Role of Mangroves Eco-System in Livelihood of Bhira Village, District Lasbela (Balochistan)

BY

Asma Bibi

Department of Environmental Economics (CEECC)
Pakistan Institute of Development Economics (PIDE)
Islamabad, Pakistan
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Asma Bibi

Supervisor:

Dr. Rehana Siddiqui

Director (CEECC), PIDE

Islamabad.

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Dedicated to

My Parents
&
My beloved Son

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Asma Bibi

Abstract

This study focuses on the role of mangrove ecosystem in poverty reduction in Bhira village District Lasbela. The objective of the study is to find the contribution of mangrove ecosystem fishing. A survey based method is used to find out the results. It is cross sectional data and total sample size is 110 households. Simple OLS technique is used for the estimation. The estimation results indicate that in the village fishing is main occupation of people. While the current production of fish catch (kg) reflects that due to the mangrove degradation the production of fish catch (kg) has decreased as compared to the production of fish catch in five and ten years ago when the mangrove ecosystem was better in the area. The poverty head count is 63.4 percent which shows higher incidence of poverty among fishermen in Bhira village. The mangrove also provides many other services such as protection from storm and flood, use as firewood, fences and framing of roof. The study concludes that the mangroves play key role in the livelihood of local community**.**

Chapter 1: Introduction

There are many types of mangrove plants. The plants grow in salt water up to the medium height and found in the tropical and subtropical part of the world. The mangrove word is usually use in three ways. Firstly the word refers to the territory plant, "Mangal" for which the word mangrove is mostly used. Secondly it is used for the plants and large bushes in the Mangal, and thirdly used for plants which belong to family of Rhizophoraceae. The amount of true mangroves comprises about 54 species in 20 genera from 16 families which are solely found in the mangrove forests[1]. Mangroves are found in the tropical and sub tropical part of the world. The mangrove ecosystem covers an area between 190,000 and 240,000 square km which become one-fourth of world tropical coastline and about 46 percent of mangrove forests are found in the Asia[2]. The total area of Pakistan is 803,940 sq km. In which 778,720 sq km consists of land and 25,220 sq km of water[3].The mangrove forest in Pakistan mainly found in the coastal area of Sindh and Balochistan. The coastal line is about 990 km and total area of mangrove forest is 600, 000 hectare in which 241 km in Sindh and 660 km in Balochistan. Approximately 97 percent of mangroves are found in Sindh coastal line in Indus delta and remaining 3 percent are found in Balochistan[4].

In Pakistan 8 different species of mangrove plants have been recorded. The name of these species are Ceriops Tagal, Ceriops Decandra, Rhizophora Apiculata and Rhizophora Mucronata in Rhizophoraceae family ,Aegiceras Corniculatum from Myrsinaceae, Avicennia Marina from Avicenniceae family and Sonneratia Caseolaris from Sonneratiaceae. Among all of these Avicennia marina is the species which is widely present in Pakistan and found in both area (Sindh and

[1] http//en.Wikipedia.org/Wiki/Mangrove

[2] Dr.Nay Win Oo (2004), "Change in habitat conditions and conversation of mangrove ecosystem in Myanmar:"

[3] www.yes Pakistan.com/people/profile.asp

[4] Ed. Wards.et al Pakistan mangroves

Balochistan). While Rhizophoras mucronata and Ceriops Tagal are found in Balochistan coast and Aegiceras Corniculatum have almost present in Sindh coast. Mangrove forests provide many ecosystem services to the coastal community. It protects coastal community from flood and other natural disasters. It is also very important for the regulation of ecosystem such as to sequestrate the carbon and a place for many flora and fauna. These are also use for fences, framing of roof and as firewood.

In Pakistan mangrove provide nurseries of about 100 fish species in Pakistan. In these species, 52 need mangrove forests in adult age however 46 in their young age. These fish have great economic importance about 75 percent of commercially catch fish rely on mangrove for the some part of life. Given the importance of fisheries we study the impact of fisheries on livelihood of fishing community in Bhira village.

1.1 Objective of the study:

The objectives of study are as follows:

1. To identify determinants of fishing production/catch by the mangrove ecosystem in Bhira village in Lasbela district.
2. Since the mangroves are claimed to be deteriorating over time, the study focuses on the fish catch over time.
3. To assess poverty level of the local population dependent on fishing.

From the objectives of the study the following questions arise:

a) How the change or degradation of mangroves has affected the livelihood of the local population?
b) What is the poverty situation in the village? How the poverty situation may change, given the dependence of the population on fishing?

The order of the study is as follows:

After the introduction, Chapter 2 covers the findings of the earlier studies. The situation of mangroves in Pakistan is briefly discussed in chapter 3. The data and methodology are discussed in chapter 4. Descriptive statistics of the survey data is reported in chapter 5. Chapter 6 highlights the results of the study. Chapter 7 concludes the study with some policy implications

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Chapter 2: Review of Literature

Hussain and Badola (2010) focus on the Bhitarkanika Conservation Area (BCA) of Indian coast. The main objective of the study was to study how the mangrove ecosystem had positive correlation between mangrove area and Prawn/ shrimp. A descriptive analysis is used for this study. For the estimation 36 villages situated in the BCA were taken and the number of household covered was 324. To find the contribution of mangrove in fish productivity the study focused on three areas. In shore fishery and off shore fishery and role of Bhitarkanika mangrove ecosystem as nursery ground for fish and shellfish. The value of catch was estimated by comparing the price of various fish species in local market. The main findings of the study was that there was distance wise variation in income from fishing and people used high degree of mangrove forest .Each household needed 14.2 percent of fuel which was met by mangroves forests and mangrove contributed greater than percentage of total income of people. The people lived near the mangrove were more dependent on mangrove forest and had low percent of income, employment and education and vice versa. The study highlighted the need for more research both in productivity of mangrove dependent system and their contribution to the local people.

Rajpare *.et.al* (2010) empirically emphasized the function and characteristic of mangrove and the contribution of local people in conservation of biodiversity in the mangrove of Gas and Hara River Delta (GHRD) in Iran coastline. In Iran large area of land covered by mangrove forest and the forest are called Hara forest. Hara (Avicennia marina) and chandal (rhizorophora mucronata) mangrove plants are abundantly found there. For the survey tweleve village of GHRD were taken randomly, for estimation of direct and indirect use of mangrove. To find the value of services total economic valuation (TEV) technique was used. The result showed that villagers were highly dependent on mangrove for the livelihood and they used mangrove as fuel, Shellfish and fish species for food and as fodder for

animal but only few people in village knew the importance of mangrove and its benefits. About 16687 type of biodiversity were record in the area, which represent the GHRD as a mega biodiversity place. However the main cause of threats to mangroves in GHRD were the overuse, lack of information about importance of mangrove resources and lack of polices for the sustainability of mangrove. So the conclusion of the paper was that public awarness should be increased for the protection and conservation of mangrove and also the involvement of the local people for the sustainability of mangroves.

Ambastha *et al* (2009) theoretically and empirically analyze the spatial characteristics and extent of anthropogenic disturbances affecting the mangrove forests of Bhitarkanika conservation area, located in the state of Orissa. It is the second largest mangrove forest of mainland India. This paper used the remotely sensed techniques and Geographic Information Systems (GIS) with socio-economic survey to assess rates, patterns and directions of change across landscape. Results show that almost 14 percent of the total fuel wood consumed annually in this area. The patterns of consumption were spatially heterogeneous determined by ease of accessibility, controlled by the availability of alternatives, human density, presence of markets and forest composition. The authors also find that 30 percent of the forests classes to be under to very low level of disturbance. This study concludes that resources use surface ascertains the zone of biotic pressure with specific mangroves and also combined with the disturbance regime map to priorities areas for mangrove restoration.

Guebas *et al* (2009) analyzed the subsistence use of mangrove forest around the Douala and three villages, Mbiaka, Yoyo1 and Yoyo11 the near the Douala-Edae reserve. The main objective of the study was to analyze the cutting and selling methods of mangrove forest product by villagers. Semi structured questionnaire was developed and two survey were conducted. One for the loggers and the other for household. In the logger survey 34.2 percent of loggers were surveyed from the population to collect information about the harvesting and wood selling methods. However the price of wood was commonly defined by loggers themselves. The second field survey was conducted from the villagers in the three

villages and interviewed 103 villagers to investigate about the knowledge for mangrove. For the estimation a post hoc analysis (Newman-Kelus test) was used to find the common wood class diameter sold in wood market. The result showed that chain saw was mostly used by those loggers who sold the large logs of Rhizophora in Duoala wood market with the diameter greater than 40cm. The household survey showed that large logs of Rhizophora were largely cut and sold in the wood market by loggers and 60 percent of mangrove market wood was their main source of income. However 85.83 percent of villagers also depend on mangrove for their multiple needs. So for the sustainable used of mangrove in future the effective measures should be taken.

Iftekhar and Takama (2007) empirically examined the social importance of mangrove ecosystem, the attitude of local people towards mangrove plantation and also to asses that how the existing mangrove could be managed in sustainable manner. The study conducted in the Nijhum Dwip Island in the Bangladesh coast, the largest mangrove plantation in the world. The size of household was 110. A descriptive statistical technique was used to find the relationship between different variable. While for analysis MS- Excel and SPSS software was used. The main finding was that about one fourth of the people are dependent on mangrove ecosystem. The results show people who depend on mangrove at small scale were 36 percent and they use the mangrove only for fuel and fire wood, while remaining population depended on mangrove for the subsistence. However 75 percent of people viewed the importance of mangrove as a supply of raw material, 57 percent of person for the protection against storm, 13 percentages for the climate regulation and 12 percentages for soil retention.

IUCN (2006) report emphasized the indirect benefit and the value of mangrove in term of fishery and coastal line protection in Panama village in south coast of Sri Lanka. For the study household survey and focus group discussion was used for the purpose of data collection. The number of households was 141 and random sampling was used in which 24 poor, 34 middle and 51 rich were interviewed. Different estimation techniques such as market price method and participatory

environment valuation were used. The results show that coastal communities highly dependent on mangrove in term of fishing, shrimp, and fuel wood for the cash income, while timber and poles herbs and vegetable are for their subsistence use. They find that poor and middle income group is highly dependent on fish, timber, wooden poles and vegetable, while high income category depends more on shrimp and crab. The estimated benefits to the poor group are 42 percent benefits from mangrove while medium and rich group derived 37 percent and 21 percent respectively. The report concluded that for the breeding ground of fish the mangrove generated value ranging from US$ 1, 77.9 to US$ 4, and 74.3 per hectare, while for coastline protection the value was US$ 392.5.

Rowan and Gunawardena (2005) reviewed the Mangrove forest in Sri Lanka which covers an area of 0.19 percent of country. But due to continuous adaptation of shrimp aquaculture the mangrove forest are depleting in the country. The study was taken in the Rewka Lagoon area of Sri Lanka. In the study for methodology TEV (Total Economic Valuation) and cost benefit analysis was used while a questionnaire based survey was used to get information about the livelihood of people and their dependency on mangrove forests in different aspect. In the Rewaka there were 20 villages in which total household were 1184 and a sample of 205 household has selected randomly. The analysis was undertaken to find the impact of proposed shrimp aquaculture project on environment. Through extended cost benefit analysis TEV methods estimated the total direct use value, indirect, option, existence and bequest value in monetary term were estimated. The results show that 49 percent of household used directly mangrove for fishery product and forest. The total internal benefit of shrimp culture was higher than internal cost but the external benefit of aquaculture was very lower than external cost to the ratio of 1:11 to 1:6. However the internal benefit to internal cost ratio was 1:5. The main reason of the shrimp aquaculture was its high profitability to generate foreign exchange. The main conclusion of the study was that the development project of shrimp aquaculture is depleting the environment and will affect the social welfare of people, in the future, negatively.

Win, O.N (2004) stressed the main causes of degradation of mangrove. The study was taken in Ayeyarwady Delta in the southern part of Myanmar. For research the four villages were taken and for data collection remote sensing images, topographic maps, ariel photographs and lastly for socio economic data field survey was used. The results show that mangroves were depleting alarmingly and main cause was the alteration of mangrove forest into agriculture land and shrimp farming in 30 to 40 years. The paper concluded that due to over exploitations the rich mangroves were transformed in to low mangroves. If no protective measure was taken then it will disappear within couple of decades.

Islam and Iftakhar (2004) studied the mangrove of Bangladesh. Bangladesh with a tropical climate having a world largest mangrove forests, "Sundarbans Reserved forest". It covers 32 percent coastal zone of the country covers. People obtain various goods and services from the mangrove. Bangladesh has adopted many strategies. The sustainable ecosystem management has been started for the protection of forest. The main goal of management was the conservation of biodiversity and to engage people into alternative source of income other than mangrove. Different organizations are working with government to reduce people dependency on mangrove. Tree plantation is encouraged in the coastal village. These measures not only contributed to the forest management but also to the social, economic and environmental wellbeing of the coastal communities.

Zhengyun, Z *et al* (2003) theoretically analyze the current status of world protection for mangrove forests. The study reports that the forests of mangroves are being destroyed in all over the world. It is worse condition for the economy because mangroves are the major sources of income and employment like as raw material of paper, firewood, packing box, matchwood industries and construction materials. That's why government and non-government organizations are trying to find out the causes of degradation and destruction of mangroves forests. Due to the natural, human-induced factors the habitant conditions of mangroves forests are destroyed in recent years. At the end, the authors give suggestions for protection, sustainable management regime and changing the pattern of shrimp far

mining. International organizations pay more attention to the protection and management of mangrove forests.

