CHAPTER 5

ADAPTIVE STRATEGIES OF THE FISHING COMMUNITIES IN THE CHANGING ENVIRONMENT

This chapter focuses on socio-economic strategies of the fishing communities to adapt with the environmental changes taking place in the two fisheries, i.e., the Shone beel and the Barak river. There are some perceptible changes, though at micro-level, in their natural environment, which are motivating the communities to change their occupations and life styles accordingly. In the Shone beel the flood water submerges the agricultural land holdings in the rainy season and the paddy lands are turned into the fishing ground while along the receding flood water in the winter the fishing ground reverts to paddy lands. Various changes in the aspects of environmental such as rainfall, fish stocks, land quality, soil texture, water quality, siltation, forest, etc. have caused some changes in life styles of the three traditional fishing communities; namely, the Patni, the Kaivartya and the Mahimal of the three sampled villages; viz., Devadwar, Kalyanpur and Belala respectively. They are adapting new strategies in respect of fishing gears, occupational activities, land use patterns, utilization of energy etc. with the changes occurring in the environment. In the Barak river basin, also, the environmental changes have generated new adaptive strategies among the communities there. The changes occurring in rainfall, status of water quality, fish stocks, fishing gears, siltation and water carrying capacity of the river are changing the life style of the three traditional fishing communities; namely, the Patni,the Kaivartya, and the Mahimal of the three sampled villages; viz., Netaji Nagar, Radha Nagar and Balighat respectively. To adapt with the changing environment, the people have been taking up new types of occupations, fishing nets, energy resources, land use patterns etc. Their cultural activities are also adapting to the environmental and occupational changes. The environmental changes taking place in Barak Valley are being discussed here with special reference to the two fisheries under the study.

THE CHANGING ENVIRONMENT

The changing environment here refers to the changes in rainfall, temperature, fish stock, soil stock, water quality, siltation, forest cover etc. constituting the natural environment of the Barak Valley and of the two fisheries in it. These changes have impact on the occupational and cultural patterns among the fishermen communities who have been traditionally depending on the resources of the existing natural environment. It seems that the occupations, specially the traditional fishing activities, are affected, directly and largely, from the changing environment and cultural patterns, in many cases, follow the occupational changes. Thus, a complex of environmental, occupational and cultural changes is reshaping the traditional life of the fishermen in the two fisheries. These are discussed below.

A. THE CHANGING ENVIRONMENT IN THE SHONEBEEL

The changes in the Shonebeel's environment can be observed in respect of siltation, rainfall, soil texture, beel ecology, forests and fish. These aspect are being analysed here.

I - Siltation Through the Shingla River

The main feeder stream for the Shonebeel fishery, the Shingla river flows down from the Jampai hills (Mizoram), passing through the Cherragi Forest

Reserve, Dullavcheera and Anipur, to reach the Shonebeel area. Before 1960, the river Shingla, usually overflowing in the monsoons, deposited silts on the agricultural fields in the periphery of the beel. No doubt, the recurring floods contributed silts to the fertility of the paddy fields, on the one hand, but it destroyed the paddy, on the other. Therefore, to protect the paddy crops and fields the Government of Assam constructed a *bandh* (dyke) in the 1960s on the two sides of the river. The *bandh* (dyke) did protect the paddy lands from the floods but it resulted into prevention of the silt deposits which made the paddy lands fertile. As a substitute, the farmers of the area started using chemicals or artificial fertilizers to increase their paddy yields. However, the silts have been carried on to and deposited in the lower (deepest) portion of the beel. As a result, the size of the main fishing ground is constantly getting reduced; the water logging capacity of the beel is on decline and the number of the beel's group fisheries has been come down from 24 to 16. Thus, the internal environment of the beel is changing and its impacts are reflected in its catchment area also.

II - Rainfall

In the beel area a high rainfall enhances the area of CPR fish as well as prolongs the period of fishing whereas a low rainfall reduces both the area and the fishing period. Thus, amount of rainfall determines water logging and fishing practices in the beel. Rainfall even in odd (winter) seasons dictates the fishing practices and agricultural activities of the villagers as it causes sudden floods destroying the paddy and other crops. But it also provides fish for longer period. The status of climatic conditions (rainfall, temperature, etc.) of Barak Valley is gradually changing.

Data collected from the Tea Research Association, Taklai, Silcooriee shows that the rainfall starts from March and heavy rainfall occurs upto August and thereafter the amount of rainfall declines. There is seen a gradual decline in the rainfall in the valley over the years. Besides, erratic rainfall is also revealed, which always keeps the people under pressure in respect of paddy cultivation. However, the amount of rainfall still favours the overall growth of fish. Other relative factors like temperature, particularly during the rainy season are also highly favourable in the valley for growth of fish. Generally, the fish grow better under the temperature ranging from 25^0 to 35^0 Celsius. In the winter, low water temperature affects the growth adversely.

