CHAPTER 1

INTRODUCTION

This chapter deals with the theoretical framework of the study. The framework includes the problem, review of literature, objectives, methodology, significance, scope and limitation of the study. These are being discussed here.

THE PROBLEM

Human beings relate themselves to environment, organic as well as inorganic, particularly to the animal or plant life in friendly or hostile manner with which the human society comes in contact. This is broadly termed social ecology (Haeckel 1866). Social ecology refers to functional adjustment of organisms with their physical environment. In social ecology the emphasis is given on their ethology, the detailed study of communities, species interrelations and communities (Trivedi 1994). As the term is derived from ecology, a branch of biology which studies the mutual relations between environment, animals and plants, the social ecology, the field of human or social ecology centers around human beings and their environments. The environment and geographical conditions have a great bearing on society, culture and civilization (Huntington 1945) and as such there is a dynamic, dialectic and determining relationship between life and environment. Without favourable environmental conditions no life can survive. Through a process of constant selection and constant adaptation, the moving equilibrium of life is maintained (McIver and Page 1998). Various

scholars (Burges 1935; Mackenzie 1925; Park 1925) have also given ample emphasis on the study of human ecology as an important field to comprehend complex human behaviour. Human ecology is basically the study of mutual relationship of environment and human action and therefore any organism that cannot adapt or change to the physical environment it invites its own extinction. Human being always strives to obtain a better state than the present one in order to develop and grow. The best environment for human growth is one in which there are new stimuli and familiar responses, the chance to explore and the ability to return (Odum 1983).

Environment provides various natural resources for sustenance as well as the conditions for sustainable growth of these organisms. Demands on various natural resources have been rising and consequently their injudicious exploitation is wreaking havoc to many eco-systems. A statistical estimation shows that at least 12% of the total rural population exploit the natural resources for their sustenance, and the people are utilizing such resources quickly to meet their present needs. However, unscientific and excessive uses lead to decline of the resources. If the overexploitation is not checked immediately, then, a large number of the people will face serious problems (Beck and Ghosh 2000). The natural resources can be broadly divided into two categories; namely, (i) living resources (biotic) e.g. fish. Forest, animals, etc. and (ii) non-living resources (abiotic) e.g. land, water, minerals, etc. From the biological point of view, the living resources can be again categorized into (i) plant resources and (ii) animal resources. The natural resources (biotic and abiotic) in the form of land, water, fish, forest and pastures are being discussed in terms of their nature, availability and utilization.

In any perspective planning of agricultural development, land development occupies the top place for all means of production. Therefore, its proper and scientific management is essentially required for sustainable development (Trivedi 1996; Von 2000). The quality of land is directly related to crop production and the growth of various flora and fauna. Without water no life can survive. Above all, water is the key to all factors of the eco-system. Traditional use of water as a common property resource has primarily been for drinking purpose, domestic use, livestock, agriculture, fisheries, etc. as per the quality and requirement of the resource. Water bodies may be considered the world's most productive sources because they provide tremendous economic benefits through fish production (Jhingran 1991). They have been source of living for a number of communities around the globe. In India several fishing communities thrive on inland and sea fish withstanding the vagaries of environmental conditions. Wetlands and river systems are the most common natural sources for fish resources since the time immemorial. Besides, the flora and fauna from fresh water wetlands have provided a great diversity of vital resources available locally, particularly to the poor for their sustenance. Fish has been one of the main, cheap and locally available animal protein sources since the early civilization, and fishing is the only livelihood for local traditional fishermen in many geographical regions. Therefore, decline of fish resources threatens the very existence of the poor (Deb 1999; Das 2001). Environmental factors like rainfall, soil texture, etc., play important role in the growth of natural fish in wetland and river fisheries. In the fish stock reservoirs where fishes grow naturally, overexploitation may bring gradual depletion of fish resources and, ultimately, it brings the 'Tragedy of Commons' (Hardin 1968).

Wetlands are among the world's most productive environments. They provide tremendous economic benefits to mankind through fishery production. Over two thirds of the world's inland fish harvest is linked to the health of wetland areas, the maintenance of water tables for agriculture, water storage and flood control. It also provides timber production, waste disposal, water purification and recreational opportunities. Moreover, wetland provides critical habitats for waterfowls and other aquatic birds as well as countless mammals, reptiles, amphibians, fish and invertebrate species, some of which are threatened with extinction. The richness of wetlands can be seen from the fact that they can produce upto eight times as much plant matter as wheat fields (Tripathy 1979). But it is possible only when these processes of wetland are allowed to continue their functioning. Unfortunately, due to unmanaging way of exploitation, it has undergone a threat (Bhuiyan 1987). Some wetlands are called 'beels'. The term 'beel' is popularly used after the Ramsar Convention held in 1971. According to the convention, beels are defined as the areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary with water which is static or flowing, fresh, brackish or salty including areas of marine water, the depth of which at low tide does not exceed six metres (Govt. of Assam 2006). In a fishery statistics published in 1993, it has been pointed out that the rural natural fishery system has provided a great source of employment. About two millions of people in India are engaging themselves as full time workers in fishing, and another four million people as part time or occasional fishermen or women (Jyotishi and Partha Sarathy 2007).

