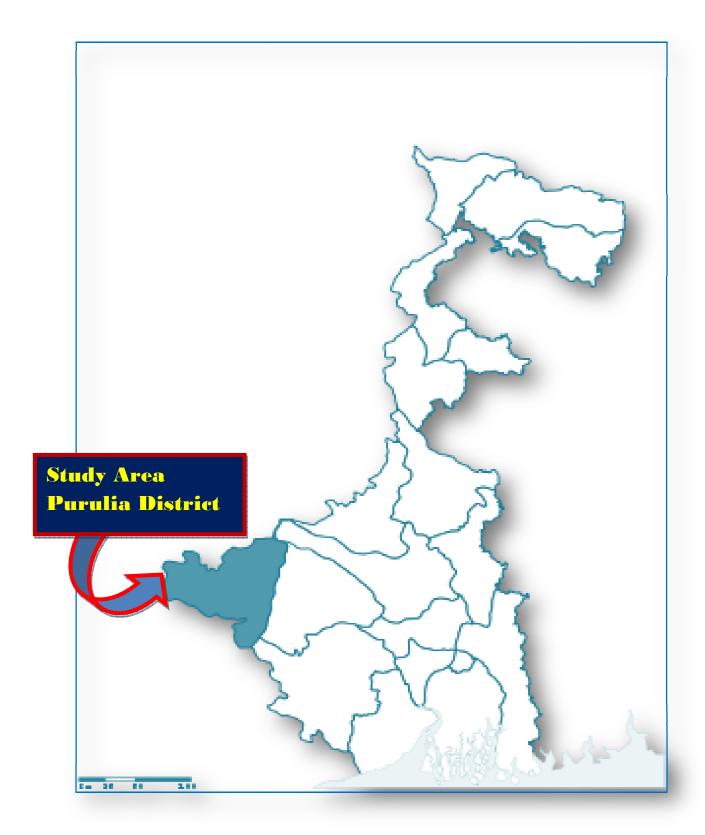# CHAPTER 4: MATERIALS & METHODS

:

The present study is based on an intensive fieldwork and some laboratory analysis (mainly soil water quality parameter and plankton diversity) conducted in blocks of both Purulia and Bankura district, West Bengal during the months of February 2014 to January 2016. Before the commencement of fieldwork, a pilot study was conducted during the month of January 2013. Based on that pilot study, Arsha, Balarampur, blocks, in West Subdivision, Purulia II and Hura blocks in East Subdivision, Kashipur and Para blocks in Raghunathpur subdivision of Purulia district were selected for final study. In case of Bankura district I have selected two blocks in BankuraSadar Subdivision namely Bankura I and Onda, Khatra Subdivision (Khatra   and   Taldangra)   and   in   Bishnupur   subdivision   Bishnupur   and   Joypur blocks.Purposive   sampling technique was   used whereas choosing the   study area.
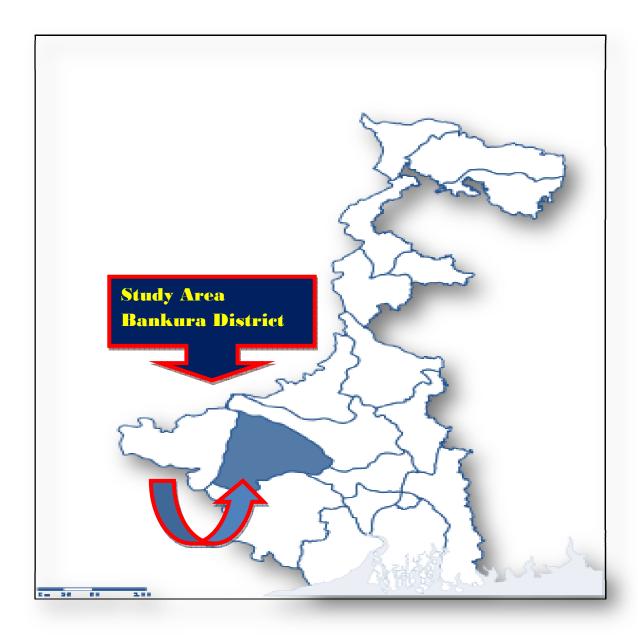
Study area

