Chapter 3

LOCATION AND BASELINE INFORMATION

This chapter is an overview of the study area selected for the present investigation. It also includes the details of shrimp culture development in the study area and its associated impacts.

3.1 Description of the study area

The study area located along the Contai coastal plain, comprises five coastal blocks of Purba Medinipur district of West Bengal. The area has significant importance in terms of aquaculture, agriculture, beach plains, sand dune and tourism. Rasulpur River, Jaldah Channel, Pichaboni Canal, Contai Canal, Orissa Coast Canal and there tributaries join the Bay of Bengal which provides extensive brackish water resources in the study site. The site selected for this study is ecologically and economically important and is a representative aquatic region for the present investigation as it is one of the shrimp farming hot spots along the East Coast of India.

3.2 Location and extent of the study area

The study area comprises Ramnagar-I, Ramnagar-II, Contai-I, Contai-II now known as Desopran and Contai-III community development blocks of Purba Medinipur district, located between latitudes 21°36'20.67"N to 21°55'17.97"N and 87°26'31.71"E to 87°53'39.76"E longitudes and it covers an area of near about 818 square kilometres (81800 hectors). The study area consists of 849 mouzas, 42 gram panchayats (GP) and 1 municipality under Contai subdivision. Location map of the study area is shown in Figure 3.1.

3.3 Physical & socio-economic status

The physical and socio-economic condition of the study area is considered as the baseline information for this present study.