The knowledge and occurrence of fish in India dates back to three millennium B.C. (Hora 1965). Fish remains with cut marks, indicative of their use

in food, have been obtained from excavations at Mohenjodaro and Harappa of the Indus Valley Civilization dated from 2500 B.C. to 1500 B.C. (Nath 1966). King Somesvara, the son of King Vikramaditya VI who composed the book Manasoltara in 1127 A.D., was the first to record the common sport fishes in India (Hora 1951a). Animals and plants associated with water have signified life, fertility and abundance from the time immemorial. The fish, one of the first forms of evolutionary higher life to appear in water, is among the earliest vertebrates (Jhingran 1991). Motifs and symbols have appeared in early Indian art, particularly those derived from water cosmology. Thus, fish becomes an integral part of human society (Hora 1951b). Some 20,000 species of fish are known to inhabitate water bodies of various descriptions. Over a thousand species of fish are found in India (Jhingran 1991). According to the International Centre for Living Aquatic Resource Management in the Philippines (Mac Kay 1991) catch data are inadequate. The underestimation occurs because as much as twice the marketable catch may be consumed or processed locally without being measured. In developing countries data on the species composition of the catch are rarely available (Jyotishi and Partha Sarathy 2007). India's total fish production stood at 0.817 million tons in 1950. It registered a decrease to 0.751 million tons in 1951 and a further decline to 0.7444 million tonnes in 1952. After 1952, it showed a steady increase upto 1.233 million tons in 1957. Thereafter, the production is gradually increasing and it stood at its all time high of 2.52 million tons in 1983. The total fish catch in India in 1986 was 2.81 million tons (Jhingran 1952).

Assam is one of the India's states, which is rich in wetlands. It contains around 3,513 fresh water wetlands covering an area of 1,012.31 sq. km. The area constitutes 1.29 percent of the total geographical area of the state. Of the

wetlands, there are reservoirs of water called beels numbering 1392, whereof only 423 are registered with the Government and the remaining 969 are

Table 1.1 : District wise Distribution of the Beel Fisheries in Assam
(Percentage in Parenthesis)

District	*Number of Registered Beels (%)*	*Number of Unregistered Beels*		*Total Number of Beels (%)*
		Government Sector (%)	*Non-Government Sector (%)*	
Cachar	45 (10.64)	21 (4.16)	197 (42.46)	263 (18.89)
Karimganj	26 (6.15)	21 (4.16)	12 (2.59)	59 (4.24)
Darang	17 (4.02)	13 (2.57)	01 (.22)	31 (2.23)
Sonitpur	03 (.71)	10 (2.36)	09 (1.94)	22 (1.58)
Dibrugarh	19 (4.49)	N.A.	19 (4.09)	38 (2.73)
Dhubri	37 (8.75)	75 (14.85)	N.A.	112 (8.05)
Kokrajhar	04 (.95)	22 (4.36)	N.A.	26 (1.87)
Goalpara	13 (3.07)	32 (6.34)	N.A.	45 (3.23)
Barpeta	48 (11.35)	25 (4.95)	02 (.43)	75 (5.39)
Nalbari	26 (6.15)	08 (1.58)	14 (3.02)	48 (3.45)
Kamrup	23 (5.44)	09 (1.78)	14 (3.02)	46 (3.30)
North Lakhimpur	22 (5.20)	57 (11.29)	74 (15.95)	153 (11.06)
Nagaon	82 (19.39)	182 (36.04)	25 (5.39)	289 (20.76)
North Cachar	N.A.	N.A.	N.A.	N.A.
Karbi Anglong	N.A.	N.A.	N.A.	N.A.
Sibsagar	16 (3.78)	10 (1.98)	28 (6.03)	54 (3.88)
Jorhat	42 (9.93)	20 (3.96)	69 (14.87)	131 (9.41)
Total (%)	423 (100)	505 (100)	464 (100)	1,392 (100)

N.A. = Not available

Source : Jhirngram, V.G., 1991, Fish and Fisheries of India. Hindustan Publishing Corporation, p. 727

The table reveals that the two districts; namely, Nagaon and Cachar contribute two fifths of the beel fisheries in Assam. The beels are found registered as well as unregistered. Nagaon has one fifth and Barpeta, Cachar, Jorhat and Dhubri have around one tenth of the registered beels in the state. The unregistered beels are found under the Government as well as the non-Government sector. In the Government sector Nagaon has nearabout two fifths of the unregistered beels followed by Dhubri and North Lakhimpur districts. In the non-Government sector Cachar has two fifths of the unregistered beels followed by North Lakhimpur and Jorhat districts. Thus, about Nagaon, Cachar, North Lakhimpur, Jorhat, Dhubri and Barpeta are the (seven) districts which contribute 70% of the beels in the state.

Nagaon and Cahcar are the major contributors of the beels among the districts. Cachar and Karimganj districts are located in the Barak Valley of the state.

In Barak Valley, there are found beels, ponds, canals, rivers, rivulets, lakes, etc as good pockets for fish varieties. The Shonebeel is the largest wetland in the valley. During the monsoon, the beel gets flooded and fish resource converts into Common Property Resource (CPR) in the area. The flood water recedes in the winter and the land becomes available for private cultivation. Several changes are perceived to be occurring in respect of the beel and land in the area which are compelling the fisherflok in the villages to readjust themselves with the changing environment. These changes offer an interesting study in the area of man – environment interactions in the region.

Man-environment interactions in India and abroad have been subjected to study by several scholars, who have reported various interactional patterns. These are being surveyed and reviewed in the following discussion..

SURVEY OF THE LITERATURE

Maharastra is famous for its varied fresh water resources, including lakes, tanks and rivers and a number of fishing communities have emerged there in response to the environmental factors. Singh (1994) studies the Dhibar, basically a traditional fishermen community, and reports that it has a large subdivisions of local or occupational nature. This study also outlined that there is a strong prohibition on marriage between the members of the same sect and between first cousins. This community is primarily of fishermen and boatmen. They have adapted to various river fishing practices as well as ferry service. Gond, another

fishing community, has been studied by Pattnaik (2000) who found that this community is now spreading from Narmada basin in North to Godavari basin in South and from Chattisgarh in East to Khandesh in West. Gabits is another fishermen community of Maharastra studied by V.A. Deshmukh (1966). This study focuses on the house structure, religious beliefs, techniques of fishing etc. of this community. Menon (1939) outlines the distribution of both marine and fresh water fisheries in Cochin state. Mathur (1967) has studied the Mopla, the Muslim fisherfolk of Kerala. He explains the relationship between the habitat, economy, society and culture of the Mopla fisherfolk, who are Muslim but, even then, they mostly follow various rituals of Hindus.

