMG) from January 1950 on a quarterly basis. The particular
paper published in this journal which worths mention is that of N.C. Rai Sircar
(1956. Vol 7, No. 2 pp. 157-60). It is the continuation of his previous work,
published in the scientific notes of the Meteorological memoir. On the basis of
the same data and same types of analysis, he came forward with some concrete
statements about the characteristics of the Bay of Bengal cyclones. Out of 793
cyclones of all intensity levels in 61 years period, he identified eight monsoon
and seven post-monsoon seasons when no cyclonic storm was developed. The
maximum frequency of disturbances and cyclones in a single month was
found to be five and three respectively though such frequency was rare in
occurrence. The probability of at least one disturbance in the months of July,
August, September and October was about .9 or 1.0 while the chance of three
disturbances to occur in the same period was .3 or .4. The probability of at
least one cyclonic storm in October or November was about .6 and of at least 3
such storms was only .03. Rai Sircar estimated the annual average frequency of
all types of storms in the Bay of Bengal at thirteen while the actual number
varies from eight as minimum in 1910 to highest at eighteen in 1908. He
observed that areas of occurrence of cyclones were fixed in the southern part
of the sea in the winter months, gradually progressing northwards in the pre-
monsoon months and restricted in the northern part during the monsoon season. October cyclones were detected as of erratic nature in finding its track and the hitting place as well. He supplemented the fact with suitable data. Both the places of origin and dissipation in different months were studied carefully and plotted in 1° or 2° latitude-longitude squares and isolines were "drawn to locate the areas having different susceptibility to depression or storm formation". Rai Sivar accounted for specific latitude-longitude squares for the originating zones of cyclones in the months of May and November (detected as disastrous ones) and worked out the percentages of their most probable direction to hit different coastal areas of the Bay of Bengal. He calculated the risks for different points in the Eastern coast of India in different months. For Calcutta it was zero during January to April as minimum and five during July as maximum. Characteristics of Bay of Bengal cyclones were studied separately by Ganeshan et al. (1994. pp. 235-42) and Landsberg (1981, PP. 257-80). The study of former was aimed at reducing cyclone disaster. To that end, Ganeshan et al. carried out a probability test for the originating place and frequency of pre and post monsoon cyclones on one degree latitude-longitude squares. Emphasis was on the cyclones of these two transition periods as these were considered the most disastrous in nature and at the same time much irregular in occurrence. In order to assess the latitudinal variation in terms of place of origin, Bay of Bengal was divided into 5° Longitudinal sectors for the convenience of study.

Landsberg was editor-in-chief of the book entitled World Survey of Climatology. Monthwise distribution of cyclones and severe cyclone including the respective latitude-longitude of their origin, striking the coast along with the recurvature were shown in a table for the period of seventy years from 1891 to 1960 both in the Bay of Bengal and Arabian Sea. K.N. Rao (1981. pp. 257-80) accounted for the variability of storms and depression in the Bay of Bengal based on monthly and annual occurrence of cyclones from 1890 to 1969. Gupta and Chand (1994, pp. 115-20) examined realtionship of perturbations in upper tropospheric easterlies with the formation of Bay
cyclones. Rao and Rao discussed occurrence and variability of rainfall on the Eastern Ghats of Andhra Pradesh not only by cyclonic disturbances in Andhra Pradesh alone, but also due to rainfall in south Orissa and North Tamil Nadu coast.

The Indian Journal of Meteorology and Geophysics began to be published later on as Mausam. Apart from a few, most of the Indian papers on cyclones were mainly the recordings of spatio-temporal distribution of different types of cyclones and depressions on land and sea in India along with meteorological data on a few parameters.

S.K. Ghosh, the Director in Regional Meteorological Centre, Alipur, published a paper in the journal of Geographical Review of India on new methods of cyclone tracking and storm warning. That aircraft reconnaissance survey is the most reliable and effective method in both cyclone tracking and warning, has been categorically stated both by Ghosh (1975, pp. 207-209) and a WMO Bulletin (1975, pp. 147-53). Koteswaram (1971, pp. 84-95) examines cyclone warning system in India and abroad in the light of its disastrous consequence like the former two. He also emphasized the importance of reconnaissance aircraft, radar and meteorological satellite in detecting the position and probable track of cyclone and making a prognostication.

Trend of research in later period has been changed. It relates to various associated factors of cyclones. In order to have an idea about the changing research trend in IMD since independence, some papers published in the IJMG and Mausam are given. First the papers published in the IJMG are such:

1) “An analysis of the Masulipattam Cyclone of October 1949” (Sen and George, 1952, p. 264); 2) “Variation of cyclonic circulation with height in September, 1951 deep depression” (Srinivasan, 1953, p. 263); 3) “Thermal thickness patterns and tropical storms” (George, 1953, p. 279); 4) “On the

The following articles were published in the journal of Mausam.


Journal of Applied Meteorology published by the American Meteorological Society is rather different on many counts from the Indian Journals in terms of the depth and variety of subject matter. Most papers are on forecasting technology either formulating new theory with the help of statistical technique or relating to efficiency of instruments. Cyclones in relation to other atmospheric phenomena e.g. ozone layer and temperature variations in cyclone field are manifest in a different form. At last, the social impact of cyclones and hazards rendered by storms constitute other topics.

Bulletins from World Meteorological Organisation also provide the records of different types of climatic events all over the world. Books published outside India consider the more fundamental topics such as relationship between tropical cyclones and sea surface temperature (SST) (Pittock and Flather, 1993
Ranjit Singh of Pune Meteorological Office examined the evolution of cyclonic storms in the monsoon field over Indian region (1989, pp.9-17). Director of the India Publications Division published a report on characteristic features of cyclones in the Bay of Bengal titled as Cyclones. How to guard against them (1963, PP.1-23). Menon (1989) and Ramaswamy (1984) worked separately on the characteristics of cyclones in the Bay of Bengal. Ramasastry’s work was on the line of Eliot and Rai Sircar. It would be unjust not to mention the Atlas prepared by the IMD. The Atlas shows month-wise tracks of cyclones on five degree squares from the year 1877-1970 and also reveal month-wise distribution of place of origin, wind speed along with dissipation in each/eight degree square. In another work IMD traced cyclone tracks for the period from 1971 to 1990. The discussion so far encompasses the published materials relating to only the physical aspects of cyclones. The next discussion is, nevertheless, concentrated on literature that take cyclones from social point of view or consider them as the agents indulging hazards to the society. Noticeably, some literatures are there which deal with cyclones both as natural as well as hazardous phenomena. Such literature will come inevitably in the next section.

3.2 LITERATURE RELATED TO CYCLONES AS HAZARDOUS PHENOMENA.

The October cyclone of 1737 in Calcutta is the first record of cyclone hazard for the entire eastern coast of India. It was reported first in Gentleman’s Magazine in June 1738. Later the report was quoted by Piddington (1853, P.11) in his letter to James Andrew, the Governor General of India in 1853 about storm waves. The report was a very short one considering only the loss in Calcutta especially on and along the River Ganges. Shipping hazards were described in detail including an account of loss of life. Piddington, after a period of more than hundred years, verified the height of storm wave in a French chart of 1740, compiled by order of M. de Maurepas, Calcutta (1853, p.11). Considering the height of storm wave he ended up with a concluding remark that a devastating situation might engulf the whole coastal territories at
least upto Diamond Harbour and Falta and he felt for the poor coastal inhabitants. Both the cyclones of June 1822 and '24 affected undivided Bengal at Barisal, Bakhargunj and Chattogram which are now in Bangladesh.