Purulia came into force as a district of West Bengal in 1956.Purulia is that the western-most district of West Bengal with all-India significance attributable to its tropical location, its shape as well as function like a funnel.It funnels not only the tropical monsoon current from the Bay to the subtopic components of north-west India, but also acts as a gateway between the developed industrial beltsof West Bengal and also the hinterlands in state, Jharkhand, Madhya Pradesh and Uttar Pradesh.This district is between $22^042'35"$ and $23^042'0"$ north latitude and $85^049'25$" and $86^054'37$" east longitude. Midnapore, Bankura and Burdwan district of West Bengal and Dhanbad, Bokaro, Hazaribagh, Ranchi, West Singbhum, East Singbhum district of Jharkhand State bound this district.The total geographic area of the district is 6259 sq. kms.Out of that the Urban and Rural areas are 79.37 sq.kms (1.27%) (Municipalities & Non-Municipalities) and 6179.63 sq. kms (98.73 %) respectively.

**Study Area
Purulia District**

Location of Bankura District:

It is one among the seven districts of Burdwan Division within the Indian state of West Bengal. The district has been delineating as connecting link between the plains of geographic region on the east and Chota Nagpur upland on the West. It is located between $22^038'$ and $23^038'$ north latitude and between $86^036'$ and $87^046'$ east line of longitude. It's a locality of 6,882 sq. kilometers. On the north and north – east the district is finite by Bardhaman district, from that it's separated principally by the Damodar stream. On the south – east it's finite by Hooghly district, on the south by Paschim Medinipur district and on the west by Purulia district (O'Malley, L.S.S., ICS, Bankura, geographic region District Gazetteers, pp. 1-20, initial printed 1908, 1995 reprint, Government of West Bengal). The areas to the east and north – east are low lying sediment plains. To the west surface step by step rises, giving way to undulating country, interspersed with rocky hillocks. The abundant of the district is roofed with jungles. The western a part of the district has poor, ferruginous soil and laborious beds of dirt with scrub jungles and sal woods in the eastern half the eye constantly rests on wide expanses of rice fields, inexperienced within the rains however parched and dry in summer ("Bankura, West Bengal". Location and extent.District administration.Retrieved 2008-12-20.)

Source of data collection:

Data are the vital quality for any variety of study and for policy formulation. Find result and allocation of recourse knowledge play vital role. Data assortment is relying upon the standard of form and researcher's communication talent as well presence of mind. So, i used to be collected data each from primary and secondary sources.

Primary data collection:

Observation:

Observation is an activity of a living being, like an individual's, consisting of receiving data of the outside world through the senses. The term refers to any data collected throughout this activity. An observation can even be the manner you verify things or after you verify one thing. Each the participant and non-participant observation ways were used for the gathering of data. As a part of participant observation the scientist stayed few days at village and took part in their day to day activities and ascertained the recent happening in their everyday life. The various sources of livelihoods, forest resources, water for irrigation and therefore the land pattern were observed. Also, the cropping pattern, the standard and trendy means that of water conservation and utilization, crop production, conservation, use of chemical, pesticide, and alternative sorts of ancient and trendy sorts of agricultural practices were rigorously ascertained.

Interview:

An interview could be a conversation between 2 individuals (the surveyor and therefore the respondent) wherever queries are asked by the surveyor to get information from the interviewee. Interview is use as technique for qualitative analysis. The qualitative analysis interview seeks to explain and therefore the meanings of central themes within the life world of the subjects. The most tasks in interviewing are to grasp the meaning of what the interviewees say (Kvale, 1996).

Structured and semi-structured interviews were conducted with the skilled worker. Interviewed were concerning their perceptions towards the current source of livelihoods. The villagers were interviewed to grasp their changing supply of livelihoods. At the time of Interviews special stress was given to incorporate agricultural laborers, landless individuals, and women. The scope of the interviews was wide-ranging covering totally different cultural practices and autochthonal data associated with resource management. Some special interviews were additionally held with agricultural laborers and non-agriculture laborers. Separate and joint targeted group interviews were conducted for

the recent individuals and beneficiaries of the developmental scheme. Separate and mixed interview were also conducted each for men and women.