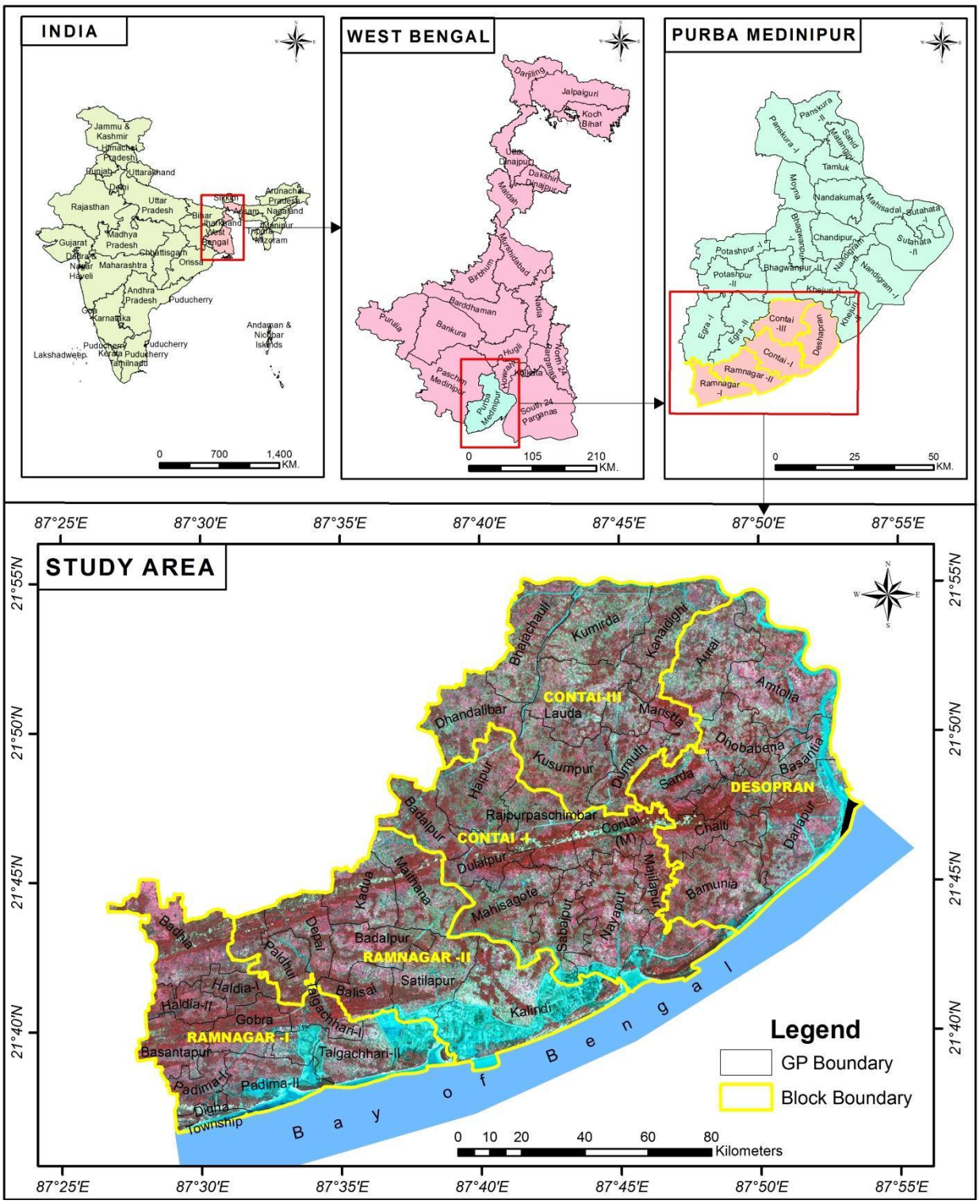

Figure 3.1 Location map of the study area consisting of five coastal blocks of Purba Medinipur district, West Bengal.

3.3.1 Geomorphology

The whole study area lies under Contai coastal plain. Geomorphologically Contai coastal plain is divided into few sections. In the north-east portion of the study area, older coastal plains are available. Middle and south-west portions are covered with Paleo beach ridge. In a wide range of south-west portion, Swale structure is present. North-eastern Dariapur, Rasulpur are mud field areas. Below these mud field areas in Saula and Dadanpatrabar saltpan is noticed. In a smaller portion towards the west side younger alluvial plain is available. Southern coastal areas are covered with beach ridge (Figure 3.2A). All these geomorphological features have been raised from the effect of wave and wind processes.

3.3.2 Relief and topography

The entire lowland tract is lying between the heights ranging from 2-3 meter above mean sea level. There are four sets of beach ridges and sand dunes around Kanthi, Paniparul and Ramnagar areas and they attain the surface height ranging from 6-10 meter above the mean sea level. The area between Rasulpur river and Subarnarekha river consists of several estuarine and tidal floodplains. These lowland areas (2-2.5 meter above m.s.l) are modified by the tidal process. Older sand dune sediments of Kanthi, Darua, Dariapur, Paniparul region are 8-11 meter. At Digha, the dune row was over 15 meter height from the mean sea level (Paul, 2002).

3.3.3 Soil characteristics

The soil of the area under study may be divided into two main categories, a) Old alluvial soil. These soils are mostly developed by river sediment. Sediment is carried down and deposited by the river or rivers or their tributaries. They are usually very deep, poorly drained, fine cracking soil occurring on the level to nearly level low lying alluvial plain with the clayey surface. The colour of the soil varies from deep brown to light brown depending on the mineral and organic matter. According to the soil map of NBSS of scale 1:500,000, the WO 38 soil group (Table 3.1) falls under this category. b) Coastal alluvial and sandy soils. These soils are very deep, well-drained, sandy soil occurring on gently sloping dunes in coastal plain with subsurface erosion and slight to strong salinity. The soils have been formed from deposition of tidal current and air. WO 73,74,77,78 of NBSS soil groups (Table 3.1) resemble this category (Figure 3.2B).

Table 3.1 Soil groups of the study area and their description

Map Index	Taxonomic Name	Description of NBSS Soil Map Indices
WO38	Very Fine, Vertic Haplaquepts	Very Deep, very poorly drained, fine cracking soils occurring on the level to nearly low lying alluvial plain with clayey surface
	Fine, Typic Haplaquepts	Associate with very deep, poorly drained, fine soil
WO73	Aquic Ustipsamments	Very deep, moderately well drained, sandy soil occurring on gently sloping dunes in coastal plain with a sandy surface, severe erosion and strong salinity.
WO74	Typic Ustipsamments	Very deep, well drained, sandy soils occurring on the moderately sloping coastal plain with a sandy surface, severe erosion and slight salinity.
WO77	Fine, Typic Haplaquepts	Very deep, poorly drained, fine soil occurring on nearly level to gently sloping coastal plain with the clayey surface, moderate flooding and slight to moderate salinity.
	Fine, Vertic Haplaquepts	Associated with very deep, poorly drained, fine cracking soils.
WO78	Fine, Vertic Haplaquepts	Very deep, poorly drained, fine cracking soils occurring on nearly level to very gently sloping coastal plain with the clayey surface, moderate flooding and moderate salinity.
	Fine, Typic Haplaquepts	Associated with deep, poorly drained, fine soils.