The next cyclone on record after a gap of 70 years is reported to have affected the port of Khejuri in Medinipur with a devastating consequence on March 10, 1807. India Gazettee of the time focussed hazards in Khejuri, Sagar Island and ships on the way as quoted by Karan (1927, p.24). The May cyclone of 1823 inundated the coastal territory of Medinipur upto 6 to 7 miles inland following a collapse of embankment by accompanying storm surge. Destruction was on all counts, e.g. damage of the port of Khejuri, loss of records in the Collector's Court at Kanthi (Contai), loss in agriculture for that year added by loss in productivity for the following years due to saline ingress and loss of life in agricultural communities due to sickness after the cyclone. Hunter was surprised to note that no steps were initiated for remission or suspension of revenue though an assessment of loss was made by the Government (Karan, 1927, pp.24-25; Reaks, 1908, pp.245-52; Hunter 1876 p.117). Remission of revenue to the extent of Rs.85,678 was granted due to loss of paddy by the May 1831 cyclone in Medinipur. Embankments were washed away again by 1831 cyclone (Hunter,1876,p.117; O'Malley, 1911 p.93; Karan,1927, p.25).

Balfour (1976, p.867) without mentioning the month or period of the 1831 cyclone, reported the loss of life of 11,000 people of 300 villages around Calcutta. The Englishman’s Overland Mail from Calcutta gives a detailed description of the 1831 cyclone quoting Princep of Sagar Island (15th October, 1864). The October cyclone dated 7th in 1832 repeated the destruction of ripening crops and revenue was exempted to the tune of Rs. 84,691. Storm surges overtopped the 15 ft. high embankment (O’Malley, 1911 P.93; Hunter p.117; The Englishman, 1864). In Blanford’s account the 1832 cyclones were reported to have occurred twice in the months of May and August (Blanford, 1877).
A pre-monsoon cyclone in the month of May caused considerable damage both in Medinipur and Twenty four Parganas Districts in 1853. Piddington in his letter to the Governor General of India mentioned the height of storm waves in different places of the district (1853. pp.17-20). The market in Khejuri was washed away and settlement process in Sagar Island received a set-back with loss of more than 3000 people. Referring to Hurkaru(a newspaper) Piddington stated that the storm surges reached Calcutta and its surroundings including Dum Dum road. (Piddington 1853. p.17; Reaks. 190 pp.245-52; Hunter 1876 p.117; O'Malley. 1911 p.93; Mitra. A, 1954, Appendix iv(a) P.Cviii; Nash. 1976 pp.744-63). These three successive years of cyclones were followed by 1842 cyclone at an interval of nine years. When Piddington started his research in 1839. it was the first Calcutta cyclone. he had for his work. It was a monsoon cyclone which occurred on the 5th June. No damage was done but it brought torrential rains for a couple of days. Settling the Sagar Island got a blow again. (Englishman’s Overland Mail, 15th October, 1864; Blanford, 1877; Mitra A, 1954 Appendix iv(a) p. Cl. viii; Piddington, 1842 pp.971-1094).

The October cyclone of 1848 is another event which retarded the progress of settlement in Sagar Island (Pargiter, 1870 pp.110-11,116-18). But its effect was not felt beyond Sagar Island or Khejuri as investigated by Piddington (1849, pp.826-57, 869-918; O’Malley, 1911, p.95). The cyclone hit the Orissa coast before coming to Bengal. Blanford, therefore, referred to it as a cyclone of Orissa in his list (1877). But Hunter in his statistical account of Midnapur (1876) recorded remission and suspension of revenue due to the damage of crop by the cyclone of 1848. Medinipur coast was once again affected by a pre-monsoon cyclone in April, 1850 (O’Malley, 1911, p.95). Piddington kept a detailed account of this storm in his Twentieth Memoir about law of storms (1852,pp.13-61, 195-207). Various direct experiences collected and quoted by him reveal the type of afflictions in the entire coast from Digha in the west to
Khejuri in the east. Effects on landslides, height of storm waves, breaching of embankments, damages to houses and roads, loss of cattle, loss of crops—all were noted carefully along with the physical parameters of the cyclone. Notwithstanding, Hunter described loss of crops only in case of indigo and stated that no remission of revenue was required since there was no paddy in the field at the time of cyclone. Apart from O'Malley’s mention of the year of 1851 as a cyclone year in Medinipur, Piddington had no account of this. It is in any way a mistake on the part of the former mentioning 1851 instead of 1852, because Piddington’s investigation on Sundarban cyclone of May 14-15 in 1852 was not recognized by O’Malley. Being a researcher, Piddington took keen interest in finding out the track of the cyclone. He described severe nature of the cyclone in Sundarban where it demolished and destroyed everything in its path whether it is a house even a brick-built one or ship on the river, crops and cattle in the field and human lives. He remarked that sudden rise of water (perhaps he meant storm surges) in all the rivers caused such havoc. He also elaborated damage and destruction of buildings, loss of cattle, uprooting of trees and moorings, breakage and overturning of country boats and ships on the Hooghly in Calcutta (1856 pp.397-461). Settlement process in Sagar Island was affected by this cyclone like the earlier ones (Mitra, A, 1954 P.C.I. viii).

The year 1864 is remarkable in cyclone history in India for its disastrous consequences. It was the severest cyclone of the century, Sagar Island was cut into two in its northern part by the storm wave during this cyclone (Gastrell, 1866 p.38). The Island of Ghoramara, situated in the north of Sagar Island was a part of it before the 1864 cyclone on October 5.

The untiring effort to settle the Sagar Island since the beginning of the century was repeatedly interrupted by cyclonic invasions. Commencement of settling the island of Sagar, almost came to a halt with the cyclone of 1864. The port Khejuri in the opposite bank of the Hugli had a similar fate. Changes in the
mid-channel flow of the river offered no chance for re-emergence of port facilities here giving a death blow to the English settlement, Post Office etc. (Abdul Ali 1934 p.5-11, Karan, 1927 p.24 -25 ; Reaks 1908 pp.245-52). The entire area up to Diamond Harbour, Kulpi in South Twentyfour Parganas district and Tamluk, Mahisadal in Medinipur and the places beyond Uluberia were engulfed in storm surges. The interior areas were flooded by rise of waters in coastal rivers and canals. In almost all the places embankments were overtopped by flood waters (Gastrell and Blanford, 1866). Gastrell and Blanford (1866) have given an elaborate description of storm waves with spatial extent and corresponding heights.