Besides, in the winter, continuous rainfall even for a few days destroys the boro variety of paddy in the beel area. Therefore, the people of the Shonebeel prefer to cultivate the traditional boro varieties (coarse grains) of crops such as tupa, bosi (the boro) varieties which mature in less time (85 – 90 days). The people of the beel do not prefer High Yield Variety (HYV) crops as they take more time to mature (115 – 125 days). The climatic factor and their changes are taking place gradually and, as a result, the phenomena like floods, erosion or degradation of soil, etc. are emerging in the valley. The following table shows the status of the climatic factors :

Table 5.1 : The Status of Climatic Condition of Barak Valley

		January	February	March	April	May	June	July	August	September	October	November	December	Total
1992	Rainfall in mm.	2.2	70.6	157.6	170.5	586.8	502.9	408.5	414.4	466.2	333.3	16.2	5.6	3134.8
	Maximum temperature in ^0C	25.7	24.8	30.2	31.6	34.7	83.0	32.4	33.9	32.4	32.1	30.6	27.3	
	Minimum temperature in ^0C	13.5	13.2	19.3	19.3	23.2	24.8	25.0	25.0	23.7	22.5	17.7	11.4	
1993	Rainfall in mm.	33.2	330.2	188.2	204.1	626.4	89.2	587.2	390.0	242.1	193.7	6.4	0	2890.7
	Maximum temperature in ^0C	24.6	27.1	29.8	31.6	30.7	32.0	32.5	33.4	32.8	32.8	31.6	29.8	
	Minimum temperature in ^0C	11.0	13.9	16.0	19.6	21.8	24.0	24.9	25.5	24.5	22.5	18.2	12.7	
1994	Rainfall in mm.	20.4	48.6	426.2	296.5	197.2	495.4	501.0	394.1	287.6	130.3	2.0	0	2799.3
	Maximum temperature in ^0C	26.8	27.6	29.6	31.9	33.5	33.0	34.1	34.1	33.3	31.4	30.2	28.4	
	Minimum temperature in ^0C	10.6	10.7	15.6	19.9	22.9	24.0	23.3	23.5	23.4	21.3	16.6	11.6	
1995	Rainfall in mm.	10.5	62.6	106.8	133.4	198.6	336.5	278.3	535.1	224.2	74.9	77.0	0	2037.9
	Maximum temperature in ^0C	26.2	27.5	31.9	33.5	34.2	32.6	34.4	33.1	33.1	35.2	30.3	27.4	
	Minimum temperature in ^0C	9.0	12.2	14.5	18.7	22.5	23.6	24.3	24.0	24.3	22.6	18.6	12.4	
	Rainfall in mm.	0.4	82.2	412.7	115.1	548.8	267.0	502.8	514.9	256.1	265.0	4.0	00	2969.0
1996	Maximum temperature in ^0C	35.2	29.0	30.3	32.6	31.8	33.1	31.8	32.6	34.1	31.9	31.2	28.6	
	Minimum temperature in ^0C	10.8	12.0	17.8	21.1	22.7	23.2	24.6	24.7	24.1	22.5	19.0	12.7	
1997	Rainfall in mm.	1.9	29.8	141.7	63.6	287.7	505.8	446.7	219.2	430.7	5.0	00	43.0	2195.1

	Maximum temperature in ^{0}C	25.3	24.9	30.9	30.5	32.6	32.0	31.9	34.0	32.1	32.3	30.9	26.1	
	Minimum temperature in ^{0}C	10.4	12.8	18.5	19.5	22.2	24.4	25.1	26.0	24.1	22.6	18.6	13.8	
1998	Rainfall in mm.	18.6	26.5	218.3	276.2	223.7	670.9	639.8	566.8	178.5	50.5	51.2	00	2921.0
	Maximum temperature in ^{0}C	24.0	27.5	28.7	31.2	32.9	31.8	31.5	31.9	33.4	33.7	31.3	29.2	
	Minimum temperature in ^{0}C	12.3	14.1	15.8	20.9	24.0	25.1	24.7	25.2	25.0	23.8	19.6	13.2	
1999	Rainfall in mm.	00	00	169.2	28.5	335.4	311.3	535.7	337.0	412.1	236.8	11.4	00	2377.4
	Maximum temperature in ^{0}C	27.1	31.5	32.3	33.9	32.1	33.0	31.8	32.9	32.3	31.5	30.5	28.1	
	Minimum temperature in ^{0}C	11.2	14.6	16.8	23.1	23.2	25.2	24.1	24.9	24.2	22.7	17.9	12.4	
2000	Rainfall in mm.	42.9	28.1	155.7	328.6	556.2	413.7	242.1	457.0	518.8	139.1	2.9	00	2885.1
	Maximum temperature in ^{0}C	25.4	25.8	28.3	31.4	30.5	32.0	33.8	31.7	31.0	31.9	29.9	27.0	
	Minimum temperature in ^{0}C	11.1	12.9	17.5	21.5	23.0	24.9	25.6	25.0	24.0	22.4	17.3	12.0	
2001	Rainfall in mm.	00	148.1	92.1	155.5	390.7	700.1	482.4	242.4	160.1	196.0	79.3	00	2646.6
	Maximum temperature in ^{0}C	25.3	28.0	31.3	33.0	31.8	32.8	33.5	34.1	33.0	32.4	19.9	27.5	
	Minimum temperature in ^{0}C	10.1	13.4	17.4	21.1	23.0	24.6	25.3	25.6	24.6	22.7	18.7	12.5	
2002	Rainfall in mm.	14.3	00	136.9	220.9	413.0	296.3	446.2	376.3	193.7	32.8	54.9	13.5	2198.8
	Maximum temperature in ^{0}C	26.0	29.8	32.3	Not recorded due to damage of station barometer									