Schedule:

It is a crucial tool that has systematic info regarding the study area. The household schedule was designed in such a way that it captured the small print of socio-cultural and economic info of the villagers within the study areas. These embody demographic details, instructional standing, activity and financial gain aspects of the beneficiaries. These additionally helped within the collection of data concerning land-holding, irrigated, and non-irrigated fields in acres, sharecropping, multiplicity of cropping and quantity of production, supply of livelihoods, migration, etc.

Resource: map:

For drawing resource map the scientist inspired the villagers in all the 3 hamlets individually. Each men and ladies participated in drawing it whereas the scientist acted as an assistant. Putting some marks on ground the villagers indicated the position of varied natural resources within the village. This resource map drawn by the villagers was traced by the scientist to develop it into village map that helped in understanding the varied natural resources in numerous elements of the study areas. Resource map is very important technique by that scientist conceptualization the accessible village resources direction and position.

Secondary data collection:

The sources of secondary data are the revealed and unpublished reports. knowledge from secondary sources were gathered from books, articles, journals, revealed reports, Census reports, and Government documents. Quantitative data with relevancy land-holding, demographic aspects, cropping pattern and irrigation system were additionally collected from block profile and District statistical Hand Book. The secondary sources like books, journals, articles, etc., additionally provided an image of ancient source of livelihoods and their management system of West Bengal.

REPORT OF THE BLOCK SURVEY

GENERAL BACKGROUND INFORMATION OF FISH FARMER:

Name: --

Village: --

Panchayet: ---

Block: ---

Total pond area: --

Type of fish culture: (Traditional / Extensive / Semi intensive / Intensive)

Annual fishproduction (Quantity):---

Annual family consumption (kg): ---

SOCIO ECONOMIC CONDITION:

Age: ---

Gender: ---

Caste: ---

Family size: --

Family Type: ---

Education Qualification: --

Occupation (primary/ secondary):--

Annual income: --

Possession of fishery equipment: --

SITUATIONAL VARIABLES:

Size of water body: --

Distance from the residence: ---

Ownership of the water body (owned/ leased/ auction)

Main source of water (rain/ canal/ both)

Water retention (seasonal [3-4month/ 4-6month]/ perennial)

Average water depth: --

Period of leased: --

Leased amount/ yr: --

CONDITION OF WATER BODIES :

Infested with weeds (yes / no)

Extent of weed infestation (completely chocked /moderate /low /nil)

Type of weeds (Floating /submerged /emergent)

Existence of local fauna: --

In case of self owned pond: ---

a) **Approximate cost of excavation:** ---

b) **Source of water:** --

c) **Any other:** --

CULTURE PRACTICES:

    Type of culture (Monoculture /Composite culture /Integrated farming)

    Culture input level (stocking /stocking +
feeding/stocking+manuring/stocking+manuring+feeding+liming):

    Species cultured: ---

    Rate of stocking (No's /Ha): ---

    Type of manure used (organic manure /inorganic manure)

    Source of manure (home made /purchased)

    Interval of manuring: --

    Type of feed used (rice bran+oil cake /only rice bran /others)

    Source of feed: --

    Interval of feeding: ---

    Method of harvesting (need based / partial / completely)

    Mode of harvesting (self /employed labour)

    Method of disposal (self /retiling /sold to whole seller /others)

CONSTRAINS TO ADOPTION OF SCIENTIFIC FISH CULTURE :

    Problems related to seed: ---

    Problems related to manure & fertilizer: --

    Problems related to use of pesticide, insecticide, fish poison: --

    Problems related to social situation: --

    Problems related to marketing: --

    Problems related to credit: --

    Problems related to transportation: --

Farming if integrated income:—

 Income before integration: --

  Income after integration: --

_____

 Signature of the farmer

_____

 Signature of the researcher

The study entitled "**Studies on Status and Future Management Strategy of Fish Farming in the Rainfed Districts like Purulia and Bankura**" was conducted in both Purulia and Bankura district, West Bengal. To conduct the study scientifically, a suitable research design was evolved in order to arrive at an authentic conclusion. This chapter deals with the details of the methodology adopted for the present study.

