CHAPTER - II

OBJECTIVES, METHODOLOGY AND HYPOTHESIS

This chapter introduces the theme of this study. But this introduction should not be seen as a flat prefatory note only. It has been carefully systematised and sub-divided into a number of aspects which are being discussed in an orderly fashion.

2.1. OBJECTIVE :-

The objective of this study was :-

a) To account for the aquatic resources of the region.

b) To investigate and analyse the severe degradation of this biospheric environment as a result of the exploitation of aquatic resources.

c) To attempt for a comprehensive planning for the best use of aquatic and other resources and

d) To prepare a blue print for sustainable development of the region.

The ‘Sundarban Biosphere’ is not only an economical base but also an ecological base for the entire state. Increasing population has caused continuous exploitation of aquatic resources from this region. It has resultantly caused an ecological imbalance and has ultimately hindered the economic
development of the entire state. Such disaster may not only endanger various life systems but also strike at the root of the human existence.

Keeping these objectives in view, this study has been directed to strive for the goal of the sustainable development.

2.2 HYPOTHESIS

The Sundarbans is ecologically very sensitive. The ecological base of the Sundarban Biosphere (as designated) is well understood.

i) The Sundarban mangrove area is dwindling due to human interference particularly due to clearing of forest for settlement and agriculture along the western sector. Many areas included within the Dampier-Hodges line and regarded as the mangrove area are now cleared of mangrove forest.

ii) The Sundarban mangrove is itself one of the most productive ecosystem rich in both phytoplankton and zooplankton which in turn contribute for the sustenance of a large number of biotic species. The growing demand for shrimps and tiger prawns in the international market has led to commercialisation and over-exploitation of such important economic species in the Sundarban estuaries.

iii) The ecosystem prevailing in the Sundarban region is having a complex and intricate but well knit food-web. Aquatic food chain plays a significant role in this entire mangrove food-web. Any loss of the
particular aquatic species due to over-exploitation may result in structural collapse of the entire ecosystem. Here lies the danger of commercialisation and over-exploitation of a particular type of aquatic species. Commercialisation and over-exploitation of tiger prawn, shrimps and indiscriminate catching of prawn spawns have already thrown a tough challenge to the existence of the mangrove ecosystem in the Sundarban region.

iv) The Sundarban mangrove eco system has been maintained naturally since long and there is no such maladjustment within the eco-framework. Human interference in recent years in terms of extraction of mangrove species, collection of prawn spawn, tiger prawn and other species, etc. is posing a danger for the sustenance of the ecosystem in general and loss of aquatic species in particular.

v) In many cases over-exploitation of economic aquatic species is found to be guided by the profit motive for short gain. A particular group of people found to be responsible for the short gain is usually the entrepreneurs or better to say the devastators. They are usually alien to this ecosystem. The local inhabitants who belong to this biosphere are opposed to this over-exploitation as it endangers their sustenance in near future. (FIG.8)

vi) Extreme commercialisation and over-exploitation of particular aquatic species is very commonly found in form of ‘Bheri Culture’ in vast areas
HUMAN INTERFERENCE IN MANGROVE ECOSYSTEM

FIGURE 8

MANGROVE FOOD WEB

Ultimate sufferer in long run

Island Format economic growth
Wrong Resources mobilisation for short gain
Bheri Culture by Big Businessmen

Tiger & Crocodile
Resources utilisation for short gain
Survival of handful of local

Phytoplankton & zooplankton
Mangrove forest Detritus

Collection of seedlings
Collection of fuel wood

Domestic consumption by Sundarban people
of northern reclaimed part of the Sundarban. It is an excellent example of wrong way of mobilisation of resources among various classes of the society. It encourages the rich to be richer and the poor to be poorer. Ultimately the gap between different economic classes of the society becomes wider. A few areas have become economically developed like an island at the cost of complete abandonment of extensive areas of resources. Good example of this island format economic growth is found in Latin American Countries of the world.

vii) The over-exploitation would only be restricted by appropriate legislation framed by the government with support of the local people for monitoring and executing the legal framework. In order to maintain livelihood of the people economic activities other than exploiting the resources must be organised on a scientific and economic base. This would generate the condition for sustenable development of the Sundarban region.