	Minimum temperature in ^{0}C	12.3	13.4	15.8										
2003	Rainfall in mm.	00	2.5	52.0	197.3	239.4	546.0	257.6	251.0	369.2	152.3	7.0	83.5	2157.8
	Maximum temperature in ^{0}C	25.3	29.1	30.6	32.0	32.3	31.3	32.6	33.5	32.8	31.5	29.1	26.5	
	Minimum temperature in ^{0}C	11.7	14.4	16.9	21.4	23.3	24.7	25.8	25.4	24.8	23.6	16.8	14.2	
2004	Rainfall in mm.	2.2	00	20.2	684.2	351.1	263.9	582.0	295.9	387.8	134.8	00	8.6	2730.7
	Maximum temperature in ^{0}C	25.1	28.1	32.3	29.0	32.2	32.2	31.2	33.7	31.0	30.9	29.5	27.2	
	Minimum temperature in ^{0}C	13.0	12.9	18.7	20.3	23.3	24.7	24.1	25.4	24.3	21.8	17.2	13.7	
2005	Rainfall in mm.	0.5	79.3	308.2	110.4	296.2	244.6	531.4	323.4	198.2	146.9	00	2.1	2730.7
	Maximum temperature in ^{0}C	24.9	2.8	29.2	31.7	30.4	33.1	32.7	33.3	31.9	24.5	14.0	Not recorded	
	Minimum temperature in ^{0}C	11.8	15.6	19.1	21.3	21.7	25.4	26.0	25.5	23.7	18.0	28.0	Not recorded	
2006	Rainfall in mm.	00	49.8	00	131.3	350.9	518.1	434.4	143.9	192.5	37.4	17.8	00	1875.3
	Maximum temperature in ^{0}C	26.0	29.7	33.8	32.2	32.9	31.6	33.1	33.4	32.6	32.5	28.9	26.5	
	Minimum temperature in ^{0}C	11.2	15.6	17.9	20.4	22.6	23.8	25.2	25.3	24.5	22.7	18.0	13.5	
2007	Rainfall in mm.	00	59.0	49.9	239.2	306.1	376.3	373.6	Not recorded					
	Maximum temperature in ^{0}C	25.4	26.4	30.7	30.9	32.6	32.0	32.0						
	Minimum temperature in ^{0}C	10.6	13.9	15.5	20.4	23.5	24.7	25.4						

Source : Tea Research Association, Tocklai, Silcoorie.

The above table reveals that there is constant decline in rainfall since 1992. This affects the water logging duration in the beel and the river basin which affects the fish niche. If the water is logged for a short duration, the CPR fishing will be carried over a short duration. Thus the amount of rainfall directly affects the fish production and fish catching in the valley.

III - Soil Texture

The soil of the Shonebeel or Barak Valley as a whole varies from alluvial to laterite soil and the texture is generally clay loam to clayey. The riverine tracts are found to have loamy to sandy loam textured soils. The soil texture of the Shonebeel is gradually changing in view of the constant siltation caused by various factors. Firstly, deforestation of forest reserve in the upstream lands of Shingla river leads to soil erosion in the rainy season and deposits the silt in the beel area. Secondly, land reclamation for agriculture, and pesticides and inorganic fertilizers used in the paddy fields are run off by the rain water and are deposited in the beel area. Thereby, they adversely affect the ecology of the soil texture. Thirdly, dumping of garbage, untreated effluents and sewage disposal also bring rapid changes in the soil texture.

IV - Changing Ecology of the Beel

Beel morphometry is affected by incursion of river water, degree of precipitation and nature of catchment. Greater percentage content of water with sediments, a deeper euophotic zone and longer sunshine hours culminating in a warmer temperature regime cause intermediate to high biological productivity levels in the beels. The deposit of decaying weeds at the bottom contributes to richness of the bottom soils in the beels (Tripathy 1969). But due to siltation and pollution caused by using of chemical fertilizer and waste disposal the ecology of the beel fishery have been changing.

V - Deforestation and Destruction of Fish Niche

Before 1970 the beel was full of a lush green forest. The *hijol* trees (*Baringtonia actangula*) were widely found in the entire beel area. Besides, *nalkhagra* and *hugla* bushes were also found. Fishes and other aquatic organisms took shelter in the bushes which offered a good niche for them. They even laid down eggs there. Even the migratory Siberian birds regularly visited the beel. But ruthless cutting of the *hijol* trees and clearing of the bushes has not only destroyed the good niche of fish but also has reduced the arrival of the guest birds to the beel. In addition, it harmed the fish on food front also. That is, excreta of the Siberian birds was a good source of food for the fish.

VI - Changing Water Ecology

Owing to the siltation in the Shonebeel the water logging capacity has been gradually declining which is adversely affecting the good niche for variety of fishes in the beel and is, ultimately, resulting into low fish production. A change in transport system among the villages has also contributed to the decline of the fish stock. Earlier, there were only paddle boats for movement of the villagers from one village to another. But since 1990, the villagers have been using motor boats for speedy movements. The motor boats produce sound pollution which destroys the fish living in the top layer of the water. The fish laying and staying in the top layer of the water are Chapila (*gudusia chapra*), Elong (*Bengata elanga elanga*), Lacho (*Cirrhinus reba*), etc. Moreover, fertilizer used by the villagers in their paddy fields in the winter is also water contamination and eutrophication in the beel. These factors frequently change the water ecology of the beel as well as hamper the natural fish production.

Briefly, the climatic conditions, deforestation, siltation, pollutants and garbage disposal are the various factors which are damaging the land, forest, water and fish resources in the beel. These are the resources upon which there has been based the pattern of intense interactions between the environment and the communities in the region.

THE CHANGING ENVIRONMENT IN THE BARAK RIVER

The water ecology of the Barak river has been changing in various respects like land, forest, rainfall, water and soil. These changes are being discussed here:

I - Changes in Land, Rainfall and Water

The parameters like total alkalinity phosphate dissolved oxygen (DO) have direct impact on the fish production level, because the fish productivity is mainly influenced by the water parameters like temperature, pH dissolved free carbon dioxide (CO_2), DO (Dissolved Oxygen), hardness, calcium and total nitrogen. In the Barak, the total alkalinity showed a decreasing trend (from 38 – 78 $mg1^{-1}$ to 18 – 32 $mg1^{-1}$) while dissolved oxygen (DO) is directly related with the rainfall. DO is very essential for the survival of the fish. There are certain aquatic lives (which include phytoplankton) which also take DO for their normal respiration. Growth of such aquatic lives mostly depends upon the existence of nitrate and nitrogenous substances. The presence of such aquatic lives (phytoplankton) reduces DO in water and, thereby, it hampers the growth of the fish. The concentration of nitrate and nitrogenous substances in the Barak river has been increasing day by day. During the rainy season, there occurs water run off from various paddy fields to the river through different channels. The run off carries high amount of nitrogenous substances which are generally used in the paddy fields for growing crops in the form of fertilizers used (Dutta 2004).

The decline in rainfall in the valley (table 5.1) is producing less dissolved oxygen in the river because the quantum of dissolved oxygen level is closely associated with the amount of rainfall. Obviously, the decline in the rainfall is also reducing the quantities of DO in the Barak river, which ultimately brings down the growth rate of fish population in the river as a whole. Thus, the land, water and fish are adversely affected by the chemical fertilizer leading to changes in the river ecology.

II - Floods, Siltation and Fish Depletion

The Barak river basin too is suffering from huge siltation. The continuous siltation causes minimization of the depth of the river bed. This phenomenon destroys the normal niche of various varieties of the fish. Because the huge siltation reduces the water carrying capacity of the river, it is often seen that during the rainy season the river water spills over its banks and frequently causes floods. Effect of the reduced of depth of the river bed becomes apparent when the quantum of rainfall in the year 1992, 1996 and 2004 (table 2.7) is comprised with the decline devastating of floods in these years. Clearly, the annual rainfall has been decreasing from 3134.8 mm in 1992 to 2969 mm in 1996 and to 2730 in 2004 whereas devastating floods were experienced in 2004.

III - Deforestation

The silt is being carried out by the river Barak and its tributaries due to deforestation in the areas of upstream and soil erosion is increasing in the river basin. The ongoing deforestation causes ecological imbalances, on the one hand, and vast soil erosions during the monsoon, on the other hand.

The villagers reported that before 1980 there was a system of COPE deforestation undertaken by the Forest Department of the Government, in which the department cut the trees of a particular area of the forest and sold the logs by inviting open tender. But the system was closed down in 1984 as it was causing massive deforestation. Besides, the Supreme Court of India also gave a judgement in 1996, banning the cutting of trees, specially in North Eastern Region. But the process of deforestation still continues in illegal way, causing huge siltation in the river bed and depletion of the fish resources.

In brief, the land, forest and fish resources in the Barak river are also endangered owing to the hazards caused by deforestation, chemical fertilizers and over exploitation / mismanagement of the resources. This has serious impacts on the existing interactions between the environment and the communities. The environmental changes are causing depletion of the resources, upon which the communities have traditionally depended for livelihood, and therefore, the fishing communities are also adopting some unsustainable methods for exploiting the resources.

Thus, both the fisheries are changing mainly due to siltation, deforestation and unjudicious/over exploitation of the resources. The changing resource pattern has adverse consequences for rainfall and vice versa in the region. And this chain reaction between the two is working out changes in the environment of the fisheries as well as the region as a whole.

ADAPTIVE STRATEGIES OF THE FISHING COMMUNITIES

B. THE ADAPTIVE STRATEGIES IN THE SHONEBEEL FISHERY

For their sustenance in the wake of the changing environment the Shonebeel fishing communities have been, for quite some time, introducing new strategies in respect of fishing, fishing gears, occupations, cropping, land uses, fishery construction, migration and cultural practices. The strategies are discussed below.

I - Migration

As the Shonebeel, a finite resource of CPR fish stock, is being exploited by an excessive number of fishermen, there is perceived a gradual depletion of the resource. As a result, the fishermen traditionally depending on it are compelled to change their traditional occupational activities; viz., fishing and cultivation and to adapt new ones such as wage labolur, rickshaw pulling, carpentry, mason work, goldsmithry, motor repairing service, etc. To take up such kind of occupations the people are migrating from one place to another. The migration status of the three villages of the fishery is given in the following table.

Table 5.2 : Population of the Three Villages in the Shonebeel Fishery

Name of the Village	*Year*		*Growth (in %)*
	1991	*2001*	
Devadwar	943	916	-2.9
Belala	959	1059	9.8
Kalyanpur	674	1252	84.4

Source : Govt. of Assam, 2006. Statistical Handbook, Guwahati : Directorate of Economics and Statistics

The table reveals that in the decade 1991 – 2001 the population growth rate in Devadwar has gradually declined to the level of negative rate (2.9%) while Belala has a positive growth rate (9.8%). But the Kalyanpur recorded extremely high growth population, i.e., 84.4% (Census 1991, 2001). Locationally, both, Belala and Devadwar are situated at the lower portion of the beel where the depth of the beel water remains maximum and even in the summer the water depth remains more than 20 feet. The water remains logged in these two villages for longer period than in Kalyanpur. Thus, the villagers in Devadwar and Belala cannot go for paddy cultivation. Sometimes, in the last part of December they take up paddy cultivation, though they know that the paddy crops may be washed away in the event of sudden rainfall. On the other hand, the rapidly receding flood water helps the villagers in Kalyanpur enjoy cultivation as well as fishing as paddy cultivation follows there recession of water from the land. This advantage is attracting the people of other villages to Kalyanpur. Therefore, a huge immigration has taken place in Kalyanpur as well as easy access to schools and better amenities.

Actually, the Patni and the Kaivartya immigrated from the East Pakistan (Presently Bangladesh) at the time of partition in 1947. A large number of these people immigrated and most of them settled in the beel like areas which provided access to CPR fish. In the Shonebeel, they settled gradually and exploited the resources year after year. But by 1980 the number of fishermen grew excessive. It resulted into depletion of the CPR fish, which ultimately compelled them to look for other occupations.

II - New Agricultural Practices

Because of the siltation the water recedes slowly in Devadwar and Belala are situated at the extreme lower part of the beel and therefore the lands cannot be used for paddy cultivation. The villagers generally cultivate paddy in the upper portion of the beel by taking the lands on the basis of lease or *adyabagi* or *tebhaga* in Kalyanpur. *Adyabhaga* – (half share) arrangement is that in which the land is given by the owner to a cultivator for cultivation and the cultivator bears all expenditure for seeds and other things and the yield is divided equally between the cultivator(s) and the owner. In *tebhaga* (one third share) the owner bears all the costs of cultivation other than the labour which is put in by the cultivator and the yield is divided between the owner and the cultivator in the ratio of 2 : 1.

Siltation is the prime cause of the changing pattern of the beel's land. Its upper portion beel is getting upped and its depth getting reduced due to constant siltation. This siltation provides more uplands in Kalyanpur and helps recede the water more quickly in that area. Moreover, the people of Kalyanpur break the bandh (dyke) in the rainy season and allow the Shingla river's water to enter area. With the flood water, maximum deposit of siltation extends the upland. Therefore, the people of Kalyanpur have started growing Sali variety of crop in place of boro variety of crops as the former yields more than the latter.

Some of the villagers' in Devadwar and Belala cultivate bosi and tupa (two of the traditional boro varieties of rice) by the end of December on their own land after recession of the water. They are not at all interested to cultivate the High Yield Varieties (HYV) type of rice such as Ranjit 68, Chaiyamora, Swarna sali, Akhri sali etc. Though they yield more in comparison of the traditional varieties of rice these varieties take more time to mature (110 – 115 days). They do not take risk to grow HYV crops as a sudden rainfall may destroy the paddy. Thus, the villagers do not cultivate the more time taking rice varieties. The bosi and tupa varieties mature in 85 to 90 days. Sometimes, a few villagers take the risk to grow high yielding varieties. These crops yield more only if they mature undisturbed. The bosi and tupa varieties yield hardly 8 mon per bigha (120 – 130 kg per .13

hectare) while the High Yield Varieties provide 12 mon per bigha (i.e., 192 – 200 kg per .13 hectare) (1 mon = 16 kg).

In view of occupational adjustments in the wake of the changing environment various new implements have been introduced by the villagers in the Shonebeel area. The Kalyanpur villagers growing HYV rice and boro varieties of rice on the portion of the beel are now using power tillers and use chemical fertilizers.. Before 1990, all the farmers used buffaloes and oxen for tilling and Cowdung was the only manure used in the paddy fields. In Kalyanpur the pressure of immigration has squeezed the grazing fields and the animal rearing has declined significantly. This compels the villagers to use both power tillers and chemical fertilizers. On the other hand, in Belala and Devadwar no power tillers are used as the most of the area remains under water. Earlier, the people of Kalyanpur irrigated (if required) manually, but now, they are using machine pump to irrigate their lands, or sometimes to water from the ditches.

Besides the paddy cultivation, the villagers have started growing vegetables and fruit trees. Earlier, only a few households grew vegetables in their kitchen gardens. But, now every household is growing various types of vegetables, not only to meet their household needs but also to sell them in the local market. They are widely producing gourd, pumpkin, green chilly, cucumber, bringal, arahar dal, Lady's finger, cabbage and other vegetables. The fruits trees like are also widely noticed in every household of the village. These indicates a shift of occupational focus from fishing to agriculture.

Before 1980 the people of the Shonebeel were not interested to plant the domestic fruit trees and other vegetables. But now they are planting various trees and vegetables in their own lands not only for their domestic consumption but also to create alternative means of income by selling these fruits and vegetables in the nearby market.

The following trees, planted for fruits or fodder, are found in the villages of the Shonebeel :

Chart 5.1 : Different Varieties of Trees Available in the Shonebeel

Local Name	*Scientific Name*
Mango	*Mangifera indica*
Jackfruit	*Artocarpus heterophyllus*
Betel nut	*Areca catechu*
Boroi	*Zigyphu Zuzuba*
Banana	*Musa paradisica*
Pineapple	*Ananas comosus*
Jam	*Engenia jambos*
Papaya	*Carica papaya*
Lemon	*Citrus Limon*
Amloki	*Emblica officinalis*
Tejpata	*Cinnamomum tamala*
Bhetu bamboo	*Bambusa polymorpha*
Mirtinga bamboo	*Mambusa tulda*
Kuma	*Cedrela toona*
Gamari	*Gmelina arsorea*
Coconut	*Cocos micifera*
Luklooki	*Flacourita cataphractu*
Neem	*Azadirachta indica*
Sirish	*Albizzia procera*
Kanchan	*Bauhinia spp.*
Guava	*Pridium guajava*
Hijal	*Barringtomia acutangula*
Kadam	*Anthocephalus cadamba*
Mon	*Randia dumetorum*
Cham	*Artocarpus chama*
Tamarind	*Tamarindus indica*
Jarul	*Lagerostroemia speciosa*
Simul	*Tetramelia mediflora*
Krishnachura	*Casulpinia pulcherima*
Amra	*Spondius mangiferae*
Arhor	*Caj a nus cajan*
Leetchi	*Litchi chinensis*
Madri	*Erythrina Indica*
Bhubi	*Bacerureo sapidar*
Jalibet	*Calamus tenuis*
Cera	*Erianthus raveneae*
Chon	*Imperata cylindrical*

Mukta bet	*Schumananthus dicitimous*
Mathan	*Carallia integerrima*
Bel	*Aegle marmelos*
Belfoi	*Elocaprue gloribundus*
Jambura	*Citrus maxima*
Atafal	*Anona squamosa L. Family*
Legumenus tree	*Perkia roxburghii*
Amar	*Ipauka*
Leboi (fuel)	*Phyllanthus acidus Family*
Chalta	*Dillenia indica*
Leucas	*Leucas appear*
Thankuni	*Centella asiatica*
Helencha	*Enhydron fluctuans*
Kalmi (aquatic)	*Ipomea aquatica*

The trees are planted mainly by the women folk in the villages. These plants provide fruits and fodder and their branches are used as fuel wood.