The case study of IUCN (2003) underlined the mangrove and critically evaluate situation of ecosystems in Puttalam lagoon area where the mangrove was depleting by the result of increase of population, industrial activities and by the use of destructive fishing techniques. In the village 90 percent people depended on fishing related activities. The mangrove control flood which play main role in ecological services. Different valuation techniques were applied to determine the value of mangrove services. The direct benefits of mangrove were determined by total economic valuation while for the indirect benefits the production function was used. For estimation of indirect benefits two separate regressions was estimated, pooled timed series for shell fish while cross sectional data was used for the Dermersal fisheries. The use of destructive fishing gear was also estimated in the study which main cause of practice was financial crisis. The study clearly showed that depleting of mangrove loss the well being of society in the future. The discussion concludes that effective policy should be designed for the sustainability of mangrove and fisheries which ensured the welfare of society.

Glaser (2002) empirically analyzed the main aspects of human utilization of mangrove ecosystem and the social and economic priorities of mangrove user for the management plan based on the concept of sustainability. The area of research was taken in Caeto Estuary in Coastal North East Para Brazil. In the North Brazilian Coast many type of extinction and viable extraction were identified. The method of descriptive analysis was used to find the result of study. For the estimation a statistical based survey was developed for the community. A sample of 2500 household was taken in 21 ruler community. The results show that 30 percent of people are engaged commercial fishing. By the use of mangrove 83 percent people derived subsistence income and cash income of 68 percent. Farming and crab collection was main profession of people. From farming and crab collection people derived 42 percent of income considering the high level of poverty in North Brazil. The paper concluded that there was need for better mangrove management in the account of the mangrove production. While in the

aspect of socio –economic importance the quality of education, professional options, medical care, the low price of mangrove product in market and the access of electricity should be improved.

Ronnback, P (1999), theoretically identified the ecological and biophysical links of mangroves that sustain seafood production. In this paper, mangroves are viewed as dynamic ecosystems with thresholds, non-linearity and discontinuities. The paper highlights the role of mangroves in sustaining aquaculture production through a wide variety of mechanisms. The author briefly described the economic significance of mangroves in seafood production by capture fisheries, penaeid shrimp, coastal sea scape perspective and aquaculture. This paper concludes that when increasing the socio-economic and ecological knowledge, the conversion of mangroves into development activities whose social costs outweigh their benefits should be reduced.

C.S. Silori (2010) analyzed the link between income of people and biodiversity conservation in different ecosystems of Thailand. The main objective of the study was to understand the conservation of forest by the community in the context of their income. Field survey was done in four villages (Doi-Mae-Salong, Doi-Suthep –Pui-National park, Phutoeis National park and Pred Nai) of Thailand. In the Pred Nai survey was done regarding the conservation of mangrove which was the last surviving mangrove forest of Thailand. Participatory Research Techniques were used for the collection data. The stratified random sampling was used and sample size was 485 households. The main result was that from >1% to □ 70% of people is dependent on forest for their income. Here the shrimp farming and intensive logging destroyed the mangrove forest which negatively affected the livelihood of villagers. For the conservation of mangrove the villagers started protesting against the logging and the shrimp ponds. It resulted in the long term participatory mangrove restoration by RECOFTC. Household survey showed that the grapsoid crab collection was main source of income. They derived 71 percent of their income directly from sale of grapsoid. While as whole mangrove contributed 74 percent of average household income directly or indirectly in their livelihood. Despite the increase of people for crab collection the quantity of

collection remained constant from 7-8 kg for the last 10-15 year. However the time spent for catching of crab decreased significantly which highlighted the sustainable condition of mangrove. Paper concludes that conservation of forest have significant role in the livelihood of people in term of subsistence benefit and yielding income and also perform as safety net at the time of Typhoons and storm.

Hence by reviewing the literature we can say that mostly around the world the local communities are highly dependent on mangrove forests directly and indirectly. The main occupation of People is fishing in the coastal areas. Mostly the surveyed based method is used for the estimation to find the income level and poverty level among the local community. According to the literature the results shows that mangrove forests are degrading all over the world**.**

Chapter 3: Mangroves in Pakistan- A Brief Introduction

3.1 Mangrove Forests

There are many types of mangrove plants. The plants grow in salt water up to the medium height and found in the tropical and subtropical part of the world. The mangrove word is usually used in three ways. Firstly the word refers to the territory plant, "Mangal" for which the word mangrove is mostly used. Secondly it is used for the plants and large bushes in the Mangal, and thirdly used for plants which belong to family of Rhizophoraceae. The mangroves comprise about 54 species in 20 genera from 16 families which are solely found in the mangrove forests[5]. Mangroves are found in the tropical and sub tropical part of the world. The mangrove ecosystem covers an area between 190,000 and 240,000 square km which become one-fourth of world tropical coastline and about 46 percent of mangrove forests are found in Asia[6].

Mangroves plants are present in 117 countries in the world, in which Indonesia has 30 percent, Nigeria 10 percent, Australia 8 percent, Mexico 7 percent and India and Pakistan have 3 percent of mangrove forests. Pakistan is the 6th largest country in the world for mangrove reserve. The largest mangrove forests in the world are the sundarbans found in Bangladesh and west Bengal India in the Ganges river delta. The sundarbans forest covers an area of 10,000 square km in Bangladesh and 6,000 square km in India. In Bangladesh they are 40 percent, of

[5] http//en.Wikipedia.org/Wiki/Mangrove

[6] Dr.Nay Win Oo (2004), "Change in habitat conditions and conversation of mangrove ecosystem in Myanmar:"

the total forest and 4.07 percent of total land mass. In sundarbans forests the plant named Sundri is the most important trees species.

The mangrove forests are intricate and ever green plants and shrubs. They are fast growing plant and grow in the special concentration of saline and fresh water. They are found in low filthy area and their seeds are like nuts. They are woody plant, which have sustained roots. Their seed disperse in the water, floats to other area and grow there. The main types of mangrove plants are red, black and white mangrove. These three kinds of mangrove plants belong to different families of plants but their variation in coastal area link them to each other. The white mangrove grows away from the salt water with small smoothed leaves. However red mangrove found near to the salt water. They seem like a cluster of trees and due to their prop roots they look like as they are moving on the surface of water, so they are also called walking trees. Their seeds fall into the water and float to other place and grow there. The black mangrove grow along the Manatee River entrance Tampa lagoon at large amount. These are recognized by their various breathing tubes. These tubes are the sources of oxygen for the plant from the salty water[7]. The mangrove forests have great ecological and economic importance. It provide habitat for many algae and fungi. For example it provides breeding ground for many fish species such as shrimp and Juvenile fish. It is the place for many reptiles and mammals. Many marine organisms depend on mangrove for their life cycle because it provides food chain to many species.

3.2 Functions of Mangroves

The mangrove forests are also a place for many flora and fauna. It is important for the habitat of many biodiversity. Such as the forest is a home for many rare algae and fungi. The main characteristic of mangrove forest is that in these forests the organism of land and sea live together. It provides a link between land and water organism and maintain stability. It provides food and breeding ground not only for fishing but also to many other animal, for example Crabs, Waterfowl, Jackals,

[7] http//www.swfwmd.state.flus/education/------mangroveswamp.html.

Wild boars, Bats, Lizards, Toads and Dolphins. It is also a place for the migratory birds. Some of the birds live in the branches and roots of mangrove. However many aquatic animals live into the costume and roots of mangroves. These organisms feel themselves save in the mangrove forest during high waves and also from their enemies as contrast to in the open sea. Some of the organism move towards the forest due to the presences of nutrients. Bacteria, algae, fungi and many other protozoa are also present there. It is estimated that in the Indo Pacific region ten species of bacteria, five species of fungi, 65 species of algae and 18 species of protozoa have been recorded[8]. However in Pakistan the number of these species is still not known. Sonmiani bay is a place of Balochistan where in the winter about 20,000 birds come from other areas. The major water birds in the area are grabs, pelicans, cormorants, flamingos, egrets, herons, storks, ibises, and spoonbills cranes, coot's shore birds, gull and terns[9].

3.2.1 Protection from flood and natural disaster

Mangroves play an integral part to control the flood and also to protect the storm. It save the coastal community from high tides and reduces the forces of the waves. The mangrove plant has the property to absorb the water energy and minimize the damages. For example during the Indian Ocean Tsunami mangrove forest reduces the forces of tides in the area where they were thick and save the lives and property of coastal community. If these forests decline then the coastal area will be open to the natural disasters and cause more damages.

3.2.2 Carbon sequestration

Mangrove forest is also important for the regulation of the ecosystem. For example one of their major functions is to sequestrate carbon. It has the quality to absorb the carbon and reduces the carbon dioxide (CO_2) emission in the atmosphere. They can also convert the carbon and it was estimated about 15.1 ton

[8] Qureshi (2005) Mangroves of Pakistan , Status and Management
[9] Jusoff and shah (2007) International Journal of System Applications, Engineering and Development

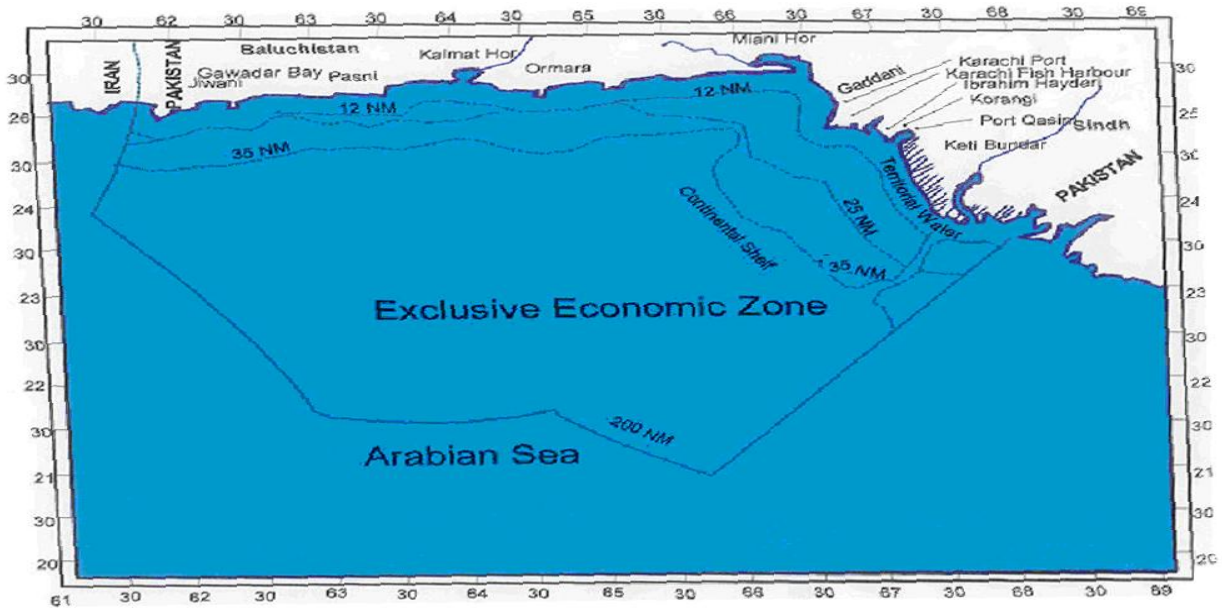
c/ha/Yr amount. As mangrove include associated soils that can sequester approximately 22.8 million metric tons of carbon each years[10].

3.3 Mangroves in Pakistan

Pakistan coastal line has its unique geographical importance, as it is near to Arabian Sea. Pakistan is dry and semi arid country which receives less than 250 mm of rainfall annually, while in the arid areas amount of rainfall is less than even 125 mm annually. The country consists of complex land with delicate watershed places, hilly deserts, and high mountains, natural alluvial and mangrove forests. The major flora and fauna in the country are Indomalayn and Palaerctic. 5.7 percent of forest are present in Pakistan which covers an area of probably 4.58 million hectare and in this less than 3 percent of forest are mangrove forest, covering an area of 0.132 million ha. The mangrove forests in Pakistan are found in the coastal area of Sindh and Balochistan. The coastal line is about 990 km and total area of mangrove forest is 600, 000 hectare in which 241 km in Sindh and 660 km in Balochistan. Approximately 97 percent of mangroves are found in Sindh coastal line in Indus delta and remaining 3 percent are found in Balochistan[11].

[10] International Union of Conservation of nature(2003)
[11] Ed. Wards.et al Pakistan mangroves

Figure 3.1: Coastal line of Pakistan



Source: Quershi, T. (2005) Mnagrove of pakistan: Status and Management

In Pakistan 8 different species of mangrove plants have been recorded. The name of these species are Ceriops Tagal, Ceriops Decandra, Rhizophora Apiculata and Rhizophora Mucronata from Rhizophoraceae family ,Aegiceras Corniculatum from Myrsinaceae, Avicennia Marina from Avicenniceae family and Sonneratia Caseolaris from Sonneratiaceae. Among all of these Avicennia marina is the species which is widely present in Pakistan and found in Sindh and Balochistan. While Rhizophoras mucronata and Ceriops Tagal are found in Balochistan coast and Aegiceras Corniculatum have present in Sindh coast.