2.3 METHODOLOGY

In order to achieve the specific objectives the following methodological steps have been undertaken :-

a) To develop an acquaintance with the geo-economic configuration of the Sundarbans in general.
b) To review the conceptual issues connected with aquatic resources of the Sundarbans from the ecological standpoint.

c) All the secondary sources of data available for the aquatic resources of the Sundarbans have been processed and analysed. Necessary maps, charts, tables, etc. have been prepared on the basis of collected data to depict the possible resource base of the region.

d) Some sample areas have been selected for field survey and sample surveys have been made to collect primary data at village and household level.

e) Various appropriate statistical methods have been employed including scattered diagram. These methods have been worked out on the basis of primary or field data collected at village and household level. These processes have helped in the establishment of the findings regarding the surveyed areas.

f) To ascertain the gap, if any, prevailing between the secondary sources of information and the findings from the field survey. And

g) A field report has been prepared on the basis of the findings of the field survey and an Environment Management Plan (EMP) has been prepared.
2.3.1 SELECTION OF SAMPLING METHOD

Scientists committed to discovery are likely to approach the selection process quite differently than those seeking to test existing hypotheses either by searching for confirmatory evidence or by attempting to disprove them. Here, they significantly prefer "Sampling Method" which refers to the selection of special units within the area of their research. There are some logical reasons for selecting particular units in the hope of uncovering new factual data. Here the researcher may enter the field with various alternative hypotheses, even hunches. None of those hypotheses is clearly formulated. But the scientists expect that new ideas may emerge from this effort.

The unmanagability of a large sized population of the area of research is one variable fostering the use of sampling method. The heterogeneity and fluidity of modern social systems are also the other factors behind it. (Gideon Sjoberg, Roger Nett, 1997).

The Scientists attempt to achieve representativeness mainly through a particular type of sampling method. In order to get necessary primary informations regarding the practice of fishing in the northern reclaimed part of the Sundarbans, the help of non-probability sampling method is taken in this study. In non-random or non-probability sampling the sample units are usually drawn using certain amount of judgement by subject matter specialist or observer rather than using probability. In this case, selection of units is entirely based on the judgement of the observer. In northern Sundarbans
covering six police stations, *purposive sampling method* has been applied to collect primary informations regarding the practice of fishing. "Purposive sampling is sometimes known as judgement or as expert choice sampling. Here, the researcher selects the cases to be included in the sample on the basis of his familiarity with the situation combined with his presumed expert judgement". (Ref:- H.L. Manheim. 1977). The dominant type of fishing which has been recently introduced in this reclaimed part of the Sundarbans is *Bheri Culture*. Mainly due to a few reasons purposive sampling method has been applied here which are as follows :-

a) Major parts of the *bheri* invaded areas are found to be highly inaccessible. Many villages are very remote totally secluded by dangerous tidal rivers from the communicable parts of the district. In this circumstances, out of many *bheri* invaded villages only these have been purposefully selected as sampling units which have at least minimum communication facility. Otherwise, collection of field data could not be possible.

b) In this case of purposive selection of villages, the sample size i.e. the total number of sample villages has become optimum. As a result of maintaining optimum number of sample villages (23 villages here, in total) the field survey has become possible to be completed within a desired period of time and at an affordable cost. It could be more time consuming as well as costly if other sampling method has been taken.
Another important factor helping in the purposive selection of sample villages is a perception regarding the location of bheri dominated villages of the northern Sundarbans. A clear idea about the exact locations of bheri dominated villages into that region has been received mainly from the intensive study of the records kept by the Land Records Department of the Government (selected records in Annexure 2). The detailed analysis of those records of land has helped in determining 23 bheri dominated communicable villages of the reclaimed Sundarban as the sample villages for field survey.

2.3.2 PREPARATION OF INTERVIEW SCHEDULE

The most common form of data collection used by the sociologists and scientists is asking questions to the people. Most studies of attitudes use questioning as the primary means of data collection. (H.L. Manheim 1997). In the field survey in the northern Sundarbans, the method of asking questions has been followed to get primary informations regarding the fishing. Interviews of the villagers have been taken individually at a time in each village unit of the area. The most common form of face to face interview has been followed here.

Selection of the type of questions to be asked to the people is an important task. Here open end questions have been selected for the interview schedule. It is because the open end questions have enabled the respondent to reply in exactly his own words. But a few risk factors like (a) to record
verbatim all that he said, (b) to categorise the data before analysing and tabulating those, etc. had to be born. The set of questions to be asked to the people during interview have been printed in advance and in this way the interview schedule has been prepared. The answers to the questions have also been recorded directly on that form at specific space. While constructing this schedule a few very important points have been followed carefully such as:

i) The questions have been worded as simply, concisely and unambiguously as possible.

ii) The questions have been so selected as to obtain all the needed data and each question makes a direct contribution to the hypothesis of this study. Questions not directly related to the hypothesis have been cautiously avoided.

iii) The length of the schedule has been kept within reason according to the subject matter and the respondents. Half an hour has been taken by an interview as a reasonable maximum time.

iv) All the necessary comments by the interviewer have been recorded on the schedule in a separately provided space.

v) To avoid the presence of ambiguous and confusing questions the schedule has been pretested. It has been administered to a few people
having nearly similar socio-economic status to those who would be actually asked later.