The water, soil, plankton sample, macrophyte and fish faunal resource were collected normally during early morning hours from each selected stations of both the district during first week of every months for consecutive 24 months (March, 2014 to February, 2016).

Collection of Sample:

Water sample:

For water quality analysis random samples of water were collected from each selected sites of both the district in the morning of each season (Pre Monsoon, Monsoon, Post Monsoon and winter) throughout the research period. Water samples were collected from 50 cm depth in each sampling station.During collection of water samples, cautions were taken so as to prevent air bubbling, which might influence water quality parameters such as dissolved oxygen.

Soil sample:

For themeasurement of soil quality parameters, soil samples were collected from the each selected sites of both the district in the morning of each season (Pre Monsoon, Monsoon, Post Monsoon and winter) throughout the research period. Bottom soils were collected from the selected ponds of both the district with 5 cm diameter core tube at a depth of 0-10 cm of the pond bottom. Approximately 1 kg samples were collected from each pond at a 10 m distance for every replication. Then soil samples were put in tight plastic bags and transported to the laboratory. In the laboratory the samples were air dried at 60°C, broken into smaller size particles with mortar and pestle and sieved through a 2mm sieve.

Plankton sample:

A conical plankton net made of bolting silk cloth (no. 21 with 77 meshes per square centimeter) was used to collect the plankton sample. About 10 litre of water was filtered through hand plankton net, where in the plankton concentrate used to accumulate in the specimen tube of 100

ml fitted at the tail end of the net. The quantity or volume of water sieved depends on the availability of plankton population.

Preservation:

The filtered sample of plankton was preserved in 4% formalin solution and stored in labeled vials for subsequent quantitative and qualitative analysis (APHA, 1998).

Estimation:

Sample was allowed to settle down for a day the volume of the plankton was measured ina measuring cylinder. When the plankters are numerous in the original sample then they are directly counted with the help of a Sedgwick Rafter cell, which provides a known volume and area for microscopic examination and enumeration of organisms. Area of the counting cell is 50 x 20 mm with 1 mm depth to hold 1 ml of the sample under a cover slip. Before transferring the sample to the counting cell, it was well shaken for homogenous mixture. Frequencies of different plankton species were noted at random from each of 10 squares out of 1000 squares at random and the average of these were used for final estimation. The detailed study of the plankton was done by using OLYMPUS inverted stereoscopic microscope (Model MLX – B) fitted with a NIKON camera.

Counting of Sezedwick Rafter Cell:

Frequencies of different plankton species are noted atrandom from each of 10 squares out of 1000 squares at random and the average of these are used for estimation. 'n' is the number of a species found in a square of the counting cell, then the number 'N' for the species in the total volume filtered (i.e for the whole sample) is calculated by :

$$N = \frac{n1 + n2 + n3 + n4 + n5 + n6 \ldots\ldots\ldots\ldots\ldots\ldots..n1}{\text{Volume in ml of sample from which sub – sample was drawn for the analysis}} \times 1000$$

Now, N is expressed in standard from i.e u/l by the formula

U/l = N/Liters of water filtered

Identification:

Identification of plankton was done according to the character mentioned by different author. Hutchison, 1957; Ward and Whipple, 1963; Needham and Needham, 1978; Prescott, 1978; Fritsch, 1979; Biswas, 1980; Sharma and Khan 1980; Round, 1984; Wetzel and Likens, 1991; Battish, 1992; Cox, 1996; Chergui et al, 1999 etc.

Water quality:

Temperature:

Surface water temperature was measured using a thermometer marked with 0.01 graduated centigrade (^{0}C) was employed to measure the water temperature at the sampling site.

pH: In the present study, the pH of water sample was measured by using a digital pH meter.

Dissolved oxygen (DO), Total alkalinity, Hardness, Nitrate- nitrogen (NO_3-N), Nitrite nitrogen (NO_2-N):

All the parameters have been analyzed using Water testing kit of Merck India Ltd.

Soil quality

pH

The pH was determined with a digital pH meter (ADCO) (Jackson,1967).

Organic carbon & Available phosphorus:

All the parameters have been analyzed using Soil testing kit of Merck India Ltd.