Table 3.1: Different Mangrove Species in Pakistan:

Species	Distribution
Rhizophoraceae	
Brugiera gymnorhiza	Karachi and Indus Delta (Hassan) Estuary of Indus (Murray); no specimen in Kew, Endinburgh and Pakistan
Ceriops tagal	Karachi and Coast of Sindh (stock) Mouth of Indus and, "Salt Water Creeks" (Murray)
Ceriops Decandra	Sindh tidal zone; existence considered doubtful
Rhizophora apiculuta Blume	Tidal marshes at the mouth of Indus Miani Hor, Lasbela(T and S)
Rhizophora Mucronata Lamk	Mouth of Indus on muddy shores and tidal creeks (Henslow; Lasbela and Makran coast (Burkill)
Avicenniceae	
Avicennia Mariana	Tidal Mangrove Swamps; Sand Spit (Stern) China creek, etc (Jafri), Kalmat Hor
Myrsinaceae	
Aegiceras Corniculatum	Mangrove Swamps at mouth of Indus (Stocks, Ritchie) Karachi (Jafri): Miani Hor
Sonneratiaceae	
Sonneratia Caseolaris	Mouth of Indus and Tidal zone (Common, fide Murray) ; Indus delta no specimen seen

Source: Quershi, T. (2005) Mnagrove of pakistan: Status and Management

Mangroves are divided into three main categories, dense mangrove, normal or medium mangrove and sparse mangrove. Dense mangrove are found in Khai, Patiani, Daboo, Sisa rivers of northern area, Pakar, Korangi,Phitti and Sir rivers of southern areas. Avicennia marina abundantly grows in the dense mangrove and present in the thin broaden blocks of rectangular form along the steams. They are fast growing plant and reach at the height of 9m long. Their leaves look like umbrella and are one meter above from the earth. The other species found in the dense mangrove is ceriops tagal and Ageciras Corniculatum. They are mostly occurring along the Khai, Pakhar and Daboo rivers. The stems of ceriops tagal are straight and single and reach about 2 to 2.5 meter of height. The normal mangroves occur widely in the Indus delta. Avicennia marina is the species which is mostly grow in the normal mangrove. The normal mangrove plant nurture in the moderate condition and it forms about 35 percent of the plants in the area. However the spares mangrove forest found in the dry and the areas cover by dust.

In the coastal area the mounds of sand are widely spread. In the dry and sandy area plants do not grow abundantly, while some bushes grow in the area such as Salsola Barysoma, Abutilon Indicm and Cressa Creatica etc. The large area is covered by the sea salt in the form of thick layers.

The mangrove forest in Sindh coast is present in the Indus delta which is situated in North West of Karachi, which covers 600,000 ha with a coastal line of 250km. There are major 17 rivers in Indus delta and some small rivers are also present. The thick mangrove forests are sited near the rivers and freshwater come from the Perennial River and about 97 percent of the mangroves are found in the Indus delta. The Balochistan coastline is 800 km long situated in the north of Arabian Sea comprises natural alluvial, barks, mountain, seashores and lagoons. The mangrove are found in three area of Balochistan, Miani hor which have 7,471 ha area cover by mangrove, Gwader bay have approximately an area of 10,216 ha of mangrove plants and Kalmat hor have 26,316 ha of mangroves[12].

Table: 3.2: The Area Summary of Mangrove Forests along the Coast of Pakistan Based on SPOTX Data of 2003

Region	Area in hectares	Area in acres	Percentages
Karachi Harbor Area	985.50	2435.00	1.14
Indus Delta Region	81684.00	20184.00	94.18
Miani Hor	3431.36	8479.00	3.96
Kalmat Hor	194.00	479.00	0.22
Jiwani	433.00	1070.00	0.50
Total	86727.86	214304.00	100.00

Source: Quershi,T. (2005) Mnagrove of pakistan: Status and Management

In Balochistan the mangroves are found in three places in which one is Sonmiani bay Miani Hor which constitute three villages (Bhira, Sonmiani, Damb and Baloch Goth). The Sonmiani bay is at 90 km distance from Karachi in the north coast of Balochistan. The total area of the village is 125.5 km^2. Mangrove forests are found abundantly in the village. The total area cover by mangrove forests in

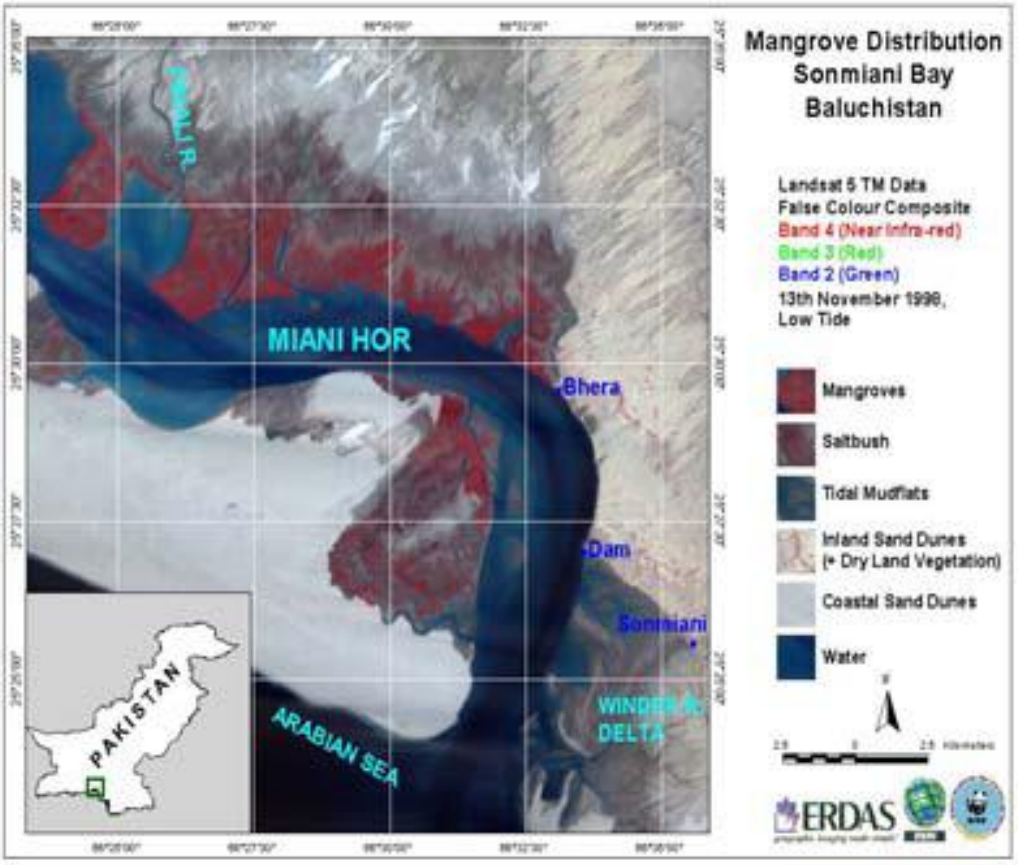
[12] Quershi,T. (2005) Mangrove of Pakistan: Status and Management

Balochistan is 7,340ha**.** However, in the Miani hor 84 percent of mangrove found while 4.86 percent of Pakistan mangrove forests found in the Balochistan. In the village the main sources of fresh water is two rivers Porali River and "Winder River". The winder river enters near the mouth of the bay, however the Porali River exhaust through the Bela and drains into the central part of the bay. The total area covered by mangrove in the village is about 3,000 ha in which 25 percentage of the area is occupied by mangrove forests while remaining area is barren and have water.

Village Bhira of Miani Hor is the study area which is situated 2 ½ km in north Damb Bunder. The village is surrounded by coast in the west and big sand dunes in the east to south. The village is not old as Damb and Sonmiani. While some villagers claim that the village is about 200 years old but no authentic report was recorded about the history of village. People of village migrated from Kalmat, Layari and Sanghoor along the Makran coast and settle there. The village is divided in to two localities one Murad Ali Para which is also called Sanghoor Baloch and second is Laghar Para. The community is very conservative and used to live in closed environment. The people are Zikri Baloch by caste. There are 171 households in the village with a population of 1300. However due to lack of basic facilities five to six families used to migrate from village every year. There is no mosque in the village except three Zikir khana where people practice Zikir regularly. Most of population in the village is poor. Their main occupation is fishing and about 90 percent of people depend on fishing for their livelihood. In the village literacy ratio is five percent and there is only one primary school in the village. Similarly health facilities are poorly equipped. Only one basic health unit is in the village which is run by a dispenser. There are only five people in the village who have the Government jobs. Mangrove forests are in the coastal area of the village which provide the breeding ground for fishing and also use as a fence, fodder and fire wood[13].

[13]Sonmiani (final report), (2005) Study on Knowledge, Attitude Fisheries and Mangrove Resources

Figure No: 3.2 Mangrove Distributions at Sonmiani Bay



Source: Hasnian (2005) Sonmiani village Development 2005

Three species of mangrove Avicennia marina locally called Timmer, Rhizophoras mucronata local name Kumri and ceriops tagal locally called Kain are found in village. In these three species the Avicennia marina is most dominant plant and it occupies 95 percent of the area in the village, however Rhizophoras mucronata is found 4 percent and ceriops tagal is in 1 percent[14]. While some bushes and wild trees are also present in the village such as Arthocnenmum Indicum (Lana) and Suaeda Monia locally called Garor. The Rhizophoras mucronata is found in the north east of the area while Avicennia marina is located all over the village and ceriops tagal grows within these two species[15]. Due to the presences of scrub the

[14] Ahmad.et al (2002) Mangrove Conservation along the Coast of Sonmiani, Balochistan, Pakistan

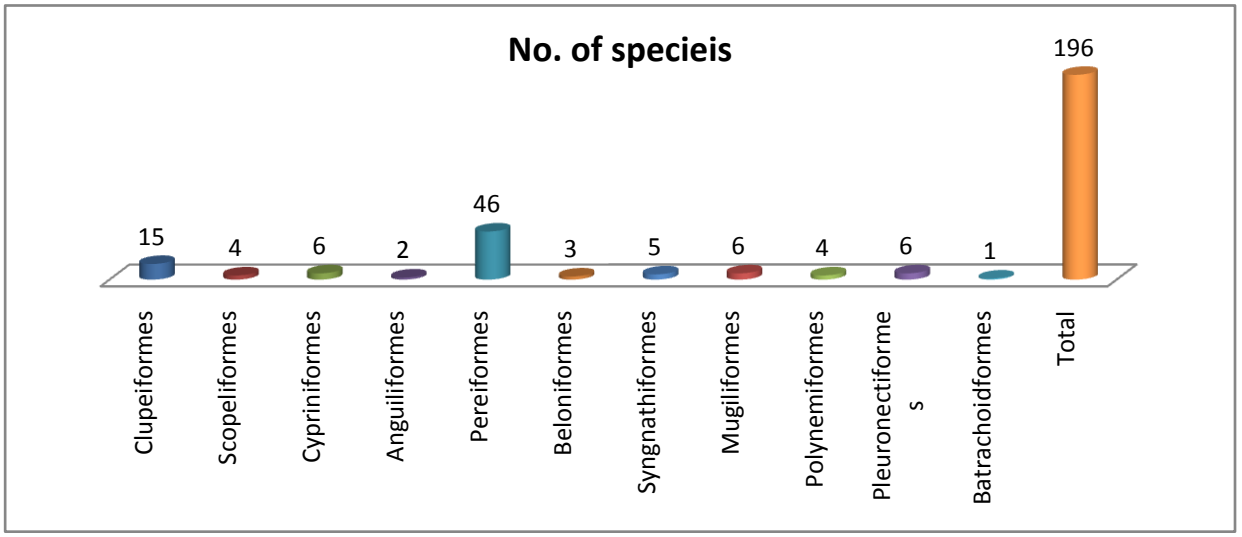
[15] Ahmad.et al (2002) Mangrove Conservation along the Coast of Sonmiani, Balochistan, Pakistan

growth of mangrove forests restricted. The Rhizophoras mucronata is the plant which exists naturally only in Sonmiani bay in the Pakistan. According to local community in the village that mangrove forests are being declined because of over harvesting. Such as the Avicennia marina is usually used as a fodder of animal so not harvested by local people at large extent. While the Kumri plant has straight wood used mostly for building house, framing of roof and for fences. So this type of plant is chopped by people largely. The Kain plant is also declining because the local community livestock used to graze this plant and also in the village Bhira every household has a camel who brows the plant. Mangrove forests also perform many other functions, such as to protect the coastal communities from storm and natural disasters as Tsunami, purify the water and act as a carbon sequestration. The coastal communities largely depend on mangrove for their livelihood. In the coastal area mostly the main occupation of people is fishing. However the people use mangrove also as wood, fuel, fire wood, and fence and for framing of roofs. Their animals also graze on the mangrove plant and collect mangrove plant for fodder.

3.4 Fishing

It is recorded that mangroves provide nurseries of about 100 fish species in Pakistan. In these 52 need mangrove forests in adult age however 46 need it in their young age. These fish have great economic importance; about 75 percent of commercially catch fish rely on mangrove. The order and number of species of mangrove fish is shown below in graph

Graph3. 1: Order of Mangrove Fish



Source: Quershi, T. (2005) Mangrove of Pakistan: Status and Management

The graph shows the order and number of mangrove fish species of different colors. Total number of fish species in mangrove forests is 196 shown by the color orange. However the fish species which belong to Pereiformes are highest in the number (46), while the other orders of mangrove species are also explaining in the graph.