Source: NBSS & LUP Soil Map; Scale 1: 500,000

3.3.4 Climate

The influence of south-west monsoon is predominating in the study area with mean annual rainfall varying between 175 cm and 125cm. Dry weather starts from the month of January and gradually it reaches the hottest days of summer in the months of March to May. The summer temperature ranges between 22^0C to 35^0C while the winter temperature ranges from 8^0C to 18^0C. Study blocks are occasionally affected by cyclones

and tornadoes. In the coastal areas under this study tidal floods are very common. The area faced flood quite regularly.

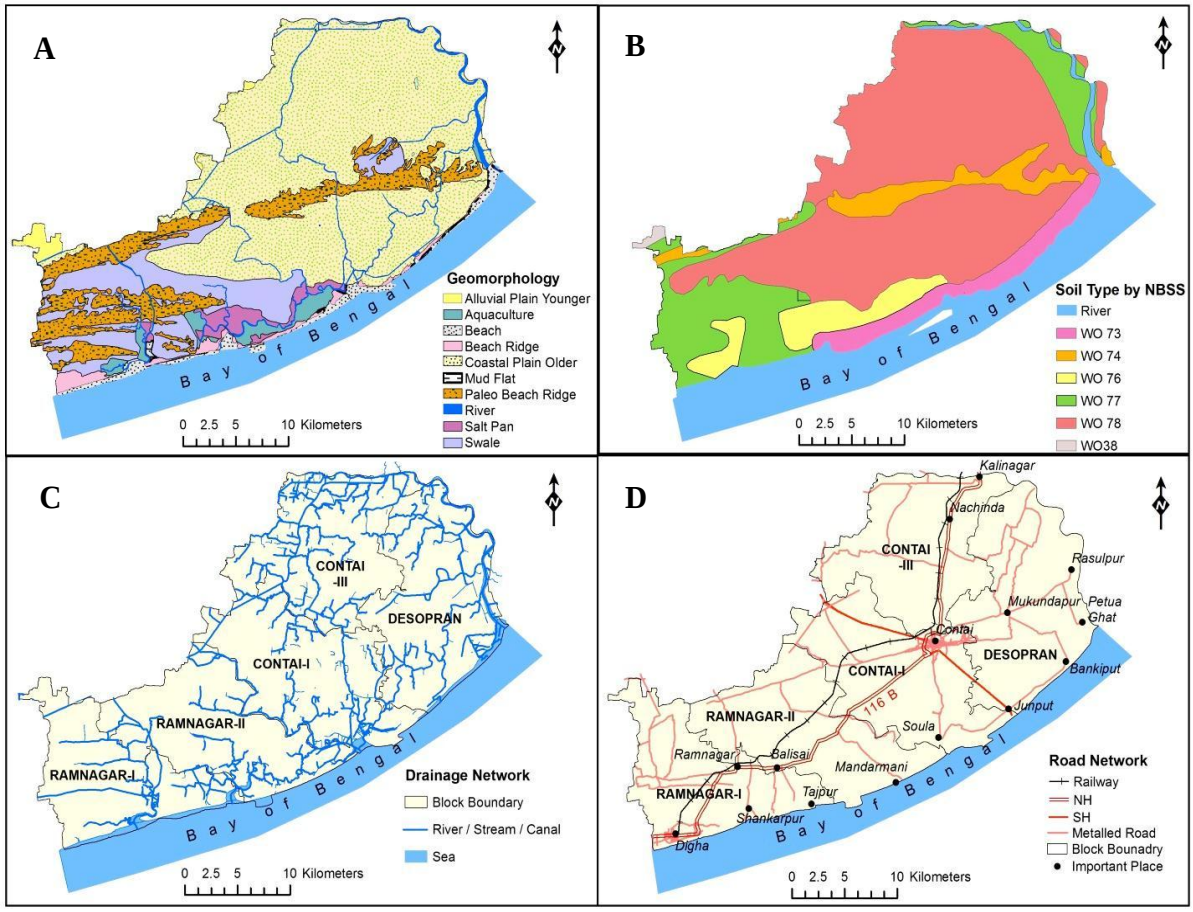

Figure 3.2 General information of the study area A) Geomorphological feature (Source: District Resource Map, GSI), B) Soil characteristics (Source: Soil Map, NBSS & LUP), C) Drainage network (Source: Google Earth), D) Transportation network (Source: Google Earth).

