

**LOCAL LEVEL PARTICIPATION IN PLANNING AND DEVELOPMENT IN THE
SOUTHWESTERN COAST OF BANGLADESH: A STUDY ON SHRIMP CULTURE
AND ITS EFFECTS ON NATURAL AND ENVIRONMENTAL RESOURCES.**

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Abstract

The southwestern coast of Bangladesh is getting importance as a functional area for its natural potentials resources including a number of economic and environmental resources. The southwestern coastal land is mainly used for agriculture. Since the seventies, international market demand and high prices of shrimp have encouraged people to go for shrimp farming. But shrimp culture changing traditional agriculture and tremendous change in land use through conversion of agriculture land, grazing land, and forestland. Besides, shrimp culture negatively affected indigenous fish & crops varieties, soil fertility, homestead & field crops, livestock, poultry and birds, fresh water reserve and environment. It has also destroyed biodiversity, ecosystem, flora and fauna of the Sunderbans- the world famous mangrove forest. Most of the shrimp farms are in the hand of outsiders and they are not sympatric to local people and as well as local environment. Historically, people in the southwestern coast depend on natural resources and live by agriculture with their own management system. But with the introducing of shrimp farming they gradually lost their resources. At present majority of the shrimp farms failed to get maximum return due to repeated virus attacks. Also, shrimp processing factories do not maintain the quality and hygienic condition of exported shrimp and thus permanently failed to achieve desired goal of earning foreign currencies. Through the study it becomes evident that shrimp culture affects natural and environmental resources in the southwestern coast. So it is high time for the government to come forward and take necessary action to mitigate problems in collaboration with local people, local government bodies, GOs and NGOs. Local people have their own glossary on local environment & resources. It is necessary to accumulate local people's indigenous knowledge and experiences that would come to a great help to the policy makers & planners. Local level planning could improve the economic conditions of the people in the southwestern coast of Bangladesh. The present study looks into the effects of shrimp culture on natural and environmental resources. It also focused on the way of local people's participation in planning and development of the southwestern coast of Bangladesh.

Key words: *Shrimp culture, natural & environmental resources, local level participation, planning & development, the southwestern coast of Bangladesh*

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Authors

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ACRONYM

ADB	= Asian Development Bank
BPATC	= Bangladesh Public Administration Training Centre
BRRRI	= Bangladesh Rice Research Institute
BR	= Bangladesh Rice
Ca	= Calcium
DDP	= Delta Development Project
ENR	= Environmental and Natural Resources
FAO	= Food and Agricultural Organization
GDP	= Gross Domestic Product
GO	= Government Organization
HYV	= High Yielding Variety
IDA	= International Development Agency
K	= Potassium
LGO	= Local Government Organization
MT	= Metric Tone
Na	= Sodium
N	= Nitrogen
NGO	= Non-Government Organization
PL	= Disease free Post Larvae
SSoQ	= Shrimp Seal of Quality
SRDI	= Soil Resource Development Institute
UNDP	= United Nations Development Program
USD	= United State Dollar
WSA	= White Spot Virus
WTO	= World Trade Organization

CHAPTER-I

1. INTRODUCTION

The southwestern parts of Bangladesh falling under the active influence of tidal effect of the Bay of Bengal and its salinity can be broadly termed as coastal region. Agriculture is the main occupation of people in the southwestern coastal region of Bangladesh. But recently people in the area engaged in agriculture are at the threat of extinction. Shrimp culture in the coastal area is gradually getting importance for its increasing foreign exchange earning and is widely practiced all over the coastal region. The total area of coastal district is 28000 sq. km i.e. about 19.5% of our national areas (USAID, 1990) and includes seventeen districts. The coastal districts are affected by different level of soil salinity. Among the seventeen; three districts are present in the southwestern coastal region. The southwestern coastal region of Bangladesh comprises with the district of Bagerhat, Khulna, and Satkhira and the Bangladesh portion of the Sunderbans mangrove forest. The entire region is criss-crossed by numerous rivers, estuaries, creeks and canals like a spider's web. The elevation of the land is one to three meters above mean sea level, but the major portion of the land is low lying being barely one meter above sea level and below high tide level. The entire region is a tidal flood plain.

1.1 Changing Agricultural Land

The present scenarios of southwestern coastal regions are rapidly expanding shrimp cultivation that is extensive in nature. The land use in the southwestern coastal region of Bangladesh has been changing rapidly since the early seventies. The newly introduced shrimp culture gives much more earning per hector of land compared to traditional agriculture. As a result, there has been tremendous change in land use through conversion of agricultural land, grazing land, forestland and many common property lands into shrimp farms. In Khulna, Satkhira and Bagerhat areas a sizable agricultural land has already been brought under shrimp culture. The area under shrimp culture has increased significantly during last decade. At the same time, the area under agriculture declined due to conversion of land to shrimp culture. It effects on green vegetation and causes deforestation and degradation of coastal ecosystem. Shrimp culture first started in some Upazila of the Satkhira district. Gradually it started in almost all the areas of southwestern coastal region. Agriculture is the main land use in southwestern coastal region and *T-aman* is the main crop. The incomes from agriculture in the areas were accounted for about 70%. But at

present it has come down to about 42%, whereas there has been a substantial increase of income from shrimp culture (*Elahi, et al, 1998*). So, agricultural land gradually turned into shrimp farming. Rich people put emphasis on shrimp farming in stead of crop cultivation.

1.2. Relation between Plant and Environment

The plant life in southwestern coast is affected by saline water and cyclones. It destroys the natural balance. To restore the natural balance, the only way is to plant more trees. It creates precautionary measure against cyclone. Plantation of trees also increases soil fertility; equilibrium of the ground water level, helps in regular rainfall, full fills the necessity of covering the soil with vegetation, supplies oxygen and food, shade and coolness, ultimately creating a healthy environment.

1.3 Shrimp Culture and Destruction of Natural Resources

Shrimp and rice both are cultivated in same land by rotation. Shrimp cultivation has become an attractive investment area where return from the field takes place in approximately 5 months. Saline water is needed for better production of shrimp but it is harmful for crop production. So with increases of shrimp farm decreased cropland. Another grave effect of shrimp farming is destruction of domestic animals by destroying natural grassland and fresh water reservoir. Horticultural crop like coconut, betelnut, banana etc. that are indigenous to the coastal area are totally damaged for increasing salinity in the soil. Unplanned and unscientific shrimp cultivation has drastically reduced the stock of indigenous fish varieties and destroyed many mangrove species of flora and fauna. Shrimp cultivation also has negative impacts on rice cultivation.

1.4. Shrimp Farming Changing Traditional Agricultural

Shrimp cultivation starts from January to September and it hampers rice cultivation. The main crop *T-Aman* is cultivated in June-July and harvested till December. Because of delay in rice cultivation, rice production has decreased by a big percentage. (*Saikia et al, 1988 and Miah et al., 1995*). Experts indicate saline water brought into the embankments and kept in the field's increases salinity of the soil, which destroys nutrients of the soil and helps sodium chloride get accumulated affecting rice production. (*Brammer, 1975*). So on the one hand shrimp culture prohibits rice cultivation and on the other hand, it destroys the natural resource base.

1.5. Conflict in Time Sharing between Seedbed Preparation and Shrimp Farming

In the southwestern coast, seedbed preparation and seed sowing of *Aman* rice is some time delayed due to over flooding of land in the shrimp farm. This factor is very common here but

some time it is delayed due to late rainfall during seedbed preparation (July-August). Transplantation of rice is also delayed due to lack of optimum age of seedling. Age of seedlings is indeed important because the age of seedlings has a tremendous influence on the yield and yield contributing characters of rice plant. (*Mannan and Siddique, 1991 and De Datta 1981*) Shrimp culture season's covers from January to September. Shrimp farms are covered by saline water up to July. In the month of June, July and August heavy rainfall have been occurred by nature in the areas. Saline water turned into fresh water due to heavy rainfall. After conversion of water, lands became ready for *T-Aman* rice cultivation. Rice cultivation season covers from June to December. So in the month of June and July a transition situation occur between the farmer and the owner of shrimp farm. The owners of shrimp farm maintain maximum level of water in the field by embankment. But farmer want to remove water from field for seedbed preparation. Most of time owners of shrimp farm remove water from the field after July or August. In the meantime seedbed preparation and seeding time already turn to go over. Besides owner of shrimp farm maintain high water level in the shrimp farm during rice transplanting time. So transplantation is delayed which affect rice yield.

1.6. Conflicting Interest between Rice Cultivation and Shrimp Farming

Most of the *T-Aman* area suffers from flash floods due to sudden rainfall or continues rainfall. Submerge condition normally tolerate not exceeding 10-12 days (*Senadhira, 1992*). In the southwestern coast, most of rice cultivable areas are located in shrimp farm. Normal water flows in shrimp farms are restricted by a gate. In the month of September most of shrimp are harvested but there are present other fishes. So owner of shrimp farm sublease it to others. The sub-leasers are not sympathetic to rice cultivator and they protect water in field certain period of time. In presence of submerge or semi submerge condition rice growing stage is restricted especially vegetative stage. Sometime tillers are damaged; sometime all tillers of hills are destroyed. These tendencies are mainly observed in low land in the coastal areas.

1.7 Shrimp Culture and Social Balance

Marginal farmers who constitute the majority of farming population do not have access to shrimp cultivation for lack of capital and become land less in course of time by selling their land to outside investors. About 70% of total shrimp farm areas are in the hands of outsiders (*DDP, 1985*), which means that most of the benefits leave from the area. The social and economic situations arisen from shrimp culture as stated above indicate some of the salient

feature. Shrimp culture seriously disturbed the small and marginal farmers. It had displaced them, denied them of their basic human rights, increased landless and reduced the means of their livelihood.

1.8. Rationale

In Bangladesh 75% of the population depends directly or indirectly on agriculture for their livelihood. The sector accounted for 32% of the country's GDP in 1996-97 and 23.46% in 2001-2002. The fisheries sub-sector contributes 5.2% to total GDP (*Economic review of Bangladesh, 2003*). Agriculture is the main land use in southwestern coastal region. But in recent years, shrimp farming is taking over rice fields extensively. From the 1980 shrimp has become an important export commodity attracting the outside investors especially from cities. The outside cultivators are not sympathetic about the preservation of local resources and as well as environment. Since the southwestern coast is resourceful with its natural and environmental resources; now it is a symbol of destruction. At present most of the people in the southwestern coast are passing through a crucial moment in absence of sufficient crops in their field. On the other hand, shrimp farm owners fail to get maximum return from shrimp culture due to severe attack of virus every year. Maximum people in the coast have lost their income source and trying to search out a new way of living and surviving in the areas. So the study is done to examine the effects of shrimp culture on natural and environmental resources. At the same time this study is able to find out a way of local people participation for planning and development of the southwestern coast of Bangladesh.

1.9. Objectives of the Study

- To find out the effects of shrimp culture on natural and environment resources in the Southwestern coast of Bangladesh
- To analyze the socio-economic return from shrimp culture in comparison to destruction of natural resources.
- To find out the way of local people participation in planning and development of the Southwestern coast
- To find out the strategies of sustainable management of natural and environmental resources in the area.

1.10. Scope of Study

The study was conducted in Mongla and Rampal Upazila, in the southwestern coastal areas of Bangladesh. Thirty years back agriculture was the main land use in the areas but after the late seventies to present shrimp farm is taking over rice field gradually. The following aspects were highlighted in the study-

- ☐ Present and future environmental issues.
- ☐ Natural resources and its present scenario
- ☐ Land use pattern from back to present.
- ☐ Introducing and causes of increasing shrimp farm.
- ☐ Lease out system of land for shrimp farming.
- ☐ Shrimp as an export goods and its future dimension
- ☐ Experts, GOs, NGOs officials and local people comments on shrimp culture.

1.11. Anticipated Benefit of the Study

Agriculture is the main land use in the southwestern coastal region of Bangladesh and *T-aman* is the main crop. Shrimp culture is gradually getting importance for its increasing foreign exchange earning. So land use in the area has been changing rapidly since the late seventies. Main issues on which government put emphasis are: people welfare, environment, food security and foreign exchange earning. So the study has examined two things: effect of shrimp culture on natural and environmental resources and local people participation for sustainable development in the southwestern coastal area. This will be helpful for future plan and development in the locality. Government would take an effective strategy for socio-economic development of people in the area. On the other hand, broad priority areas of BPATC are: development administration, policy intervention, policy planning and share it to the government. So outcome of the research could be helpful for policy making and it will also be incorporated in relevant module of different courses of BPATC.

1.11. Limitations:

- a. The owners of shrimp farm were not easily available. So in some cases information were collected from the manager's of shrimp farm.
- b. The southwestern coast comprises of three districts: Bagerhat, Khulna and Satkhira. But the study areas covered only two coastal Upazilas of Bagerhat district.
- c. The data collection areas were not the remote. It might have hindered the process of getting the real picture of backward areas.
- d. All concerned local officers were not available during the period of data collection.
- e. There were two groups of respondents: pro and anti-shrimp speakers. So the question of destruction of natural and environmental resources due to shrimp farming was not clearly answered by the owners of shrimp farms.