Many type of fish and shrimp species found in the mangrove forests. The aquatic fish is the main natural resource of the coastal people. Almost 90 percentage of community's occupation in coastal area is fishing and fish related activities such as net maker and repair, boat maker and repair and the fish traders. So the coastal population mostly depends on fishing for their livelihood. According to local communities the main species of fish found in the Miani Hor , Sonmiani, Damb and village Bhira are Dannthi, Giser, Goli, Suwa, Sisery, Ladyfish, Safaid paplet, Kiddi, Pitas, Taira, Tikori, Jelly fish,Morri, Mittoo, Chaky, Luer, Seem, Loor, Moor, Shrimp, Dandiyoon, Ghore, Khage, Paplet Chodi and others. The kinds of shrimps are Jaaro, Kalree, Patal, Kiddi and Kaket. The Shrimp has a great economic value. The local name of this fish is Sana. It is very famous among the fishermen and considered as main sources of income. The reason is of its great

export value and commercial value in the market. The main fishing season started in the month of August and continues till the month of March. However in the month of June and July fishing is not done due to high waves in the sea. As June and July are also breeding season of the fish so fishing activity is restricted officially. In these two months mostly the fishermen who work as labor borrow money from the local fish traders for their needs. Some fishermen also catch the Crabs during these months. The fishermen sell the fish to local traders who sell them in the Karachi which is the main market of fishing. According to Balochistan fisheries Department statistics 11,000 metrics tons of fish was caught in the area of Sonmiani Bay and the surrounding village (Bhira, Damb, Sonmiani) in the 2003 which become total 9% of fish catch in Balochistan[16]. In the area there were some other kinds of fish which disappeared with in the some years, such as Palla, Mungro and Sood.

In the summer season due to high waves the fishermen do not go into the deep sea for fishing. They catch fish in the Canal of Winder River. As in the Damb village there is a facility of jetty, so many fishermen from Bhira and Sonmiani come to Damb for fishing. Three classes of fishing are common in the village. First large scale fishing, medium scale fishing and small scale fishing. The large boat do the large scale fishing and small boat do the small scale fishing. However for the fishing, two types of boats are commonly used such as motorized and mechanized boats. As discussed above that many fish species are declining in the sea. The main reason of their decline is the over exploitation of the fish resources and another major cause is the use of illegal nets during the fishing. The types of illegal nets which are common used by local fishermen are Thukri, Raybiyoon, and Makhan rach. Another cause of over exploitation is that in the fishing season people from neighborhoods countries such as Bangladesh, Burma and Afghanistan came into the village for fishing. They also use the illegal nets and cut the mangrove plants for the framing of their roofs and fences, fuel and fodder. The local fishermen also mourns that big fish trawls which come from Karachi

[16] Jusoff and Shah(2007) International Journal of System Applications, Engineering and Development.

use the illegal nets which affects the quantity of fish catch. The local fishermen claimed that Balochistan Government and fisheries department and marine fisheries department giving no attention to these issues. Villagers are of the view that use of illegal nets can be stopped if all the fishermen become united and protest against the use of illegal methods of fishing. So that can force the fisheries department to take action against the unsustainable methods of fishing.

3.5 An Overview of Location

3.5.1 Lasbela

Balochistan is the largest province of Pakistan. It covers an area of about 347,000km^2. The 65% population of live in rural area and 35 percent of population live in urban area. The population density is 19 percent per km^2. Quetta is the capital city of province and according to the social and development ranking of district in Pakistan Quetta is ranked as high in both social and development sector. Sibi, Ziarat and Lasbela are high in economic sector and low in social sector development. Literacy rate in Balochistan is higher in Ziarat district with 34.3 percent and lowest in Dera Bugti with 11.7 percentages. The name of Lasbela drives from two words “LAS”a plain and “BELA” a jungle. It was notified as district on 30 June 1954. The Lasbela district is situated in between 24^0 53 to 26^0 37 north latitude and 65^0 15 and 67^0 27 east longitude on the southern coast of Pakistan. District Lasbela is bounded on north by Khuzdar district, in east by Dad Malir Karachi, district of Sindh, in south by the Arabian Sea and in west by Gwader and Awaran districts. Geographically, Lasbela can be divided in to three parts, the north eastern mountains and hilly areas, the south western hilly area and the Porali trough. The sub division of district is Bela, Dureji, Hub, and Kanraji. The total population of the district was 312695according to the population census report of 1998 and the household size was 6.2. The district has seven Tehsil and 2 subs Tehsil, while the numbers of union council are 22. The growth rate is 3.03 percent and the main native of the district are Baloch and Sindhi. There is tribal set up in the district and main tribes are Jamoot, Runjhas, Sheikh, Burma Afghan and Brahivi other than Baloch. The

climate of district remain cold in winter and hot in summer while the rain fall in Lasbela is above 243 millimeter. There are total 405 schools and two colleges and three universities. The literacy ratio in district was 22.30 percent in 1998. The people of lasbela are very traditional. They follow strictly their norms and customs and the main languages are Sindhi and Balochi. In the infrastructure sector the main road is Makharn coastal highway. There is no air port and railway station. While in the communication sector, Pakistan Tele Communication Company limited (PTCL) and mobile companies have their network in district. The energy is provided by the area from KESC (Karachi electricity Supply Corporation). The agriculture is main source of population income and especially by horticulture. Tubes well are main source of irrigation while Hub dam also provide water to some area of district. The major crops of district are vegetables, wheat, fodder, fruit and cotton. The livestock rearing also take place in the district. Most of the people have goats, sheep, camel cows and poultry for their domestic use. Lasbela is also famous for the origins of Red Sindhi cattle breed which survive in sever condition.

The major industries found in Hub and Winder and more than 166 industries are functioning in Hub. In small scale the Balochi embroidery and carpets are common. The main minerals found in district are marble, limestone basalt, shale, building stone and red ocher. The main trees are mangroves, kimi, kand and wilayati kikar. There are many important historical places in the district such shrine of Shireen- Farhad, Sassi-Panue, Shah Bilawal and historical building are Shahi- Jamia mosque at Bela, tomb of General Haroon at Bela and picnic spots are Gaddan Damb Bander, Hingol National park. The main occupation of population is agriculture and livestock while people are also engaged in public sector and industries. The unemployment rate in the district is 27. 24 while employment ratio is 13.60 percent.

3.5.2 Bhira village

Lasbela is the district of Bhira village while Sonmiani Bay or Miani hor is the Tehsil of Bhira. Sonmiani bay is located at the distance of 95 km away from Karachi near Windor River. The village cover over 127 acres. The town has one Daragh, five mosque and three Chhapras locally name for company. The *chhapra*s are the place where the fish are purchased. The total population of the town is 3000 and number of household is 300. The main occupation of people in the Tehsil is fishing. The Sonmiani bay is economically very important place for the mangrove forest and for fishing. The mangrove covers an area of about 3000ha which become the 25 percent total area of town. The Sonmiani bay is divided into three villages Dam, Sonmiani and Bhira.

The village Bhira is situated 2 ½ km in north Damb Bunder. The village is surrounded by coast in the west and big sand dunes in the east to south. The village is not old as Damb and Sonmiani. While some villager claims that the village is about 200 years old but no authentic report was recorded still about the history of village. The people of village migrated from Kalmat, Layari and Sangoor along the Makran coast and settle here. The village is divided in to two localities, one Murad Ali Para which is also called Sanghoor Baloch and second is Laghar Para. The community is very conservative and used to live in closed environment. The community belongs to Zikri Baloch. So the avoid to mix with the community other than Zikri. The main occupation of people is fishing but all of them have not their own boats. The village has 171 household. According to the villager the Government has approved 200 acres land for the villagers but still no person in the village has the ownership right of the houses. The total population of village is 1300. All of the houses in village are ‘Katcha’. Only one school, one dispensary and two Zikir khana are ‘Pucca’. In the village there is no mosque but two Zikir khana are in village one for male and one for female. People do the Zikir regularly but in them there is no concept of Pesh Imam. The Imam also stands in the same row with other people. The local community of village Damb and Sonmiani consider them non Muslim. Every year about 5 to 6

families migrate from village. The main occupation of villagers is fishing and 90 percent of people earn their livelihood needs from this profession. There are 100 small and big boats in village. The villagers depend only on fishing, so there is no other alternative source of livelihood for them. Most of the people have only the skill around fishing related activities such as boats making and repairing, net making and repairing. The people in village are mostly poor because the people who have not their own boats and nets work as labors are poor. The middle class people in the village are those who have their boat and two to three nets, while rich group are consider to those who have government jobs and shop in village. Mostly the community is poor and only 40 percentage people belong to middle class. As the fishing have their main sources of income so in off season they take loan from fish trader and middle men for their livelihood needs.

The literacy rate in the village is only five percent among male and less than one percent in female. There is only one primary school in the village but the condition of it's not good. The school has no furniture and children sit on the ground by using mat. The enrollment ratio in the school is also very low. As in the village there is no middle school so the student has to go in nearby Damb village school for further education. In the village 50 people are only matriculated and only five people passed the intermediate examination. The ratio of Government job holder is also very low. Only five people have government jobs in which two are teachers, one peon, one midwife and one dispenser.

The village lacks all basic health facilities. Different kinds of diseases are common in village such as TB, Allergy and diarrhea etc. there is only one Basic Health Unit in the village (BHU). The in charge of BHU is one MBBS doctor who visits the unit one day in a week. The unit is run by one dispenser in the village. The BHU has the severe shortage of medicines. The main reason of health problem in the village is unhygienic condition and ignorance of health. Another reason of the disease is also that the villager keeps their livestock in the houses without any proper management of sanitation. The women also suffer too many diseases but due to their strict traditional norms they feel reluctant to tell their

problem to their male. As in BHU there is no lady doctor, so they have to take their pregnant women to Karachi for delivery that becomes expensive for them. So they prefer to childbirth at home by untrained midwives. One disease which is common in both male and female in the village is dental problem. Both male and female use to chew the betel leaf (Paan), and the women usually takes 7 to 8 paan daily. The diseases among the infant are Diarrhea, fever cough, polio, throat and Jaundice etc. There is no vaccination system in the village for new born babies. The women of village used to fetch water from well with help of donkeys away from three km to the village. In the village only one Community Based Organization (CBO) is working named Coastal Association for Research and Development (CARD).

Chapter 4: Data and Methodology

4.1 Data Description

The primary data is collected for this study. A fully structured questionnaire is developed. The investigators went to the field and collected the data from the respondents of village. The main source of data is primary data and sample size is 110. First we collected information of mangrove and main characteristics of mangrove forests in village and also the livelihood pattern of local population. After obtaining necessary information then questionnaire has developed. Ten questionnaires were filled first for the pre testing of data. The pre testing is important as it provides the additional information and also makes sure that which information should be included or extract from the questionnaire. Lastly the final questionnaire was filled from the village labors and fishermen. The sample size was 150 but only 110 questionnaires were filled. Most of the people in the village are laborer working on the boats and only few people have their own boats. However some people also work as a net repair and boat repair and boat maintenance and boat maker. However the women not only do the household work, but collect fodder for livestock and also go up to 3km away for fetching the water. The community is very conservative and lives in closed environment.

The methodology of study includes

- Descriptive analysis
- Statistical/Econometric analysis

4.2 Descriptive Analysis

The descriptive analysis describe quantativly the main properties of a collection of data. The descriptive analysis also present the data in the form of ratio, percentages, tables, charts and graphs. It also measures the central tendency such as average, mean, mode and median, graph, ratios and percentages of explanatory variables showed their influence on the dependent variable. All of the explanatory variables such as qualities of boat and net, recurring cost and Patti system and household expenditures are plotted in the form of graph, percentage and ratio for

the interpretation that how the economic valuation of fish are dependent on these variable[17].

The most common methodology use in environmental to measure the economic value of the ecosystem and environmental services is the total economic valuation (TEV). The concept of economic value is defined as in the standard Economic theory as, "The measurement of change in personal well being". So the total economic valuation is the monetary form of measurement in which changes occur in human welfare due to the change in ecosystem quality. The economic valuation of mangrove consists of direct use value, indirect use value, option value and non use value.

We are using production function approach to study the current and previous determinates of fish catch. The main factors which are important affecting fish catch are quality of boat and net, cost of diesel, Patti system (sharing arrangement), situation of mangrove and household expenditure. In the quality of boat the main factors are boat size, type and life of boat. The life and type of boat also positively improve the fish value. In the quality of net the foremost factor is the type of net use in fishing Plastic net and Makhan. If the net use for fishing is legal then it will increase the fishing amount and if the illegal nets are used then it will adversely affect the value and amount of fish. Other factors are how far go for fishing, number of hours and fish catch in per trip (now, five and ten years ago) are also considered.

Then by recurring cost is measured which is borne by the fishermen in fishing trip. In the recurring cost the fishermen has to bear the cost of inputs (Diesel/fuel, net repair, boat maintenance and ice) in every trip. The important factor is Patti system or sharing arrangement in which five to ten people take the boat together and distribute the net income according to person sharing percentage. In the sharing arrangement the major aspects are boat size, number of fishermen in boat, duration and average number of fishing trip in month, estimated cost and net income from trip. However in the sharing arrangement the number of person,

[17] En.wikipedia.org/wiki/Descriptive statistics

share of boat owner, boat captain and labor share are considered. These all factors play major role to determine the economic value of fish.

4.3 Statistical/Econometrics Analysis

4.3.1 Estimation of Production Function

Standard production function is specified on:

$$\textbf{Production} = f(\textbf{Capital, labor})$$

$$P = f(K, L)$$

Where

P: Production

K: Capital

L: Labor

Extended production function estimated is:

$$P = \beta_0 + \beta_1 BS + \beta_2 OB + \beta_3 TN + \beta_4 AB + \beta_5 FM + \beta_6 FC + \beta_7 NHTP + \mu_i$$

Where

P: Production of the Fish / Fish catch

BS: Boat size

OB: Ownership of boat

TN: Type of Net

AB: Age of boat

FM: Number of Fishermen on boat

RC: Fuel cost

NHTP: Number of Hours per trip.