3.3.5 Drainage

Rasulpur River and its tributary, Contai Canal, Orissa Cost Canal, Pichaboni Channel, Ramnagar Canal are the main drainage system of the study area (Figure 3.2C). Digha estuary, Jaldah estuary is also the main tidal spill. This area is lying between the Hooghly River and Subarnarekha River. Clayey sediments of tidal flats provide an ideal ground for salt-loving plant and animals (Paul. 2002).

3.3.6 Natural vegetation

Natural diversity is noticed in the study area from place to place. In the coastal area, dense bushy shrub named as *Pandanus odoratissimus l.f (Keya)* is seen. *Ipomoeatuba (schl.) G. Don* and *Tylophora tenuis.BL* climbers are noticeable in the coastal dune areas. The plants of the coastal river and canal sides are *Cannavelia sosea (SW.) de*, *Fimbrystylis ferrugin (L.) vahl*, *Barringtonia racemosa Roxb.* etc. A dense forest of *Casuarina equisetifolia L.* (Jhau) is widely spread over the coastal shoreline. Dune area is filled with *Anacardium occidentale* (cashew nut) fields. *Cocos nucifera* (Coconuts), *Areca catechu* (Betel nut) are seen throughout the whole study area. The areas which are little far from sea have plants like *Acacia auriculitormis* (Akashmoni), *Eucalyptus globulus* (Eucalyptus) and *Gum Arabic* (Babla), *Azadirachta indica* (Neem), *Bambuseae* (Bamboo) etc.

3.3.7 Agriculture

Agriculture is the main source of income of the rural areas. It is also mentioned in the report of Human Development department of Purba Medinipur district that in the areas under study the main source of income of people is agriculture. Paddy is the main crop in this area and cultivated three times. Principal harvest is that of winter crop called Amon. This is show in the months of July and August and reaped in November, December. The Aus, rice is show in the months of May, June and reaped in August, September. Boro, rice is show in the months of October, November, and is cut in March and April. Pan (Betelvine) and cashew nut, oilseed, birhi (Phaseolus mungo), vegetable are another major agriculture.

3.3.8 Education & economy

The study is under the Contai subdivision in Purba Medinipur district. As of 2011 Indian census, Contai subdivision has literacy rate as high as 88.75%, which is higher than the national average rate of 74.04%. The literacy rate of Contai-I block is 89.32 %, Desopran block is 88.33 %, Contai-III is 89.88 %, Ramnagar-I and Ramnagar-II literacy rates are accordingly 87.84% and 89.38 %. In the study area, many reputed schools and colleges are available. Along with famous colleges for general course study like Contai P.K College, Ramnagar College, Marishda College, there is also one Polytechnic College, one IT college, Ayurvedic college and Veterinary college available. Agriculture is the main

source of income of the middle-class families of study area under consideration. Tourism, cashew processing, fishing industry are other important industries of the area. Development of tourism industry is noticeable and it is one of the most influential socio-economic parameters. Some of the famous tourist places of the study areas are Digha, Sankarpur, Tajpur, Mandarmani, Junput etc. In the last two decades, shrimp culture has become a major source of income here. Dry fish and betel leaf export business are other sources of income.

3.3.9 Transportation

The study area selected for this present research is well connected through railway, state highway, national highway and important metalled roads. The railway line is under South-Eastern railways and it is joined to Kharagpur-Howrah main line in Panskura. Also, national highway 116B (NH-116B) has passed through the study area which is joined in Nandakumar with national highway 41 (NH-41) in one side and the other side is connected directly to Orissa state. The study area is also well connected to Kharagpur by state highway 5 (SH-5). Apart from this many metalled roads are connected the study area from the above-mentioned roads (Figure 3.2D). Through all these roads many government and private buses run on daily basis. For short distance communication, people used three wheels shared auto, two-wheelers and bicycle. The Petughat fishing harbour is also available in the study area. Fish landing centres of the areas are Soula, Sankarpur and Digha.

3.4 History of shrimp culture in the study area

The study area selected for present investigation has long shrimp culture history spanning over than two decades. Purba Medinipur district, where the present study has been conducted ranks third in the state in shrimp farming. After the year 1994 when the technical viability of culture is realized the brackish water shrimp culture started to grow fast. Another cause of the rapid expansion is that, the farmers realized the heavy profit margin from shrimp production would be capable of bearing the increased investment cost involved in this culture.