However, the study conducted over some selected southwestern coastal areas is able to give an idea on the effect of shrimp farming and way of local level participation for planning and development in the area.

CHAPTER- II

2. METHODS OF STUDY

To have effective data collection and results, the methodology of this research project was divided into different technical parts, which are as follows-

2.1. Types of Study: Survey based empirical research.

2.2. Study Areas: Since different parts of Bangladesh are affected by different types of salinity, this research project intended to cover respondents from the following areas-

- **Mongla Upazila:** a southwestern coastal area of Bangladesh located in Bagherhat district. The Sunderbans, the second natural sea port Mongla, aquatic biodiversity and many other natural resources covered the area. The important agricultural pattern in the area is local rice and shrimp both are cultivated in same land.
- **Rampal Upazila:** a southwestern coastal part of Bangladesh located in Bagerhat district. The northern parts of the upazila are protected from salinity by embankment. The important agricultural pattern in the areas is local rice, vegetables, prawn and shrimp farming. HYV rice cultivates in some areas of the Upazila in where salinity level is low.

2.3. Respondents: The total number of respondents: $(70+150+50+80+25) = 375$.

- Shrimp farm owners: respondents: 70
- Internal landholders/farmers in the shrimp farms: respondents: 150
- Public representative, social worker and teacher: respondents: 50
- Officers of GOs & NGOs: respondents: 80
- Specialists: scientists, academic, researchers etc: respondents: 25

2.4. Sample Size:

The primary data are collected by questionnaire from 375 respondents but some information is collected from group discussion and from expert's opinion. These are not included in the total number of respondents.

2.3. Sampling Procedures

For collecting the primary data purposive sampling procedure was followed.

2.4. Data collection process

Data were collected based on the basis of both primary Information and secondary Information. Secondary information was collected for comparison of both data and also for the best out come of the study. The primary data were collected with the help of questionnaire.

Primary information: One set of questionnaire with five parts was formulated for data collection (**annexure -I**).

- **Part-I:** For the shrimp farm owners
- **Part-II:** For the internal landholders/farmers in the shrimp farms
- **Part-III:** For the public representative, social worker, teacher etc.
- **Part-IV:** For the officers of GOs & NGOs
- **Part-V:** For the specialists like scientists, teachers etc.
- **Types of questionnaire:** Some questions were open ended and some questions were closed ended i.e. mixed type questions in questionnaire. It depends on the result of pre-testing of questionnaire and needs of the study. Besides, non-structured questionnaire were used.
- **Pre-testing questionnaire:** Each parts of the questionnaire were pre-tested before finalizing the questionnaire. Pre-testing was done on the basis of interviewing of some selected respondents in the locality. Some questions are rearranged according to the results of pre-test.
- **Secondary information:** Some necessary data were collected from the secondary sources in comparison to primary data and also needs of the study. To accomplish the research many published document had been used from BPATC library, BRRRI library and Internet. Some unpublished documents were collected from GO and NGO officials. The primary data were collected on the basis of secondary information and needs of study.

2.5. Methods of data collection:

- **Interview method:** Members of the research team were assigned for collecting data. They collected data with the help of questionnaire or interviewing people as mentioned earlier.
- **Observation method:** Team members were responsible for keen observations of natural and environmental resources of study areas. Their observations were reflected in recommendations in relation to the gathered information.
- **Group discussion:** The research team arranged group discussion at the field level with experts, GO and NGO officials & also local people.
- **Documents analysis:** While interviewing the respondents the team-members analyzed the present situation In comparison to back history of the areas.
- **Experience sharing with farmers:** We observed two crops cultivable areas, one was inside the shrimp farm and another was out side of the shrimp farm and talk to the farmers in that localities.

2.6. Data Processing and Analyzing

The collected data were arranged and scrutinized carefully on the basis of the completed questionnaire. Data were analyzed by measuring mean, percentage, central tendency, dispersion and relationship.

2.7. Data Presentation

Then data were presented in an orderly and systematic way in columns and rows in a table. Some suitable data were presented by graphs and pie charts.

2.8. Report Plan: The report comprises of six major chapters having the following contents:

- **Chapter I:** Introduction, objectives, scope and limitations
- **Chapter II:** Methods of study
- **Chapter III:** Review of literature with an emphasis on coastal resources
- **Chapter IV:** Primary data analysis and results discussion.
- **Chapter V:** Local people participation in planning and development
- **Chapter VI:** Findings, recommendations and conclusion

CHAPTER-III

3. REVIEW OF LITERATURE WITH EMPHASIS ON COASTAL RESOURCES

3.1. Resources in the Southwestern Coast of Bangladesh

The southwestern costal part is the richest area of Bangladesh with its natural and environmental resources. The resources include the flora, fauna & biodiversity of the locality and the Sunderbans, world famous mangrove forest. It also includes crops, fisheries and livestock resources (**table-1**). It is said that our national economy directly or indirectly depends on the natural resources in the southwestern coast of Bangladesh. Proper management with participation of the local people could enhance maximum outcome from the resources.

Table- 1: Southwestern Coastal Resources

Resources	Brief description of resources
Forest resources: • Flora • Fauna	The Sunderbans, largest mangrove forest in the world & the 522nd position of world heritage. • Out of 35 mangrove species in the world, 14 are present in the Sunderbans. • Reptile 32, mammalian 35 and birds 187 species are found in the Sunderbans.
Fish resources: • Sea & river fish resources • Shrimp known as white gold resources	The southwestern coasts are the richest with its open and closed water fisheries. • Around 15- 20 % fish in our country arisen from sea & river's fish resources. Its amount is around 4-5 million MT • Second source of foreign exchange earning in our country. In the year 2001-2002, Bangladesh earned 15908 million taka & production was 1,14751 MT
Crops: • Field crops • Horticultural crops	The southwestern coast is known as a source of indigenous crops and organic farming. • Local T-aman: Disease resistant & relatively salt tolerant cultivars. Need minimum fertilizers, pesticides, irrigation and tillage. • Coconut, betlenut, banana etc.
Livestock:	• Cattle, Black Bangle Goat, Buffolow etc.

Source: Ahmed, 2003, BBS, 2003, the Economic Review of Bangladesh, 2003

3.2. Coastal Land, its Salinity and Crop Production Status

The coastal areas covered about 20% of our national areas in seventeen districts with the length of 710 km long. Among the seventies Bagerhat, Khulna, Satkhira and Potuakhali occupied maximum saline areas (**table-2**). In the southwestern coast salinity level gradually increased after the Farraka barrage due to restricted flow of water from the Ganga during dry season. In absence of fresh water from the Ganga and the Padma, saline water moves towards upper portions of coastal land during high tide period. So salinity covered new areas every year.

Table- 2: Saline affected land in the coastal areas

District	Area of land (ha)	District	Area of land (ha)
Khulna	1,45,000	Barguna	14,000
Bagerhat	1,25,000	Patuakhali	1,39,000
Satkhira	1,47,000	Gopalgong	10,000
Jessore	1,100	Madaripur	1,000
Narail	16,000	Laksmipur	1,9000
Pirojpur	29,000	Noakhali	49,000
Jhalakathi	4,000	Chittagong	46,000
Barisal	11,000	Cox's-Bazer	55,000
Bhola	94,000		

Source: SRDI & the Ittefaq, 7 May 2005

The total arable agricultural land of the coastal zones was 14, 59,150 ha in the early seventies. Out of the total arable agricultural land, saline affected land increased from 8, 33,000 ha to 10, 20,750 ha from the year of 1973 to 2000. Salinity increasing rate is 22.47% (SRDI and the *Ittefaq*, 7 May 2005). At present about 40% agricultural land remain without cultivation due to the effect of high salinity. In the southwestern coast highly saline affected soil and moderately saline affected soil are 4, 00,000 ha and 6, 00,000 ha respectively. Crop production ability of highly and moderately saline affected soil are 0-5% and below 50% respectively. It is estimated that the total crop production lost 14, 50,000 MT/year in the coastal area of Bangladesh. In the southwestern coast soil salinity classes varied from moderately saline to strong saline (**table-3**) due to lack of fresh water. There is no critical point of salinity where plants fail to grow. As the salinity increases growth decreases until plants become chlorite and die. Plants differ widely in their ability to tolerate salts in the soil. Salt tolerance ratings of plants are based on yield reduction on salt-affected soils when compared with yields on similar non-saline soils (*FAO report, Internet*).

Table- 3: Soil salinity classes and crop growth status

Soil salinity class	Conductivity of the saturation extract (ds/m)	Effect on crop plants
Non saline	0-2	Salinity effects negligible
Slightly saline	2-4	Yields of sensitive crops may be restricted
Moderately saline	4-5	Yields of many crops are restricted
Strongly saline	8-16	Only tolerant crops yield satisfactorily
Very strongly saline	> 16	Only a few very tolerant crops yield satisfactorily

Source: Saline soil and their management, FAO observation

3.3. Shrimp Culture Affects Coastal Agriculture

In the seventies majority of the people in the southwestern coast depends on crop based agriculture. Local people protect their cultivable land from saline water by seasonal embankment from December to June. In the month of July and August there may occurs heavy rainfall and farmers prepare their lands for *T-aman* cultivation. Traditionally farmers in the regions practiced organic farming system. They do not apply any fertilizers, pesticides and irrigation in crops. The cultivable land was naturally fertile by high tide silted water and need minimum tillage. So farmers in the areas get maximum return from rice cultivation.

Shrimp cultivation started in the southwestern coast from the late seventies. Saline water is essential for shrimp cultivation and fresh water is an important factor for rice cultivation. The owners of shrimp farm enter saline water into the cultivated land in January and this water stay on land up to August. Saline water limits soil fertility and soil microbial activity. So crop production ability of soil gradually decreased. The major impact of shrimp culture in the southwestern coast is salinity and salinity is the main constraints of coastal agricultural. The effects of over salinity in soil expressed below-

3.3.1. Salinity affects seed germination

Although some crops seem to tolerate salinity as well as during seed germination as during later growth stages, germination failures are most commonly responsible for poor and spotty stands and bare spots in otherwise cultivated fields. Frequently this is not the result of crops

being especially sensitive during germination but rather is caused by exceptionally high salt concentration in the shallow surface zone where seeds are planted. These high salt concentrations result from the salt that is left behind as the upward moving water is evaporated near the soil surface. Most plants are more sensitive to salinity during germination than at any other growth stage (FAO, *Observation, on-line*).

3.3.2. Salinity affects crop growth in absence of timely rainfall

Transplanted *aman* rice is the main crop in the southwestern coast affected by salinity caused by post-monsoon drought. Usually, the effect is only to reduce yield. However, if salt damage occurs as early as September or early October, affected crops can be killed or so badly stunted that farmers abandon the crop and turn cattle onto the fields to graze the leaves. If a drought in the post-monsoon season is not followed by satisfactory rainfall in November-December dry season salinity may occur earlier, more widely and more severely than normal, which may either prevent normal dry land *rabbi* crops from being sown or greatly reduce their yields.

3.3.3. Salinity affect crop yield during dry season

Rice is an important crop in many coastal regions and is grown during the rainy season. Although initially the soil salinity may be high, after one or two rains salinity is reduced in the upper few centimeters of land enabling planting of seedlings grown in a relatively good soil. Salinity is usually a greater constraint in the dry season when the evaporative demand is high and supply of good quality water restricted. Under these conditions when groundwater of high salinity must be used, salinity becomes a major constraint to obtaining satisfactory crop yields.

3.3.4. Salinity affects nutrient availability and uptake by plants

At moderate salt concentrations in the soil solution, plants generally try to exclude unwanted ions, as far as possible, and promote the uptake of nutrients. With increasing salt concentration, the uptake of sodium and chloride ions increases sharply. This luxury consumption of ions is essential for the plants to compensate for the increased outside osmotic pressure but is responsible for growth retardation. Excessive uptake of certain ions in turn, often results in reduced uptake of some essential nutrient for the plants to compensate for the increased outside osmotic pressure but is responsible for growth retardation. Excessive uptake of certain ions, in turn, often results in reduce uptake of some

essential plant nutrients causing nutrient imbalances and deficiencies. Thus, although the available status of a nutrient in a soil might not be in a deficient range, its application might compensate for the decreased uptake by plants resulting from the antagonistic effect of excess uptake of certain ions. Results of several studies tend to show that deficiencies of the elements K and Ca appear to play an important role in the observed growth depressions in many saline soils (*Finck, 1977*).

Proper fertilization of soils of low or medium salinity should serve to:

- Supplement nutrients that are present in insufficient amounts;
- Supplement nutrients that, although present in sufficient amounts, are not taken up in adequate amounts due to antagonistic effects, e.g. K or Ca; and decrease the uptake of harmful ions, e.g. K against Na or phosphate against chloride (*Rankovitch and Prath, 1967*).