Aquatic Macrophytes Characterization:

Macrophytes were studied by collecting them at frequents interval and preserved in Herbarium sheet for future study, identified through standard literature (Sanyal 1994).

Ichthyofaunal Diversity:

Fish catch and yield were recorded from fishermen, local fish markets, Primary Fishermen Co Operative Society Ltd, office of the Assistant Director of Fisheries, Purulia. Fishes were identified using standard literature.

Statistical Analysis:

Statistical analyses were performed using Microsoft Office 2007 data analysis tool pack. Correlation coefficient (r) was calculated for the water quality and available plankton to know their relationship. One way analysis of variance (ANOVA) followed by least significant test in the form of critical difference was performed to test the significant difference between samples in the case of water and soil quality and seasonal variation of available plankton.

Plan of Work

The study entitled "Studies on Status and Future Management Strategy of Fish Farming in the Rainfed Districts like Purulia and Bankura" was conducted in both Purulia and Bankura district, West Bengal. To conduct the study scientifically, a suitable research design was evolved in order to arrive at an authentic conclusion. This chapter deals with the details of the methodology adopted for the present study. Now for the sake of convenience, this chapter is subdivided into following sub headings:

Plan of Work (Flow Chart):

Step – 1:

▸ For both the district we have selected 2 no of blocks in each sub divisions based on some criteria. These are: i) no of water body present or max availability of fresh water area.

ii) No of fishermen population (max)

iii) No of Reservoirs present or depending on reservoir water area.

Step – 2:

▸ In the first phase, extensive survey will be conducted through a structured survey schedule to collect primary data on the culture practices and management aspects from the farmers. This will also incorporate the socio-economic aspects of the fishers also which will help in formulating future management strategies. The level of intensification and degree of integration will be assessed through this survey.

Step – 3:

▸ The physico-chemical and biological parameters of the selected ponds will be monitored at regular intervals with respect of pH, dissolved oxygen, transparency, alkalinity,

hardness, ortho-phosphate, NO_2- N, NO_3- N of water will be analyzed following the methods described in APHA (1995). The biological parameters such as plankton density and composition, primary productivity, macrophyte composition will be monitored following the methods described in APHA (1995).

Step – 4:

▶ Selected physico-chemical parameters of bottom soil viz. pH, organic – C, available – P, available – N and K will be analyzed following the methods as described in Jackson (1967).

Step – 5:

▶ In the second phase, fisheries management aspects of the selected reservoirs from both the districts with respect to stocking, species composition and ratio, stocking size, macrophyte management, fishing methods, catch per unit effort, catch composition, other input variables like feed, manure etc. will be surveyed through a structured survey schedule. The primary data obtained from the survey will be corroborated with the time series data available from the respective Block office Department of Fisheries, Govt. of West Bengal. Specific fisheries management strategies will be formulated for that drought prone areas through trial.

Step – 6:

▶ The physico-chemical and biological parameters of the reservoirs will be monitored at regular intervals with respect of pH, dissolved oxygen, free carbon di-oxide, alkalinity, hardness, ortho-phosphate, NO_2- N, NO_3-N, of water will be analysed following the methods described in APHA (1995). The biological parameters such as plankton density and composition, primary productivity, macrophyte composition will be monitored following the methods described in APHA (1995).

Step – 7:

▶ Formulation of advance fisheries management strategies according to present scenario.

Sampling Frame

Table 2: Proposed Sampling Frame for the study:

Stage	Selected Zone	Sampling Procedure	Number of Unit	Data Collection
Stage 1: District	Purulia, Bankura	Purposive Sampling	2	Secondary data
Stage 2: Subdivision	Purulia Sadar East, West, Raghunathpur, Bankura, Bishnupur, khatra	Purposive Sampling	6	Secondary data
Stage 3: Block	2 Block from each subdivisions of both the districts	Purposive Sampling	12	Secondary data
Stage 4: Village	2 village from each block of both the districts	Purposive Sampling	24	Secondary data
Stage 5 Fish farmer	5 Fisherman from each village of each block of both the districts	Random Sampling	120	Questionnaire and Interview