Because of these factors in freshwater agriculture areas (paddy), brackish water shrimp farming started spreading. There are areas of Purba Medinipur district of West Bengal

that never experience saltwater intrusion. When people started to do brackish water shrimp farming within the paddy field areas, it has raised concerns about adverse environmental effects and also about the productivity of the agriculture of those areas. It is fact that due to massive shrimp culture development, sometimes the industry reached dizzy heights in terms of production, land utilization and the same time it faced the worst ever experience, due to the outbreak of several viral/bacterial diseases in the same time. This massive destruction took place due to improper pond management practice and non-availability of good quality shrimp seed and feed. Due to the increased demand for feed and seed, some entrepreneurs resorted to the import of seed and feed without following the quarantine measure, leading to the introduction of diseases in the Indian shrimp culture scenario.

3.4.1 Shrimp culture production statistics

As a huge area in Purba Medinipur district is steadily changing into shrimp farming areas, the farmers are getting benefited economically. The traders and government are also experiencing its economic benefit. Where there are almost 25,000 shrimp farms in Purba Medinipur district, only 500 have the legal permission. From Shrimp export, the state of West Bengal earns almost INR 1500 crore foreign exchange every year. According to the article published in The Time of India dated on 14 December 2017, West Bengal holds the first position in production of Tiger Shrimps according to the data of the year 2015-2016.

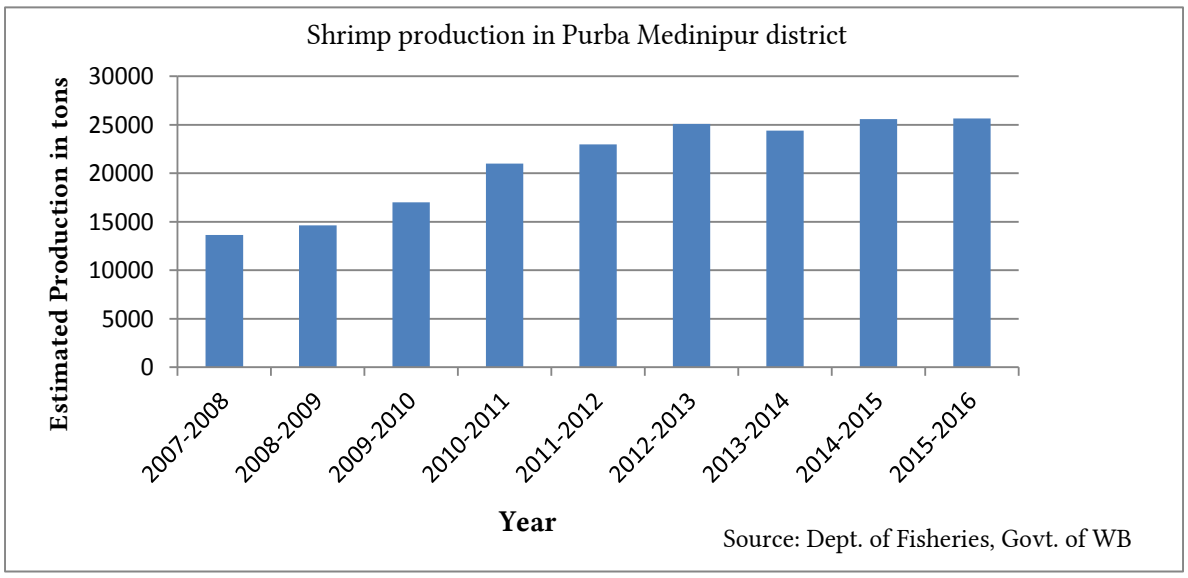

Figure 3.3 Shrimp culture production statistics in Purba Medinipur district

The total production of Tiger Shrimps for that year was 81,452 MT, where West Bengal's contribution was 61,998 MT followed by second largest producer of Tiger Shrimps Odisha with 9,191MT. In case of Pacific white shrimps it has produced 6,777MT in year 2015-2016 which was the second largest production of that year. Andhra Pradesh was the largest producer of Pacific White Shrimps with the production of total 295,332 MT. The state has the largest brackish water pool of the country and almost 30% of the total resources. The total shrimp culture production of the Purba Medinipur district increased approximately double during the last eight years. Detailed shrimp culture production statistics from 2007 to 2016 is shown in the Figure 3.3.