3.3.5. Salinity hampered microbial activity in soil

High salinity may interfere with the growth and activity of the soil's microbial population and thus indirectly affect the transformation of essential plant nutrients and their availability to plants. It has been reported that over salinity reduced symbiotic nitrogen fixation due to the toxic effect of salts on plant rhizobia (*Bernstein and Ogata, 1966; Bhardwaj, 1975*).

3.3.6. Salinity causes toxic effects on plant:

Apart from the effect on water availability to plants and the possible toxic effect of some constituents, excess neutral soluble salts in soils may also interfere with the normal nutrition of crops in saline soils. Soluble salts most commonly present are the chlorides and sulphates of sodium, calcium and magnesium. Nitrates may be present in appreciable quantities only rarely. Sodium and chloride are by far the most dominant ions, particularly in highly saline soils, although calcium and magnesium are usually present in sufficient quantities to meet the nutritional needs of crops. Many saline soils contain appreciable quantities of gypsum in the profile. Soluble carbonates are always absent. The pH value of the saturated soil paste is always less than 8.2 and more often near neutrality (*Abrol et al., 1980*).

Symptoms of specific element toxicities, such as marginal or tip burn of leaves; occur as a rule only in woody plants. Chloride and sodium ions and boron are the elements most usually associated with toxic symptoms. Non-woody species may often accumulate as much or more of these elements in their leaves without showing apparent damage, as do the woody species.

3.3.7. Salinity causes water scarcity for plant growth

Excess soil salinity causes poor and spotty stands of crops, uneven and stunted growth and poor yields, the extent depending on the degree of salinity. The primary effect of excess salinity is that it renders less water available to plants although some is still present in the root zone. This is because the osmotic pressure of the soil solution increases as the salt concentration increases. Apart from the osmotic effect of salts in the soil solution, excessive concentration and absorption of individual ions may prove toxic to the plants and may retard the absorption of other essential plant nutrients (FAO).

3.3.8. Salinity affects crops, poultry and livestock production

Rahman (1990) cited that shrimp culture causes sudden change in the cropping pattern in the southwestern coast. Other negative impact of shrimp culture include fall of poultry and livestock population, decline productivity of land, destruction of trees, decline of meat and milk supply and shrinking of grazing lands. Shrimp cultivation had also reduced the number of livestock and poultry in the locality.

3.3.9. Affects indigenous crop yield and limits income source of local people

Fruit trees, such as, coconut, date palm, guava and mango are also affected, and tended to disappear in many parts, thus jeopardizing the supplementary sources of income of the traditional farmers.

3.3.10. Affects open water fisheries

During the spring tides, shrimp larvae and fries are swept along the low-lying coastal areas by the poor people. Many local landless people, mostly children and women, collect larvae from the nearby channels & rivers and supply them to the shrimp farms. These are collected by a very crude method and since the collection is only species specific, other species, such as, zooplankton including fin-fries is discarded along the shore. The process leads to:

- Destruction of zoo-plankton and other small fishes
- Imbalance in marine food cycle and
- Destruction of open water fisheries.

3.4. Impacts on Environmental Resources

The shrimp farm owners have illegally occupied water channels with their farm for shrimp cultivation thus affecting drainage system of agricultural land and causing massive loss to crops during cultivation season. Shrimp farming has adversely affected the local ecosystem in a number of ways. These are as follows-

- Tidewater remains only for a few hours a day, while saline water is kept stagnant in shrimp farms for more than six months at a time. Thus both the solid and the underground water table are increasingly becoming saline. This has produced a side effect of potable water for drinking and other household uses. Seepage of saline water from shrimp farms into adjacent agricultural lands causes damage to the crops.
- Salinity has also caused loss of fertility and productivity of the agricultural land.
- The use of chemicals to destroy microorganisms harmful to shrimp is also killing beneficial bacteria. When this water is released into the river in the water changing process, the natural river system becomes polluted, causing harm to the biological diversity of the region.
- The collection of shrimp fry from open water bodies in and around the Sunderbans is causing loss of aquatic bio-diversity and reducing the fish population of the region. Experts say as more than 200 fry of other species are destroyed for each shrimp fry collected.

3.5. Impact on the Sunderbans Forest:

Shrimp farming extended up to the Sunderbans forest by removing of plants. The destruction of mangrove for the constriction of shrimp farms is of great consequence as is the shrinking of grazing land and destruction of inland forests. The horizontal expansion of traditional extensive shrimp farming adversely affects different types of trees in the Sunderbans, due to prolonged retention of saline water.

3.6. Impacts on Livelihoods of People

- Agriculture has been reduced, resulting in reduction of employment options for the poor and landless.
- Destructive methods of shrimp fry collection have damaged aquatic bio-diversity which resulted in reduction of the fish population that adversely affecting the livelihoods of fishermen.
- Salinity has also adversely affected homestead beatable gardening, poultry farming and cattle rearing, thus denying the poor people their sources of homegrown nutrition and subsidiary incomes.
- Salinity enhanced by shrimp culture has killed off vegetations and this has resulted in lack of sufficient firewood.
- The lack of vegetables, fruits, eggs and milk has resulted in massive malnourishment, especially of women and children, in the region.
- The shrimp farms abandoned due to repeated attacks of the white spot virus are no longer capable of being used for agriculture because of salinity, and are thus permanently lost to the national economy.
- Shrimp culture has changed livelihood patterns of people in the area.

3.7. Impact on Social Harmony and People Relations

3.7.1. *Conflict between local people and outsiders*

The issue of shrimp culture may appear to be a paradox at the first sight. This is a lucrative venture earning a lot of foreign exchange. Most of the shrimp producing farms have taken away land from local farmers which are mainly controlled by rich people. This could have been available for crop cultivation. Indeed if properly planned the local landowners could have done both shrimp farming and rice cultivation. But in some cases outsiders have deprived small and marginal farmers from such an option. There is no harm in an economic enterprise like shrimp farming if parts of the profits from it were reinvested and the social fabric was left unharmed. But this has not happened in the areas. The outsiders have not only deprived the local landowners from the profits of shrimp cultivation, they have also been destroying the local environment by flushing saline water into the croplands and the homesteads of the local people. So local people are not satisfied with their activities and sometime they protest without getting any results.

3.7.2. *Arisen social violence*

Since 1980 the amount of export earning from shrimps has been on the rise. Unfortunately, this has not changed the lot of local people. Instead owners of the shrimp farms have been getting richer and stronger incidence exploitations and violence have also been increasing. This has displaced some of the local poor and marginal farmers and forced them to become landless. The policies governing shrimp cultivation are confusing and many due to shrimp cultivation can surely blame the local administration for lack of enforcement of good policies for stopping violence, exploitations and hence fast dispossession of lands. At the initial stage of shrimp farming, some incidents create problems between the shrimp cultivators and farmers. But within short time there arisen competition among the shrimp cultivators that resulted social violence in the locality.

3.7.3. *Impact on social environment*

The social environment has also been deteriorating in shrimp farming areas. There are increased evidences that some of the workers are not being paid enough, and in some instance, they are not paid at all. In fact, the local laborers are not encouraged to work in the farms by external farm owners. They bring in their loyal laborers from outside causing loss of employment for the local laborers. The end result has been fast increase of landless households in an otherwise prosperous region. The outside cultivators are not sympathetic

about the preservation of local environment, profit is their main aim. Experts indicates that unscientific and in discriminates shrimp cultivation is creating social hazards among other things. The kind of profits coming from shrimp fields has been developing animalism in a class of people (*Gain and Moral, 1995*). From broader perspectives and considerations shrimp cultivation is very harmful.

3.8. Evaluation of Shrimp Farming in Relation to Damage of Natural Resources

Shrimp play an important role in the country economy of Bangladesh and become on of the majors export earner. In 2003-2004, the country earned about 21,632 million taka from the export of shrimp, which is almost 6% of the total national export earning (table-4, 5). It is also found that income from exported shrimp gradually increased from the year of 1999 -2000 to 2003-2004 and its amount is from 14,746 to 21,632 million taka (table-4).

Table – 4: Export trend of shrimps from Bangladesh

Years	Income from export (million taka)
1999-2000	14,756
2000-2001	17,986
2001-2002	15,908
2002-2003	18,965
2003-2004	21,632

Source: Fish fair Souvenir, 2003 & Foreign Trade Section, BBS, 2003

Bangladesh scored 11th position in the world, for shrimp production. (*Weekly Robber, 19 Jan 2003*). Shrimp farming is the key to the economy of Bangladesh and the most traded seafood product in the world. Currently, Bangladesh produces 2.5% of the global production of shrimp and the shrimp sector is the second largest export industry of Bangladesh (DOF, 2002). The quality and hygienic condition of exported shrimp is not up to the mark. Majority of the shrimp processing factories do not maintain international standard. So our country received minimum price from exported shrimp.

The fisheries sector accounts for 10% of agricultural GDP, 3% of total GDP, 8% of total export earnings, 60% of animal protein intake and 7% of total protein intake (*Khan, nd*). It is

observed that shrimp alone contributed approximately 90% of total export earning from fisheries sectors (table-6).

Table – 5: Positions of shrimp as an export commodity of Bangladesh

Year	% of shrimp of total exported fisheries	Contribution of shrimp of total export earning
1999-2000	90	6.0 %
2000-2001	93	5.0 %
2001-2002	88	4.5 %
2002-2003	91	6.0 %

Source: Prothom Alo, 8 December 03 and New Age, 5 April 04

On the other hand, shrimp farming has rendered many lands unfit for rice cultivation and also reduced the land available for grazing cattle. Trees and others plantations are also affected by the holding of saline waters in fields. Potable water is becoming more saline in some areas. It is also destroyed natural environment and many important resources in the locality. But experts think out that appropriate management technique could promote shrimp sectors without disturbing natural and environmental resources of the Southwestern coast of Bangladesh.

CHAPTER-IV

2. PRIMARY DATA ANALYSIS AND RESULT DISCUSSION

The primary data were collected in the study area with the help of questionnaire and observation schedule. Some relevant data were collected through group discussion and case study methods. Expert's opinion like scientists of Bangladesh Rice Research Institute (BRRI) and Fisheries Research Institute (FRI) contributed a lot to incorporate recent information in the research report. The data were collected from four groups of people. These are as follows-

- Shrimp Farm Owners (shrimp cultivators)
- Internal Landholders/ Farmers in the Shrimp Farms
- Public Representative, Social Worker and Teachers
- Officers of Government and Non-government Organizations
- Specialists: Scientists, Academic, Researchers etc

4.1. Analysis Opinion of Shrimp Farm Owners

The study was conducted to find out a way of local people participation for planning and development of the southwestern coast of Bangladesh. It is evident that the southwestern coast is the richest areas of its natural resources. Unplanned and unscientific shrimp culture affects natural resources and as well as environment though shrimp is an important export commodity of Bangladesh. To fulfill the demand of the study data were collected from both the primary and secondary sources. The results of the study have been arranged into different categories, which are as follows.

4.1.1. Age and educational qualifications of shrimp farm owners

When age distribution of shrimp farm owners are compared, it is found that majority (38.57%) of them were found between 30-40 years age which is followed by 40-50 years age group (28.57%). This indicates that majority of the farm owners are energetic. It was found that 14.29% shrimp farm owners were illiterate but majorities (85.71%) of them were literate (**table-6**). So it is possible to introduce scientific methods of shrimp culture in the southwestern coast. But need advocacy program and supportive measure from concern organizations. Need based training program and others facilities could ensure environment friendly shrimp cultivation in the locality.

It is said that our national economy directly or indirectly depends on the natural resources of the southwestern coast of Bangladesh. Proper management with participation of the local people could enhance maximum outcome from the resources.

Table – 6: Demographic characteristics of the shrimp farm owners

Age & educational qualification	No. of respondents	% of respondents
Age:		
• <20 years	5	07.15
• 20-30 yr.	11	15.71
• 30-40 yr.	27	38.57
• 40-50 yr.	20	28.57
• >50 yr.	7	10.00
Educational qualifications:		
• Illiterate	10	14.29
• < SSC	29	41.43
• SSC-HSC	15	21.42
• Degree	13	18.57
• Masters	3	4.29

Source: field survey

4.1.2. About the shrimp farm owners

As occupations, business ranking the first position and its percentage is 28.57%. It is also found that 24.29% respondent's profession is shrimp farming and rests are service holders, farmers and many other professionals (table-7). It is observed that most of the shrimp farm owners are businessmen because there are involved large amount of money and businessmen could easily manage it. Shrimp farming in the locality developed more than twenty five years. So many people involved in shrimp farming which scored in second position (24.29%).