The production functions for fish catch currently, five years ago and ten years ago are specified below.

$$P_t = \beta_0 + \beta_1 BS + \beta_2 OB + \beta_3 TN + \beta_4 AB + \beta_5 FM + \beta_6 RC + \beta_7 NHTP + \mu_{i\text{-----A}}$$

$$P_{t-5} = \beta_0 + \beta_1 BS + \beta_2 OB + \beta_3 TN + \beta_4 AB_5 + \beta_5 FM + \beta_6 RC_5 + \beta_7 NHTP_5 + \mu_{i\text{-----B}}$$

$$P_{t-10} = \beta_0 + \beta_1 BS + \beta_2 OB + \beta_3 TN + \beta_4 AB_{10} + \beta_5 FM + \beta_6 RC_{10} + \beta_7 NHTP_{10} + \mu_{i\text{-----C}}$$

The dependent variable is the production function of fish catch and the explanatory variables are (boat size, ownership of boat, type of net, age of the boat, fuel cost, and number of fishermen on boat and number of hours per trip). Now I explain that what is the specification of these variables and why we take these variables in the model and how it can be captured.

4.4 Specification of the variable

The main variables used in the model are the fish catch, quality of boats and nets, recurring cost, sharing system, services provided by mangrove and house hold expenditure.

4.4.1 Fish Catch

Fish catch is an indicator of how many people in the village depend on fishing for their livelihood and their income by fishing and the importance of mangrove for fish species. Here the fish catch is our dependent variable. The fishing depends on seven different explanatory variables such as boat size and ownership of boat, type of net, number of hours per trip, number of fishermen on boat, recurring cost of diesel and Patti system. The dependent variable is captured by fish species that what type of fish species are common in the village such as shrimp, loor, mor, dandiyoon, ghore, khage, palpet, and chodi, catch by the people. Then the total production (kg), total home consumption (kg), net production, fisheries price (Rs/kg) and the market value of the fish is calculated. We also estimated the income generated by fishing currently, five and ten years ago, and lastly, calculated the selling cost (cleaning cost, transportation cost and storage cost) of fish when fishermen catch the fish and sale in the market.

4.4.2 Size (ft), Ownership and Age of the Boat

The first explanatory variable is the size of boat (ft) and its sign is (**BS)**. As in the fishing the size of boat (ft) is the main component for catching the fish. These variables are captured in the form of that what is the size of boat, which size of boat that is commonly used for fish catching and ownership of boat shown in equation by sign of **(OB)** and whether it is owned and rented. The dummy variables are used for the estimation of ownership of boat. The rented boat is showed by 1 and owned by 0. The age of boat is estimated to find the age of boat that larger boat may help the fishermen to catch more fish per trip. Therefore the expected sign of boat is positive and in equations it is shown by (**AB)**.

4.4.3 Quality of Net

The net is used to catch the fish in the sea. The net is captured as quality of net, which is used in fishing that whether it is legal or illegal and did the type of net effect for the production of fish catch. In Bhira village the primary data shows that mostly in the village the two types of nets are being used. One is mukhan and

other is plastic net. These two net are legal and has positive affect in fish catching. For the estimation of type of net we used it as dummy variables such as for mukhan net 1 is used and for plastic net 0 is used as a dummy and sign of type of net in equation is **(TN).**

4.4.4 Recurring Cost of Diesel

The recurring costs are those costs which the fishermen have to bear in every fishing trip. The cost of trip was estimated by the valuation of recurring cost. The cost of inputs is in the form of diesel, fuel, net repair, boat maintenance and ice are included in recurring cost. In this recurring cost of diesel is very important for the fish catch. Its sign for the estimation in equation is **(RC)** and its unit of measurement is in rupees (RS).Then we will compare the recuing cost of diesel currently, five years ago and ten years ago.

4.4.5 Number of Fisherman on Boat and Number of Hours per Trip

The independent variable number of fishermen on the boat indicates that how many people goes on the boat for the fishing and for how many hours they spend in the sea. Then we also compare this with 5 years ago and ten years ago to see the result that how many people goes for fishing now, 5 and ten years ago. The number of fishermen on boat sign is **(FM)** and number of hours per trip is shown by **(NHTP).**

4.5 Poverty Estimation

Poverty is stated that if one state who lack of necessities or desirable ingredients especially, the lack of food, clothing and sheltering. It has been associated with low level of skills and education, poor health, high rates of descriptive or disorderly behavior and an inability or an unwillingness to work. Poverty is defined as, whether households or individuals have enough resources or abilities today to meet their needs, inequality in the distributions of income, consumption or other attributes across the population (World Bank 2012).

According to Amartya Sen (2007), "Poverty is a state of deprivation of several capabilities that the poor face simultaneously". It is a general agreed upon by the poverty theorists and economists that poverty is a multidimensional phenomenon those falling below the poverty line experience multiple deprivations. Poor households are often uneducated have poor, lack productive economic assets and experience inferior living conditions.

Three following methods are most commonly used for the measurement of poverty, 1) Incidence of poverty (Headcount Index), 2) Depth of Poverty (Poverty Gap), 3) Severity of Poverty (Squared Poverty Gap). All these three are briefly describe in the following.

4.5.1 Head count index

The head count index estimate the ratio of the people who are poor. This index is used commonly for measuring the poverty; the reason is that because it is very easy to calculate but this index does not tell us about the depth and severity of poverty. The most common index is head count index to measure the poverty. It simply tells the ratio that is considered as poor. We can write the formula as

$$\boldsymbol{FGT_0 = H/N}$$

Where

FGT_0: Head count index

N: people in the economy

H: number of poor

4.5.2 Poverty Gap

This provides information regarding how far off households are from the poverty line. This measure captures the mean aggregate income or consumption shortfall relative to the poverty line across the whole population. It is obtained by adding

up all the shortfalls of the poor (considering the non-poor having a shortfall of zero) and dividing the total by the population. Put differently, it gives the total resources needed to bring all the poor to the level of the poverty line (divided by the number of individuals in the population). This measure can also be used for non-monetary indicators, provided that the measure of the distance is meaningful.

World Bank (2012) define the poverty gap in this term, "Poverty gap is the mean shortfall from the poverty line (counting the number poor as having zero shortfall), expressed as a percentage of the poverty line. This measure reflects the depth of poverty as well as its incidence". It is necessary to understand what is poverty line? Poverty line is defined as, "A minimum income level used as an official standard for determining the proportion of a population living in poverty".

The poverty gap in education could be the 'number of years of education missing to reach the defined threshold'. In some cases, though, the measure does not make sense nor is not quantifiable (e.g. when indicators are binary, such as literacy, in which case only the concept of the headcount can be used). The poverty gap can be used as a measure of the 'minimum amount of resources necessary to eradicate poverty', that is, the amount that one would have to transfer to the poor under perfect targeting (i.e. each poor getting exactly the amount he/she needs to be lifted out of poverty) to bring them all out of poverty. Poverty gap is measured by this formula

$$FGT_1 = 1/N \sum_{i=\alpha}^{H} (Z - \frac{Y_i}{Z})$$

Where α =1

Where FGT_1 is poverty gap, H, number of poor **N** is size of sample; **Z** is the poverty line and **Yi** individual income.

4.5.3 Severity of Poverty

This takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor. That is, a higher weight is placed on those households who are further away from the poverty line. The formula of the poverty severity is following below

Where

α =2

$$FGT_2 = 1/N \sum_{i=\alpha}^{H} (Z - \frac{Y_i}{Z})^2$$

Chapter 5: Descriptive Analysis

The descriptive analysis describe, quantative the main characteristics of data. The descriptive analysis also presents the data in the form of ratio, percentages, tables, charts and graphs. It also measures the central tendency such as average, mean, mode and median. All of the explanatory variables such as qualities of boat and net, recurring cost, Patti system, and household expenditures are plotted in the form of their frequencies distribution and cross tabulation, graph, percentage and ratio for the interpretation that how the economic valuation of fish are dependent on these variable.

5.1 Data Descriptive

The primary data is used in this study. The total sample size is 110. The frequencies of the data are explained below.

Table: 5.1: Work Status of Population

Work status	Frequency	Percent	Valid percent	Cumulative percent
Labor	84	76.4	76.4	76.4
Fishermen	24	21.8	21.8	98.2
Others	**2**	**1.8**	**1.8**	**100.0**
Total	**110**	**100**	**100**	

The table 5.1 estimate that from 110 people 84 are labor, 24 are fishermen, and 2 are evolves in other work. The percentage is that 76.4 percent are labor and 21.8 are fishermen and 1.8 is others. So it indicates that mostly people are labor in the village and they depend for fishing for their livelihood.

Table 5.2: Fish species

Fish species	Frequency	Percent	Valid percent	Cumulative percent
Shrimp	96	24.4	24.4	24.4
Loor	1	3	3	24.6
Mor	66	16.8	16.8	41.6
Mukhansh	86	21.8	21.8	63.2
Ghore	1	0.3	0.3	63.5
Palpet	74	18.8	18.8	82.2
Chodi	70	17.8	17.8	100.0
Total	394	100.0	100.0	

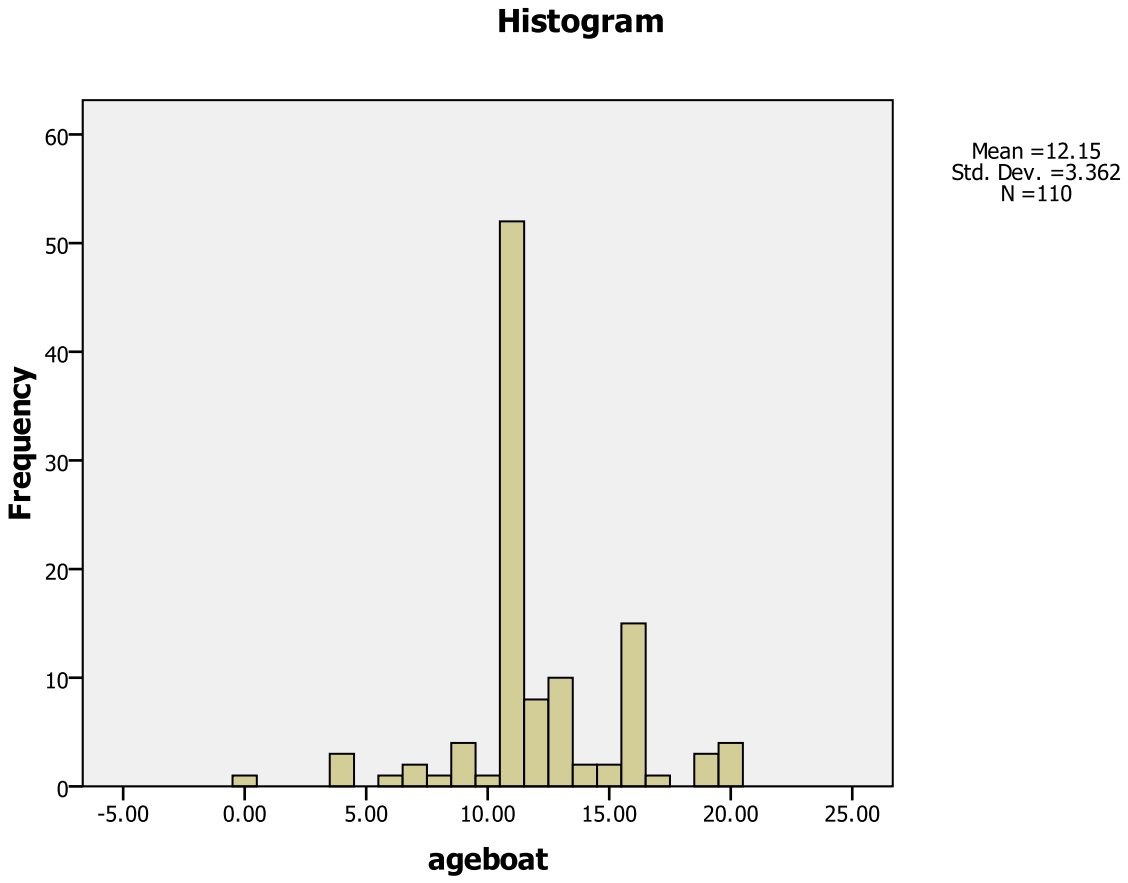
The table constructs the frequency of fish species catch by the local communities in the village that are shrimp, Loor, Mor, Mukhansh, Ghore, Paplet and Chodi. From the total sample size the percentage of fish species catch by people is 17.4% shrimp, 0.2% Loor, 12% Mor, 15.6% Mukhansh, 0.2% Ghore, 13.4% Palpet and 12.9% Chodi.

Table 5.3 Size of Boat:

Boat size(ft)	Frequency	Percent	Valid percent	Cumulative percent
18	22	12.0	12.0	20.0
20	2	1.8	1.8	21.8
21	3	2.7	2.7	24.5
22	23	20.9	20.9	45.5
23	1	0.9	0.9	46.6
24	21	19.1	19.1	65.5
28	18	16.4	16.4	81.8
30	4	3.6	3.6	85.8
33	16	14.5	14.5	100
Total	110	100	100	

The table calculates that mostly 22ft of boat is used for the fish catching with the frequency of 23 and percent of 20.9 while the mean of boat size is 24.4.