3.5 Farm size distribution and culture management practices

The coastal blocks selected for the present investigation are blessed with potential river network, which provides brackish water for shrimp farming. For the water supply in shrimp farming, it depends on nearby river/stream/canal/creeks. Presently about 5895 ha is under shrimp culture in which most of the farmers are having a farm size less than 1 ha that is 61% and about 10% area 1ha to 2 ha and 11% area 2 ha to 5ha and rest of the area is big farm that is 18 %, more than 5 ha. The percentage distribution of shrimp farm size of the study area is shown in Figure 3.4.

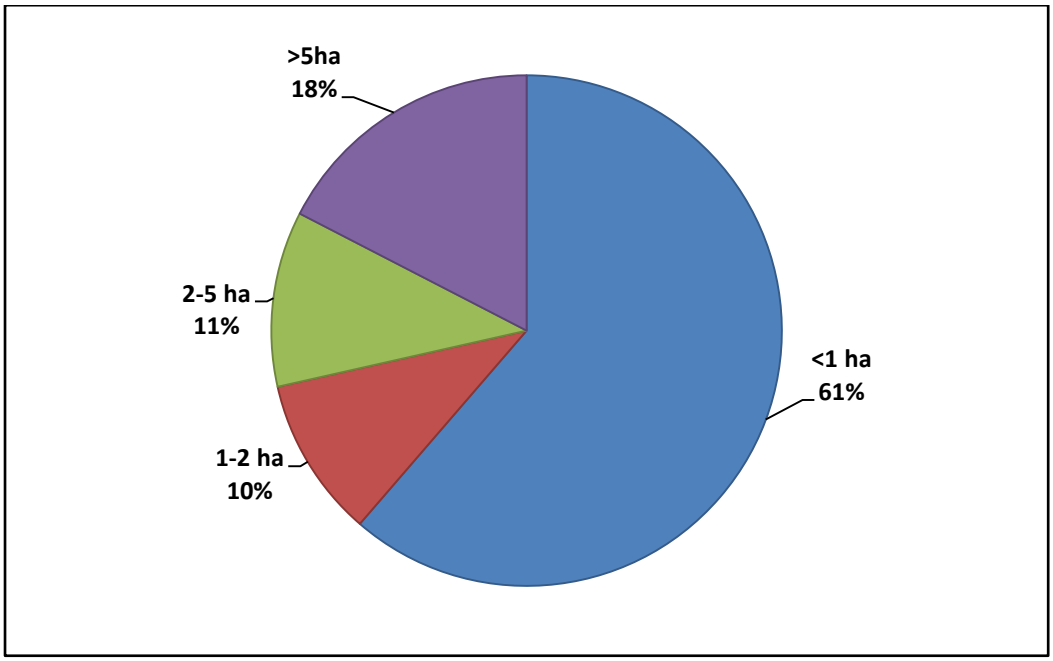

Figure 3.4 Percentage of the shrimp farm size distribution in the study area

Presently 90% farmers culture Vannamei (Litopenaeus vannamei) of total shrimp culture because of its high market price, fast growth rate and its culture period which is significantly less compare to Tiger shrimp (Penaeus monodon). The most of the shrimp farm is converted from the agricultural paddy field. Maximum farms are not having the proper water inlet and outlet systems. Each farm zone is separate 2 to 6 tanks. Generally, farmers are taking up the single culture, particularly during summer when the fluctuation of hydro-biological parameters especially the temperature is less. The pond bottom of new or excavated pond is treated with high dose lime power around 400 – 500 kg/ha and also used dolomite. To eradicate the micro/macro-organism, the pond is allowed to dry and crack. It also influences the capacity of H_2S (Hydrogen Sulphide). The scraping of pond bottom is made up 3-4 inches. The saline water is entered into ponds by pumping from nearest river, stream, canal or creek after fine filtration. Water is treated with chlorite at 20 ppm – 30 ppm. Pond water is conditioned with mineral, probiotic, yeast. The stocking density of ponds is in range 70-130 no/m^2. During the first 30 days no water is exchanged. Therefore 15-25% of exchange is conducted once in 7-10 day. Aeration of the ponds using paddle wheel aerator for 12 to 16 hours/day. Feeding frequencies of the most farms are 4 time/day.