Table- 7: Professions of shrimp farm owners

Professions of shrimp farm owners	No. of respondents	% of respondents
• Business	20	28.57
• Agriculture	11	15.71
• Shrimp farming	17	24.29
• Service	12	17.14
• Others	10	14.29

Source: field survey

4.1.3. Criteria of shrimp farm owners

It is found that four categories of people like, local people, local but lives in out side, outsiders and outsiders but relatives to the local people are involved in shrimp farming. The important finding is only 30% shrimp farm owners are in the local people and 70% shrimp owners are totally or partially outsiders (**table-8**). It is found that 35.71% people are local but they live in outside. So they don't observe actual picture of the locality. Outsiders are not known about the local resources and local environment and profit is their main target. So they cultivate shrimp in their own way which is harmful for rice cultivation in the locality. Similar results also found in a study that was about 70% of shrimp farm are in the hands of the outsiders (DDP, 1985). This means that most of the benefits leave from the areas. It is also true that outsiders are not sympathetic to local people and as well as local environment and the local resources.

Table-8: Criteria of shrimp farm owner

Criteria of shrimp farm owner	No. of respondents	% of respondents
• Local people	21	30.00
• Local but live in out side	25	35.71
• Outsider	07	10.00
• Outsiders but relatives to the local people	17	24.29

Source: Field survey

4.1.4. Areas of shrimp farm and yearly income

It is found that there are practiced three types of shrimp farms i.e. small, medium and large in the study areas. Majority of the people practices small and medium farm and its percentage are 38.57 and 40.00 respectively. It is observed that income from medium farm is relatively higher than small and large farm. When the farm size is around 10 ha then maximum income 1,20,000 tk/year and when farm size is around 20 ha then maximum income 5,00,000 tk/year and when farm size is above 20 ha then maximum income 7,00,000 tk/year (table-9). The owners of shrimp farm said that medium farm could easily manageable than those of small and large farm. So shrimp production from these farms is higher. But some respondents said small farms could easily manageable because there are minimum shareholders. Most of them said that large farms are gradually divided into small farm for avoiding conflict among the landholders, shrimp producers and rice cultivators. They said

shrimp cultivation has an attractive investment area at the initial stage of shrimp farming where return from the farm take place in three to four month. But at the present situation is changed. So majority of owners fail to get maximum return from shrimp cultivation due to severe attack of virus.

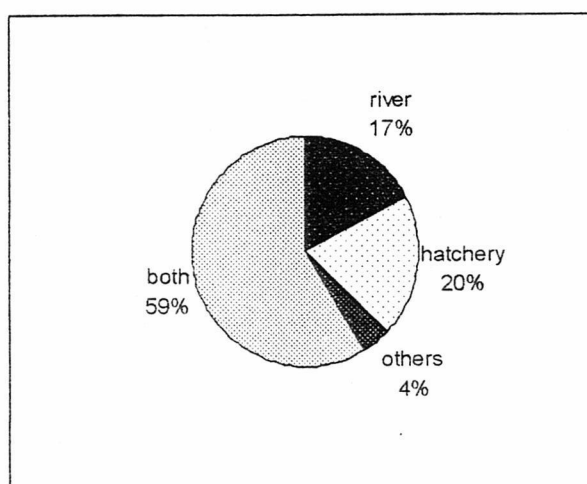
Table- 9: Areas of the shrimp farm and yearly income

Types of shrimp farm	Areas of shrimp farm (hectars)	Respondents (%)	Average annual income (000' taka)
Small farm : Up to 10 ha	< 1	5 (7.14)	30-50
	1-5	12 (17.14)	40-80
	5-10	10 (14.29)	70-120
	Total: 27(38.57%)		
Medium farm: 10-20 ha	10-15	17 (24.29)	150-180
	15-20	11(15.71)	250-500
	Total: 28(40.00%)		
Large farm: Above 20 ha	>20	15 (21.43)	350-700
		Total: 15(21.43%)	

Source: field survey

4.1.5. Source of shrimp fry

To ask the question 'what are the sources of shrimp fries' maximum respondents said that they collect shrimp fries from different sources. It is observed that 17.15% and 20 % shrimp owners collect shrimp fry from river and hatchery respectively. Most of them (58.57%) collect fry from both sources i.e. river and hatchery (fig.1).



Source: field survey

Fig 1: Sources of shrimp fry

They mostly rely on wild shrimp stock i.e. river because the wild fries are relatively virus resistant and mortality rate low than hatcheries fry. There are 53 hatcheries in our country but most of them are located in Cox's Bazar, which lead to an increased cost of shrimp farming. So shrimp farm owners depend on natural sources of fries. But a large number of other fish fries destroyed during collecting shrimp fries from natural sources i.e. water bodies. Many reports indicated that 5-6 thousand fries from 80 to 90 species destroyed only for collecting five shrimp fries. It also affects aquatic food chain of different fishes. On the other hand the children of local poor people are engaged in collecting shrimp fries from open water bodies to supplement the income generating efforts of their families instead of going to school which have become more impoverished due to shrimp farming. Many of these children seldom return to their school for the rest of the year.

4.1.6. Comments on problem facing in cultivating shrimp

Majority of the respondents said that they could not get maximum profit in their shrimp farm due to repeated attacks of virus in the recent few years. They also said maximum shrimp in a farm died within short time after attacks of virus. There is no preventive measure to overcome the problem. Most of the owners cultivate shrimp by taking loan from banks and they faced problems as defaulters of bank loan. Sometimes owner's handed over the farm to the others. The owners of the shrimp farm also faced problems due to market fluctuations, low prices and natural calamities.

They pointed out the following causes for low prices of shrimp in the international market-

- Shipping is not available as per schedule
- Quality is not maintained properly
- Disease affected shrimp
- Health hazard chemicals were found in exported shrimp.
- Not maintained international standard.
- Dishonest and corrupt businessman at mid-level insert liquid or heavy materials in harvested shrimp for increasing of its weight
- Less weight and low quality of shrimp
- No supportive measure should be taken by the government
- Most of the farmers, businessmen and processors do not maintain WTO prescribed sanitary rules because they have no training

Shrimp culture is of central importance to the fisheries sector. Bangladesh produced about 3% of global production of shrimp (Bari, 2004). The production may be raised up to 10%

applying by SSOQ technology. The Shrimp Seal of Quality (SSOQ) is a new technology for proper nurturing of disease free Post Larvae (PL). Presently, White Spot Virus (WSV) affects large number of shrimp farm since 1995. The WSV has become the major concern of shrimp production in the country. In the early nineties, shrimp farm increased very rapidly. So demand of shrimp fries increased than its production in the hatchery and natural sources. At that time shrimp fries were imported from the Thailand for the first time to fulfill the demand. Experts say these fries were virus affected and spread it from shrimp farm to river and river to the Bay of Bengal and the WSV was contaminated in whole water bodies. So at present, majority of shrimp fries (rivers and hatcheries) are found disease infected. Because, mother shrimp collected from sea and it is used in hatcheries for further production of fry. Current national average shrimp production rate is 200 kg/ha. It may be raised up to 1000 kg/ha by applying scientific methods of shrimp cultivation.

4.1.7. Shrimp farm size, yearly income & market price

Table-10 shows that shrimp farm size gradually decreased from 25 ha to 10 ha from the year of 1990 to 2005. Majority of the respondents said small farms are easily manageable but economic return from medium farm is relatively higher than small and large farm. Local market price of shrimp gradually increased from 1990 to 2005. Its range is from 200 taka/kg to 550 taka/kg. So the rich people and outsider's businessmen invested large amount of money for shrimp farming in the locality. This is why the small and marginal farmers have no access to land for rice cultivation. So maximum agricultural lands turned into shrimp farm and poor farmers suffer due to food insecurity.

Table -10: Shrimp farm size, yearly income and market price.

Components	Year			
	1990	1995	2000	2005(March)
Average shrimp farm size (hectars)	25-30	15-25	12-20	10-15
Average yearly income (000' taka/ha)	10-15	15-20	20-35	30-60
Local market price (taka/kg)	150-200	250-300	400-450	500-550

Source: field survey

4.1.8. Sources of land for shrimp cultivation

It was observed that there are three types of shrimp farm i.e. small, medium and large. **Table-11** shows own land in a shrimp farm is minimum percentage and its amount is 11.43%, 2.8% and 0% in small, medium and large farm respectively. Majority of the shrimp farm owners leased on small and marginal farmers cultivable land and cultivates shrimp there in addition with their own land. Its percentage was 24.29%, 21.43% and 11.43% in small, medium and large farm respectively.

Table- 11: Farm size and sources of land

Farm size	Sources of land in farm	Respondents (%)
Small Up to 10 hectors	• Own	8 (11.43)
	• Lease & own	14 (20.00)
	• Lease	5 (7.14)
	Total:	27 (38.57)
Medium 10-20 hectors	• Own	2 (2.86)
	• Lease & own	15 (7.14)
	• Lease	11 (15.71)
	Total:	28 (40.00)
Large Above 20 hectors	• Own	-
	• Lease & own	8 (11.43)
	• Lease	7 (10.00)
	Total:	15 (21.43)

Source: field survey

4.1.9. Yearly payment for lease on land

It is found that the rate of lease money gradually increased from 1995 to 2005. It is cited by the owners of shrimp farm that at the early eighties they did not give any compensation to the small and marginal farmers. But with the passed of time there may arisen competition between the shrimp farm owners for lease on land. At that time there is established lease on and lease out system with given certain amount of money as compensation to the land holders. There is no hard and fast rule for giving compensation in the seventies but at present the system is running by the guidance of local administration

In 1995 to 2000 yearly payment for small, medium and large farm was from 1000 to 1200 taka/ha of land. In 2000 to 2005 the amount of lease money increased and its range was 7000 to 8000 taka/ha in small, medium and large farm respectively (**table-12**).

Table-12: Farm size and yearly payment for lease on land

Farm size	Yearly payment (taka /ha)	
	1995-2000	2000-2005
Small Up to 10 hectors	1,000-1,200	7,000-8,000
Medium 10-20 hectors	8,00-1,000	6,000-8,000
Large Above 20 hectors	8,00-12,00	7,000-8,000

Source: field survey

4.1.10. Problems of shrimp farming

In the southwestern coast there are found different species of shrimp. But two species like Penacus monodon (tiger shrimp) and Metapenacus monoceros (prawn) are cultivated commercially in most of the shrimp farm (table-13). Between the two, the first one is severely attacked by White Spot Virus (WSV), which was started from the year of 1995 and continued to the present.

Table- 13: Present scenario of shrimp farming

Types of shrimp	Affected by	Disease affected shrimp larvae	Disease free post larvae (PL)
Bagdha <u>Penacus monodon</u> Adopted in medium to high saline water	Severe attacked by White Spot Virus (WSV) every year Natural calamities like flood, & tidal surge. Low market price due to not maintain quality and hygienic standard.	Sustain: 45-60 days Weight: 12-17gm Yield: 100 kg/ha Price: 100-150tk/kg	Sustain: 85-90 days Weight: 30-80 gm Yield: 250-300 kg/ha Price: 350-550 tk/kg
Galda <u>Metapenacus monoceros</u> Adopted in moderate saline to fresh water	Minimum or no disease Natural calamities like flood & tidal surge Market price fluctuation	-	Sustain: 20-250 days Weight: 100-300 gm Yield: 350-500 kg/ha Price: 450-650 tk/kg

Source: field survey (first two columns) and the daily Observer, 24 July 2004

It was observed that disease affected shrimp showed below quality and scored minimum market price. So to ask the question is there any problem in shrimp farming? Majority of shrimp cultivators mentioned 'repeated attacks of virus in the shrimp farm' is an important problem. But they do not take any preventive measure in protecting their farm from virus diseases. So they lost invested money almost every year. In case of Metapenaeus monoceros minimum disease appeared in the species but it is not sustain in high saline water. They also mentioned there is no shrimp based training institute and virus testing laboratory in the area. So they do not apply latest technology in shrimp farming. They cited that government should take necessary initiative as early as possible.

4.1.11. Comments of shrimp producers on local environment

To ask the question is there any change in environment due to shrimp cultivation, 52.86 % respondents said yes but 21.43% mentioned no. Around 26% respondents have no idea on the question. So it is an evident that shrimp farming causes damage of environment as well as local resources. There occurred different types of changes in environment like deforestation, untimely rainfall, siltation of river and channel (**table-14**). The impacts of shrimp culture on environment are: increased salinity that results minimum rice yield. On the other hand shrimp farming destroyed many rare species of plant in the locality.

Table-14: Shrimp farming causes change of environment.