Graph: 5.2: Age of the Boat



The graph shows that mean of boat age is 12.15 and minimum age is 4, maximum is 20. The higher frequency of boat age is 11 with percent of 28.8

Table 5.4: Diesel cost

Diesel cost(Rs)	Frequency	Percent	Valid percent	Cumulative percent
5000	1	0.9	0.9	0.9
6000	1	0.9	0.9	1.8
8000	17	15.5	15.5	17.3
9000	3	2.7	2.7	20.0
9500	1	0.9	0.9	20.1
10000	21	19.1	19.1	40.0
12000	20	18.2	18.2	58.2
13000	1	0.9	0.9	59.1
16000	1	0.9	0.9	60.0
18000	1	0.9	0.9	60.9
19000	10	9.1	9.1	70.0
20000	20	18.2	18.2	88.2
22000	1	0.9	0.9	89.1
24000	12	10.9	10.9	100
Total	110	100.0	100.0	

The table estimates the recurring cost of diesel. The maximum cost of diesel that is used for fish catching is 24000, while the minimum cost is 5000.The highest frequency of cost is 10,000 and minimum frequency is 5000, 6000, 9500,13000,16000,18000 and 22000.

Table 5.5: Number of Fishermen on the Boat

No of fishermen	Frequency	Percent	Valid percent	Cumulative percent
4	25	22.7	22.7	22.7
5	2	1.8	1.8	24.5
6	8	7.3	7.3	31.8
7	2	1.8	1.8	33.6
8	22	20.0	20.0	53.6
10	20	18.2	18.2	71.8
11	31	28.2	28.2	100.0
Total	110	100	100	

The table constructs the frequency distribution of number of fishermen on boat. The maximum numbers of fishermen on boat are 11 with the frequency of 31 and

percentage of 28.2. However the minimum numbers of fishermen on boat are 5 and 7 with the percent of 1.1.

Table: 5.6: Type of Net

Type of net	**Frequency**	**Percent**	**Valid percent**	**Cumulative percent**
Plastic net	71	64.5	64.5	64.5
Mukhan	39	35.5	35.5	100.0
Total	110	100	100	

The table illustrates the frequency distribution of type of net used for fish catching. The table shows that two types of nets are used for fishing one is used for plastic and other is used for Mukhan. The plastic net frequency is higher than mukhan. Percent of plastic net is 38.8 and mukhan percent is 21.3.

Table: 5.7: Ownership of Boat

Type of boat	Frequency	Percent	Valid percent	Cumulative percent
Own	106	96.4	96.4	96.4
Rented	4	3.6	3.6	100
Total	110	100	100	

The table analyzed the frequency distribution of type of boat. The table showed that only two type of boat are used for fish catching, one is rented and other is own. The frequency of own boat is greater than rented boat with percent of 57.9 and 2.2 respectively.

Table 5.8: Cross Tabulation of Principle Means of Livelihood and Work Status

Principle Means of Livelihood	Work status			
	Labor	**Fishermen**	**Other**	**Total**
Boat labor	84	0	0	84
Boat owner	0	24	0	24
Other	0	0	2	2
Total	84	24	2	110

The table explains the cross tabulation between principle means of livelihood and work status of people. Work status is on row wise and principle means of livelihood is on column wise. The cross tabulation of work status and principle means of livelihood estimate that 84 people work status is labor 24 has fishermen and 2 are other.

Table: 5.9: Cross Tabulation of Boat size and Ownership of Boat

Boat size (ft)	Own	Rented	Total
18	**21**	**1**	**22**
20	**2**	**0**	**2**
21	**2**	**1**	**3**
22	**23**	**0**	**23**
23	**1**	**0**	**1**
24	**21**	**0**	**21**
28	**18**	**0**	**18**
30	**4**	**0**	**4**
33	**14**	**2**	**16**
Total	106	4	110

The table demonstrates the cross tabulation of boat size and type of boat. The result explain the cross tabulation of size of boat and ownership of boat that boat size varies on 18ft, 20ft, 21ft, 22ft, 23ft, 24ft, 28ft, 30ft and 33ft. The table shows that mostly owned boats are used for fish catch in village.

Table: 5.10: Cross tabulation of Different Fish Species (Shrimp, Loor, Mukhansh, Paplet and Chodi) and their Net production

Net Production (kg)	Shrimp	Net Production(kg)	Loor	Net Production(kg)	Mukhansh	Net Production(kg)	Paplet	Net Production(kg)	Chodi
45—60	4	20—35	1	20--35	2	20--35	1	50--70	11
61—75	4	36—50	1	36--50	1	36--50	2	70--90	3
76—90	29	51—65	2	51--65	2	51--65	6	91--110	19
91—105	28	66—80	9	66--80	8	66--80	16	111--130	2
106—120	17	81—95	18	81--95	20	81--95	16	131--150	2
121—135	3	96—110	19	96--110	15	96--110	19	151--170	3
136—150	5	111—125	2	111--125	10	111--125	6	171--190	18
151—165	0	126—140	6	126---140	5	126--140	3	191--210	5
166—180	0	141—155	4	141--155	11	141--155	2	211--230	1
181—195	5	156—170	0	156--170	0	156--170	1	231--250	3
196—210	1	171—185	0	171--185	2	171--185	1	251--270	0
		186—200	2	186--200	9	186--200	1	271--209	3
Total	96	Total	64	Total	86	Total	74	Total	70

This table demonstrates the cross tabulation of different fish species and their net production (kg). The result compute that largest amount of shrimp net production (kg) is between rang of 76kg to 90kg and this is catch by 29 fishermen. The lowest amount is 196kg to 210 kg which is catch by only one person. The cross tabulation of loor fish species and its net production show that highest amount of net production is between the range 96kg to 110kg that catch by 19 fishermen and the lowest amount is between the range of 20kg to 50kg. The cross tabulation of Mukhansh and its net production estimate that maximum range of Mukhansh fish net production is from 81kg to 95kg. Its amount of catch is 20 times. However from 96kg to 110kg the production is also 15 times. The lowest range of production is from 36kg to 50kg that is catch by only one person. The table also derives the cross tabulation of net production of Paplet fish. The results find that the largest amount of production is from a range of 96kg to 110kg. In this range the 19 time Paplet was caught. The lowest amount of production is only one time that is between 20kg to 35kg,156kg to 170kg,171kgto 185kg, and 186kg to

200kg. The cross tabulation of fish chodi and its net production explain that from 110 primary data 70 people catch chodi fish by fishing .Its highest amount of net production is from 91kg to 110kg which is catch by 19 people and lowest amount of production is 211kg to 230kg which frequency is only.

Table: 5.11: Cross Tabulation of Type of Net and Boat size

Boat Size(ft)	Type of Net		
	Plastic net	Makhan	Total
18	17	5	22
20	0	2	2
21	3	0	3
22	18	5	23
23	0	1	1
24	13	8	21
28	17	1	18
30	2	2	4
33	1	15	16
Total	71	39	110

The table demonstrate about the cross tabulation between boat size and type of net use for fishing. From seven types of nets only two type of net are being used in the village which are plastic net and Mukhan. In 110 data 71 people use plastic net while only 39 people use Mukhan net. This shows that plastic net was use commonly. The boat size is also different from 18ft to 33ft are in use. In the 22ft size of boat the plastic net is use largely as by 18 people. The minimum use of plastic is in boat size of 33ft. Mukhan net is use highly in the boat size of 33ft.

Table 5.12: Situation of Mangroves Plant and the Use of Plants

Use of plant	Avicennia marina	Rhiphoroas mucronata	Ceriops tagal
Fodder	110	78	67
Fire wood	106	73	44
For sale	0	4	2
Fence	1	34	8
Framing of roof	5	83	94
Honey	0	14	32
Other	2	26	93

The table illustrates the type of plant and the use of plant for fodder, firewood, for sale, fence, framing of roof and honey. The result finds that according to respondents, the Avicennia marina plant is used mostly for fodder of animal and less use for making of fence. It is not use for honey and other. The plant Rhiphoroas mucronata is use mostly for making the framing of roof and then fire wood and fodder. However less use of this plant is for the sale. The plant Ceriops tagal is usually used for framing of roof and other purpose and also for the fodder of animal

Table: 5.13: Type of Plant and Services Provided by Mangrove

Services of mangrove	Avicennia marina	Rhiphoras mucronata	Ceriops tagal
Thick	82	2	9
Storm protection	104	20	14
Breeding ground for shrimp	36	84	7
Purification of water	4	92	21
Flood protection	108	32	91
Carbon sequestration	3	10	93
Other	2	4	73

The tables show the type of plants and the services provided by these mangrove plants. The result shows that Avicennia marina plant of mangrove mostly provide the services of flood protection and then the storm protection. It also provides the services of other and purification of water very often. The plant Rhiphoroas mucronata is mostly provide the services for the purification of water and breeding ground of shrimp and fewer amounts provide services for the thickness. The plants Ceriops tagal provide the service of carbon sequestration and flood protection at large amount while it is also provide many other services. This plant also provides a service of breeding ground for shrimp.

5.2 Analysis and Income Distribution

In the fishing the most common trend is the Patti system or sharing arrangement. Simply, we can say that it is the partnership in fishing. This can be defined as the system in which five to ten people take the boat together for fishing as partner,

and bear the cost of trip. Then the net income derived from the fishing trip is divided by all the members according to their percentage of sharing. This variable is calculated in the form of that the number of fishermen on the boat, duration of fishing trip, average number of fishing trip in a month, estimated cost of trip and sharing arrangement. The sharing arrangement is captured as the number of sharing persons in the boat, share of boat owner, boat captain, boat labors and some other special share. By this we can calculate the percentage that what how many percent of net income goes to boat owner, boat labor and boat captain. The sharing of income distribution estimates the Patti system. Patti system means that when 8 to 10 people take the boat for the fishing as partner, then the cost of trip is bear to the entire sharing person and net income derived from the production of fish catches is also divided in to the sharing person. The main share of income is mostly divided into share of labor, share of owner and share of boat captain. The frequency distribution of share of labor, share of income and share of boat labor is given below:

Table: 5.2.1: Frequency Distribution of Share of Boat Owner

Income (Rs)	Frequency	Percent	Valid percent	Cumulative percent
1<(35000)	31	28.2	28.2	28.2
2(35001—50000)	54	49.1	49.1	77.3
3(50001—75000)	23	20.9	20.9	98.2
4>(75000)	2	1.8	1.8	100.0
Total	110	100.0	100.0	

The table illustrated the frequency distribution of share of boat owner. The result showed that the mean of share of boat owner is 41859.09, maximum is 84500 and minimum value is 24000Rs. The highest frequency of the share of boat owner is between (35001—50000) Rs with 49.1 percent. While minimum frequencies of share of boat owner are above 75000Rs with 1.8 percent.

Table: 5.2.2: Frequency Distribution of Share of Boat Captain

Income(Rs)	Frequency	Percent	Valid percent	Cumulative percent
1<(15000)	64	58.2	58.2	58.2
2(15001—25000)	32	29.1	29.1	87.3
3(25001—50000)	8	7.3	7.3	94.5
4> 50000	6	5.5	5.5	100.0
Total	110	100.0	100.0	49.1

The table interprets the share of boat captain that the mean value of boat captain is 18260.37, maximum value is 61500Rs and minimum value is 10000Rs. Less than 15000Rs values have largest frequency with the percent of 58.2. However the minimum frequencies of share of boat captain are greater than 50000Rs with of 5.5 percent.

Table: 5.2.3: Frequency Distribution Share of Boat Labor

Share of boat labor(Rs)	Frequency	Percent	Valid percent	Cumulative percent
1<(3000)	50	45.5	45.5	45.5
2(3001—4500)	31	28.2	28.2	73.6
3(4501—6000)	16	14.5	14.5	88.2
4>6000	13	11.8	11.8	100
Total	110	100	100	

The table illustrated the frequency distribution of share of boat labor. The result shows that the mean of share of boat labor is 3723.91, maximum is 6666Rs and minimum value is 2400Rs. The highest frequency of the share of boat labor is less than 3000Rs with 45.5 percent. While minimum frequency of share of boat labors is greater than 6000Rs with percentage of 11.8 percent.

Table: 5.2.4: Cross Tabulation of Share of Boat Owner and Captain

Owner income(RS)	Captain income(Rs)				
	1<(15000)	2(15001--25000)	3(25001--50000)	4>(50000)	Total
1<35000	29	2	0	0	31
2(35001—50000)	35	18	1	0	54
3(50001—75001)	0	11	7	5	23
4>(75000)	0	1	0	1	2
Total	64	32	8	6	110

The table illustrate the cross tabulation of boat owner income and captain income in sharing system. The result reveals that share of captain is higher in 1(<15000) Rs. The share of boat owner is (35001---50000) rupees.

Table: 5.2.5: Cross Tabulation of Boat Owner and Labor

Owner income(Rs)	Labor income(Rs)				
	1<(3000)	2(3001—4500)	3(4501—6000)	4>(6000)	Total
1<(35000)	13	6	11	1	31
2(35001—50000)	31	20	0	3	54
3(50001—75000)	6	5	5	7	23
4>(75000)	0	0	0	2	2
Total	50	31	16	13	110

The table indicates that labor is getting income from2400Rs to 6666Rs values which higher percentage of values is <3000Rs. It means that major share of labor lies in less than3000Rs .while the owner share is more between the value(35001---50000) rupees.