The cyclone not only destroyed the crops of that year, but also adversely affected the produces of the subsequent years due to saline invasion in the agricultural fields. (Gastrell & Blanford, 1866; Hunter,1875 .1876; O’Malley, 1911). Loss of cattle, birds, uprooting of trees, damage and destruction of huts and buildings, breaching of embankments, destruction of ships etc. brought life in despair at least for a fortnight. The friend of India, a newspaper from Calcutta described the hazardous situation in and around Calcutta. William Carey’s garden in Srirampur in Hooghly enriched with rare and beautiful species of trees was left with a few stumps. (The friend of India, 1864 October 6 p.1115-Front p. cols. 1-2). Loss of human lives over a period long after the cyclone due to sickness or starvation was equal or might outnumber the death caused during or immediately after the event. (Gastrell & Blanford, 1866; Hunter, 1875,1876; O’Malley, 1911 p.96). The 1864 cyclone was studied both by official and unofficial personnel and the record covers both physical and social aspects of cyclone hazards. J.P. Beadle, who was the chief engineer to the Government of Bengal was a pioneer in this regard. His reports were published in the Calcutta Gazette as Official papers on November 9, 1864 at pages 366-68 and on November 30, 1864 at pages 369-94. The Friend of India dated the 6th, the 13th, the 20th and the 27th of October 1864 published weekly reports mainly on hazards rendered by the cyclone. A table was produced showing low pressure conditions at different times during the storm but
without mentioning the place of occurrence. Various first hand narratives were gleaned from affected areas such as Diamond Harbour, Moyapur, Srirampur to publish them in the weekly newspaper. Advertisement for cyclone relief fund was possibly the first publication that reflects also a general awareness of the occurrence of such a devastating situation. Gastrell and Blanford (1866) observed the phenomenon from all corners. Hunter (1875,1876) and O’Malley (1911 pp.95-97) also had special accounts on the event. A Mitra (1954 p. C1 viii), Kuran (1927 p.28), Reaks mentioned the 1864 cyclone specially as a devastating one. Abdul Ali (1934. pp.5-11) in a research paper. Shastri (1979. p.406) in a historical essay. Sen (1959, p.409) in his autobiographical writings mentioned the October cyclone of 1864 while describing a disastrous event or situation. In the same year, another severe cyclone visited Andhra in November. The necessity for early forecasting of such disastrous phenomena was felt by the common people as well as the government and those who worked in this regard for the own interest and gained some sort of expertise. Later on the government realised the need for daily meteorological observation. To that end, India Meteorological Department was set up in 1875 appointing Blanford as the first Meteorological Reporter to the Government of India (IMD 1976. pp.19-24).

Sen (1959, p.409) in his autobiography mentioned five consecutive cyclones 1864, 1866, 1868, 1869 and 1876. Of these the latter two occurred in present Bangladesh. O’Malley, however considered the 1867 cyclone as the next devastating one after 1864. Blanford’s list (1877) may however be taken as authentic, since he himself was a researcher on cyclone. Considering his report, the next cyclone in Bengal passed east of Calcutta over Port Canning from October 27 to November 2 in 1867. Respective dates of occurrence, however, differ in O’Malley’s report being the 15th-16th October of the year. But again Blanford is to be taken as correct since he himself worked on this where as O’Malley only collected information. (Blanford, 1889, p.219). The 1867 cyclone was also referred to in a personal memoir published in Bengal Past and Present (1908 pp.120-25). Notwithstanding, details about this storm
are not available anywhere except the District Gazetteer of O'Malley (1911 pp.97-98). He described this cyclone of 1867 as even more disastrous than that of the 1864. His evaluation seems doubtful because very little information about diameter of the cyclone and loss of human lives and cattle were noted by him.

In Blanford's list three cyclones (intensity is not known) passed through Bengal in 1869 – one on May 13-17, the second on June 5-10 and the 3rd or the last on October 7-8 across Medinipur and Puruliya. Sen perhaps mentioned about the last one in his autobiography (1959, p.409). No other detail is available.

The 1874 cyclone is the next one. This occurred on October 13-16 as referred to in Blanford's list (Blanford, 1887; Blanford 1889 pp.237,240). O'Malley again described it as more severe than the 1864 cyclone and added that the storm wave generated by it would have been more destructive had not the sea-dyke been completed between Birkul (Near Digha) and the mouth of Rasulpur (1911, p.98).

The Bakharganj cyclone in 1876 on October 29 to November 1 is also well known for its destructive effects. Sen had a direct experience of this in Chattogram (Bangladesh). He has described a heart-rendering situation of the people in Chattogram and Sandwip (1959, pp.409-13). West Bengal coast in Medinipur was again affected in 1901 on 26th November. A sea dyke protected the inland area from inundation (Reaks, 1908, pp.245-52).

The common people in West Bengal coast especially in Medinipur still remember and consider 1942 cyclone as the most severe and disastrous phenomenon in their direct or indirect (listened from ancestors) experiences. This does not mean at all that no cyclone was developed between 1901 and 1942 or after that. But their intensity was not at such level as to involve
scientific personnel or persons of literature to show any special interests. Otherwise monsoon depressions are annual phenomena and IMD continued the publishing of meteorological memoirs or scientific notes consisting of analysis of cyclonic occurrences along with other climatic features. IMD's publication directed towards the seamen describe such a cyclone entitled as "severe storm of 22nd-29th May 1936 in the Bay of Bengal"(1942,p.36). It has been referred to as a severe storm and also is said to have passed over Sagar Island. But the book, specially written on South Twenty Four Parganas (Chowdhury, 1987) does not include this in the list of cyclones nor described it as a disastrous phenomenon. It reveals that not the nature of cyclones i.e. the severity of the parameters but its effect is remembered by the inhabitants by generation. Such events get recognition as disastrous ones recorded in history. So the emphasis is given on the 1942 cyclone in the following discussion.

"1942 was a black year for Bengal" was a statement made by Narayan (1944, p.35) not only for the cyclone but indicating also the combined multiple disastrous effects at a time. The cyclone itself was severe in nature, but the conditions before and after the event certainly aggravated its effects. As it was in the midst of the second world war, the wireless service operating between ships in the sea and land transmitting weather data was kept in silence. Consequently correct and advance forecasting of weather became a difficult job (IMD 1977, pp.106-07). The 1942 cyclone did not flash in news headlines even a fortnight after it hit the coast. The British administration perhaps wanted to suppress the news from the media and also from the ministry. The reason may be for the August revolution (Quit India movement) which began only two months back with leading participation of the people in coastal Medinipur. Narayan, with a pinch of salt presented government, 'Conservative estimate' about the loss of 15,000 people and 2,00,000 cattle (1944, p.40) caused by the cyclone. It may as well be mentioned in this connection that after the cyclone of 1942, a severe famine visited Bengal (present West Bengal and Bangladesh) in 1943. A few books are available on this man-made famine. But little work on the 1942 cyclone was done at the government level
as we know from the work of previous researchers on the subject or at least from the scientific notes or meteorological memoirs. So, we are almost in the dark about the physical parameters acquired by the 1942 cyclone. But some remarks in the books relating to famine about the hazardous effects of the cyclone suffice to give an idea about its intensity.

"The cyclone left it dangerously short of food" (Narayan, 1944, P.43). Ingression of salt water made a vast cultivable land unproductive for the years to come (Bedi, year not stated, pp.44-46). Bedi wrote from Contai "It is probably the worst affected area in Bengal, having suffered the devastation, first of cyclone and flood, and then of famine and disease" (Ibid,p.50). "...immense tidal wave and a furious cyclone ... upset the lives of some two million people living in the coastal districts of Midnapore and South Twenty Four Parganas" (Narayan, 1944, p.35). Many such quotations may be produced from Humayun Kabir, Tushar Kanti Ghosh, Panchugopal Bhaduri along with Narayan and Bedi. But this will only be repetitions. Their books abound in descriptions about the havoc caused in the 1942 cyclone in terms of loss of people, loss of cattle, vegetation, damage to buildings, communication, education, occupation etc.