Here is the particular schedule which has been prepared for the field survey into the studied area of northern Sundarbans:

Name of the interviewee – Other Property –

Village’s Name

dag no-

Total area of the land –

Type of the land –

Date of Interview –

Q.1. How many years are you residing in this village?

Q.2. How many members do you have in your family?

Q.3. How did you use this land in early days?

Q.4. How are you utilising this land at present?

Q.5. How many years are you running fishery in this land?

Q.6. Do you have any other land in this village?
Q.7. How are you using those lands?

Q.8. What is the method of fishing run by you in your fisheries?

Q.9. What is the amount of profit in the practice of bheri fishing in comparison with agriculture?

Q.10. How much is the profit per unit of land per season bheri fishing in one season in comparison with that in agriculture?

Q.11. What is the improvement in your economic condition at present compared with those days before starting bheri fishing?

Q.12. How many fields of this village have been converted into bheries?

Q.13. Have you found any ill-effect of bheri culture on the surrounding environment?

Comments by the interviewer:

2.3.4. DATA PROCESSING AND ANALYSING:

In order to analyse the collected data, firstly the raw data must be manipulated in such a manner that those may be ready to be analysed. It is called "data processing". Here raw data has been collected in writing on the
printed forms or papers of the interviewed schedule. Firstly, those pieces of papers with raw data have been filed up according to an order. In the next step, those data have been edited properly to remove all sorts of inconsistencies and incomplete writings. Coding was the next necessary step. In this step, the foremost task was to determine two important parameters, such as, (a) economic status (Table 3) and (b) Environmental Awareness (Table 4). Each of these parameters has four categories or classes and each class has a specific range of ‘score’ or ‘number’. Such as,

a) Economic Status :-

<table>
<thead>
<tr>
<th>Class - I</th>
<th>Scores from 76 to 100</th>
<th>For the answer of the person indicating highest economic status.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class - II</td>
<td>Scores from 51 to 75</td>
<td>For the answer of the person indicating medium to high economic status.</td>
</tr>
<tr>
<td>Class – III</td>
<td>Scores from 26 to 50</td>
<td>For the answer of the person indicating low to medium economic status.</td>
</tr>
<tr>
<td>Class - IV</td>
<td>Scores from 1 to 25</td>
<td>For the answer of the person indicating very low economic status</td>
</tr>
</tbody>
</table>

(Table 3)
b) **Environmental Awareness** :-

<table>
<thead>
<tr>
<th>Class - I</th>
<th>Scores from 76 to 100</th>
<th>For the answer of the person indicating highest environmental awareness.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class - II</td>
<td>Scores from 51 to 75</td>
<td>For the answer of the person indicating medium to high environmental awareness.</td>
</tr>
<tr>
<td>Class - III</td>
<td>Scores from 26 to 50</td>
<td>For the answer of the person indicating low to medium environmental awareness.</td>
</tr>
<tr>
<td>Class - IV</td>
<td>Scores from 1 to 25</td>
<td>For the answer of the person indicating lowest environmental awareness.</td>
</tr>
</tbody>
</table>

(Table 4)

In this procedure, each sample person has been designated with two scores at a time, one indicating his socio-economic status and the other indicating degree of environmental awareness. Ultimately, 23 sets of data for 23 sample villages have been arranged according to the mentioned method and 23 sets of frequency distribution have also been prepared. (in Chapter VII), with two variables, i.e. (1) Socio-economic status and (2) environmental awareness.
2.3.5. STATISTICAL ANALYSIS :-

It is this point in the research process where various statistical procedures are to be used in order to analyse the arranged data. As the simplest and most common first step, the data have been arranged into frequency distribution. Here, total 23 sets of frequency distributions have been arranged for 23 sample villages of Northern Sundarbans. As two variables are being studied, such as (1) economic status and (2) Environmental awareness, the most useful thing is to know the extent to which they are related to one another. To find out this relationship in each of the studied villages, Spearman’s rank co-relation method has been followed. After that, multiple regression analysis has also been estimated for each set of frequency distribution.

2.3.5.1 SPEARMAN’S RANK CORRELATION :

Correlation may be said as the appropriate tool for discovering and measuring the existing relationship between two or more variables. It is very useful tool for scientific study as it shows numerically the degree of strength of the association between variables. Thus, in this statistical analysis, the degree of closeness between the economic status and environmental awareness of the people of studied area has been expressed in terms of correlation co-efficient or r.

Here, Spearman’s rank correlation has been used to find out the degree of correlation or r in case of 23 studied villages, because
a) Available data on 23 villages are in ordinal form. In other words, accurate values of the variables are not known. Thus data has been ranked in order of magnitude.

b) It has been thought to be the most convenient method as it is very easy to calculate such a large sized data of 23 villages.

The formula of rank correlation co-efficient is:

\[ R = 1 - \frac{6 \sum d^2}{n^3 - n} \]

there, \( n \) = number of individuals and \( d \) = difference between \( R_1 \) and \( R_2 \)
whereas,

\( R_1 \) = rank of an individual for environmental awareness.

\( R_2 \) = rank of an individual for economic status.

The rank correlation coefficient lies between -1 and +1

\( -1 \leq R \leq +1 \).

1 indicates perfect correlation which rarely exists. The maximum correlation coefficient value possible is ± 0.9919. Here, in calculating the correlation between economic status and environmental awareness of the people of 23 studied villages, the correlation in all the cases has always been found negative or inverse. Because the increase or decrease in economic status of the people is found to be associated with the decrease or increase in their environmental awareness. (detail calculation in Chapter VII).
2.3.5.2. REGRESSION ANALYSIS:

The method of regression analysis has also been followed for each set of frequency distribution of each studied village of Northern Sundarbans. Here, the data has been statistically analysed by computer with the help of SPSS (Statistical Package For Social Science) package. SPSS is “an integrated system of computer programmes designated for the analysis of social science data”. (Nie et al, 1975). All the 23 sets of data for 23 sample villages have been firstly arranged separately into frequency distribution and tabulations of those have also been completed by SPSS Package. Then multiple regression analysis have been calculated on each set of frequency distribution. Finally along with this calculations, individual graphical presentation has also been completed for each village.

At the final step of the statistical analysis, all the regression analyses of 23 villages have been compiled together to produce comparative analysis denoting the entire surveyed area of north Sundarbans. This comparative study has helped in having an overall idea about the relationship between the two variables, i.e. economic status and environmental awareness in the studied area. (Calculations in Chapter VII).

2.4 DATABASE

This study has been supported by both the secondary and primary data having different sources.
2.4.1 SECONDARY DATABASE

Sources of secondary data are many and include principally the following bases:

i) Background Literature: These include the books and articles on the conceptual background of the environment of the Sundarbans, environmental degradation, sustainable development, etc. Reports on Sundarban Planning Region, Sundarban Biosphere Reserve, periodicals on estuarine and mangrove formation, articles on general characteristics of the Sundarbans, on various villages of the area, etc. have also been followed.

ii) Census: Census information related to the Police Stations and the villages of the districts of North and South 24 Parganas for 1981 and 1991 are particularly helpful to have an idea about the regional economy of the Sundarbans as well as the population character. Census report of 1951 has also helped in having an idea regarding geographical base of the region. The administrative maps of the census reports are also very useful.

iii) Cadastral and Topographical maps: The topographical maps by Survey of India and the Thematic Maps by National Atlas and Thematic Mapping Organisation have become very useful in this study. Along with these, the cadastral maps of different villages and Police Stations have also helped a lot in analysing the physiographic characteristics of the Sundarban region.
iv) **Satellite Imagery**: Above all, the Satellite Imagery taken on the Sundarban region in the year 1996, 1997, 1998 have been consulted and compiled with the other available maps to have more concrete and recent idea regarding the physiographic features of the Sundarban region. This imageries have been available from State Remote Sensing Centre, W.B. under control of the Department of Science And Technology and Non-conventional Energy.

2.4.2. **PRIMARY DATABASE**

Since the secondary information from the existing maps and census reports are inadequate, backdated and sometimes full of errors, primary data generated from field survey form the most important component of the database. Following the purposive sampling method, twenty three villages of different police stations of the Northern Sundarbans have been very intensively surveyed and the local population have been very carefully interviewed individually. Moreover, a number of fishing ghats and fish markets have been surveyed and related persons have also been interviewed in the southern coastal Sundarban region.

To get very useful primary informations, those data have been analysed by various statistical methods. In this case, both manual and computer procedures of calculation have been considered.