Table: 5.2.6: Cross Tabulation of Share of Boat Captain and Labor

Captain income(Rs)	Labor income(Rs)				
	1<(3000)	2(3001—4500)	3(4501—6000)	4>(6000)	Total
1<(15000)	44	7	11	2	64
2(15001—25000)	0	24	5	3	32
3(25001—50000)	6	0	0	2	8
4>50000	0	0	0	6	6
Total	50	31	16	13	110

The cross tabulation of boat captain and boat labor reflects that labor share is from less than 3000 to greater than 6000Rs. The boat captain income is from <15000 to >50000. The share of boat captain percentage is high in the values of >15000Rs and boat labor share is more in <3000Rs income.

Table: 5.3: Descriptive Statistics of Production of Fish (current, 5 and 10 years ago)

Variable	Current				5 years ago				10 year ago			
	Model (linear)		Model(log linear)		Model (linear)		Model (log linear)		Model (linear)		Model (log linear)	
	Mean	Std deviation	Mean	Std deviation	Mean	Std deviation	Mean	Std deviation	Mean	Std deviation	Mean	Std deviation
Constant	104.40	52.344	4.5310	0.58904	156.87	73.150	4.9506	.57557	246.02	101.667	5.4321	0.51276
Boat size	24.35	4.928	3.1665	0.19888	24.36	4.944	3.1666	0.19959	24.58	4.991	3.177	0.20141
Ownership of Boat	0.04	0.189	0.04	0.191	0.04	0.191	0.04	0.194	0.04	0.200	0.04	0.203
Net type	1.70	0.957	1.70	0.958	1.66	0.945	1.66	0.945	1.62	.929	1.60	0.920
Boat age	12.1370	3.37603	2.4690	0.28975	7.4151	2.97247	1.9375	0.41862	2.8557	2.67702	.6953	0.83887
Diesel cost	14426.61	5666.187	9.4949	.40246	7559.43	3018.223	8.8344	0.47222	4055.76	1857.011	8.2018	0.49467
Numberof fishermen	8.06	2.724	2.0127	0.39621	8.13	2.705	2.0242	0.39208	8.32	2.714	2.0498	0.39272
Hours/trip	21.07	5.721	3.0383	0.27173	11.52	2.812	2.4504	0.17288	6.974	2.1703	1.9295	0.27412
N	109	109	106	106	106	106	103	103	97	97	94	94

The descriptive analysis estimate Mean and std. deviation of the production of fish , boat size, ownership of boat, age of boat, type of net, number of hours per trip, recurring cost of diesel, and number of fishermen on boat . The mean value of production of fish catch is 104.40 kg.

The mean value of boat size is 24.35ft, 24.36ft and24.58ft currently, 5 and ten years ago respectively. The result indicates that the size of boat is same currently and ten years ago.

The mean value of number of hours per trip is 21.07 means currently, 11.52 means value 5 years ago and 6.974 mean value ten years ago which estimate that 5 and 10 years ago they went for few hours and catch more fish as compared to currently. The mean value of ownership of boat is 0.04 in all three cases depicts that mostly own boat is used for the average production of the fish catch currently, 5 and 10 years ago. However the age of boat is 12.13 years currently, 7.4 5 years ago and 2.8 years ago ten years ago. It means that larger the age of boat less will be production. The mean value of type of net showing that mostly plastic net is used for the production of fish catch currently and before ten years.

Lastly the mean value of number of fishermen on boat is 8 currently 5 years and ten years ago. However the mean value of fuel cost showing that the average fuel cost of diesel is 14426.61 currently is higher than 5 years and ten years ago. It means that usually 8 person went on boat for the fish catch.

Chapter 6: Result and Discussion

6.1 Determinants of Fish Catches (kg)

We estimate fish catch/production by applying the OLS techniques to estimate the production function. Three models are estimated, one is production of fish, for current catch, second is for the fish catch poverty five years ago and the third is for the fish catch 10 years ago. Poverty analysis is in the next section.

Table: 6.1: Estimation Result of Production/Catch of Fish (current, 5 and 10 years ago)

Variable	Current		5 years ago		10 years ago	
	Model(linear)	Model (log)	Model(linear)	Model(log)	Model(linear)	Model(log)
	Coefficient (t statistics)	Coefficient (t statistics)	Coefficient (t statistics)	Coefficient (t statistics)	Coefficient (t statistics)	Coefficient (t statistics)
Constant	-53.950 (1.633)	-5.539 (-4.351)	-14.574 (-0.281)	-2.286 (-1.679)	-63.959 (-0.726)	-0.0670 (-0.381)
Boat size	-0.15 6 (-0.154)	0.275 (1.104)	1.988 (1.281)	0.553 (1.983)**	5.914 (2.345)*	0.548 (1.616)
Ownership of boat	37.629 (1.860)**	-0.500 (-2.449)*	27.676 (0.890)	0.317 (1.384)	69.183 (1.593)**	0.419 (1.795)*
Type of net	-4.274 (0.960)	-0.161 (-3.399)*	-24.996 (-3.864)*	-0.273 (-5.520)*	-31.929 (-2.818)*	-0.244 (-3.787)*
Hours / trip	3.601 (4.854)*	0.422 (2.587)*	5.112 (2.385)*	0.067 (0.255)	19.866 (3.955)*	0.324 (1.515)**
Diesel cost	0.004 (6.414)*	0.733 (7.251)*	0.013 (6.537)*	0.579 (6.272)*	0.030 (5.743)*	0.501 (4.622)*
Fishermen number	3.240 (1.907)**	0.239 (2.022)*	-1.248 (0.481)	0.059 (0.444)	-5.904 (-1.500)**	-0.013 (-0.087)
Age of boat	0.220 (0.183)	0.296 (2.059)*	2.679 (1.301)	0.275 (2.541)*	0.763 (0.191)	0.036 (0.498)
R^2	0.493	0.592	0.413	0.477	0.389	0.311
AdjustedR^2	0.458	0.563	0.37	0.438	0.341	0.255
F test	14.035	20.344	9.849	12.355	8.107	5.538
N	109	106	106	103	97	94

Notes: value in parentheses denotes underlying student t value (The t statistic, significant at 5% and 10%. Level of signifance are indicated by *and **respectively).

The table indicates the estimation of fish catch, currently, 5 years ago and 10 years ago in linear and logarithm form. The table depicts that in linear model the boat size of current production showing the negative relationship with the production of fish. The t value is -0.156 means that if the boat size (ft) is increases 1ft, then the production of fish catch decreases by –0.15 percent. However its t-statistics value is insignificant. While the boat size (ft) of ten years ago is also significant and positive relation, but the t- statistic value 5 years ago is negative and highly insignificant. The second variable is the ownership of boat shows positive relation with fish catch. If the coefficient value of ownership of boat is 1.860 increases by one ft then the production of fish also increases by 1.86 percent and its t- statistic value is significant. While the coefficient values of type of boat in 5 and 10 years ago are positive but the t-statistics value of 5 years ago is insignificant.

The coefficient value of type of net in linear model indicates negative relation currently, 5 years ago and ten years ago. The t-statistic value of type of net currently is highly insignificant or statistically zero, however its value is highly significant in 5 and 10 years ago. The variable number of hours per trip showing the positive relation currently 5 years ago and ten years ago. Currently the coefficient value of no of hours per trip is 4.854 means that if the number of hours per trip increases by 1 feet then the production of fish catch also increases by 4.85 percent and all its t statistic value is also highly significant. The explanatory variable diesel cost has positive relation and is highly significant in all three cases. In logarithm model, the estimated result show that the boat size is positive in all three cases. The coefficient value of ownership of boat has negative relation with current production of fish catch and its t- statistic value is also highly significant. It is also highly significant 10 years ago. The type of net has also negative relation in all three cases and its t- statistically value is also highly significant. The independent variable diesel cost has positive relation with the dependent variable

and highly significant in all three cases. The number of fishermen coefficient is showing positive relation production of fish, currently and five years ago while it has negative relation ten years ago. Its t- statistics values is highly significant in current production and statically zero in 5 and 10 years ago. Lastly the age of the boat in logarithm model is showing positive relation in all the cases while it is highly significant in current production and 5 years ago. The R^2 values of linear model showing that our independent variables i.e 49 percent currently, 41 percent 5 years ago and 38 percent ten years ago are explaining our dependent variable. However the F test value showing the goodness of fit in the model .Its value is highly significant in model of current production/catch of fish.

6.2 Poverty Analysis

Poverty is stated that if one state who lack of necessities or desirable ingredients especially, the lack of food, clothing and sheltering. It has been associated with low level of skills and education, poor health, high rates of descriptive or disorderly behavior and an inability or an unwillingness to work. Poverty is defined as, whether households or individuals have enough resources or abilities today to meet their needs, inequality in the distributions of income, consumption or other attributes across the population (World Bank 2012).

Three following methods are most commonly used for the measurement of poverty, 1) Incidence of poverty (Headcount Index), 2) Depth of Poverty (Poverty Gap), 3) Poverty Severity (Squared Poverty Gap). All these three are briefly describe in the following.

To measure the poverty level in the village first we assumed that the person whose income is less than 1745Rs is considered below the poverty line. Then we calculate it in two ways. First, we calculate the poverty level simply with household size. In second method we calculate it with the adult adjustment. In adult adjustment method we assumed that the person whose age is equal to or greater than 18 is considered 1 while the person whose age is less than 18 is considered as 0.8.

6.2.1 Head Count Index

The head count index (P0) estimate the ratio of the people who are poor. This index is use commonly for measuring the poverty; the reason is that because it is very easy to calculate but this index does not tell us the quantity that how the poor are poor. The most common index is head count index to measure the poverty. It simply tells the ratio that is considered as poor. The estimation result are given below

Table: 6.2: Estimate of Poverty: Head Count (Based on Family size)

	Frequency	Percent	Valid percent	Cumulative percent
0.00	40	36.4	36.4	36.4
1.00	70	63.4	63.4	100.0
Total	110	100.0	100.0	
Where 1=<1745Rs(per month) and 0= all other values				

The table estimate the head count index of poverty in the Bhira village. The result indicates that in the village there are 63.4 percent peoples are living below the poverty level. And 36.4 percent people are not poor. It reveals that the population dependent on fishing is poor and the proportion is expected to rise.

Table: 6.3: Estimate of Poverty: Head Count (Based on Adult Equivalent Scale)

	Frequency	Percent	Valid percent	Cumulative percent
0.00	49	44.5	44.5	44.5
1.00	61	55.5	55.5	100.0
Total	110	100.0	100.0	
Where 1= < 1745Rs(per month) and 0 = all other values				

The frequency distribution of adult poverty estimates that with adult adjustment the poverty level is that 44.5 percent people are not poor while 55.5 percent people are less than poverty line. So the result depicts that with adult adjustment the level of poverty decrease.

6.2.2 Poverty Gap

This provides information regarding how far off households are from the poverty line. This measure captures the mean aggregate income or consumption shortfall relative to the poverty line across the whole population. It is obtained by adding up all the shortfalls of the poor (considering the non-poor having a shortfall of zero) and dividing the total by the population. Put differently, it gives the total resources needed to bring all the poor to the level of the poverty line (divided by the number of individuals in the population). This measure can also be used for non-monetary indicators, provided that the measure of the distance is meaningful. The estimated value of poverty gap is 0.002919 and for the adult poverty the value is –0.01615. This means that in the village the poverty gap is statically non zero and also in adult poverty gaps the negative value showing fall in poverty gap.

6.2.3 Severity of Poverty

This takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor. That is, a higher weight is placed on those households who are further away from the poverty line. As for the poverty gap measure, limitations apply to some non-monetary indicators. The result of poverty severity showing the value that for poverty is 0.056119 and for the adult adjustment the poverty severity is 0.065359.

Chapter 7: Conclusions and Policy Implications

7.1 Conclusion

The study in hand estimates the impact of mangrove ecosystem in poverty reduction of village Bhira. The main objective of the study is to find the economic value of mangrove ecosystem in terms of fish catch and also to measure the poverty level in the village. The mangrove ecosystem has key role in livelihood of people not only in term of fishing but it also provide many other services to the local community. Many aquatic organisms depend on the mangrove ecosystem for their life. As it provide nurseries for them. In Pakistan 100 species of fish live in mangrove forest in which 46 species depend on these forest for youngest age and 56 species rely on mangrove in the adult age. The reason is that mangrove ecosystem provides breeding ground for shrimp and many organisms uses the nutrients for their food present in the mangrove forest. Besides the fishing it also provides many other services to the local communities. Such as they use mangroves as fodder for the animal, making for fence and framing of roof and also use the mangrove plant for firewood. It also acts as a buffer for the storm protection, flood protection, carbon sequestration and for the purification of water. For estimation we calculated the production of fish currently and then compare it to the production of fish 5 and ten years ago. The result reveals that the mean production (kg) is 104.40kg, while the mean production (kg) five and ten years ago are 156.87kg and 246.02 kg respectively. It indicates the decline in the quantity of fish catch currently and 5 and 10 years ago.

However the results also show that ten years ago the community used to catch more fish as compare to current production. The estimation results related to the situation of mangrove ecosystem also indicate that ten years ago the mangrove forests was improved in the village but currently they are being deteriorated. So it means that if the mangrove ecosystem in village remain sustain then the quantity of fish catch also increased and if the mangrove forests degrade then automatically the production of fish decrease. So the study shows the direct

relation of mangrove with the production of fish. The study also analyzed that with the degradation of mangrove forests the production of fish (kg) also decreased which ultimately increase in poverty level in the village. The current poverty level of Bhira village is 63.4 percent. It means that 63.4 percent of population is living below the poverty line. This reflects the indirect relation of mangrove with poverty level. Thus, we can say that if the quality of the mangroves keeps deteriorating, the poverty in the village will rise and the population of the village should be looking for alternative sources of livelihood.