Pattern of cyclone reporting was changed after the independence with the publication of the Indian Journal of the Meteorology and Geophysics and later on Mausam. Physical parameters of cyclone are recorded with other meteorological data and in the synoptic charts of Indian Daily Weather Reports. Articles in the journals regarding annual occurrences of cyclones and depressions are also very superficial in physical as well as in social aspects. In such circumstances, there is no other way but to consider news papers as the only source of information both for physical as well as social aspects though these are scattered in haphazard manner, when no other source is available to analyse the cyclone as a whole.
Chowdhuri (1987, pp.125-26) in his book on South Twenty Four Parganas has mentioned the cyclone year of 1833, '64 and '67 in the 19th century and of 1942, '71 and '73 in the last century as responsible for retarding the settlement and development of Sagar Island. The 1973 cyclone, according to him, was the most disastrous being accompanied by storm surges. Maiti (1991, p.67-68), on the contrary, did not refer to the years 1971 or '73, instead noted 1979 when the Island was inundated by cyclone and cyclone waves. 10th December of 1981 by cyclone and December 29, 1988 when the ships named ‘Kumri’ and ‘Candol’ were submerged. Samanta (1977, pp.2424-428) in his paper mentioned the 1976 cyclone to have killed 40 persons and 40 cattle. It was accompanied by 2-3 meters of high storm surge. 1981 cyclone (no mention about the month) was reported to wash out a few hundred kilometers of embankments out of 3000 kilometers. Thousands of cattle perished and 1.5 million people faced drinking water problem including a large number being homeless. November cyclone of 1988, although not of a severe category, killed 30 persons and damaged forest properties along with capsizing launches of the Sundarans Tiger Reserve.

The cyclone years in recent period are not in conformity with each other. These require verification. In the later chapters these will be discussed in detail. Here the next section deals with fishing as it is affected by cyclone.

### 3.3 FISHING AS AFFECTED BY CYCLONES

Sea-fishing as affected by cyclones in the coastal zones of West Bengal is a subject of enquiry in the present study. The people engaged in this occupation are not to be taken as mere an economic group, rather they deserve to be considered as belonging to the primary producer group of the human ecosystem supplying food as a valuable fish item to the rest of the society, so that any disruption in the economy is liable to bring about a destabilization spatially and temporally in the distant and near ecosystems. Despite the introduction of technocentrism in the operational process, it is still outrightly a primary activity, practising a ‘hunting and collecting stage’ of organization (Becht & Belzung, 1975, p. 136). Based on
these facts, some points are taken into consideration for literature review. First is the inception of sea-fishing on a commercial basis in the study area. This is related to the survey of cyclone-afflictions on fishing in the past. Also it connects a point of human ecosystem concerning energy fixation in the primary producing level while its commencement is connected with food requirement with the ever-growing population. Second is the nutritional value of fish and its fundamental requirement in human diet in the study area. The last and the most important point for the present discussion are the impact of cyclones on fishing.

As early as in the days of John Company in the year 1828, the English traders speculated the prospect of marine and estuarine fishing in the Bengal coast. In an analytical paper a detailed description was given on existing fish market in Calcutta, kind of fish intake and purchasing power of the Calcutta people, types of fishing boats and nets, inefficient fish preservation system, poor transport facility by country boats added by little demand and poor market of fish in the vicinity of Sagar and neighbouring islands. Such a thoughtful note was published in the Calcutta Gazette (September 22, 1828) following an advertisement in a pamphlet indicating the establishment of a fishery on an extensive scale at the mouth of Hugli at Sagar Island. After examining all the facets, some conclusive statements were made that sea fishes, when carried for 12 days’ journey, were inevitably brought in rotten condition due to time taken and improper preservation system.

In such circumstances fishing at Sagar would not be feasible if the British skill and know-how of sea-fishing were not applied in lieu of indigenous techniques. But these fishermen might have gained proficiency and expertise in deep sea-fishing like their counterparts in Bombay, Madras, Ceylon, Malabar and Coromondal coasts, if they were aided and encouraged by the expert British traders.

Problems of estuarine fishing, either in the midst of the forest-clad islands or in the rivers congested with riverine transport were mentioned at the same time
while giving it a priority over deep sea-fishing at the advent of hazardous weather conditions.

It was assumed that estuarine fishing would encourage settlement in the forest-clad islands. On the other hand, the Sundarban forest was taken as an obstacle for the development of a fishery at the head of Bay.

Lastly, a coastal fishing ground was suggested extending from Point Palmitas to Chattogram stretching over a length of 448 km. It was considered “the finest grounds in the world being a series of rivers and banks where boats might ply in the worst weather, making choice of the lee sides of at least 50 sand banks at pleasure, and having at all times a river to run into for protection, when the weather is too rough to continue at sea” (Das Gupta A. C., Ed. 1832, p 321-27).

The British trading Company, nevertheless, had no contribution to introducing modern appliances in marine and estuarine fishing in the Bengal coast. It is not till 1859 when the first assistance of the British government came in the form of lease given in return for tax to the people practising fishing in the estuarine rivers of the Sundarban (Pargiter, 1934, pp. 110-11). The lease was issued for the period of five years. The 1864 cyclone was accompanied by storm surges and devastated Calcutta along with coastal settlements. The report of this cyclone was surprisingly silent about any loss in the fishing sector. Earlier cyclones of 1831, ‘32, ‘33, ‘48 and of ‘52 also had no account regarding loss in fishing. This missing information about fishing or about the fishermen must not be taken as a consequence of negligence to them, because fish is a palatable food item to the Bengalis of all categories. The probable reason might be that fishing was a secondary occupation after agriculture to almost all the fishermen during cyclone prone periods. In most cases, people were compelled to buy fish of inferior quality due to the time taken between catching and marketing of the commodity. Therefore it was argued in the Calcutta Gazette (1828, p.321) that
any improvement of fishing would be reflected on the quality of food of the inhabitants of Calcutta, though nothing was done actually in this regard. Even sometimes the fishing sector had been ill managed. In 1859, tax was imposed on estuarine fishing and in 1943 boat denial policy appeared as a deliberate attack on this economic sector.

The initial stimulus for first sailing in the open sea came probably in search of fish, as remarked by Becht and Belzung (1975, p. 135) while giving opinion about cognizance of food resources of sea in its naivete as well as accepting the primitiveness of marine fishing. They also correlated the ‘rise of world naval powers’ among the fishing people - in Carthage, Greece and England, the Netherlands and Norway’ (Becht & Belzung, 1975, p. 135). But spread of this activity is not older than the decade of the early twenties. Japan and USSR took their decisions separately but almost at the same time for expanding deep sea-fishing to meet the increasing demand of food for ever-growing population. Both the countries had a deficiency in meat and other animal protein. According to an account of 1963 in India, population increase by 2% per annum would far exceed the demand for fish as was available from sources of inland fisheries. Out of the daily requirement of 125 gms of fish, less than 15 gms were available from internal production. At the rise of such acute shortage, people began to think about exploring the sea fishes. (Guha & Chattoraj, 1963, p. 257).

According to a FAO report, production of fish is to enhance by 60% with the increase of population. It is also reported that out of the total production of animal food, about 29% are obtainable from fish.

Demand for fish arises from demand for protein in human diet (Cushing, 1975, p. 9-10; Sambad Pratidin, January 7, 1994). Vegetable protein cannot be the substitute of animal protein. Two amino acids are available in fish, which are not obtainable from vegetable (Cushing, 1975, p. 9-10). A statistical diagram was drawn to investigate the dependence on kinds of food for protein among different countries of the world. It revealed that the rich countries like to get it from meat
whereas the poor ones depend much on vegetable with a little quantity of fish for protein requirement (Cushing, 1975, p. 9-10). Also fish is considered cheap and easily available than meat (Cushing, 1975, p. 9-10). Bhattacharya (not stated) mentioned the food value of fish as important animal protein. Only fifteen gms of fish equalise four hundred grams of rice (Rohde & Pierce, 1973, p. 173). Fishing to Maunder is a primary industry (1970, p. 92) and Ahmad (1966, p. 274) mentioned fishermen as a primary producer group in the human ecosystem. Indian people, specially the Bengalee, are much fond of fish and it is an important item in their food habit next to rice (Bhattacharya, Ibid; Rohde & Pierce, 1973, p. 173-175; Narayan, 1944, p.8). Hunter, as early as in 1872, explained the importance of fish as a highly valuable food for enjoyment to the rich and necessities of the poor (1872, p.160). Despite this, sea-fishing started late in the state though the Bay of Bengal had been described as rich and plentiful of fish by a report of an international expert team of UN Food and Agriculture Organisation (Bhattacharya, Ibid, p.28). Narayan criticizes the British Government for neglecting the state in full exploitation of its land and water resources and also for not organizing any deep sea-fishing programme (1944, p.8). Bhattacharya blamed the State Government to believe in the myth about dislike by average Bengalee of sea-fish and for not accepting the scheme for deep sea-fishing (p.36-42). The Government of India selected Bombay as an experimental field for initiating deep sea-fishing after Independence. In case of West Bengal, the State Fishery Department, instead of Medinipur coast comprising Kanthi and the adjacent areas, preferred Sundarban. This may be due to the more fertile estuarine ecosystem than the less fertile open sea area (Hickling, 1975, p. 113).

After Independence the Government of India tried to expand marine fishing by starting a campaign 'catch more eat more fish (Parliamentary Debates, Vol I, Part I, 1950, p. 271) and also launched the Applied Nutrition Programme in collaboration with UN’s Children’s Emergency Fund, Food & Agricultural Organisation and World Health Organisation (WHO) (Bhattacharya Ibid, p. 61-69). Junput in Medinipur was a selected research station for marine and estuarine
fishing and in order to encourage the exploitation of sea fishes, various other
types of uses, such as oil, biscuits, fertilizers etc. were begun to be introduced.
(Bhattacharya Ibid. p. 61-69). Nevertheless, an overview of the contemporary
papers or articles relating to fishing reveals a fact that these are mostly concerned
with improvement of marine fishing as well as are apprehensive of both
composition and population. Fishing in West Bengal is economically important
like in other countries being a source of income (Maunder, 1970, p. 92;
Bhattacharya, Ibid.p. XI). Becht and Belzung express their opinion that 'sea is
not inexhaustible resource insofar as fishing is concerned' (1975, p. 136).
Another important statement regarding exhaust of sea fishes is that 'Nothing
has illustrated the impact of man on the ecology of the earth more dramatically
than the occupation of fishing (Nierenberg, 1975 introduction). A special article
was published in a Bengali Daily Newspaper ‘Sambad Pratidin’ on January 7,
1994, Saturday, regarding diminishing trend of fish resources all over the
world. An article on marine pollution also discusses about depleting fish
resources of Kerala by 25 per cent from 1966-67 to 1987-88 (The Statesman,
April 4, 1992, p. 12).

Very few papers related to fishing are aware of weather hazards and their
afflictions. Hurricane damage on fishing fleet was first recognised by Majumdar
(1939, p.219-20) in the year 1939. According to his opinion, the type of fishing
boat, that would have otherwise capsized, manufactured by a Chinese gentleman
for fishing in the East Bay of Bengal was supposed to withstand hurricane.
Fishing is identified first as a hazardous occupation and an occupation of the poor
54, 92). An important statement made by him may be quoted in this regard, ‘The
weather-related factors in turn are associated with the retail price of fish and if
adverse weather conditions continue for any length of time, the decreased catch
of fish would have significant economic effects on the fishing community’
(Maunder, 1970, p. 92). Dried fish, which is also an important source of protein
in countries like Philippines and Sri Lanka, is spoilt due to adverse weather
It has already been mentioned in the earlier section that cyclone reports of the past do not record fishing hazards. Only one account about loss of fishermen on Orissa coast in the 1942 cyclone is mentionable in this regard. Bedi, a Tribune reporter, reported this from Punjab covering the Bengal famine of 1943. Nevertheless, loss of 300 fishermen off north Kerala and south Kanara coast in 1953 compelled the government to organise special weather bulletin for fishermen. IMD started warning for fishermen ‘against squally weather and strong off-shore winds’ and broadcasting of storm warning in local languages throughout the coast was also introduced in the year 1953 (IMD, 1976, p.109). Nevertheless, Datta acknowledged the traditional knowledge base of the fishermen as having precautionary techniques and tackling systems in disastrous situation (1991, p. 12). Jana & Chatterjee, on the contrary, in an article on problems and future development of Sundarban fishing do not include weather hazard, specially the cyclonic phenomena as one of the problems in the regions of fishing, despite encouraging coastal fishing and government’s help at the infrastructure level. Eventually, they do not also necessitate the introduction of insurance scheme for fishermen to share their loss by the society (1974, p. 76-81). Suryanarayan directly associates fishing industry with risk subjected mainly to climatic exigencies, but do not connect it with cyclone hazards (1977, p. 35). Fishing along with agriculture, general science and air transportation is ranked next to general public as user group of weather information among the other 18 user groups identified by the US Department of Commerce, Weather Bureau (1964) (Maunder, 1970, p. 275). Samanta, however, credited the fishing community in and around Digha, Ramnagar, Shankarpur as developing a capacity to escape quickly from the ravages of incoming cyclone hazards and adopted it as their ‘routine behaviour’ (Samanta, 1997, p. 24-27). Besides, the Fisheries Minister, Government of West Bengal admits the insecurity and hazard in sea-fishing regretting the missing of 14 fishermen from Jalda, Medinipur in 1984. At the advent of such untoward incidences, the Fisheries Department of the State Government of West Bengal introduced group insurance scheme in 1984 and in 1985. The Minister also reported that in order to safeguard the interest of
fishermen the Marine Fisheries Act is being introduced (The Statesman, Saturday, April 22, 1995, p. 7). Cyclonic weather was reported to be disastrous in the Sundarbans (compared to the Medinipur coast) and 136 fishermen perished here in 1988 cyclone. The Frazergunj fishing harbour, notwithstanding, is arranged in a manner to protect the fishermen (The Statesman, April 12, 1995, p. 7). It can be concluded from the above discussions that articles on fishing including the old government reports though are silent about weather hazards in marine fishing, the Government at the Centre as well as the State level is now conscious about the impacts of cyclones on fishing and the plight of the marginalized people engaged in the industry.

3.4 PERFORMANCE OF CYCLONES

In ecological classification of communities, McKenzie categorized recreational resorts under the fourth type of service community drawing sustenance from outside areas (McKenzie, 1968, p. 7) and tourism belongs to tertiary group of economic activity in contrast to fishing which is primary both as economic activity (Maunder, 1970, ) and ecological community (McKenzie, 1968, p. 7). The need for more leisure time with the increasing industrialization enhances the value of oceanic water and coastal sites as recreational resources (Becht & Belzung, 1975, p. 133). Recreational facilities in many coastal sites developing as tourist centers are, therefore, of a great value to the 'holiday makers and day trippers'. Carter argued for the complementary and conflicting coastal activities along with the identification and monitoring coastal hazards (1993, p. 425). Therefore, some points emerge naturally from specific economic point of view.