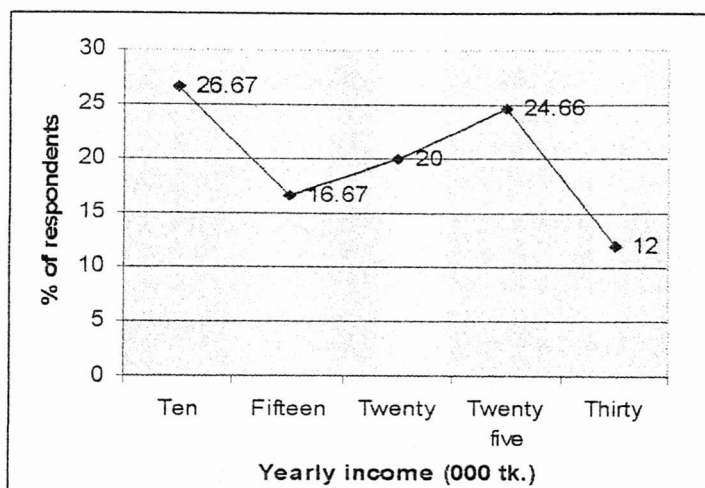
Comments on	Respondents (%)	Types of change
<i>Change in environment</i>		• Increase salinity • Decrease soil fertility • Destroy many trees • Decrease other fisheries • Decrease yield of rice
• Yes	37 (52.86)	
• No	15 (21.43)	
• No idea	18 (25.71)	

Source: field survey

4. 2. Analysis Opinion of Farmers and Landholders

4.2.1. Basic information about the farmers and landholders

It is found that most of the farmers in the shrimp farm occupied minimum land and its range is from 1 to 5 bigha. A few land holders occupied more than 5 bighas of land and they are small sharer of the shrimp farm.



Source: field survey

Fig 2: Average annual income of farmers and land holders

Most of the respondents depend on rice cultivation and their average annual income range is from 10,000 to 30,000 taka. Most of the respondents (26.67%) are small and marginal farmers and their average annual income is 10,000 taka only (**fig-2**). They said that income from rice cultivation is gradually decreased due to shrimp farming in the locality. So their annual income is lower.

4.2.2. Crop production status in inside and out side of the shrimp farm

Research team observed two crops cultivation areas: inside and out side of shrimp farm during data collection and asked to the farmers of the locality on crop production status in their fields. We found that lands inside the shrimp farm are low fertile, high saline and land remains submerged condition more than nine months in a year. Farmers do not cultivate their land in optimum time and they are deprived of desirable crop yield from their field. But land out side the shrimp farm always shows better performance in rice yield (**table-15**). The lands are fertile and farmers cultivate the land in time. So they got better yield. There are cultivated few HYV rice (BR22 & BR23) in the same area by farmers, which have shown tolerant to moderate saline soil, at the upper portion of the southwestern coast. Before starting the shrimp farm people in the southwestern coast cultivated crops without application of fertilizers, pesticides and irrigation. The agricultural lands of the southwestern coast were naturally resourceful. *T-aman* was cultivated in some land without tillage and without application of any fertilizers before shrimp farming. This procedure practiced by farmers for a long time traditionally. This type of farming system is known as 'organic farming' which was more popular in the areas. These types of farming system are now under the dark side.

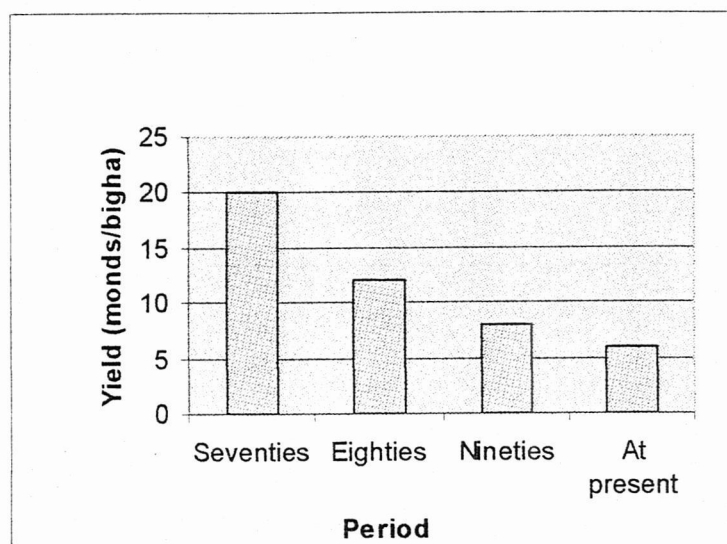
Table- 15: Crop cultivation status inside and outside of shrimp farm

Land inside shrimp farm	Land outside shrimp farm
<u>Criteria of land:</u> Low fertile, always shows submerge condition, medium to high salinity level, restricted microbial activity. <u>Crop cultivation status:</u> • Delayed of seedbed preparation & seed sowing time (in August). • Crop fields covered by saline water from January to June every year. • Land remains unfertile due to restricted flow of silted water during high tide in shrimp farm. • Late transplantation of rice in the shrimp farm causes lower crop yield. • High water level in shrimp farm causes maximum mortality of rice tillers. • Homestead crops contributed lower yield due to high salinity • Winter and summer vegetables are almost absent in homestead.	<u>Criteria of land:</u> Fertile land due to siltation of tidal surge, submerge only high tide period, salinity level low, microbial activity normal <u>Crop cultivation status:</u> • Seedbed preparation and seed sowing completed in optimum time (in July). • High tide saline water from river protected by barrage (locally constructed) from January to June & the barrage cut down in the month of July when monsoon rainfall starts. • Soil fertility level high due to free flow of silted water in shrimp farm. • Crop shows higher yield due to maintained optimum time of seed sowing and transplantation of rice seedling. • Maintained optimum water level in the crop field. So crop shows better performance. • Homestead crops contributed higher yield. • Sufficient winter and summer vegetables are grown in the homestead land.

Source: field survey

4.2.3. Shrimp farming and trends of rice production

It was found that rice production per bighah gradually reduced after introducing shrimp culture. In the seventies around 20 mounds rice per bigha were produced, whereas at present it has sharply reduced from 20 to 5- 6 mounds/bigha (**Fig-3**). Besides shrimp farming creating a scarcity of cultivable rice land and has also been destroying the fertility of the lands adjacent to the farms. Due to the seepage effects of increased salinization of the soils, the rice yield of the lands adjacent to shrimp farms has been declining significantly.



Source: field survey

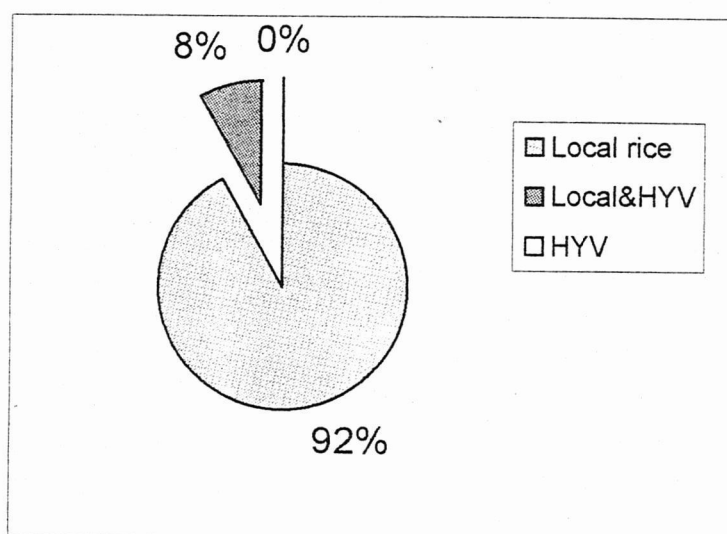
Fig 3: Local rice production trends from back to present

It is said by the local people that the production of *aman* rice in these land was 20-25 mounds/bigha before starting of shrimp cultivation; it has dropped 3-4 mounds/bigha. The rice production had lost due to unplanned shrimp farming. This is true for the area where the shrimp farming is unplanned without much social control of the local community.

4.2.4. Types of rice cultivated in the southwest coast

It is found that local rice varieties are mainly cultivated in the southwest coast and its percentage is 92. There are cultivated some HYV rice in the high land in addition to local rice and its percentage is 8 (**Fig-4**). The local cultivars of *aman* rice like, rajashial, nonakachi, sadamota etc. are relatively salt tolerant than HYV rice. So farmers cultivate these cultivars from early to present. But these cultivars gradually decreased with the increased of salinity in the southwestern coast. In the mean time some cultivars of local rice like, rajashail, kartikshail and batibalam had lost from the farmer's field and as well as in the locality.

The development of salt-tolerant rice varieties has been one of the major research thrusts of the Bangladesh Rice Research Institute (BRRI) during the last few years. Two rice varieties, BR-40 and BR-41, have been released recently for growing in the coastal region during the wet season. These varieties have the potential of giving about 2.0 ton/ha higher yields than the local traditionally cultivated varieties under moderately saline conditions (soil ECe around 6 dS/m) in the wet season (FAO, internet). These varieties are not popular here due to unavailability of seed at farmer's level.



Source: field survey

Fig 4: Varieties of rice cultivated in the southwestern coast

4.2.5. Status of homestead trees and domestic animals of local people

Coconut, betel nut, banana are the important homestead fruits and palm tree, rain tree and white kari are the important timber yielding plant which is cultivated almost every homestead in the southwestern coast. These fruits and trees gradually lost in the area after introducing shrimp farm due to excess salinity. At present there are grown sophada, jujube and rain tree which is relatively salt tolerant. Cows, goats and buffalo are the common domestic animals in the area (table-16). In absence of sufficient grass land people could not maintain their domestic animals which is now uncommon here. The cited information is collected from people in the locality.

Table-16: Status of homestead trees and domestic animals

Status of the resources	Before shrimp farming	After shrimp farming
Homestead trees	Coconut, mango, betlenut, papaya, banana, sophada, guava, palm tree, rain tree, black beery	Coconut, sophada, palm tree, rain tree are minimum in number and other trees are already been destroyed due to over salinity.
Domestic animals	Cow, goat, buffalo, sheep and horse	There is observed cow and goat but minimum in numbers. Except these all others are lost in the locality due to shrimp farming.

Source: field survey

4.2.6. Shrimp farming and its effects on environment & the resources

The southwestern coastal people live by agriculture before shrimp culture. But in the last three- decade expansion of shrimp farm causes reduction of homestead crops, field crops, fisheries, livestock, poultry, birds and fresh water reserve (**table-17**).

Most of the agricultural crops have salt tolerant up to 500 Mhos/cm and suitable soil PH ranges from 5.5 to 7.0. But PH range should be required from 7.5 to 8.7 and intensity of salinity required more than 2000 Mhos/cm for better production of shrimp (*Elahi et.al*). The shrimp cultivators maintained these PH and salinity level in the shrimp farm. So with the increase of shrimp farming decreased crop yield, this causes self-destruction of mid level and marginal farmer in the area. On the other hand salinity causes deforestation, damage of homestead tree. Marine food cycle and coastal biodiversity have already been risked in position. Excessive salinity has also destroyed nutrients of soils. Shrimp farming involves frequent water exchange, which silts up the canals as well as the land, thereby hampers rice fields and subsequently rice production. Conversion of common grazing land into shrimp farms has reduced the availability of food for livestock. Further, the saline water encroachment in the internal canals, which served as fresh water source, has become unusable for human population, livestock, poultry and birds. The beneficial microorganisms lost their normal activities due to high level of salinity and thus reduced crop production ability of the farmer's field and limited their income sources. Shrimp culture is also affecting indigenous fish and crops varieties. It was found by the research that unplanned and unscientific shrimp cultivation creates problems among the southwestern coast people.

Table -17: Shrimp farming & its effects on the resources

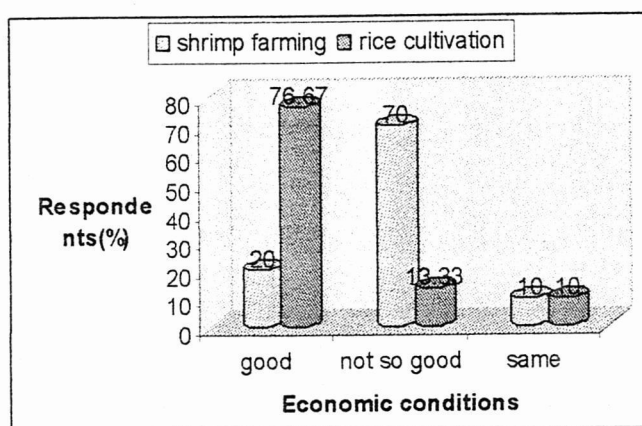
Resources	Effects of shrimp farming on natural resources
Homestead trees: Coconut, betel nut, fruits, timber yielding trees.	• Destruction of homestead crops, trees and vegetations • Causes lower production of aman rice due to stalinization. • Causes minimized production of vegetables & crops
Field crops: T-aman, HYV rice, seasonal fruits and vegetables	• Adverse affects on indigenous rice varieties like, rajashail, nonakachi, batibalum etc. These rice varieties extinguished now.
Fisheries: Open & closed water fisheries.	• Reduced stock of indigenous fish varieties • Reduced fresh water fisheries
Livestock's: Cows, goats, buffalos, sheep etc.	• Limiting grazing ground & fresh water reserve for the livestock and declined in production of livestock.
Birds: Winter birds and other birds	• The birds have already become quit difficult due to destruction of trees & green vegetation.
Water resources	• The availability of sweet water for drinking and other daily necessities has become scare.
Farmer's condition:	• Self-destruction of mid level & marginal farmer. • Decline in household incomes from non-farm sources, especially those from ecological reserve.
Environment:	• Affects bio-diversity production of estuarine water and agro-ecosystem. • Adversely affects local ecosystem.