7.2 Policy Implication

The following implication should be taken for the sustainability of mangrove ecosystem

1. Environmental knowledge, appropriate management, good strategy and research in the mangrove ecosystem can also help to sustain and save this exclusive ecosystem.
2. In order to ensure sustained growth of mangrove, it is imperative that awareness about benefits of these plants should be created among the people. Non Govt organizations can play a crucial role by forming community based organizations.
3. The quality of mangrove should be improved.
4. Alternative sources of income should be provided to the villagers to improve the mangrove forests.
5. Due to non existence of formal market price of mangrove the study recommends further research on the issue and formation of markets in the coastal area.
6. In order to attain the maximum value of mangrove it was observed that examined area has a great potential attracting both national and international tourists. Therefore the study recommends formalizing institutions for the development of tourism in the area.

Appendix A

Table 1: Cross Tabulation of Ownership of Boat and number of Hours per Trip

Hours/trip	Type of Boat		
	Owned	Rented	Total
10	5	0	5
12	6	0	6
14	3	0	3
15	2	0	2
16	3	0	3
17	9	2	11
18	1	0	1
20	8	0	8
24	5	0	5
26	15	2	17
29	1	0	1
30	2	0	2
Total	106	4	110

Table 2: Cross Tabulation of Ownership of Boat and Diesel cost

Diesel cost(Rs)	Type of boat		
	Owned	Rented	Total
1(5000)	1	0	1
2(5001—10000)	40	3	43
3(10001—15000)	20	1	21
4(15001—20000)	32	0	32
5>(20000)	13	0	13
Total	106	4	110

Table 3: Cross Tabulation of Boat size and Fish Catch by People

Fish catch(kg)	Boat Size(ft)									
	18	20	21	22	23	24	28	30	33	Total
0	0	0	0	0	0	0	1	0	1	2
25	0	1	0	1	0	0	1	0	0	3
30	2	0	0	3	1	0	0	1	5	12
32	0	0	0	0	0	0	1	0	0	1
35	3	0	0	0	0	0	0	1	0	4
38	0	0	0	1	0	1	0	0	0	1
40	0	1	0	0	0	0	0	0	0	2
80	0	0	0	1	0	0	0	1	0	2
90	0	0	0	0	0	0	0	1	0	1
100	10	0	2	1	0	4	14	0	0	31
110	0	0	0	14	0	1	1	0	0	16
120	3	0	1	2	0	0	0	0	0	6
125	0	0	0	0	0	0	0	0	7	7
130	4	0	0	0	0	0	0	0	2	6
200	0	0	0	0	0	15	0	0	1	16
Total	22	2	3	23	1	21	18	4	16	110

Table 4: Cross Tabulation of Diesel and Recurring Cost

Recurring cost(Rs)	Diesel(input)	Total
5000	1	1
6000	1	1
8000	17	17
9000	3	3
9500	1	1
10000	21	21
12000	20	20
13000	1	1
16000	1	1
18000	1	1
19000	10	10
20000	20	20
22000	1	1
24000	12	12
Total	110	110

Table 5: Cross Tabulation of Recurring Cost and Net Repair

Recurring cost(Rs)	Net repair	Total
200	1	1
1000	29	29
1200	1	1
1500	24	24
2000	3	3
5000	19	19
6000	6	6
6500	15	15
12500	6	6
2300	6	6
Total	110	110

Table 6: Cross Tabulation of Recurring Cost and Boat Maintenance

Recurring cost(Rs)	Boat Maintenance	Total
500	1	1
800	1	1
1000	32	32
1050	1	1
1100	1	1
1500	19	19
2000	2	2
3000	36	36
4000	1	1
5000	3	3
7000	1	1
10000	6	6
13000	6	6
Total	110	110

Table 7: Cross Tabulation of Recurring Cost and Ice

Recurring cost(Rs)	Ice	Total
1000	22	22
1100	1	1
1500	5	5
1700	1	1
2000	18	18
3000	24	24
3300	1	1
3500	1	1
4000	3	3
5000	9	9
Total	85	85

Table 8: Cross Tabulation of Non Recurring Cost and Boat

Non recurring cost(Rs)	Boat	Total
40000	10	10
50000	13	13
55000	1	1
60000	19	19
70000	15	15
80000	2	2
10000	2	2
160000	19	19
175000	6	6
20000	22	22
Total	109	109

Table 9: Cross Tabulation of Nonrecurring Cost and Net

Non recurring cost(Rs)	Net	Total
10000	50	50
11000	1	1
12000	2	2
13000	1	1
17500	1	1
24000	24	24
25000	21	21
30000	6	6
40000	2	2
50000	2	2
Total	110	110

Table10: Cross Tabulation of Nonrecurring Cost and Motor

Non recurring cost(Rs)	Motor	Total
12000	44	44
12600	1	1
13000	1	1
14000	3	3
15000	2	2
16000	1	1
18000	16	16
24000	2	2
33000	6	6
36000	1	1
Total	77	77

Table 11: Cross Tabulation of Non Recurring Cost and Bucket

Non recurring cost(Rs)	Bucket	Total
12000	59	59
13000	1	1
14000	17	17
15000	31	31
16000	1	1
24000	1	1
Total	110	110

Table 12: Cross Tabulation of Boat size and Net Income from Trip

NITP(Rs)	Boat size(ft)									
	18	20	21	22	23	24	28	30	33	Total
48000	12	0	0	0	0	0	0	0	0	12
55000	0	0	0	0	0	0	0	0	9	9
60000	1	0	1	1	0	1	2	0	0	6
64000	0	0	0	0	1	0	0	0	0	1
70000	1	0	0	1	0	0	0	1	0	4
72000	0	0	0	19	0	0	0	0	0	19
76000	0	0	0	1	0	0	0	0	0	1
80000	0	1	1	2	0	5	0	1	1	10
100000	2	0	0	0	0	0	21	0	5	28
108000	0	0	0	0	0	1	0	0	0	1
110000	0	0	0	0	0	12	0	0	0	12
120000	0	0	1	0	0	0	1	0	0	2
150000	0	1	0	1	0	0	0	1	1	4
169000	0	0	0	0	0	0	0	0	1	1
Total	16	2	3	25	1	19	24	3	17	110

Table13: Cross Tabulation of Number of Sharing Person and Boat size

Sharing Person	Boat size(ft)									
	18	20	21	22	23	24	28	30	33	Total
5	2	0	0	0	0	0	0	0	0	2
6	13	2	1	2	0	6	0	0	0	24
7	1	0	0	0	1	0	0	0	0	2
8	0	0	1	2	0	2	2	0	9	16
9	0	0	1	0	0	0	0	1	0	2
10	0	0	0	19	0	0	1	1	0	21
11	0	0	0	1	0	0	0	0	0	1
12	0	0	0	1	0	11	0	1	7	20
13	0	0	0	0	0	0	21	0	1	22
Total	16	2	3	25	1	19	24	3	17	110

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SURVEY ON ECONOMIC VALUATION OF MANGROVE ECOSYSTEM IN BHIRA VILLAGE

Centre for Environmental Economics and Climate Change (CEECC)

Pakistan Institute of Development Economics (PIDE)

A survey is being conducted for the economic valuation of Mangrove ecosystem in Bhira village. The following questions will be mainly concerned about your household income generated by Mangrove Forest and fishing. Please take a few minutes to express your options to improve and conserve Mangrove Forest in your community. Your answers are important for the success of this study. This information and identity of respondent will be kept confidential. The information will only be used for this study and not any other purpose.

Enumerators Only **Date: ……..**

Province: …… **District: ……**

Tehsil: …… **Village: ……**

UC: …….. **Household Code: ……**

Enumerator name: ……

Address: ……..

A. Household Details

1. **Name of the respondent: ……**

2. **Respondent Gender: Female or Male**

3. **Are you the head of the household? Yes/No**

4. **Name of the head of the house hold: …….**

5. **Please fill up the household roster table.**

5. Household Roster

Sr No.	Name of Household members	1. Relation to household Head	2. Gender	3.Age (In Years)	4. Marital Status	5. Years of Education			6. Employment		7.Work Status	8. Principle means of livelihood
						Years	Completed	In School	a) Employed /Unemployed	b) Govt /Private		
	Codes for 1. Head=1, Spouse=2, son/daughter=3, Grandchild=4, Father/Mother=5, Brother/Sister=6, nephew/nice relative=7, other=8		**codes for 2**. Male-1, Female=0		**Codes for 4.** Married=1, Unmarried=0	**Codes for 5**. Completed=1, In stream=0			**Codes for 6.a** Employed=1, Unemployed=0, **6.b** Govt.=1, Private=0		**Codes for 7.** labor=1, Fisherman=2 others =3	**Codes for 8.** Boat labor=1, boat captain=2, boat owner=3, net maker=4, boat maker=5, rental fishermen=6 Other=7

6. Fish Catch (Species), own Consumption and prices

1. Fish Species	2. Production (catch in Kg)	3.Total home consumption (kg)	4. Net Production	5. Fisheries Price (Rs/Kg)	6.Market value (Rs)	7. Income generated by fish catching 10 years ago (Rs)	8. Income generated by fish catching 5 years ago (Rs)	9. Income generated by fish catching currently (Rs)	10.Selling cost		
									A. Cleaning cost	B. Transport cost	C. Storage cost

Codes for 1: Shrimp=1, Loor=2, Mor=3, Dandiyoon=4, Mukhansh=5, Ghore=6, khage=7, Palpet=8, chodi=9, Others=10

7.Qualities of Boats and Nets:

1.Boat size	2.Boat Qualities	3. .Type of Boat	4. When the boat was Bought?	5. Type of net uses for fishing?	6. How far you go for Fishing?			7. No of Hours Per trip			8. Fish catch		
					A Now	**B** 5 yrs **ago**	**C** 10 yrs ago	**A** Now	**B** 5 yrs ago	**C** 10 yrs ago	A Now	B 5 yrs ago	C.10 Yrs ago
Codes for 2. Mechanized boats=1, Motorized boats=2, other=3,		**Codes for 3.** own=0, Rented=1, Collectedly owner=2,	**Cods for 5.**Plastic net =1, Rach Lara=2, Makhan=3, Thukree net=4, Boolo-gujja net=5, other illegal net =6, other=7.										

8. Recurring Cost:

1. Inputs	2.Initial Cost (Rs.)	3.Recurring Cost (Rs.)	4.Recurring cost five years ago	5.Recurring Cost ten year ago
Codes for 1: Diesel/fuel=1, Boat=2, Net=3, Motor=4, Net repair=5, Boat maintenance=6, ice=7, other=8,				

9. Non Recurring Cost:

1. Inputs	2. Initial Cost (Rs.)	Recurring Cost (Rs.)	4. Recurring Cost five years ago	5. Recurring Cost ten year
Codes for 1: Boat=1, Net=2, Motor=3, Vehicle=4, Bucket=5, Other=6				

10.*Pati* System/Sharing Arrangement and Net Income/cost (Yes/ No)

Boat Size (ft)	2. Number of fishermen on boat	3.Duration of fishing trip	4. Average number of fishing trip	5.Estimated cost of trip (Rs.)	6. Net income from a trip (Rs.)	7. Sharing arrangement				
						7.1 No. of sharing persons	7.2 Share of boat owner	7.3 Share of boat captain	7.4 Share of boat worker	7.5 Others (special Share)

11. Situation of Mangrove:

1. Type of Plant	2. Use of plant	3. Collection of Wood (kg)	4. Market price of wood (kg)	5. Net income for wood(Rs.)	6. Services provided by mangroves	7.Situation of mangrove currently	8. Mangrove situation five years ago	9.mangrove situation ten years ago
Codes for 1. Avicennia marina (timmer)=1, Rhiphoroas mucronata(kummri)=2, Ceriops tagal(kain)=3, other=4		**Codes for 2.** Fodder=1, Firewood=2, For sale=3, Fence=4 Framing of roof=5 Honey = 6. Other=7	**Coding for 6:** Thick=1, Storm protection=2, Breeding ground of shrimp=3, purification of water=4, flood protection=5, carbon sequestration=6, Other=7			**Codes for Q 7, 8, 9**. Same=0. Deteriorated =1.Improved =2.		

12. House hold Expenditure (Monthly):

Items	Cost/expenditures (Rs.)
Food	
Clothes	
Education	
Health	
Transport	
Communication	
Fuel and firewood	
Electricity and gas	
Recreational and entertainment	
Others(specify)	

13. Impact of international Trawler:

1. How many families come to village during fishing seasons? _____

2.. What type of net they use during fishing? Legal/Illegal

3. Is there any restriction on the use of illegal nets? **Yes/ No**

4. How many people pursue? **_____%**

5. What are the major cause of using illegal nets? **_____**

6. What should be the effective measure taken to prevent the illegal fishing? **_____**

14. ROLE OF ORGANIZATIONS:

1. **How many organizations working in the village.** _____
2. **What is main purpose of the organization?** _____
3. **Does the organization play any role for the community well being?** _____
4. **How much the organization strong in the village?** _____

SOME OTHER INFORMATION.

1. How many people migrate from village per year? _____

2. Does they migrate permanently / temporary? _____

3. What is the major cause of migration? _____