There is a gradual decline in natural resources mainly due to extensive and intensive agricultural practices, population increase and environmental degradation. In his study of Nabastha village in Bardhaman district of West Bengal, Greenough (1982) found substantial reduction of fish, fodder, etc. due to large-scale reclamation of waste lands, wetlands and marshy lands for cultivation. Thus, the water-based CPR has become extremely limited in the village. In another study, it has been found that the changing pattern of fish catch from traditional to modernized way has resulted into reduction of the fish stocks in Malta river affecting the livelihood of fisherfolk (Kurien 1995). In Dwarbasini village in North 24 Parganas of West Bengal, the poor households exclusively maintain a village tank, handed over by the State Government in 1950 to Malo community who migrated to this village from Bangladesh (then, East Pakistan). This community maintains the tank (88 acres approximately) as a commercial fishery (Beck and Gosh 2000). Banerjee (1942) and Mookerjee (1946) studied the River

fisheries of Bengal and highlighted the distribution of fisheries emphasizing the conditions of fishermen and the need for appropriate measures for the conservation of the resource.

Henry Balfour (1925) studied the geographical dispersal of a special and peculiar form of conical trap used for catching fish in Naga Hills. His study focuses mainly on the cultural affinity of the fishing communities of North Arakan, Western Burma, China and New Guinea. The hunting appliances used by the Onges also showed a great affinity with Negrito races (Chaterjee and Kumar 1954). Anthropological Survey of India undertook a detailed study of marine fisherfolk with a view to finding out how they are responding to the adoption of modern technology and innovations.

Fishery resources of lake, beel etc. are the most potential sources of income of the local people and also to the concerned government. Annadale and Kemp of Zoological Survey of India (ZSI) have carried out a survey in 1914 – 15 on the biological sources of the lake Chilka. Jhingran and Natarajan (1969) also carried out an extensive work on the fisheries aspects of the lake. Dynamics of the fish production yearwise have been reported by Misra (1988), Devasundaram (1954b), Fisheries Department, Government of Orissa (1970, 1986). The fishing communities comprise pre-dominantly the Oriyas. Additionally, some Telugu fishermen communities are also found fishing in the Chilka lake. The Oriya fishermen of different castes; namely, Keot, Kaivartyas, Behra-Kaivartyas, Teors, Ghodies, Kandaras, etc. are studied by Ram Krishnaiah (1994). The caste structures of the fishing communities are so dominant that the upper caste Kaivartyas, who belonged to a higher strata, do not engage in trap fish (taken to

be low pride) and catch fish by net only. The Teors, Ghodies and Kandaras are treated as lower class and then operate the traps and catch the crabs and prawns. The total number of fisherfolk making a livelihood from fisheries of Chilka is around 1,00,000 with 27,000 active fishermen.

Devasundaram (1954b) has carried out a detailed survey of the fishing gears and crafts used. The various types of crafts and gears are classified under three major categories; viz., net fishing, jano fishing (barricade fishing) and trap fishing. Baviskar (1995) has studied the Chilka lake into a new dimension. He studied those communities who depend on the natural resource of the Chilka lake for their sustenance but have been deprived. For which there happens a wider loss of cultural autonomy, knowledge and power. In the name of development, the people have been pushed off the land, their forest, their water related customs, etc. Samal and Meher (2002) studied how the non-fishermen community has reduced drastically the share of the fishermen in their fish capture activity. The study focuses that how this phenomenon affects mostly the economic condition of the fishermen. Besides, poor fishermen are feeling that their livelihood is threatened due to the entry of the non-fishermen, mostly from upper caste and the upper class background who have emerged as strong competitors. Pattanaik (2007), on the other hand, looked this matter differently. His study emphasizes that there happens a psychological effect on the fisherfolk that how long they can sustain with this fishing activity and hence the fishing communities have started shifting to other places in search of livelihood. There are three traditional fishing communities; namely, Kaivartyas, Patnis and Mahimals in Barak Valley of Assam. It is said that Patnis are originally migrants from Patna of Bihar to Jaldhup village of Bangladesh and from there they migrated to various parts of NorthEast India.

In Bengal, the word 'Patni' means *parkarani* (meaning one who ferries people in boat from one place to another. Their socio-cultural life, religious beliefs, economic conditions and their kinship organization were studied by Das (1996) Choudhury and Kar (1995) and Risley (1891) provided a brief account of Kaivartya of Bengal and NorthEast India in the late nineteenth century. In a recent study, Purkayastha (2000) described the life style and resource management among the Kaivartya of Chatla Hawr in Cachar district of Assam. Haque (1982) studied the Mahimal, the only Muslim fishermen community in the Barak Valley of Assam.

In Manipur, many of the tribes like Marams, Maos and Pimai of different villages have been practising traditional fishing methods such as using of nets, hooks, bamboo traps, partial diversion of rivers, herbal poisoning etc. Herbal poisoning is resorted to occasionally and usually not very toxic, thereby, within manageable level. In fact, there is a traditional belief that periodic poisoning of river enhances the fertility of the river. However, after 1990s, the people of these villages started to exploit the river by using toxic chemicals like bleaching powder, pesticides, insecticides, fungicides which are not only devastating to the fishes but also dangerous to the cattle and human beings. Besides these chemicals, the people started fishing with explosive devices and electrical appliances which in fact facilitate to collect more fishes with a short period of time. The net outcome is fast depletion of fish and aquatic life in mighty Barak (ARSAC and SAC report 1997). Due to the huge demand and high rate of fishes in the market, the fishermen are using such unsustainable methods to catch more fishes and to earn more within a short duration.