Source: field survey

4.3. Opinion of Public Representative, Social Workers and Teachers

4.3.1. Economic conditions of people in the area

To ask the question 'what are the economic conditions of mass people'. Majority of them said present economic conditions of mass people are not so good in comparison to earlier. They said southwestern coastal people economy depends on agriculture. In the seventies majority of the people cultivate their land by *T-aman* rice and got better yield and economic return from rice distributed almost all people. But after introducing shrimp farming in the locality, economic return from shrimp got some rich people. Actually maximum people lost their land and homestead garden. They have no other source of income.



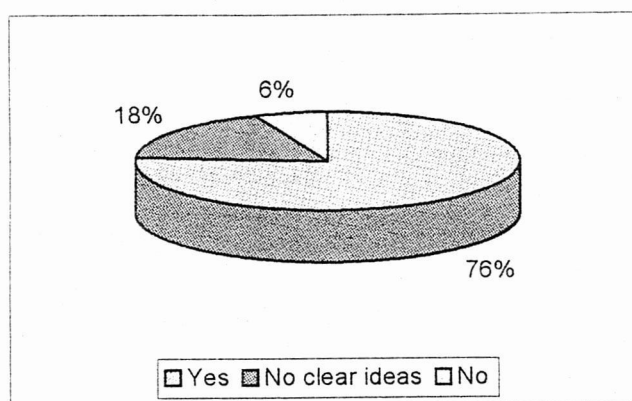
Source: field survey

Fig 5: Economic conditions at shrimp farming and rice cultivation period

Economic condition of mass people is very weak at present. It is observed that 76.67% respondents said the economic condition was good at the rice cultivation period and similarly 70% said economic condition is not so good at shrimp cultivation period (fig-5). On the other hand only 20% people said economic condition is good at the shrimp farming period. They have facilities to cultivate shrimp with their land individually. So it is important to develop the area with an emphasis on mass people interest.

4.3.2. Comments of local people on environment & natural resources:

It was found, 76% local people, teachers, leaders and public representatives said that shrimp culture negatively effect on environment and causes destruction of natural resources. Only 18% said they have no clear idea about the subject matter (fig-6). Shrimp culture promoted as a monoculture and important contributor to the earning of foreign exchange but the question of environment degradation in the unique coastal ecosystem have become prominent.

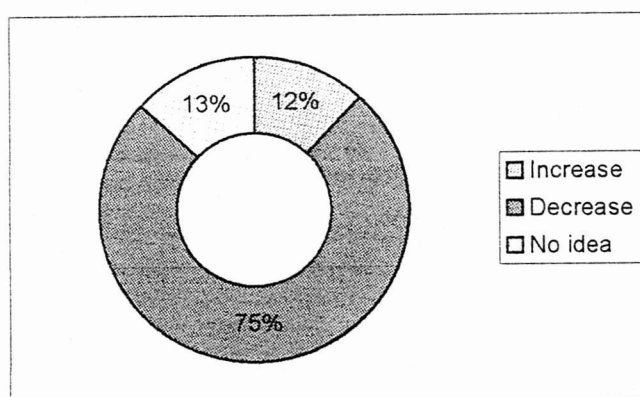


Source: field survey

Fig 6: Change of environment & destruction of natural resources

4.3.3. Comments on fisheries status after introducing shrimp farm:

Fig-7 shows comments on total fisheries status in the southwestern coast after introducing shrimp farm.



Source: field survey

Fig 7: Fisheries status after introducing shrimp farm

Majority (75%) of the respondents said that total fisheries have been decreased and only 13% said they have no idea about the question. Many reports indicated that large numbers of other fish's fries destroyed during harvesting of shrimp fries from river. Besides, open water and fresh water fisheries gradually decreased due high intensity of salinity.

4.4. Opinion of GO and NGO Officials

4.4.1. Opinion on local resources:

The Go and NGO officials highlighted that valuable and rare natural resources are present in the southwestern coast (table-18). The Sunderbans contributed a much to protect environment and as well as economic development of the area. Many people passed away

their lives by collecting forest goods from the Sunderbans. The southwestern coastal parts are the richest areas of Bangladesh with its indigenous crop and fish varieties. The organic farming practices are very popular here which is absent in the other parts of the country. The attractive tourism spots of Sunderbans and the second natural seaport Mongla added a scope of revenue earning in our country.

Table-18: Opinion and Suggestions of GOs & NGO Officials on LNR

Local Natural Resources (LNR)	Suggestions for sustainable use of LNR
• The Sunderbans: Its biodiversity & sound environment • Indigenous varieties of rice, horticultural crops like coconut, banana & betlenut • Sea-fish resources • Shrimp the second largest export commodity of Bangladesh • Attractive tourism spots • Mongla, the second largest natural seaports.	• To protect illegal trespass in the Sunderbans by which sound wild life could be maintained. • Honest & responsible officers should be posted in the Sunderbans zone. • To identify crop production areas & reserve it only for rice cultivation. • To maintain genetic resources of indigenous crops and fishes • To protect different species of fry with the help of coast guard. • To implement the protection and conservation of fish act, 2002. • To introduced SSOQ technology in shrimp culture. • To maintain hygienic and quality standard during processing of shrimp. • Corrupt businessman should be punished. • To implement scientific method of shrimp culture. • To implement code of conduct for tourist. • To improve communication system and tourism spots near the Sunderbans. • To establish infrastructure facilities in the ports. • To handle ports labour conflict effectively. • To restore the coastal resources involving all sectors: LGIs, civil society, GOs & NGOs and local people • A comprehensive study needs to be done by a body of experts to formulate an effective model for coastal resource management.

Source: field survey

4.5. Opinion of the Specialists

4.5.1. Comments of experts on environment in the southwestern coast

Table-19 shows past and present environmental consequence in the southwestern coast. Information from different studies showed that shrimp farming adversely affects biodiversity, agro-ecosystem and friendly environment in the southwestern coast (*Islam, et al*, 2003). Experts say low rain fall and lack of fresh water increased salinity in the coastal areas. In the month of March to April salinity level near the Sunderbans rivers are 2000-4000 mmhos due to lack of fresh 'water flow' from the Padma but in July to August salinity level turned into 1000 mmhos due to high rainfall (*Banik, 1999*). High intensity of salinity causes mortality of trees and influences the 'dieback' disease in the Sunderbans.

Table-19: Past and present environmental condition of southwest coast

Resources	Past	Present
<u>Soil condition:</u> - Salinity level - PH - Organic matter content in soil - Soil fertility	- Moderate: 400-500 Mhos/cm 6.00-6.5 - Optimum level - Medium to high	- Navigation observed. High: 700-1500 Mhos/cm. 7.00-7.50 - Very low due to low crop residues in the field. - Very low due to destroy nutrient of soil.
<u>Green vegetation</u>	Most of the areas are covered by green vegetation	Deforestation occurred, due to high salinity
<u>The Mangrove forest</u> - Biodiversity - Flora - Fauna	Full with natural resources which maintained sound and friendly environment in the southwestern coast.	- Uninterrupted trespass by mass people in the forest - Affects ecosystem, biodiversity and friendly environment of the Sunderbans. - Large number of trees destroyed due to dieback disease.
<u>Condition of rivers</u>	- Siltation was minimum, due to speedy movement water during high & low tide in the river - Smooth navigation facilities were available	- Maximum rivers and channel are silted due to restricted flow of water from the Padma due to the Farraka barrage. - Problematic

Source: field survey and SRDI, DAE, Khulna

The specialists like scientists, professors in this field highlighted past and present environmental conditions in the area. Shrimp farming adverse impact on soil properties by increasing soil salinity levels in non-saline area that hampered crop cultivation. Some times shrimp producers keep on adding extra salt into to the farm to ensure better growth of shrimp. This extra salt eventually gets stored in the field and adds to the level of soil salinity further. This process hampers the microbial system and decreases of soil fertility significantly. Water bodies contaminated with high salinity that does not favor growth of many fresh water organisms. They pointed out shrimp farming protects normal water flow of river and causes problem in navigation due to siltation on river body. They also said many birds and animals have been abolished from shrimp producing localities. Degradation of mangrove forest, salinity intrusion as well as the shrimp farmers destroyed many wild lives and fisheries resources. Habitats for animals, birds, fishes have been lost primarily due to degradation of mangroves and excessive salinity.

4.5.2. Opinion on shrimp culture and the local resources

Members of the research team had collected information from the experts of the relevant field. Out of 25 respondents, 80% respondents said shrimp farming have negative impact on natural resources and 20% respondents comments not only shrimp farming but also others factors like natural calamities affects natural resources in the southwestern coast. But both of them put some suggestions to overcome the problems which are shown in the table (table-20). Similarly 92% respondents opined that shrimp culture causes negative impact on coastal environment. They pointed out the causes of destruction of environmental resources in the southwestern coast. But 20% experts said 'shrimp' itself is a natural resources and an important export commodity of Bangladesh. So it is necessary to promote the sector for maximum out come. On the other hand 8% respondents said not only shrimp farming have negative effect on environment but also many others factors including shrimp farming causes negative impact on environment in the southwestern coast. Majority of the experts put suggestions for managing and preserving of the resources with the help of local people. They said local people are experienced in the local resources and local environment. So people participation in local level planning will ensure optimum utilization of local resources. They also suggested that community participation; local government bodies, GOs and NGOs could play an effective role for maintaining local environment and as well as local resources.

Multi-sector approaches are the important strategies to overcome the present situation in the southwestern coast. Government should play an effective role as coordinator of all the organization. Special budget should be sanctioned for the development of locality. Local level planning should be emphasizing for taking development program in the locality.

Table- 20: Comments of experts on shrimp culture & their suggestions

Comments of respondents (%)	If yes, how	Suggestion for managing resources & environment
Does shrimp farming have negative impact on natural resources? Yes: 20 (80%) No: 5 (20%)	Destruction of mangrove forest resources Destruction of fresh water and open water capture fishes. Destruction of other fishes during collection of shrimp fry from river Minimum yield of rice Destruction of trees and vegetation Decline in the production poultry and livestock Losses of resources like grazing land.	To identify shrimp areas, crops & forest land and manage it planned and scientific way. Ensure local people participation in all kinds of activities in the Southwestern coast. Discourage local people to collect shrimp fry from natural sources & establish sufficient hatcheries to mitigate the demand of shrimp fries.
Does shrimp farming have negative impact on environment? Yes: 23 (92%) No: 2 (8%)	Reduced soil fertility Hampered microbial activity Causes high level of salinity Decline in ecological reserve Losses of biodiversity Losses of scenic resources Arisen various form of social conflict Affects survival of traditional farmers and fisherman	Empower community participation for protecting environment The Local government may arrange program to aware people about environment degradation. Discourage over use of salt, fertilizers & others chemical in the shrimp farm. Planting more trees on the side of shrimp farm.

Source: Field survey

CHAPTER-V

5. LOCAL PEOPLE PARTICIPATION IN PLANNING AND DEVELOPMENT OF THE SOUTHWESTERN COAST

Local level participation in planning is a discipline which is very important for development of the locality. But local level participation in planning has been paid very little attention by the development planners, administrators and the policy makers. It is important issues involved in people-oriented development planning and with the attempts to explore the conceptual and operational problems of an alternative development strategy with particular focus on people's participation and local level planning. One of the major objectives of local level planning with the active participation of local people is to improve the economic conditions of the poorer sections and to make them self reliant. This will enable them to identify their own problems and solve them and also to have a greater control over their own affairs. The existing problems of southwestern could be managed through appropriate planning and also with the participation of local people.

5.1. People Participation and Development

Shrimp farming has a significant impact on the economy of poor and mid level people. It has high environmental costs, including destruction of mangrove forests and reduction in crop production especially rice and green vegetation in the locality. It has also set in motion socioeconomic changes. All these changes may have serious implications for the sustainability of shrimp farming. Most of respondents opined that government should take necessary action for protect the poor and marginal people and as well as natural and environmental resources. It is necessary to implement shrimp culture policy by which rice and shrimp farmers both will be benefited. Government should be taken an area based development program with the participation of local people. The foreign exchange which is earning from shrimp export must be sanction for the development in the southwestern coast. Different types of GOs and NGOs are working in the southwestern coast with their specific goal by using local resources. They said that socio-economic conditions of people in the locality are not so good. Majority of people are suffering from different kinds of risks. They pointed out that there are arisen some problems like, environmental degradation, destroying of natural resource due to unplanned and unscientific shrimp culture. They suggested the followings-

- Local people must be involved in development activities and to give opportunity for sharing their ideas in relevant activities.
- Local level planning should be emphasized with the participation local people instead of central planning.
- Policy should be introduced by which both rice farmer and shrimp producers will be benefited from both crops.
- Step should be taken for conserving biodiversity and natural resources through environmental friendly shrimp-rice cultivation.
- Appropriate measures to be taken to encourage rice and shrimp culture in a way that would not destabilize the ecological balance.
- Shrimp farming be considered an export industry and given facilities like others industries where local people should be prioritize.
- Training program should be conducted with the help of concerned organizations for scientific methods of shrimp cultivation.