3.4.1 Tourism in West Bengal Coast.

In West Bengal, a few tourist centres have developed in coastal areas of which Digha in Medinipur and Bakkhali - Frazergunj and Sajnekhali in South Twenty Four Parganas are important centres. Among these Sajnekhali is identified as a place of solitude with boating recreation facilities being situated in estuarine Sundarban and connected with Tiger and Crocodile Project. Its spatial expansion and development as a big tourist centre is very limited as that will go against the Tiger Project.
Ganga Sagar in the Sagar Island on the mouth of Hugli in South Twenty Four Parganas District, initially a pilgrim centre is also a tourist place at present. It has much scope for development as a big tourist centre.

Beerkul, which was situated in the south of Digha, is now a name in history being diluviated by sea erosion. But it is evident from old records that Beerkul had tourism attraction even at a time more than hundred and fifty years back. Captain Spens wrote that many bungalows were there in Beerkul. Most of these along with the one of Warren Hastings the then Governor General of the East India Company had already been washed away by sea invasion, only two remaining during 1850. Nonetheless, Spens praised the pleasant weather of Beerkul and adjacent areas from March to May. Beerkul however was situated two miles south west of the Digha creek (Piddington, 1852, pp. 13-61, 195-207). After independence, the State Government of West Bengal started a serious thinking to develop Digha as a coastal resort since the early sixties of the last century (Brahma, 1972, p.9). The government was also aware about the erosional problems already faced by Digha (1982, p. 27-30). The report of Irrigation and Waterways Department, West Bengal on coastal erosion esteems Digha sea-beach as 'really attractive' and discusses various protective measures taken by different Departments to safeguard the coast. The temple at Ganga Sagar had to shift within 10 years between 1960-70 due to erosional effects. Places under erosional or depositional phases in Frasergunj were also discussed in detail (Brahma, 1972, pp. 8-10). Though the place is now more popularly known as Bakkhali or conjointly as Bakkhali – Frasergunj, but old Frasergunj is associated with the name of Fraser. In fact, Fraser took the first initiative to develop the island as early as in the nineteenth century (Pargiter, 1934).

3.4.2 Impacts of cyclones on tourism

In the analysis of various factors causing coastal erosion in West Bengal, cyclones were considered as a major damaging agent on coastal topography. In addition to relate the periodicity of cyclones and their extent of reaching the coast, it was stated that no record of cyclone damage was found here. However.
1942 cyclone has been discussed specially (Brahma, 1972, p. 4-6). Different complementary and conflicting activities emerge from the same objective to use coastal sites. In West Bengal, fishing and tourism are two such economies which most often are placed in a conflicting relationship. The State Government of West Bengal therefore, tries to bring them into complementary relationship as has been done to some extent at Shankarpur in Medinipur and a similar endeavour has been shown at Frasergunj in South Twenty Four Parganas. (The Statesman, Saturday, April 22, 1995, p. 7). But the Government has not yet shown much awareness about cyclone hazard on coastal tourist centres, although weather hazard on fishing has been given due importance.

Becht and Belzung (1975 p. 133) identify and classify different types of ‘water recreation’ of the coastal areas which include fishing, boating and scuba diving, sunbathing, surfing and swimming. These different recreational activities, appear to Carter as conflicting and complementary which have been produced in a matrix (1988 p. 425-27). Carter refers Mitchell (1982 cited in Carter, 1988) who argues that coastal zone management programme in the developing nations like Indonesia, Srilanka, Thailand, The Philippines and Nigeria is directed to examine the effects of cyclones on human health and economic prosperity e.g. water pollution or hazard mitigation (Mitchell, 1982 cited in Carter 1988 p. 381). Carter himself however emphasized other pollution problems related to urban areas which are not associated with weather phenomena or specially the cyclones. Nevertheless, it was Maunder, who for the first time showed an interest to relate cyclone hazard to tourism industry. He argued that afflictions on villages and coastal resorts could not be averted even with the best forecasting system (1970, p. 11). The U.S. Department of Commerce, Weather Bureau, however, included recreation as an activity as user of weather information (1970, p. 275). Walker in an article on The Peopling of the Coast consciously remarked about the protection of resort hotels from the storm waves by erecting sea walls (Walker in Ma & Noble, Ed., 1981, p. 101)
Marx (1977) brought direct accusation charge against such "Caribbean island developer" who "erects a luxury hotel on a recently filled seafront, newly exposed to the force of the waves by the removal of a reef" and places, "his guests at risk from hurricanes and earthquakes, both relatively common hazards in the region" (1977, p. 30).

In Maunder's The Value of the Weather, an entire section is devoted on 'Weather and tourist industry.' From his writings it can be assumed that tourism also is a weather sensitive industry. He identified two types of relation of weather to tourism, the weather at the place of visit and the weather at the place of origin of the tourists. He gave example from Australia where people are able to take or change decision regarding their visit to a place with a notice of a week or two or at a much shorter notice. Maunder criticized the existing literature on tourism for its utter neglect of the effects of weather on tourism. Therefore very little information is available about the extent to which the tourists or tourism industry are affected by weather. However he himself organized an investigation in this regard. He arranged interviews of the officials of the federal, provincial and municipal governments of Canada as well as of the tourists. Questions to tourists included the duration of bad weather at the place of visit (up to the duration of their staying there) and how far they decide their programme on weather information. However, Maunder dealt with any type of weather hazard on tourism industry and had not given any specific emphasis on stormy events whereas the objective of the present study is to examine the relationship of cyclones to tourism on the West Bengal coast of India.

3.5 CONCEPTS

'Disaster' and 'hazard', seemingly belonging to a common parlance, are different in meaning and concept by dictionary definitions as also in the views of most of the authors engaged in disaster study (Hewitt, 1983, p. 5; White, 1974; Burton et al., 1978; Marx, 1977; p. 13, Collymore, 1992, p.88; Oliver & Fairbridge, 1987, p. 279; Parker & Harding, 1979, p.307; Sinha, 1991, p. 5; Quarantelli, 1978, p. 2-3; Cannon, 1993). In Webster's dictionary, hazard as a noun is 'a source of danger'.
‘a chance’ or ‘a chance event: accident’ and as verb it manifests ‘venture’ or ‘risk’. On the other hand, ‘disaster’ implies an unforeseen mischance bringing with it destruction of life or property or utter ‘defeat’. Moreover ‘disaster’ is synonymous to ‘calamity’, ‘catastrophe’ and ‘cataclysm’ of which ‘calamity’ is a grievous misfortune, ‘catastrophe’ implies ‘disastrous conclusion to a series of events’ and ‘cataclysm’ ‘connotes overwhelming or shattering natural or social forces’ (Webster, 1969, p. 236-37, 382). The definitions reveal that ‘hazard’ inherits risk, but in no way it is a disaster until and unless it brings a negative impact on human society. So it may be said that hazard is a cause and disaster is the effect. Hewitt (1983, p. 6-11) considered hazards as synonymous to extreme geophysical events ‘that destabilize or violate ordinary life and relations to the habitat (Hewitt, 1983, p.11).

White (1974, p. 4) and O’Riordan (1986, p. 276) made no difference between hazard and disaster. Disaster study has gained a different dimension during the sixties of the twentieth century. Various disciplines of the natural science were engaged since long in revealing the phenomena as these were taken as the supreme factors for a resultant disaster. (Aysan, 1993, p.1; Parker & Harding/ McCall, 1992, p. 2; Doornkamp, 1989, cited in McCall, ibid.). Cyclone research from the meteorological point of view was initiated by the non-meteorologists towards the end of the eighteenth and the beginning of the nineteenth century with an objective to reduce shipping hazards in the sea. Hewitt (1983, p. 12 ) observed natural hazards to be ‘carefully roped off’ from the rest of man-environment relations’. This is also considered ‘as an extension of every day life’ (Susman, O’Keefe, Wisner, 1983, p. 263) or disruption of normal life (Cisin & Clark, 1962 cited in Susman, et al., 1983, p. 263). Scheidegger (1975, p. 2, cited in Hewitt, 1983, p.11) and is labeled as ‘unscheduled events’, ‘emergency social situations’, ‘negative resources’ or simply ‘hazards’ (Hewitt, 1983, p.12).

The Natural Hazard Research Group at the U.S. University of Colorado in 1969 (Marx, 1977; Susman et al., 1983 p. 64-65) defined and categorized disaster separately in terms of the form and extent of damage (Burton & Hewitt, 1974, p.260). The three categories of damage are as following:

1969                  1983
(i) Where more than    at least    $1 million in damage.
Disaster is defined according to the area covered by this.

Large area disaster covered 10° latitude-longitude squares whereas small area disaster depicts less than that (Susman et al., 1983, p. 264).

Both White and Scheidegger thought almost similarly about reducing the negative effects of hazard. White emphasized on accurate and in-time forecasting disaster (Parker & Harding, 1979, p.309). White first focused the human aspect in relation to disaster. He introduced the concept that no extreme natural event was able to create disaster where there was no man or at the place of little interest of man. (White, 1974, p.3). Susman, O’Keele and Wisner (1983, p.264) only echoed the statement that ‘without people, there can be no disaster’. White’s statement is a milestone in disaster survey to oppose the earlier ‘dominant view’ of extremes-oriented persuasion. “An extreme event was taken to be any event in a geophysical system displaying relatively high variance from the mean”. Therefore ‘extreme events which exceed the normal capacity of the human system to reflect, absorb, or buffer them are inherent in hazard’ (White, 1974, p. 4). Consequently, O’Riordan argued for considering ‘the man-hazard relationship’ “not in terms of a man-environment interactive relationship but largely in a man-man context, where the environment is an independent phenomenon” (O’Riordan, 1986, p.280).

Disaster is mainly classified into two as (i) natural disaster, the sources of which are extreme natural phenomena, such as, earthquakes, cyclones, landslides, floods, droughts, avalanches, tsunamis etc. and (ii) man-made disaster, mainly the disaster from accidents. The second is also termed as technological disaster (O’Riordan, 1986, p.272). Aysan (1993, p. 2) classified disaster into three categories — the first is identical with the first in the above classification. Only the point of epidemics by natural organisms, like bacteria, virus etc., has been added to this. The second is also the same with the previous one, added by the point of disaster due to war. But the
A third point refers to the disorganization, misjudgment in the social sector resulting in poverty, malnutrition etc. Aysan’s third point actually deserves a little space for a separate category. The criteria here in consideration for producing social disorder are really the questions for the validity of ‘naturalness’ of natural disaster (Doornkamp, 1989, cited in McCall, 1992, p.2; Hewitt, 1983, p.3-31).

Hewitt’s ‘alternative view point’ in disaster modeling is in total disregard for geophysical extremes for consequent ‘natural disaster’. He imposes absolute responsibility on socio-economic consideration in the places concerned (Hewitt, 1983, p.24-28). Hewitt’s ‘alternative view point’ is supported by Bryant (1991, p.7).

White relied much upon exact predictions of extreme natural phenomena regarding their nature, and proper time and place of occurrence. He assured a negative disaster having exact forecasting technologies in hand (White, 1974, p.3). It shows that consideration of social phenomena is blurred and not very clear in White’s statement. Scheidegger, on the other hand advanced a step ahead by stating that, disaster could not be a concluding situation if the prevailing status quo was allowed to continue (Hewitt, 1983, p.11). This incorporates the concept of toleration ecology from Odum’s concept of ‘the limits of tolerance of organisms’ (Odum, 1959, p.93 cited in Burton & Hewitt, 1974, p.260). Threshold limit of toleration in the disaster context is defined as ‘the limiting range of manageable environmental stresses’ (Burton & Hewitt, 1974, p.261). In these considerations, natural hazard research is taken as parallel to ecological studies where the latter involves into the natural communities and the former performs in the context of environmental sciences (Burton & Hewitt, 1974, p.259-60).

The social relativity of disastrous consequence incorporates risk factor which in turn makes the zone vulnerable. Before elaborating the risk from the social point of view, we must mention that hazard prone areas or the places of ‘hazardous events’ inherit vulnerability from the natural environmental viewpoint. ‘Hazardous events’ have been defined by Burton as the events liable to occur everywhere but with an
irregularity in occurrence such as to make it difficult for the people to adjust with
them. He distinguished 'hazardous event' from 'hazardous place' which belong to a
permanently less productive, ecologically viable, inhospitable areas, such as high
mountain zones with ice caps, desert areas etc. (Burton & Hewitt, 1974, p.259).
People usually have a negative attitude towards such areas. Therefore the probability
of disaster is insignificant in such no-man’s land (White, 1974, p. 3; Aysan, 1993.
Parker & Herding, 1979) after White’s remarks of no man and no disaster. But the
place of ‘hazardous events’ are otherwise attractive for human habitation especially to
the people of the marginalised groups. Such places are, for example, general fertile
soil in the flood-prone areas, fertile estuarine ecosystem for fishing in the coastal
tracts, agricultural or industrial effluences near a dormant volcano etc. They are
generally deprived socially and economically by the decision-makers in the society
and are pushed or forced to inhabit the areas where short term risks prevail amidst a
long term gain. Vulnerability is the degree to which different classes in society are
differently at risk, both in terms of the probability of occurrence of an extreme
physical event and the degree to which the community absorbs the effect of extreme
physical event and helps different classes to recover........And poor people are
generally more vulnerable than rich ones. Disaster is therefore defined as the
'interface between an extreme physical event and a vulnerable human population”
(Susman, O'Keefe & Wisner, 1983, p.264). Being dispossessed of other resources,
they capitalize the risks of vulnerability as the landless fishermen venture into the
cyclone-prone tropical seas in search of livelihood. So the vulnerability is not of a
place, but of the society or the group of people who find no other way but to inhabit a
physically vulnerable place. Oliver and Fairbridge (1987, p.280) identify densely
populated region, fertile coastal tract and deltas as the three most vulnerable areas in
their discussion on climatic hazards. Sometimes, a place becomes physically
vulnerable by multifarious human intervention in the form of deforestation, soil
erosion, over grazing, over population (Marx 1977) and various types of pollution in
the land, air, water and the social pollution as well. Interaction with hazardous events
manifests modification or adjustment to physical event system and/or human use
system. Modification in the physical environment in the form of constructing
embankment on river or sea, reclamation of marshy tracts may reduce the chance of
vulnerability or simply increase the quality of land. But the poor cannot afford for that increased land value and they only become more vulnerable by shifting on to the more unfavourable, negative zones (Marx 1977).

Stanissis, the Permanent Representative of the League of Red Cross and the Red Crescent Society, observes the role of a 'vicious cycle' in the form of limitation in leadership, resources and preparedness and lack of gaining experience from past disaster for reducing their inflictions on socio-economic as well as political situation in the less developed countries like Bangladesh, Nicaragua etc. (Oliver, 1987, p.107-08). Cannon has given a model relating hazard with vulnerability in consideration to their sources and effects(Cannon in Merriman and Browitt, 1993,p. 100). Similarly Aysan ( Aysan in Merriman and Browitt, 1993 p. 12) categorized types of vulnerability as the following:

- Lack of access to resources (material / economic vulnerability)
- Disintegration of social patterns (social vulnerability)
- Degradation of the environment and inability to protect it (ecological vulnerability)
- Lack of strong national and local institutional structures (organizational vulnerability)
- Lack of access to information and knowledge (educational vulnerability)
- Lack of public awareness (attitudinal and motivational vulnerability)
- Limited access to political power and representation (political vulnerability)
- Certain beliefs and customs (cultural vulnerability)
- Weak buildings or weak individuals (physical vulnerability)

It is ruthlessly true that all these criteria of vulnerability attach the poor who suffer weakness from different types at their sources. Strictly speaking the marginalized areas are inhabited by marginalized people. Disaster school of thought precisely impose the responsibility to theoretical appliances of capitalism for the deprivation and oppression of some simple people by the power groups. These poor people
become moneyless, landless, occupationless and powerless to be vulnerable politically to move into hazard-prone areas. ‘Vulnerability is essentially associated with poverty and powerlessness, which are often linked to ignorance and defenselessness’ (O’Riordan, 1986, p.280). Nevertheless, forceful interaction with or optionless acceptance of disastrous consequences incorporates essentially two associated aspects of perception about the phenomena and responses towards these by the affected people. Both the perception and response largely depend upon previous experience, socio economic condition and technological know-how in hand.

‘Perception is the term employed by most geographers and some psychologists to define the process, whereby individuals and groups judge the degree of danger they face in relation to the benefits they enjoy by staying where they are and hence search for and evaluate various means of reducing that danger should they be motivated to do so. Perception is regarded as the mechanism which links judgment to action’ (O’Riordan, 1986, p.281). Each person perceives a phenomenon on the basis of his ability to protect himself from the negative effects rendered by this. ‘Hazard perception is related to an individual’s time horizon and to cognitive and effective obstacles’. (Parker & Harding, 1979, p.310). Emergence of hazardous phenomena generates some reactions among the persons involved in this. O’Riordan observed four types of reactions:

i) making an adjustment,

ii) waiting for relief,

iii) moving away, and

iv) simply suffering the loss.

Such response is at individual level. Response may be at societal level and also at the level of administration. Different social organizations response mainly in providing relief and assistance towards the affected persons in a disastrous situation. ‘Social response is by no means uniform across the globe, even when danger is manifest and lives are being lost’ (O’Riordan, 1986, p.273). Administrative response is three fold,

i) at the interval period between disasters, when actually there is no disaster,

ii) before the occurrence of a disaster, and

iii) during and after the hazardous phenomena are over.
The first signifies different preventive and precautionary measures during the normal condition. It is actually the preparation for extended normal situation at the period of normalcy. This includes construction of buildings as disaster shelters, improvement in transport and communication systems, arrangement for better forecasting technology, previous arrangements for dissemination of forecasting, arranging for sharing the losses of the affected persons by means of insurance. The second manifests proper forecasting in terms of time and place, dissemination of the news in right place and at the right time, evacuating the people in danger and preparing for relief and assistance for expected losses. The third is the direct manifestation of relief, rehabilitation and sharing of losses by various measures. White’s opinion deserves to be quoted in this respect. ‘If the means of enabling individuals to take intelligent action or governments to design and carry out effective programs of assisting individuals are to be improved, it will be essential, along with further appraisal of both physical mechanisms and social accommodations, to gain greater knowledge of the processes by which people do, in fact, cope with hazards in nature’ (White, 1974, p. 3). This view is supported by McCall and Collymore. In appraisal of disaster McCall has given equal emphasis on sociological viewpoint as well as on scientific one and has given thrust on ‘perception and response of the local populace’ in adjusting with the disastrous situation (McCall, 1992, p. 2). Similarly, Collymore argued for the inevitable recognition for the ‘traditional knowledge sources which reflect a continuous and evolving adjustment to the environment’. (Collymore, 1992, p.93).

White (1974, p. 4) raised questions about different types and forms of human response ‘to different sorts of initiative, such as information programmes, land-use regulation, improved warning systems and insurance systems’. In answering himself, he introduced the cultural aspect in the context of different hazards. ‘Cultural attributes’ are given special significance in the discussion of environmental hazards by Burton & Hewitt (1974, p.253-83).
This is to be mentioned here that people may have different types of choices in order to improve their quality of life or to avoid vulnerability, but they are not free to implement their choice and satisfy their decision. "The manner in which individuals and various social institutions cope with both pre-disaster preparation and post-disaster relief should therefore suggest something about the relationship between political power and vulnerability to environmental risks" (O'Riordan, 1986, p.273).

Pattern of land use or land use regulation is an important aspect in disaster management. Collymore (1992, p.95) suggests land use regulations in order to reduce long-term risk of human life and property. Oliver (1987, p.111) refers Cocks and Dangces who studied The Role of Land Use Planning in Reducing The Impact of Certain Extreme Meteorological Events. Berz (1994, p.330) directly advocated for restrictions on land use to prevent population pressure on endangered area, such as the coastal zones. He warned of the "natural disaster refugees" like the "environmental refugees" (Berz, 1994, p.336). Insurance scheme for the vulnerable as well as marginalized people is considered another important criterion as a means of reducing disastrous impact by sharing the loss. Berz in this regard, rightly observed the miserable condition in the developing countries where "the individuals do not have the capacity to pay and the value of their assets are so small" (1994, p.334-35).

Truly speaking marginalisation is a direct consequence of poverty. The activities of the poor and the poor countries are deliberately controlled by the man or country of resources and power to take and implement their decision to dominate the weak for the sake of themselves. This may be explicated by the fact of neo-colonialism and associated world economy which often impose their demand on the poor countries through the international institution for financial help e.g. World Bank. The poor farmers in the developing countries, for example, are sometimes forced to cultivate cash crop instead of indigenous food of their desire or have to cultivate the deteriorated land only to aggravate the problem. Recurring cyclone disaster in Bangladesh and recently in Orissa (October, 1999) in India, accompanied by heavy toll and losses in the primary sectors of economy such as agriculture or fishing in contrast to flood "disaster" in U.S.A. in six northern and central California states (The
Statesman, January 6, 1997, p. 7) with negligible losses of life (20 people), but exceeding much in property loss ($50 million) evidently show the social attributes of the so-called ‘natural disasters’. The conceptual aspects that evolve from the discussion, link the question of poverty with the problem of vulnerability, marginalisation and oppression of the weak by the dominant power group and consequent disaster. Bryant is of the opinion that socio-economic status of a person is more important at the time of hazard occurrence than the parameters of the physical event. Bryant is of the opinion that socio-economic status of a person is more important at the time of hazard occurrence than the parameters of the physical event. (Bryant 1991, p. 7).

The Indian Geographers, Chakrabarty and Biswas (1980 pp. 91-99) are much clear in their views in this regard that 'Inequality in redistribution may, however, accentuate the proneness of certain segments of the society to become more vulnerable than the others when the conditions of production are upset'.

CONCLUSION
In the above paragraphs survey of cyclone related literature has been made on the basis of availability of materials in Kolkata and Burdwan only. This survey reveals that cyclone is still dealt by meteorologists who are not interested in
social connotation of this event. In hazard or disaster studies, contribution of economists is more than that of other social scientists. Geographers have little contribution in this field. Moreover most of the research on hazard or disaster was initiated by American geographers. The American school of hazard studies gives emphasis on the physical parameters of cyclone as hazard stimulating factors. Our research efforts take a scientific viewpoint. Society and societal characteristics of India have been given equal emphasis to study the impacts of cyclones on sea-fishing and beach-tourism.