Leap (1977) has focused on the fishing expedition exclusively made by the tribal and peasant societies. He showed how the tribal and the peasant

societies combined hunting, agriculture or other occupations. The Ao Nagas of Nagaland, though primarily dependent on agriculture, practise both collective and individual fishing in the rivers as well as in the streams. The Apatanis of Arunachal Pradesh rear fish in the paddy fields. Thus, the Ao Nagas and the Apatanis include fishing in addition to agriculture. The Andamanese, however, subsist on hunting, fishing and collecting. The fish in the sea and the pools using nets, short spears, harpoons, bows and arrows. Traditionally, they were aware of the method of poisoning fishes in the pools by means of certain plants which they crash and place in the water (Malinowski 1926).

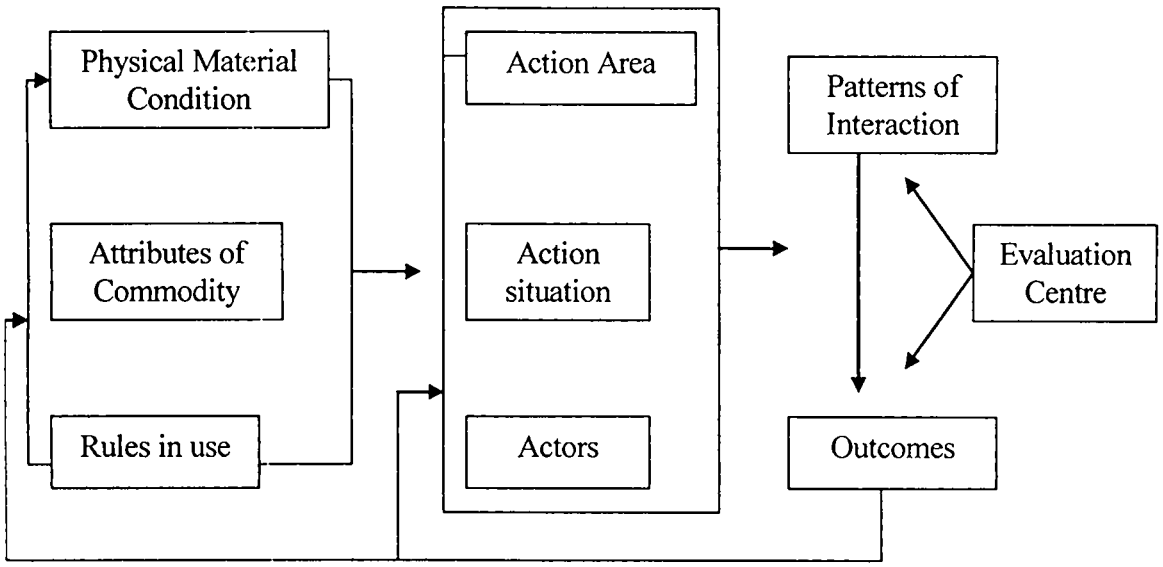
Sharma and Ali (2006) studied the Kaivartya, a fishing community of Boripara village of Assam where they found the fishing co-operative society of the village. It provides boats and fishing nets who cannot afford to have their own. To them, this community employs different fishing techniques like traps, nets, rod and line and so on. The simplest type of trap used by them are polo (cage trap) made of bamboo strips. It is generally used in the knee deep water (stagnant) of the beel. Fishes hidden in the mud are usually caught by this trap. Besides, sometimes artificial dams are prepared in shallow running water having a small passage. The fishermen place a roonga (a valve trap) at the passage, where the fishes exit, to block the open mouth of the trap by placing the valve against the current of the water. The fishes are lured into the trap. Nets used are of various size and types. During the non-season, the fishermen use another techniques for fishing in paddy fields, island pools or in shallow water. The fishermen use hooks where they generally use earth worm as bait and the hook is attached with a stick by a rope. The small and sometimes big fishes are caught by these hooks.

Fish constitutes almost half of the total number of vertebrates in the world. India, particularly the north-eastern region of India has been identified as a hot spot of bio-diversity by the World Conservation Monitoring Centre (WCMC, 1998). Hora (1921, 1950, 1956, 1957) is one of the pioneer researchers of the fishes of North East India. Ghosh and Lipton (1982) had reported 172 species of fishes with reference to their economic importance. Sen (1982) reported 187 species of fishes from Assam and its environs. Sinha (1994) compiled a list of 250 species of fishes from North East India. Kar (2006) has studied the Barak river and found cyprinids (42.58%), Siluriformes (17.15%) and perciformes (55.89%). Besides, a pilot survey has been worked out about the ichthyofauna of Mizoram, Tripura and Barak drainage of Assam (Barman 1984, 1992, 1994).