5.2. Way of Local People Participation

To ask the question 'What are the ways of local people participation in planning and development activities? The specialists pointed out the followings-

- For successful local based natural resources management, there are need to establish differential facilities like financial support, training etc. by which local people would be benefited.
- Social learning is important factor for local level participation. The facilitators and the local people are learning from each other and this will apply in their own activities.
- Public and private sectors could work hand in hand with the help of local people in conservation of local resources and all development activities.
- Indigenous Knowledge is the key in mobilizing rural people in environmental and natural resources management. Start from what the people know and what they appreciate and incorporated indigenous knowledge.
- There is needed to accumulate wisdom among the people of the locality. Because local people have their own glossary on local resources and local environment. So local people must be involved in local level planning.
- Locals must decide on the options for the local resource use and they also put suggestions on maintain local resources and as well as environment.

5. 3. Development of Locality by Using Natural Resources

To ask the question, "how can the natural resources of this region be used to develop the areas?" The specialist highlighted the following-

5.3.1. *Provide training of local people*

Local people, farmers, owners of shrimp farm must be trained up for their specific works as well as natural resources and the environment. For example, during collection of shrimp fries, many important species of other fishes destroyed along with the shrimp fries. Social awareness could be build up by proper training. If the people would be trained up properly, the valuable fish resources in the southwest coast could be protected to a great extent.

5.3.2. *Ensure proper compensation of land and labor*

Adequate wages to the worker of shrimp farm could ensure their participation in shrimp culture. Compensation should also be given to the landowners for their land resources and other people who are affected by the shrimp cultivation. Shrimp farm registration system; amount of compensation and distribution of compensation money should be maintained by a guideline with the help of local administration, community leaders and land owners.

5.3.3. *Involving local representatives*

Local Government Organization's representatives, GOs and NGOs should take initiatives for managing natural and environmental resources. They should monitor the problems of farmers and take necessary measures according to the rules and regulations.

5.3.4. *Implement Coastal Green Belt Program*

Ensure the integrated development in the region by implementing Coastal Green Belt Program. It is a program by which reforestation and other suitable activities could be maintained.

5.3.5. *Proper Government policies and programs*

The Government may undertake proper policies and programs which are needed to manage natural and environmental resources and ensure sustainable development in the area.

5.3. Local Level Planning and Protection of Resources

It is necessary to take local level planning by the government right at this moment to protect natural and environment resources. It is necessary to involved local people in their own professions by creating appropriate environment especially for the rice farmers and shrimp cultivators. Local elected representatives should be involved in this program. Local people must be given priority to include them for all types of development activities. The following program should be taken-

- Participation of local people for proper implementation of government programs. Program includes regulation, assistance to the aquaculture sector, basic infrastructure, financing, property rights and land tenure.
- Establish local resource based research centers for enhancing indigenous crops, livestock and fish resources
- Preserve and utilize the local knowledge in formulation of strategies to overcome the problems in the regions.
- To motivate local people against degradation of natural & environmental resources.
- To build awareness of local people to prevent extinction of other fishes when catching shrimp fry from natural sources.
- Encouraging plantation along with roadsides and enclosure of the shrimp farm.
- More efficient aquaculture production, developed within the sustainable capacity of the coastal ecosystem, managed through aquaculture parks, with open participation from all sectors and organized as one association with an entrepreneurial vision.
- Environmental monitoring program & technology should be developed and exchange ideas with the experts of surrounding countries.
- Build awareness to the mass people on local resources and their sustainable use.
- Multi-agency and multi-disciplinary approaches work better for environmental issues. Ecological sciences, social sciences and local knowledge can be applied together for resource management
- Ensure bio-security, increased genetic capacity of the of crops and fish resources.
- A friendly environmental policy is necessary for devolution of responsibilities to local people and there is needed for greater advocacy for more devolution.
- Method demonstration and result demonstration for the preservation of resources should be implemented by concerned organizations.

Monitoring and evaluation system in shrimp cultivation might be an important tool to ensure the sustainable shrimp farming. Government can set up monitoring units with the help of local administration in the region and observing the shrimp cultivation, harvesting and processing activities. Proper monitoring could ensure the quality and hygienic conditions of exported shrimp.

5.5. Development Strategies of Southwestern Coast

The southwestern coast of Bangladesh is very prospective and economically viable. To develop this area and protect the resources the following strategies should be implemented-

- Establish and adapt viable shrimp culture policy for betterment of the local people and as well as protect natural and environmental resources.
- To create a development fund by cutting certain portion of foreign exchange generated from shrimp export and this fund may be used to recover the environmental degradation in the locality.
- Implement special land use policy in shrimp cultivating area to prohibit misuse of land resources.
- Encourage people to cultivate fresh water tolerate fishes and saline tolerant variety of rice at the same time or by rotation.
- Implement benevolent service structure for the poor workers of the shrimp farm.
- Strengthened, rationalized and effectively implemented environment and natural resources policies, frameworks and plans.
- The capacity of local government units and communities to effectively manage their local ecosystems should be enhanced.
- Pursuing research to detect the salt resistant species of crops and introducing them in the southwestern costal area.
- Introducing the technology to cultivate crops by using rain water through harvesting of rain water.
- Introducing the scientific methods of shrimp cultivation with least use of land and to popularize rice-shrimp integrated farming system in the area for the best economic return from both sectors.

CHAPTER- IV

6. FINDINGS, RECOMMENDATIONS AND CONCLUSION

6.1. Findings and Recommendations of the Study

The entire southwestern coastal region of Bangladesh is facing an environmental disaster as an outcome of excessive salinity due to shrimp farming. The districts of Satkhira, Khulna, Bagerhat and the 5600 square km Sunderbans are now affected by different degree of salinity. The cultivable land in this vast region is being turned into a wasteland due to excessive salinity. More than five million people living in the coastal areas are affected by salinity in different ways.

The government of Bangladesh recognized shrimp farming as an industry under the Second Five-Year Plan (1980-85) and adopted measures necessary for increased shrimp production (Haque 1994). According to an estimate by the Master Plan Organization (MPO 1989), the total area under shrimp culture was expected to rise from 96,048 ha in 1990 to 135,000 ha in 2005. Since the seventies, international market demand and high prices of shrimp have encouraged people to resume shrimp farming in coastal areas. But it affects natural and environmental resources. A research work is done to find out the effects of shrimp farming on natural and environmental resources and also to find out the way of local people participation for planning and development in the southwestern coast of Bangladesh. The findings and recommendations of the study are highlighted below side by side-

6.1.1. Findings: about the shrimp cultivators and rice farmers

- Shrimp cultivation changing traditional agriculture in the southwestern coast. So there is arisen conflicting interest between rice farmers and shrimp cultivators. In the most cases, influential persons are involved in cultivating shrimp on the farmer's land. Most of the cases farmer's don't have any return from their cultivable land.
- Marginal farmers who constitute the majority of farming population in the area do not have access to shrimp cultivation due to lack of capital and become land less, in course of time they selling their land to the shrimp cultivators.
- Majority of the people in the area depend on rice cultivation. Most of them are small and marginal farmers and their average annual income is 10-30 thousand taka only. Where as limited number of people involved in shrimp farming and they earned handsome amount of money every year by using farmers land for shrimp cultivation.

6.1.1. Recommendations: for the shrimp cultivators and rice farmers

- *Actual compensation of land should be given to the landowners/farmers in the shrimp farm and other people who are affected by the shrimp farming.*
- *Special land use policy should be implemented in the shrimp farm areas to prohibit misuse of land.*
- *Encouraging the formation of cooperative society among the small and marginal farmers and to aggregate their lands for enabling them in shrimp cultivation through financial support from bank.*

6.1.2. Findings: on coastal agriculture

Field crops

- Rice is the most important crop in the southwestern coast of Bangladesh. Rice production gradually decreased after introducing of shrimp farm. In the seventies there are produced 20 mounds rice per bigha, whereas at present it has sharply come down by 5-6 mounds/bigha
- Shrimp farming creating a scarcity of cultivable rice land and has also been destroying the fertility of the lands in the shrimp farm and adjacent to the farms. At present about 40% agricultural land remain without cultivation due to high salinity and crop production lost by a big amount.
- Lands inside the shrimp farm are low fertile, high saline and land remains submerged condition more than nine months in a year. Farmers do not cultivate their land in optimum time and they deprived of desirable crop yield.

Homestead garden

- Horticultural crops like coconut, betel nut, banana that is indigenous to the area, which is totally damage due to shrimp farming. Besides, productions of rabbi crops, vegetables and other agro-products have decreased.
- Salinity has also adversely affects homestead beatable gardening, poultry farming and cattle rearing, thus denying the poor people from their sources of home grown nutrition and subsidiary incomes.

Fish resources

- In the study majority (75%) of the respondents said that total fisheries have been decreased due to shrimp farming. Many reports indicated that large numbers of other fish's fries destroyed during harvesting of shrimp fries from river.

- Unplanned shrimp cultivation has drastically reduced the stock of indigenous fish varieties. So, open water fisheries gradually decreased in the area. Besides fresh water fisheries reduces due to high intensity of salinity.

Livestock and poultry resources

- Shrimp cultivators enter saline water into the land in January and saline water stay on land more than nine month. Salinity causes mortality of grass on land. So in absence of sufficient grass land people could not maintain their domestic animals which are now uncommon here.
- Unplanned shrimp farming disturbed natural environment that has affected the production of poultry and livestock in the locality.

6.1.2. Recommendations: for managing coastal agricultural

As an economy still dependent on agriculture to feed and employ with its growing population. Bangladesh is one of the world's lowest lands: man ratio country. So the following strategies need to be pursued for raising productivity of agriculture –

- *Negotiate agreements should be made between shrimp producers and rice farmers regarding the times of the year when saline water will be allowed on the land.*
- *Harvest shrimps early so that the land can be protected from further salt-water flooding before the time for transplanting rice preferably and also use rice varieties which are suitable for late transplanting,*
- *Integrating the shrimp cultivation and agriculture by encouraging the farmers to cultivate the moderately salt tolerant rice varieties in the shrimp. The most popular moderately salt tolerant rice varieties are BR-41 and BR-42 within.*
- *Developing intensified and diversified cropping systems and to close yield gaps and maximize output and economic returns,*
- *Yields of rice could be raised with better farm management. Hybrid rice, salt tolerant rice and 'super rice' should be introduced and at the same time local varieties of rice must be popularized.*
- *Arrangements must be made and suitable conditions created for cultivation of rice in shrimp farm areas. Solve the water logging problems in the shrimp farm during crop growth stage through mutual agreement.*
- *Developing suitable technologies in rain fed farming systems to close the yield gap and enhance farmers' productivity*

- *Establish local resource based research centers for enhancing indigenous crops, livestock and fish resources*
- *Ensure bio-security, increase genetic capacity of the crops and fisheries.*
- *Pond aquaculture should be continued to expand with environmentally sound management of open water and marine fisheries.*
- *Protect open water fisheries with the help of local administration and local people.*
- *Developing support facilities and services for diversified production systems and better vertical coordination of the activities in crops, livestock and fisheries.*

6.1.3. Findings: on shrimp farming

- Majority of the shrimp cultivators leased on small and marginal farmers cultivable land and cultivate shrimp in addition with their own land.
- At early eighties there was no provision to pay compensation for lease on farmers land. But with the passed of time there may arisen competition between the shrimp farm owners for lease on land. At that time there is established lease out system with given certain amount of money as compensation to the land holders. There was no hard and fast rule to provide compensation in the seventies but at present the system is running by the guidance of local administration.
- Sometime maximum shrimp in a farm died within short time due to attack of virus. There is no preventive measure to overcome the problem. Most of the shrimp farm owners cultivate shrimp by taking loan from bank and they faced problems as defaulters of bank loan. Sometimes owner's handed over the farm to the others.
- The owners of the shrimp farm also faced problems due to market fluctuations. Sometime buyers put complain against quality and hygienic conditions of exported shrimp that causes lower market price of shrimp.
- The owners of shrimp farm said that medium farm could easily manageable than large farm. So shrimp production in medium farm is higher than large farm. But some cultivators said small farms could easily manageable because there are minimum shareholders and profit is relatively higher.
- It is found that educated person involved in shrimp farming. So there is a scope of scientific methods of shrimp cultivation. But needed advocacy program and supportive measure from concern organizations.

- Some shrimp farms were abandoned due to repeated attacks of the 'White Spot Virus'. This is no longer capable of being used for agriculture because of salinity and is thus permanently lost to the national economy.