III - New Fishing Strategies

(i) Katibandh

Before 1990, the beel possessed more CPR fish due to the less exploitation of CPR fish. But now due to high demand of fish in the market, the fishermen have adopted new strategy. The only route to enter the migratory fishes into the beel is the Kachua river, an outlet of the Shonebeel fishery. During summer, after the intervention of the migratory fish from the river Kushiara, Longai through the Kachua river to the beel. The beel dwellers erect bamboo fencing called *Kathi* band on the route of fishes to block the fishes from moving out from the beel through this channel.

(ii) *Gata* Fishery

Before 1970, none of the fishermen practised pisci-culture but thereafter they started pisci-culture at individual level, for which they use a new technique to retain the flood water on their own land. They construct number of trenches called *gata* on their own land to block the flood water for a longer period even after its recession. They release some specific varieties of fish seed in the *gatas*, which becomes mature within two or three months and thereafter they sell them in the market.

(iii) Changes in Techniques and Tools

Prior to 1980, the fishermen usually formed a group of twenty members to operate Mahajal as the size of the net was very big. But now the fishermen have begun to use small size mahajal which requires 10 to 15 members for deploying it. Considering the time spent on operating the jal total catch is not sufficient to support the group of fishermen. That is why they have now begun to use small nets (*jals*) like *patanhal*, *ghurrainna jal, paloin jal* and *fash jal*. For using the small nets, they require a small group of six to seven members, sometimes even smaller it. This helps them in managing the fishing activities as well as the cost of the net. The small size and the less number of fishermen in operating a mahajal brings a fair income to the members of group.

The changes have taken place in using various nets in fishing. As a result of the increasing number of fishermen in the same limited space and decline in incomes. The fishermen, particularly the Kaivartya of Kalyanpur have begun to use small mesh nets. Prior to 1970 they used nets having large mesh size, which trapped only the big and medium size fish. But now they are using the small mesh size nets which can catch even the smallest size of spawn. This phenomenon augments the depletion of fish stock and variety.

(iv) Violation of Fishing Arrangements

In the Shonebeel fishery, the Patni and the Mahimal are using comparatively big mesh nets than the Kaivartya. This invites a constant conflict among the three communities. The people of Devadwar (Patni) and Belala

(Mahimal) appealed the people of Kalyanpyur (Kaivartya) for not to use small mesh net. But the Kaivartyas not listening them, which brings a conflict among them. Again, there is regular feature of stealing canoes and encroachment of one's jurisdiction intentionally also invites quarrel among them. Sometimes, this quarrel turns into violence also. However, the people of the beel tries their best to resolve such problems by negotiating themselves on various issues. The villagers of Devadwar and Belala believe that using of such small (mesh) nets by the Kaivartya is causing depletion of the fish stock of the Shonebeel. They also claim that if the small mesh nets are withdrawn from the beel and the catch is strictly banned during breeding season, then, the Shonebeel fishery alone is enough to meet the fish needs of the Barak Valley as a whole. Before 1970, due to the availability of fish, they were used to prepare dry fish. However, presently, due to huge demand they sell the fish as cash crop.

(v) Intermediary Fish Marketing

Before 1980 the fishermen of the Shonebeel sold their fish to the local market. But now most of them are selling their catch through *chuari*. *Chuari* means the middlemen who purchase fish directly from fishermen of an area and sell it in another area. The catch is now not enough to support their lives and therefore they engage in various activities other than fishing as well. Thus, the do not want to waste much time and efforts for fish marketing.

(vi) Alternative Fuel Sources

Before 1970s, there were a huge number of *hijol* trees (*Baringtonia actungula*) in the beel which are widely used by the beel dwellers as fuel and fodder. But due to their overexploitation, the trees have depleted to an alarming level. As alternatives, the beel dwellers are now using cow dung cakes, stalk of the crops, dry leaves, etc. as fuel. Use of the alternative fuels is constantly increasing along the depletion of the common property forests.

The pattern of alternative fuel utilization in the Shonebeel villages is presented in the following tables :

Table 5.3 Use of Cowdung Cakes as Fuel in the Households of the Shonebeel Village (2005 – 06)

(Percentage in parenthesis)

Number of Cow dung cakes used per day	*Devadwar*	*Belala*	*Kalyanpur*	*Total*
1	01 (2.2)	02 (4)	03 (6)	06 (4.11)
2 – 3	17 (37)	22 (44)	28 (56)	67 (45.89)
4 – 6	20 (43.5)	18 (36)	14 (28)	52 (35.62)
6+	08 (17.3)	08 (16)	05 (10)	21 (14.38)
Total	46 (100)	50 (100)	50 (100)	146 (100)

Source : Field Survey Conducted During January 2005 to December 2006

Table 5.4 Use of Fuel Wood in the Households of the Shonebeel Villages (2005 – 06)

(Percentage in parenthesis)

Consumption of fuel wood per day (in kg.)	*Devadwar*	*Belala*	*Kalyanpur*	*Total*
1 – 3	04 (8)	04 (8)	04 (8)	12 (8)
4 – 7	31 (62)	29 (58)	28 (56)	88 (58.67)
7 +	15 (30)	17 (34)	18 (36)	50 (33.33)
Total	50 (100)	50 (100)	50 (100)	150 (100)

Source : Field Survey Conducted During January 2005 to December 2006

Table 5.5 Use of Dried Leaves as Fuel in the Households of the Shonebeel Villages (2005 – 06)

(Percentage in parenthesis)

Consumption of Dried Leaves per day (in kg.)	*Devadwar*	*Belala*	*Kalyanpur*	*Total*
1 – 2	02 (4.5)	03 (6.5)	03 (7.9)	08 (6.25)
3 – 4	10 (22.7)	12 (26.1)	13 (34.2)	35 (27.34)
5 – 6	15 (34.1)	24 (52.2)	17 (44.7)	56 (43.75)
6+	17 (38.7)	07 (15.2)	05 (13.2)	29 (20.66)
Total	44 (100)	46 (100)	38 (100)	128 (100)

Source : Field Survey Conducted During January 2005 to December 2006

The table 5.3 reveals that all the households are using cowdung cakes as cooking fuel and half of them use four cakes or more per day. Before, 1960, the Shonebeel villagers were using only fuel wood as cooking fuel but now due to its scarcity they are using cowdung cakes also. The women folks are mainly preparing these cakes. The villagers first collect the cow dung from their own cattle or from common or unguarded private lands. The cow dung is first churned with feet and then the cakes of different size are made. Generally, a cake has a diameter of about 5 to 10 cm. Sometimes, the cow dung is moulded into small lumps pierced through by a bamboo stick which is removed from the stick when they dried. The table 5.4 reveals that most of the households in all the villages are using fuel wood more than 4 kg. per day. Thus, wood is still a major part of the fuel of the household. The table 5.5 reveals that most of the households use more than 3 kg. dried leaves as fuel. But the increased of the dried leaves specially indicates an emerging fuel crises in the villagers, probably as a result of environmental changes. How long it will sustain is doubtfull.

(v) Cultural Adaptation

Before 1980 the villagers performed several rituals at the household and village levels. The average income of the people was then sufficient to support the priest. They contributed generously to conduct the rituals. The rituals lasted for long periods by observing lengthy procedures. But after 1980 the average income of the villagers has been gradually decreasing and therefore the time spent on and the procedures used for the traditional rituals have been shortened. Almost all the villagers are now adopting some new practices like celebration of birth anniversary and marriage anniversary. Even before 1980, the villagers of Devadwar and Kalyanpur regularly practiced *Nam Sankirtan, brotos* (fasting), *pujas* (worship) and festivals. But, now, in view of decreasing income and changing occupational structure they are performing some of the rituals for a short duration.

Briefly in the changing environment the villagers of the Shonebeel are adopting migration, occupational diversification, new agricultural practices, new fishing practices and tools, alternative fuel sources and cultural accommodation as the strategies for their survival.

ADAPTIVE STRATEGIES IN THE BARAK RIVER

Like the Shonebeel villages the Barak river villagers are also adopting various strategies in the changing environment. Their adaptive strategies are being discussed here.

I - Migration

The villagers od Radha Nagar and the Netaji Nagar exploit the CPR fish from the No. 6 Jalkar Fishery while the villagers of Balighat catch the CPR fishes No. 7 Jalkar fishery. The two Jalkar fisheries are managed by the Central Silchar Fishermen Co-operative Society Limited and the Machimpur Fishermen Co-operative Society Limited respectively. In the fisheries there are 154 and 213 fishermen respectively. Before 1980 they were 55 and 103 respectively. Earlier, a fisherman could catch 4 kg. fish per day from the fisheries. But, now, due to the fishing the average catch has gone down to 1 kg. per day. This phenomenon is compelling the fishermen to change their traditional occupation, i.e., fishing and to adopt other occupations in various places.

Besides, some fishermen have changed their fishing fields from the Barak river to the Boula haor, 3 km from the Barak. Before 1980, one member from each household of the villages participated in catching fish in the Barak river. But, in Netaji Nagar now, the number of the fishing households has come down to 20, whereas 10 households have settled near Boula haor for catching fish and another 20 households are engaged in the occupational activities other than fishing and agriculture such as wage labour, rickshaw pulling, petty business, etc.

Such change in occupation causes migration of people from one place to another. The following table represents the migration status of the villagers of the Barak river.

Table 5.6 : Population Status of the Three Villages of the Barak River Fishery
(percentage in parenthesis)

Name of the Gaon Panchayat	*Census Year*		*Decadal difference*	*Decadal Growth (in %)*
	1991	*2001*		
Dudhpatil Grant (including Netaji Nagar & Radhanagar)	4224	6390	2166	51.3
Balighat	1640	1851	203	12.3

Source : Deputy Director of Economics and Statistics, Cachar 2006.

Dudhpatil Grant (Gaon Panchayat) consists of 9 villages which include Netaji Nagar and Radha Nagar. According to the Census 1991 and 2001, the population of Dudhpatil Grant increased by 51.3% whereas the population of Balighat increased by 12.3%. However, the field data indicate a decline in growth rate in Netaji Nagar and increase in Radhanagar. This, indicates that there is going on village to village migration within Dudhpatil Grant.

The people of Netaji Nagar go to Silchar to engage in various occupations. Some of them are staying permanently in Silchar or in the areas nearby. Consequently there is a trend of decline in Netaji Nagar. Most of the young villagers of Balighat are engaged as motor mechanics in garages and in other occupational activities in Silchar town. As good transport system available all they are residing in their own villages. The villagers of Radha Nagar also go to Silchar town and return home in the evening. Initially, a few youths of Radha Nagar were engaged in goldsmith activities and earned a good amount. Subsequently it inspired most of the youths of the village to choose this occupation for livelihood.

II - New Agricultural Practises

The villagers of Radha Nagar and Netaji Nagar cultivate the Sali and high yield variety of crops. These crops return a good amount of rice in both the villages. The villagers are now practicing mostly high yield variety of rice which provides more yield than earlier as these villages are not the frequent flood prone. In view of decreasing returns from fishing they are shifting their focus from fishing to agriculture.

For better tilling of the land, most of the villagers are now using power-tiller as rearing of cows and buffaloes have become problem in view of the continuously shrinking of grazing fields there is constant encroachment of the field, as many the people are migrating to Radhanagar. The farmers are now mostly interested to rear cows and she-buffaloes for obtaining milk rather than oxen and he-buffaloes manly used for tilling. In Balighat also the villagers prefer using power tiller for tilling the land. However, the people of Netaji Nagar are still practicing traditional method, i.e., oxen and buffaloes for tilling their cultivable lands. As most of the villagers having the oxen and buffaloes alongwith the she-bafalloes and cows.

The villagers of Radha Nagar and Balighat are using chemical fertilizers while those of Netaji Nagar are using organic manure (i.e., cow dung etc.) in their paddy fields as it is available in their village.

III - New Fishing Strategies

For exploiting the CPR fish in the river Barak, (before 1980) the big mesh nets were being widely used. But after 1980 the small mesh nets were introduced to maximise the fish catch. Besides, in *mahajal* operation the number of fishermen as well as size of the *mahajal* has been reduced. Now-a-days mostly the nets operated by one fisherman or two are being used in the river.

IV - Alternative Fuel Sources

Before to 1980, all the villagers were fetching their fuel wood from the Kanaikuri forest under the control of the Dudhpatil Tea Estate. But now the Tea Estate authority has banned the collection of fuel wood, which compelled them to adopt new cooking fuel. They are now using cow dung cakes, dry leaves and fuel wood as a fuel resource. The following tables show the use of these alternative fuels in the villages of the Barak river.

Table 5.7 : Use of Cowdung Cakes as Fuel in the Households of the Barak River Villages

(Percentage in parenthesis)

Number of Cow dung cake used per day	*Netaji Nagar*	*Radha Nagar*	*Balighat*	*Total*
1	01 (2)	01 (2)	0	02 (1.9)
2 – 3	09 (18)	24 (48)	01 (14.2)	34 (31.8)
4 – 6	27 (54)	21 (42)	05 (71.2)	53 (49.5)
6+	13 (26)	04 (8)	01 (14.3)	18 (16.8)
Total	50 (100)	50 (100)	07 (100)	107 (100)

Source : Field Survey Conducted During January 2005 to December 2006

Table 5.8 : Consumption of Fuel Wood per day in the Households of the Barak River Villages

(Percentage in parenthesis)

Consumption of fuel wood per day (in kg.)	*Devadwar*	*Belala*	*Kalyanpur*	*Total*
1 – 3	06 (12)	06 (12)	06 (12)	18 (12)
4 – 7	28 (56)	28 (56)	25 (50)	81 (54)
7 +	16 (32)	16 (32)	19 (38)	51 (34)
Total	50 (100)	50 (100)	50 (100)	150 (100)

Source : Field Survey Conducted During January 2005 to December 2006

Table 5.9 : Use of Dried Leaves in the Households of the Barak River Villages
(Percentage in parenthesis)

Consumption of Dried Leaves per day (in kg.)	Devadwar	Belala	Kalyanpur	Total
1 – 2	03 (7.3)	03 (6.5)	02 (7.4)	08 (7.7)
3 – 4	14 (34.2)	12 (26.1)	06 (22.2)	32 (30,8)
5 – 6	19 (40.3)	24 (52.2)	08 (29.6)	51 (49.1)
6+	05 (12.2)	07 (15.2)	11 (40.8)	23 (22.4)
Total	41 (100)	46 (100)	27 (100)	104 (100)

Source : Field Survey Conducted During January 2005 to December 2006

The table 5.7 reveals that more than two thirds of the people all the villages are taking more than four cowdung cakes as fuel daily. The table 5.8 shows that all the villagers are using 4 – 7 kg. of fuel wood per day. The table 5.9 exhibits that the Mahimal are using minimum dry leaves as fuel for their cooking, the people of Netaji Nagar and Radha Nagar are using maximum due to availability of the dry leaves in the villages as these villages having more trees.

V - Cultural Adapation

In the Barak river villages also all the villagers now prefer rituals of short duration. They have changed their traditional dress into modern one. Jeans trousers, shorts, etc. have become a common fashion among the youths in the three villages. The changes are more or less patterned on the line of urban life style as all the villagers are in constant contact with the Silchar town for various purposes.

In sum, the change in the environmental conditions of the two fisheries has played a major role in the new strategies that are being adopted by the fishing communities. The change in occupational activities owing to the depletion of CPR fish lead the people to migrate from one place to another and to adopt specially urban cultural elements depending on their occupational activities. Occupationally the people are focusing afresh on agriculture and engaging in various occupations in tertiary sector. Even in the traditional occupation of fishing they are adopting the methods and techniques efficient enough to overexploit the PPR fish. Thus, the occupational changes migrations and heightened rural urban contacts are accompanying various adaptations in cultural life, specially, in the material culture.

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