Besides the above studies Kar (2005) who studied the Assam beels specifically in Dhir, Dora and Shonebeel focuses on the catch composition of these beels such as carps contributed 24% and others 76%. Hilsa ilisha also occurs in these wetlands. The study revealed that due to the migration of the different fish species from the main river systems; viz., the Brahmaputra and the Barak the beels get enriched with the fish varieties. Kathia et al. (2005) also report that Assam is one of the richest in terms of inland surface water resources with a total water spread of 3.47 lakh hectares of which one lakh hectares area is under flood plain wetlands (locally called beels). CIFRI (2002) reported that the present fish yield from these nutritionally rich biomes is about $100kg^{ha-1}$ which is less than one tenth of their production potential. It also found that the major constraint in harnessing this potential is of the non-availability of quality fish seed for stocking in the beel. Kathia, Dutta and Barik (2005) have carried out a study about the water property

regims of three specific beels of Assam; viz., Kurmi (Goalpara district) and Samaguri and Haribhanga (Nagaon district). They found that the Government leased out the beels to the lessee at least for five to seven years which encourages the fisherfolks to invest on fisheries development. Singh and Dhajiwali (1998); Jayaram and Selvaraj (2000); Choudhury et al. (2001); Kathia (2000) and Kathia et al. (2002) observed that due to the overexploitation of the fish resources, there occurred non-availability of quality seed and feed, high mortality rate, poaching, transportation, lack of proper marketing channels and technology upgradation among the farmers. The misuse of water body, swampifications and the type of management were the initial drawbacks for every beel of Assam, Barua et al. (2000). The socio-economic and institutional problems faced by the fishermen included high fluctuations in fish prices and multiple use of water. The poor knowledge of new techniques is also responsible for the lower socio-economic condition of the fishers. Jodha (2001) observed that in the dry regions of India, including Rajasthan, rural people are heavily dependent on common pool resources which supply most of their fuel, grazing and other means of livelihood. It is also an important source of employment and income for the poor, especially in periods when other opportunities are not available (Jodha 2001).

Elinor Ostrom, in her empirical work "Governing the Commons" (1990), analysed the long-enduring, self organized and self governed CPRs. Recognizing that communities may come forward to develop institutions that can provide a viable solution to the CPR related problems. She also opined that with the earlier theories provided by Hardin, Achelson and others, it is not easy to explain CPR management institutions. Hence, she suggested a set of eight design principles for CPR management as given in the chart.



Source : Ostrom, 1999, Institutional Rational Choice : An Assessment of the Institutional Development Framework. In P. Sabatier (ed.), Theories of Policy Process, West View Press. Bountier, Pp. 35-71.

Wade (1980), another scholar spelt out the conditions for organizing successful management of CPRs. Adams et al. (2002), on the other hand, provide a framework for policy makers. They say that resource managers with the power to make relevant decisions may be part of formal or informal institutions. Katar Singh (1994) observed that CPR management is a relatively nascent art of specialization. As a matter of principle, these programmes are implemented with people's participation and this turns the task of CPR development into an institutional building exercise. Chopra et al. (1990) say that particularly models are difficult to establish. Hence, it becomes more important to understand the process of establishing people's institutions for effective utilisation of the large investment and sustainable management of the CPRs.

From the Survey it is found that the studies of fish and fishing mainly constitute the following classes :

(i) Fish and fishing Communities

(ii) Socio-cultural life of fishing Communities

(iii) Fishing Communities and fishing practices

(iv) Changing relationship between fish resource and fishing Communities

These classes of studies are closely related each other and are concerned with various aspects of the dynamic relationship between man (society) and environment. In a way, the studies, each, represent a partial and fragmented understanding of the relationship between the fish resource and the communities. The same nature is found in respect of those studies which pertain to Assam and its Barak Valley. Thus, none of the studies available provides a holistic understanding of the fishing practices and their sustainable development in the perspective of man-nature interactions. In Barak Valley there are three traditional fishing communities; namely, the Patni, the Kaivartya and the Mahimal, representing harmonious man-nature interactions, but they are now re-adjusting there interactions with the changing environment wherein the fish resources are depleting. Therefore, a question arises : What patterns of fishing practices are being perceived among the fishing communities of the Barak Valley? For operational purpose the question is being differentiated into the following part questions :

i) How is the socio-cultural life of the fishing communities adapted to local environment?

ii) What are the political-economic structures and religious practices found among the fishing communities?

iii) What are the institutional mechanisms existing for exploiting and managing the fishing?

iv) What are the different tools and techniques employed in fishing in water and soil, affecting the growth of fish in different water bodies?

v) How is the pollution of water and soil affecting the growth of fish in different water bodies?

vi) What are the adaptive strategies employed for sustainability of fish stocks?

vii) What are the marketing strategies and drives of fisherfolk?

viii) How differently the CPR (Common Property Resource) and PPR (Private Property Resource) fishing management is carried over?

OBJECTIVES

Keeping in view the above research questions, the study has focussed on the following objectives :

1. To study the interplay of environment and social systems of the fishing communities.
2. To understand patterns of fishing practices and sustainability of fish stocks in CPR and PPR.
3. To find out adaptive strategies of the fishermen to cope up with the changing environment and availability of fish.

The research questions have been attempted with reference to the Barak Valley.

RESEARCH METHODOLOGY

(i) Theoretical Framework

As man and nature are so closely related, man cannot think of anything without depending on nature. Man is considered as the most intelligent living species. But due to lack of proper environmental knowledge, man has already created a hazard on natural resources. Due to lack of knowledge or mismanagement

of the resources of nature, man has already lost a large number of species while a lot of species are being endangered. These species help in maintaining the environmental equilibrium. Therefore, their extinction or endangered condition may jeopardise the nature, thereby, affecting human population. Although, of late, people have realized that the various resources must be preserved. And this can only be feasible if a well organized management policy is undertaken. Natural resources can be broadly managed as common property resources (Berkes 1989), state property, private property and non-property regimes (Schlager-Ostorm 1992). Common Property Resources (CPR) may be defined as the natural resources like land, water and forest which are commonly owned by a community as a whole. Many of the social scientists try to establish that easy access to CPR bring ecological disaster, causing 'tragedy of the commons' (Watson 1989; Hardin 1968). At the same time, Bromley (1992) opined that as man is the wisest animal of the universe and not irrational, he must put forward some rules and regulations by which the CPR can be managed. While introducing a new term 'Common Pool Resources' Ostorm (1990) tries to put forward a new definition for understanding the common property. He introduces the concepts like excludability and substractability. By excludability, it is meant that it is difficult or costly to exclude other potential resource while by substractability it is meant that the particular class of property where exclusion is different but one user's gain is the other's loss (i.e., resource is substractable). Common pool resources, thus, can be derived out of two classes of resources; viz., public goods and private goods. Public goods are those which can be used by any member while private goods are those which are absolutely restricted to the users (Runge 1984a : 808). Hardin (1968) believes that the CPR management in every case leads to depletion of the resources within a finite resource

base. Overexploitation takes place without any customary right to exploit the resources. Anybody can access to exploit the resources. The open access gradually depletes the natural resources. Only an intervention of a third party can provide a solution to prevent depletion of the resources.

Thus, resource management occupies extremely important place for exploitation of any existing resources, specially those of CPR type. Many institutions have emerged both at the community and the state level. Scientists analyse different institutions for managing the resources with a view to their sustainability. Ciriacy - Wantrup and Bishop (1975) developed a conceptual framework for institutional analysis. According to it, the social scientists viewed institutions as of two types : The organisation which regulates the human action is one while the other type is the outcome of the aggregate of individual actions. That is, an organization (institutional management) may be formal or informal and may be constructed or evolved through a process.

There are various approaches / theories which explain the Natural Resource Management (NRM) under the CPR regime. Major ones are as follows :

(i) Ostorm's Game theory

(ii) Eggertsson's Property right school

(iii) Mc Cay and Acheson's Revisionist approach.

(iv) Institutional approach of neo-institutional economics.

Game Theory : Von Neumann and Morgenstern's game theory (1945) analyses the problems of collective action in the perspective of game – game in the sense that someone's benefit may create a problem for others and vice-versa (Heap et al. 1992 : 94), when two or more individuals are using the same resource following

a particular rule. Broadly, the game theory has two types of game; viz., cooperative and non-cooperative games. These two types of game can be understood under the prevailing sets of rules and incentives of game such as :

(i) The prisoner's dilemma game

(ii) Nash equilibria

(iii) Repeated games

(iv) The multi-person prisoner's dilemma game and

(v) The assurance problem

Prisoner's dilemma as well as other games of the same type can be defined as 'game of chicken'. A participant may not have any knowledge about the choice of other participants, thus, causing a 'defect' in the system. There are four different pay offs classified in the matrix. The participants cannot communicate each other's decision in consequence of which the outcome amongst the participants at different types of decision affects the result (pay off) of other decisions. These prisoners may take part in crime, which reflects in a short sentence (1, 1). On the other hand, if one participant exploits the sources alone and avails opportunity as a whole, others will be deprived, i.e., the distribution of resources will be either (2, -2) or (-2, 2). In the play of such manner, every participant may be of the dominant condition which is the prime defect of such game (-1, -1). The prisoner's dilemma is shown in the following figure.

Chart 1.1 : The Prisoner's Dilemma

First Person		*Second Person*	
Co-operate	*Defect*	*Co-operate*	*Defect*
1	-2	1	2
2	-1	-2	-1

Source : Knudsen, A. 1995, Living with the Commons : Local Institution for Resource Management. Chr. Michelsen Institute. Dev & Human Right Studies, p. 12.

The prisoner's dilemma can be utilized by representing all participants of their equal contribution for the development of games. Social scientist Nash proposes the outstanding equilibrium point – which is popularly known as Nash equilibria where the game is classified as 'a set of strategies'. Each participant can continue until he possesses the minimum pay off (level of subsistence), no player can improve his pay off by alternative extract of game (Heap et al. 1992 : 101). According to Nash, equilibrium point will be ahead of ending and will not have any incentive in future due to extensive ploughing of natural resources. Notably, by repeated using of the finite resources there would be diminishing returns. Thus, the repetition may be compared as a parasitic relationship between the participants and the environment. To maintain the equilibrium between the participants and the resources, a 'tit for tat' strategy is highly appreciable (Axelrod and Hamilton 1981 : 1993). This strategy provides an equal opportunity. If one participant breaks the proposed procedure, the other will act similarly.

If the prisoner's dilemma is played several times. It is known as 'repeated games' where dominant strategy cannot be outlined. Robert Axelrod in his thesis 'The Evolution of Co-operation' (1984) argues for the first time that co-operation can take place in case of repeated games. He shows that the move of the participants is followed by the others whereby reflecting a 'tit for tat' strategy. However, he is clear in his explanation that this 'tit for tat' strategy is 'neither exploitative nor can it be exploited' – co-operation occurs automatically without any external intervention.

Multi-prisoner's dilemma is a more complex kind of this game where Runge (1981) shows that the outcome of the game depended mostly on the 'structure of

incentives' and number of participants playing the game. Runge (1981) in his theory explains that in case of such game there is voluntary co-operation more than defection. The choice made by the participants affects the game which he termed as 'assurance problem'. To analyze the assurance problem it can look into the theory as has been put forward by Amartya Sen.

Amartya Sen (1976) differentiated between assurance problem and his own term 'isolation paradox' which is a reflection of non-co-operative game played by a number of participants keeping in mind their own benefits only while the assurance problem is a reflection of co-operative game. Sen argues that 'multi-person non-co-operative game always showed it outcome as (i) Pareto inferior, (ii) Rigorous dominance of personal strategies and (iii) a need for evolving new strategies. Thus, this rigorous dominance of personal strategies which are Pareto inferior in their outcome is defined by Sen as 'isolation paradox'. Sen also argues that if the participants are assured of other's choices, then, a problem arises which he termed as 'assurance problem'. It is different from the concept of Runge as in case of his definition of assurance problem, there is not any particularly dominant strategy and there may be only one equilibrium point which is Pareto optimal. In case of Pareto optimal the participants are assured that the choice made by other participants in the game is the right choice where question of enforcement does not arise.

Social critics like Bardhan (1993), Brox (1990), North (1977), Van Damme (1993), Sumaila (1994) have questioned the implication of these theories in the real world situation and formulated certain sophisticated dynamic model. In such dynamic theories there are no fixed rules, and the pay off varies as the game goes on. The participants in these advanced dynamic theories involve themselves

in different strategies. By reviewing these strategies, they attempt to formulate a model which may be applicable in real world situations. However, these models have been very much influenced by game theoretical models.

The Property Rights School : As far as viewed from the economic sense, property rights are not just strategies for controlling the assets but are more than that. The social character of the property right developed by Demsetz (1967), Alchian and Demsetz (1973) and Furubton and Pejovich (1972) shows that this school highlights not only the relation between man and thing but also the behavioural pattern that arises from the use of those things. Sometimes this school of thought is called 'property rights paradigm' (Demsetz 1967; Alchain and Demsetz 1973). Diagrammatically it is presented as follows :

Man $\xrightarrow{\text{Controls over things}}$ by economy (economic sense)

Man $\xrightarrow{\text{Controls over things}}$ by behavioural pattern (Social Sense)

This theory introduces a new concept of exteranalities which points out that without involving internally, only the gain is to be enjoyed from the resources. In this process, a participant's action may produce harm (or benefit) to other participants. That is, it may produce a negative externality (Pigon 1920). Demsetz opined that this problem can be solved only by means of internalizing the externalities; i.e., the costs of negative externalities must be borne by those who cause them. This sensation will ultimately develop either the concept of private property resources or to introduce taxes or fines. Demsetz (1967) pointed out that in this way when the benefit takes place by internalizing the externalities, the evolution of private property will take place. Thus, the main motto of the theory is to know how the private property resources are endorsed from the communal property resources. People always wanted to exploit the nature in their convenient way.

Institutional Approach of Neo-Institutional Economics Theory : This approach mainly focuses on the role of institution in different fields like property rights, economic behaviour and collective action. In the book 'The Great Transformation' (1944), Karl Polanyi has pointed out how the institutions are key units of economic analysis. In this book, he focuses on the institutional aspect of non-market to market exchange and a linking between the communal property to private property regime. Polanyi argues that three different transactional modes are existing in the society; viz., reciprocity, redistribution and market exchange. To understand this, North has formulated transaction cost analysis while combining a theory of the state. However, North (1977) criticizes Polanyi, for he could not explain how one mode of transaction replaced another. North defines the transaction cost as the cost of defining and enforcing property rights. It is here that whole reviewing the property rights approach comes into effect. Libecap (1986) argues that when the transaction costs are high, the initial distribution of property rights become very important. Likewise, North also feels that low or 'non-existent transaction cost' occurs rarely. Broadly argues that transaction costs are never zero because the transaction costs in case of future generation would be high due to extensive exploitation of resources. North has then stressed the importance and role of informal rules and constraints in order to regulate the behavioural pattern retaining the basic implications of rational choice theory.

The Revisionist Approach : The approach has been developed as a reaction to the property rights school which claims that private property is better at protecting resources rather than other property regimes. To argue against such private property regimes, the theory that has been developed is called the revisionist approach. However, the propounders of this approach do not have

any uniform concept; rather multiple concepts based on their common research agenda and works under a common framework known as Oakerson's framework.

In the revisionist approach, the concept of private property is outrightly rejected as a better property of resources compared to common property regimes. Because, in case of the open access situation, there is, of course, a great chance of overexploitation, but practically it does not happen. Instead, due to lack of proper and effective management of resources the CPR produces a break down. In this approach, all scientists try to explain their findings regarding both PPR and CPR in a specific model commonly called Oakerson model. Actually this approach propounded by many scholars including Acheson (1989b), Mc Cay (1978) and Oakerson (1986). They have vehemently refuted Hardin's concept of the 'tragedy of the commons'. According to Hardin, private property is protecting resources better than other property regimes. However, revisionists raised voice against this idea. Acheson claimed flaw in all assumptions put forth by Hardin. He listed the flawed axiomatic assumption of Hardin as follows :

(i) CPR means absence of property rights, i.e., open access.

(ii) Everywhere there is a level of technical capacity to overexploit resources.

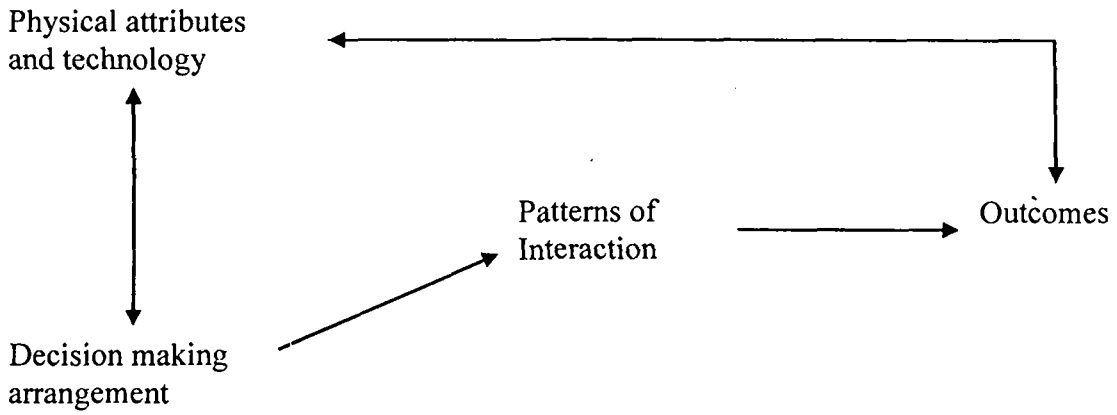
(iii) There is a general inability to craft local institutions for resource management and

(iv) Finally, only the private property and government intervention accord a viable solution to resource management.

The revisionists refuted all the assumptions of Hardin by developing a model called Oakerson model wherein they viewed that the overuse of resource is not the only cause for the breakdown of common property resources. But it is

the situation where no property rights and no effective management of resources exist. Rather, Oakerson, a leading revisionist, emphasized the interplay of four important factors; viz., (i) physical and technological attributes, (ii) decision making arrangement,, (iii) patterns of interaction and (v) outcomes. Diagrammatically, the Oakerson model is given below.

Chart 1.2 : The Oakerson Framework



Source : Knudsen : Living with the Commons.

Oakerson showed very analytically how the resources can be managed even under common property regimes. Oakerson (1986, 1992) considers four factors. The physical and technological attributes represent characteristics of the resource such as jointness, indivisibility and exclusion; decision making refers to 'who decides what in relation to whom'; patterns of interaction refers to the range of possible strategies available, while outcome refers to distribution, equity and other measures of institutional efficiency. The strength of Oakerson's framework is in that it can be used to analyze common property problems and also allows for a case by case analysis, while its weakness is that it applies only up to a limited degree (1986).

From the above discussion, it appears that the revisionist approach, within Oakerson's framework is accommodating various aspects of common property

resource management and it offers better explanation of the situation of CPR management.

The four different factors of the CPR proposed by Oakerson can be examined in the context of common property resource management in the Barak Valley such as the fisheries of the Shonebeel and the Barak River. The physical and technical attributes are found in the villages of the Shonebeel where water is logged in different privately owned lands during the summer and converts them into the common property resources. Fish is considered as both private and community properties exploited by individuals and groups. In Barak river also the fish is communally owned. The cooperative societies formed in the Shonebeel and various parts of the Barak River decide maintenance and exploitation of CPR (fish). In both the fisheries the villagers adopt various strategies, e.g., tools and techniques, differential rentals for different types of nets to check overexploitation of the fish resources. Finally, the fish resources are equally distributed among the claimants by applying a code of conduct. Thus, the Oakerson framework has been used to examine the Common Property Resources (CPR) management of the Shonebeel and the Barak River fisheries.

(ii) Data and Their Sources

In the study there have been used two types of data; namely, qualitative and quantitative. Qualitative data pertain to the relation between environment and society, CPRs, changes in the environment, resource management and adaptive strategies in the conversion of CPR to PPR and vice versa. These data have been collected from the fishermen of the Shonebeel and the Barak River. The quantitative data pertain to population, rainfall, epedemiology, landholding,

income, expenditure, livestock and energy utilization. These data have been collected from the fishermen as well as the office of the Tea Research Association, Tocklai, Silcoorie, Census records, revenue records and the office of Deputy Director of Economics and Statistics, Govt. of Assam. The oral and documentary, both, data have been tapped from the field of the study.

(iii) Universe and Units of the Study

The universe of the study comprises two natural fisheries; namely, the Shonebeel in Karimgnj district and the Barak river in Cachar district in the Barak Valley. Barak river fishery is found divided into several part fisheries for smooth fishing by the fishermen of the areas. The data have been collected from six villages, three each, of the same fishing communities, each from the two fisheries Besides, 12 cases of private pond owners, six each, from the villages and the town areas of 3 districts in the Barak Valley have been studies to examine of sustainability of fishing practices in the valley. The three villages from the Shonebeel – Devadwar, Kalyanpur and Belala - in Karimganj district. And another three villages from the Barak River – Netaji Nagar, Radha Nagar and Balighat in Cachar district are inhabited by the same three fishing communities; namely, Patni, Kaivartya and Mahimal respectively.

Household was taken as the unit of data collection in the study. In a preliminary survey it was felt that the fisherfolk in the villages were homogeneous and fishing practices were important for the study. Therefore, instead of going for random sampling purposive sampling was applied to collect data from 50 households, each, of the villages, in all making 300 households, i.e., 150 households, each, from the Shonebeel and the Barak river.

(iv) Tools for Data Collection

The data from the households were collected by administering a structured interview schedule to the fishermen of the selected households and also by making observations of their fishing activities. The data were collected during the period from January 2005 to December 2006.

SIGNIFICANCE OF THE STUDY

The fishing practices and their sustainability among traditional fishing communities is becoming a challenge. An attempt to develop a basic understanding of this phenomenon vis-à-vis a theory is made to explore the various facets and qualities of life style determined by the environmental situation of the valley. This study leads to the basic understanding of various forces at work on the sustainability of fishing management of the two important types of fishery; viz., wetland (beel) fishery and the river fishery in the valley. The study analyzes how environment converts the property resources from common to private and vice versa. The study also attempts to understand how much impact do the socio-cultural aspects of the three traditional fishing communities; viz., the Kaivartya, the Patni and the Mahimal have on the environment of their society and how the equilibrium of the man-nature interactions is distrubed by certain forces working upon the interactions.

LIMITATION OF THE STUDY

Keeping in mind the time constraint, only the two systems of fishery, i.e., Beel fishery and the river fishery system have been thoroughly examined alongwith 12 case studies of private property resources, i.e., pond fisheries. There are many more systems using various tools, techniques, practices and strategies.

Their study is as much important as that of the fisheries undertaken in this study to acquire a complete and dynamic view of the man-environment interactions (resource management) in the Barak Valley.

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