6.1.3. Recommendations: for shrimp farming

- *Need based training program and others facilities should be ensured by concerned organizations for environment friendly shrimp cultivation in the locality.*
- *Appropriate national shrimp cultivation policy must be evolved and shrimp cultivation must be totally banned in selected rice producing areas, where rice production is economically viable.*
- *Lease out and lease on system of shrimp farm should be modernized and provide actual compensation to the landholders/farmers with the help of local administration and public representatives.*
- *Shrimp itself is a natural resources and important export commodity of Bangladesh. So it is necessary to promote the sector by introducing scientific methods of cultivation.*
- *To establish virus-testing laboratory in the southwestern coast immediately.*
- *Shrimp cultivators, businessmen and others personnel should be trained up for maintaining quality standard and hygienic condition of shrimp during cultivation, marketing, processing and packaging.*
- *Shrimp farming be considered an export industry and given facilities like others industries where local people should be prioritized.*

6.1.4. Findings: on the natural and environmental resources

Biodiversity

- Shrimp farming has negative effects on biodiversity, productivity of estuarine waters and agro-ecosystem in the area.
- Destructive methods of shrimp fry collection have damaged aquatic biodiversity.
- Numbers of other fish fries destroyed during collecting shrimp fries from river.
- It also destroyed zooplankton and misbalancing marine food cycle
- Many birds and animals have been abolished from shrimp producing localities.

Environment

- The impacts of shrimp culture on environment are: increased salinity that results minimum rice yield and destroy many rare species of plant.

- About 70% of shrimp farm are in the hands of the outsiders that means most of the benefits leave from the areas. The outsiders are not sympatric to local people and as well as local environment.
- Majority of the shrimp farm owners are totally or partially outsiders. So they don't observe actual picture of the locality.
- Outsiders are not known about the local resources and local environment. Profit is their main target. So they cultivate shrimp in their own way which is harmful for local environment.

Local resources

- The southwestern coastal parts are the richest areas of Bangladesh with its indigenous crop and fish varieties.
- The organic farming practices are very popular in the southwestern coast which is almost rare in the others parts of the country.
- Shrimp culture affects natural resources. People in the area depend on natural resources for their livelihood. But the resources gradually lost after introducing shrimp farming.
- Tremendous change in land use in the area through conversion of agricultural land, grazing land, forestland and many common property lands into shrimp farms

Forest resources

- The Sunderbans maintained ecological balance and long-term environmental security. But it had destroyed due to expansion of shrimp farm into the forest land.
- Unplanned shrimp cultivation destroyed many mangrove species of flora and fauna.
- Salinity intrusion as well as the shrimp cultivators destroyed many wild lives. Habitats for animals, birds, fishes have been lost due to degradation of mangroves by excessive salinity.
- The Sunderbans contributed a much to protect environment and economic development of the area. The forest materials are important resources of food, fuel, fiber and timber. Apart from their economic benefits these resources are also useful. Many people passed away their lives by using forest goods from the Sunderbans.

- High intensity of salinity causes mortality of trees and influenced on 'dieback' disease in the Sunderbans.
- Shrimp cultivation has not only destroyed soil but also polluted the environment in and around the Sunderbans, the famous mangrove forest and a unique ecosystem in the world.
- Bangladesh is fortunate to be extremely rich in biodiversity both in its forests and wetlands, some of which are termed protected areas.

6.1.4. Recommendations: for the natural and environmental resources

Population growth over the next 25 years in our country will put enormous pressure on the country's natural resources, like land, water, forests, biodiversity and environment. The following steps should be taken for overcoming challenges-

- *Biodiversity should be protected through the sustainable management of forests and wetlands with community participation.*
- *Identifying the endangered and threatened species of flora and fauna of the coastal region and taking necessary initiatives for their preservation.*
- *Local people are experienced in the local resources and environment. So people participation in local level planning will ensure optimum utilization of resources.*
- *Community participation, local government bodies, GOs and NGOs could play an effective role for maintaining local environment and resources.*
- *Appropriate measures to be taken to encourage rice and shrimp culture in a way that would not destabilize the ecological balance*
- *Strengthened, rationalized and effectively implemented environment and natural resources policies, frameworks and plans.*
- *Conserving biodiversity through shrimp culture in the rotation with rice*
- *Protect the forest and biodiversity of the locality with the participation of local people, not only as a national heritage but also as a legacy for all mankind.*

6.1.5. Findings: about the socio-economic conditions of people

- The southwestern coastal people's economy depends on agriculture. In the seventies majority of the people cultivate their land by *T-aman* rice. Incomes from agriculture in these areas were accounted for about 70%. But at present it has come down about 20-30%.

- At present economic conditions of mass people are very weak in comparison to earlier. About 76.67% people said that economic condition was good before eighties when they cultivated rice in their land.
- Economic return from rice distributed almost all people in the locality. But economic return from shrimp distributed only some rich people.
- Small and marginal farmers in the locality lost their land and homestead garden. They have no other source of income.
- A large number of other fish fries destroyed during collecting shrimp fries from natural sources and resulted in reduction of the fish population that adversely affecting the livelihoods of fisher's men.

6.1.5. Recommendations: for socio-economic conditions of people

- *Introducing mutual farming practices between rice farmers and shrimp cultivators*
- *Program should be taken to establish small and medium farm for maximum out come from shrimp farming.*
- *Motivates small and marginal farmers to cultivate rich with shrimp in their own land by which they will be benefited from both sectors.*
- *Fresh water based farming system by rice with prawn should be introduced..*

6.1.6. Findings: about the local level participation

Majority of the plans in our country are centered based. Most of the cases the central plans failed to meet up the demand of local people. So it is an important thing to develop area based plan where local people could play vital role. In the southwestern coast the natural and environmental resources are very important for economic development of the country and as well as betterment of the people in the locality. Local level plan with the participation of local people could maximize the out come from natural and environmental resources. The respondents cited the following -

- Shrimp farming is practices almost all over the area in the southwestern coast. So it is difficult to escape the crop land from shrimp farming. So mutual farming practices with rice farmers and shrimp cultivators is important thing to mitigate the problems.
- Effective shrimp culture policy could minimize the gap between rice farmers and shrimp cultivators.
- Local people have much knowledge about the local resources. So it is possible to utilize resources by their active participation in development activities.

- Government have responsibilities to take necessary action for protect the poor and marginal people and as well as natural and environmental resources.
- Local people have recessive powers they don't use it with the help of others. People participation in development activities could enhanced local development

6.1.6. Recommendations: for local level participation

- *It is necessary to implement shrimp culture policy with the help of local people by which rice and shrimp farmers will be benefited.*
- *Government should be taken area based development program with the participation of local people. Local people must be involved in development activities and to give opportunity for sharing their ideas.*
- *The foreign exchange which is earned from shrimp export must be sanction for the development in the southwestern coast of Bangladesh.*
- *Local level planning should be emphasized instead of national planning.*
- *Appropriate policy should be introduced by which both rice farmer and shrimp producers will be benefited.*
- *Multi-agency and multi-disciplinary approaches work better for environmental issues. Ecological sciences, social sciences and local knowledge can be applied together for managing resources.*
- *Special budget should be sanction for the development of locality. Local level planning should be emphasizing for taking development program.*
- *Local people, farmers, owners of shrimp farm must be trained up for their specific works as well as natural and environment resources. Social awareness could be build up by proper training.*
- *The Government may undertake proper policies and programs needed to mange the natural and environmental resources and ensure sustainable use of it with the help of local people.*
- *Ensure joint participation of GOs, NGOs, public representatives and local people for development of the southwestern coast.*

6.2. Conclusion

Shrimp culture in Bangladesh has emerged as an important economic activity that is contributing significantly to the country's export earning. But its rapid and unplanned expansion has given rise to a lot of social and environmental tension at the local level. Shrimp farming has brought into question its sustainability, benefit-cost distribution and equity. Initially local rich people and businessmen from outside introduced shrimp farming in the southwestern coast, there was little participation in shrimp farming by the local people. Neither was there any national policy or strategy for the industry. Many of the owners of these farms used to take land on lease from local people at a very nominal price. With the passing of time, shrimp cultivation has now become deeply rooted in the southwestern coastal areas of the country. The shrimp sector has been contributing significantly to the national GDP by earning over US\$ 300 million a year in foreign currency (*Chowdhary online*). However, this macro-level performance of the sector is not a reflection of the well being of the people at grass root level. At the micro-level many issues have been raised by the concerned people, such as access to land for cultivation, control of land, environmental degradation, health hazards, losses of fertility of soil, salinity intrusion etc. All these issues are closely related to present and future livelihood of the people of the locality.

Through the study, it has been realized that shrimp culture affects natural and environmental resources in the southwestern coasts of Bangladesh. Though shrimp itself is a resource and important export commodity of Bangladesh. But the foreign exchange earned from exported shrimp, at the cost of damaging local resources, biodiversity, ecosystem, environment and farmer's cultivable land. At present majority people in the southwestern coast are passing through a crucial moment in absence of sufficient crops in their field. On the other hand shrimp cultivators failed to get maximum return from shrimp culture due to severe attack of virus in shrimp farms almost every year. Besides, the quality and hygienic condition of exported shrimp is not up to the marks. Majority of the shrimp processing factories do not maintain international standard. So our country deprived of actual price from exported shrimp. Both the rice farmers and shrimp farm owners in the southwestern coast lost their

income sources and try to search out a new way of living for their survivable. It is the time for the planner to come forward and assess whether present method of shrimp cultivation is sustainable or not.

The southwestern coastal region must not be seen in isolation. It must be considered as a part of the major eco-system and should be planned for the greater national benefit for which a national policy for the development of appropriate strategies is required. Steps should be taken with a vision of success, with the help of local people, local government bodies and government & non-government organizations. Local people have their own glossary on local environment and local resources. It is necessary to take Ideas, share indigenous knowledge and experiences of local people that would come to help the policy makers, planners and government. Local level planning with the participation of local people could upgrade the situation. The country will emerge as an economic power by earning foreign currency from the shrimp sector and at the same time the local people in the southwestern coast will up graded their economic conditions which make them self-sufficient.

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QUESTIONNAIRE

Bangladesh Public Administration Training Centre
Savar, Dhaka-1343

Title of Study:

Local Level Participation in Planning and Development of the Southwestern Coast in Bangladesh: A Study on Shrimp Culture and Its Effects on Natural and Environmental Resources

Objectives:

- To find out the effects of shrimp culture on natural & environment resources.
- To analyze socio-economic return from shrimp culture in comparison to destruction of resources
- To find out a way of local people participation for planning and the development of southwest coast
- To find out the strategies of sustainable management of natural resources.

PART-I

A. For the Shrimp farm owners.

1. a. Name: _____ Age: _____
b. Profession: _____ Educational qualification: _____
c. Criteria: Local people/ outsiders/local but live in out side/relatives of local people.
2. a. What are the areas of your shrimp farm?
b. How long have you been cultivating shrimp?
c. What is the yearly earning from shrimp cultivation?
d. What are the other sources of your income?
2. a. How do you collect prawn? : River/hatchery/others
b. How can prawn be collected from river?
c. During collection. What does happen to other fish seeding?
4. a. How many people's lands are involved (approximately) in a shrimp farm?
b. How did you make farm on that land? On lease/lease & own/own land
c. How much do you need to pay for per bigha land on lease?

5. a. Is there any problem in cultivating shrimp? Yes/No
b. If yes, what are these problems?
c. Have you taken any measures to solve these problems?
d. If yes, what types of solutions are these?
6. a. Is there any change in the environment due to shrimp cultivation? Yes/No
b. If yes, what are the changes?
7. What can the government do for the development of this locality?

B. For the internal landowners of the shrimp farms:

PART-III

C. For the Public/Public representative/Social worker/Teacher:

13. a. Categories of Respondents:
b. Age: Educational Qualification:
c. When was shrimp cultivation started in your locality?
d. When was the economic condition of people better? Earlier/at present
e. What are the reasons?
14. a. Is there any change in the environment due to shrimp farming? Yes/no
b. If yes, what are the changes?
15. What can the govt. do for the development of the locality?
16. How can the local people be involved in order to preserve environment?
17. a. Apart from shrimp, fisheries have increased/decreased/required same.
b. What are the reasons?

PART-IV

D. For the Government/nongovernmental officers:

18. a. Identify of the official: Designation:
b. Office:
19. a. What are the natural resources of the locality?
b. How can natural resources be used for the local development?
20. How can the local people be involved in order to preserve environment and natural resources?

PART-V

E. For the Specialists:

21. a. Type of specialist: Scientists/Academic/Researchers

b. Institution:

Place:

22. a. Does shrimp farming have negative impact on the resources of the locality?

Yes/ No

b. If yes how?

23. What are the past and present environmental conditions in the area?

24. From your point of view, what sort of planning and work programs should undertake to protect environment and natural resources?

25. The southwestern coast was the richest with rice, coconut, betel nut. The shrimp farming causes serious damage to these things.'- how can people be involved in order to protect crops and natural resources?

26. What is your opinion regarding the future of the shrimp farming in this locality?

27. a. How can people be involved in the development of the southwestern coast?

b. What are the ways of local people participation?

28. How can the natural resources of this region be used to develop the areas?

29. What sort of planning can be undertaken by the government right at this moment of protect environment and natural resources?

Thanks for the answers. Given information have been used in the research work.

Name of data collectors:

Address: