CHAPTER II

STUDY AREA

2.1 INTRODUCTION

The study area Vellar estuary falls in the Pichavaram mangrove ecosystem in the Tamil Nadu coast of south India. This ecosystem fringed with a variety of mangrove plants, mud flat shrubs which serve as the breeding ground for a number of marine and brackish water organisms (Muthukumar et al., 2014). The Vellar estuary is one of the prominent estuaries along the Southeast Coast of India. It has fishing activities and landing centers. Further, agricultural activities and shrimp farm operations are going on in this region.

2.2 LOCATION AND EXTENT

The study area comes under Parangipettai Block, Cuddalore District, Tamil Nadu, India. It is bound on the north by Kurinijipadi Block, east by the Bay of Bengal, west by Bhuvanagiri and Kumarachi Blocks and south by Keerapalayam Block. For the present study, the chosen areal extent of Vellar estuary is around 0.625 km$^2$ (6,25,000 m$^2$). It falls in the Latitudes 11° 25’ to 11° 30’ north and the Longitudes 79° 45’ to 79° 50’ east in the Survey of India (SOI) toposheet No.58M/15 of 1:50000 scale. The Cuddalore District Blocks map and the study area location map are shown in (Figure 2.1 & 2.2) respectively.
Figure 2.1 The Block map of Cuddalore District.
Figure 2.2 Location map of the study area.
2.3 PHYSIOGRAPHY

The study area consists of plain terrain, gently sloping towards east. It is well suited for biological and hydrographical studies. The influence of the neritic water with the estuarine environment promotes a perfect exchange of both biotic and abiotic components, in the backwater and mangrove regions. The Vellar estuary is an open type of ocean and it has connections with the adjoining sea throughout the year.

According to the Rochford (1951) the estuary has classified into four zones (viz. marine zone, gradient zone, tidal zone and fresh water zone) by their estuarine environment (Ramamoorthi, 1954; Antony Fernando et al., 1983).

2.3.1 Marine zone

This zone extends up to 0.8 km upstream from the mouth of the Vellar River. The mean salinity under the stable condition is 33% and the difference in salinity between the surface and bottom water is 0.4%. The waters of the bottom are sandy with black mud at the surface.

2.3.2 Tidal zone

This zone extends up to 3 km from the river mouth. The difference in salinity between the surface and bottom waters is more than 4%. The bottom consists of black flocculent mud.
2.3.3 Gradient zone

This zone is about 4-5 km from the river mouth and represents a transition between marine conditions prevailing in the tidal zone and the near limonitic conditions of the freshwater zone. The difference between the surface and bottom salinity is 8 to 9%, with grayish black mud constituting the bottom.

2.3.4 Fresh water zone

This is situated further upstream 2 km beyond the gradient zone. The salinity of the water ranges between 0 to 4% and the bottom is mostly by sand mud.

The Vellar River is classified as a medium river (Rao, 1975) and has a total catchment area of 2975.26 km² (Public Works Department Record, 1990). It traverses Peninsular India from west to east over 218 km. The eastern coastal parts near to Porto-Novos (Parangipettai) have lagoons and backwaters. Vellar is a seasonal river, which drains the major portion in the southern part of the district. Manimuktha, Gomukhi and Mayura are the major tributaries which joins the Vellar River.
2.4 DRAINAGE

The Cuddalore District is endowed with five river basins from north to south; namely, i) Pambai River Basin; ii) Pennaiyar River Basin; iii) Gadilam River Basin; iv) Vellar River Basin, and v) Cauvery-Coleroon River Basin. Almost all the rivers of the district flow east into the Bay of Bengal.

The Vellar River originates from the Shervarayan Hills, Salem District, Tamil Nadu. It joins the Bay of Bengal at Parangipettai and is said to be a ‘true estuary’ as there is no complete closure of the mouth. This estuary has been demarcated into marine, gradient, tidal and freshwater zones based on salinity characteristics (Ramamoorthy et al., 1954). It is being subjected not only to alterations in chlorinity but also to seasonal variations in the amount of freshwater input and consequent circulation of elements in between the estuarine system and the neretic waters. It is subjected to semi-diurnal tides and varies in amplitude from 0.15 to 1.0m (Kathiresan, 2000). The width of the estuarine mouth is about 100 m. However, the position of the mouth and width are changing frequently due to sandbar formation as fresh water inflow is very much reduced in summer (Kesavan et al., 2010).
2.5 CLIMATE AND RAINFALL

The Porto-Novo area, experience heavy downpour during the northeast monsoon (October-December) and Vellar river drains into the estuary from 2.3 m to 5.0 m. The average annual rainfall of Vellar estuary is 652 mm. The Indian climate is classified as,

Northeast monsoon or winter season (December to February)

Hot weather or pre-monsoon season (March to May)

Southwest monsoon season (June to September)

Retreating southwest monsoon season (October to November)

The Vellar river basin is grouped under the retreating southwest monsoon season. According to Ram Mohan (1978), this division holds well in the case of Tamil Nadu too. Instead of calling the period October to November as the retreating southwest monsoon season it would be more appropriate to note this also as the Northeast monsoon season because most of the rainfall in Tamil Nadu is received in these two months. Consequently, the period December to February could be called as winter season.
2.6 VEGETATION AND FOREST

Along Vellar estuary, study area vegetation is restricted due to soil saline nature. Paddy, some dry crops, cereals, pulses, oilseeds are the important crops in the area. Mangrove formation in this area is considered, as a healthy, dense occurrence in the world. The mangrove forest arrests the inflow of tidal waters from the sea and protects the coast. These tropical mangroves extend over 11 km$^2$ and consist of 51 islets, which are covered by forest (50%), waterways (40%), and mud and sand flats (10%). Thirteen species of indigenous trees are present in the forests belonging to *Avicennia* and *Rhizophora* spp. (Kathiresan, 2000).

2.7 GEOLOGY

The Vellar estuary study area is covered by alluvium deposition in the western part of the block, and eastern part of the block area is covered by fluviomarine and beach sands. The Vellar river basin consists of the following geological formations (Krishnan, 1954: G.S.I, 1976a, b).
Lithological sequences:

- Alluvium of Sub-Recent to Recent.
- Cuddalore sandstone of Mio-Pliocene.
- Fossiliferous sandstone of Upper Cretaceous.
- Basic dykes.
- Granite and Pegmatites.
- Charnockites.
- Ultrabasic rocks with magnesite and chromite.
- Amphibolites and pyroxenites.
- Hornblende gneisses, steatite, chlorite schists, quartz schists and quartz-magnetite-schists.
- Biotite gneiss.

2.7.1 Biotite gneiss

The biotite gneiss is the oldest rock in this region; it is in grey coloured foliated gneiss, generally containing a good amount of biotite. Quartz, granite and pegmatite veins are intruded in this rock formation.
2.7.2 Hornblende gneisses

The biotite gneisses are succeeded by hornblende gneisses, quartzites, quartz schists, talc schists, chlorite schists and magnetite-quartz-schists. Many of the hill masses like the Kanjamalai, Godumalai, Chitteri, Kalrayans and parts of the other hills are composed of these rocks. They may be partly of igneous and partly of sedimentary origin, but belong to the Precambrian sequences and are pre-charnockitic in age. These different rock types are frequently well foliated. The hornblende rocks are sometimes associated with much garnet forming garnet amphibolites at the foot of the Kanjamalai.

2.7.3 Amphibolites and pyroxenites

Some bands of amphibolites and pyroxenites are present in association with the above mentioned rocks.

2.7.4 Ultrabasic rocks

Ultrabasic intrusive and extrusive rocks are represented by metamorphic equivalents of anorthosite, pyroxenite, peridotite, dunite, etc. They have suffered many alterations (e.g. the formation of magnesite and serpentine) during metamorphism.
2.7.5 Charnockites

The charnockites are generally acid to intermediate garnetiferous type some varieties are hybrid types (recrystallised khondalites) and some types.

2.7.6 Granite and pegmatites

Granites and associated pegmatites which are very prominent in these areas are represented by intrusive bosses amidst the older rocks. Pegmatites and quartz veins are quite common (Mohan, 1990).

2.7.7 Dyke rocks

Basic dykes, mainly doleritic in texture and composition, are fairly common in these areas. As they cut across the other formations, they are considered to be the youngest rocks in the stratigraphic sequence.

2.7.8 Fossiliferous sandstone of Upper Cretaceous

Overlying unconformably the Archaeans, are the fossiliferous Upper Cretaceous formations mainly occurring about 10 km northwest of Virudhachalam, between the two rivers namely Manimukta and Gadilam.

2.7.9 Cuddalore sandstone

Overlying the Cretaceous rocks are the Cuddalore Sandstone of Mio- Pliocene age. This comprises often ferruginous, pebble bed, sand and clay with lignite seams at places and silicified wood at other places.


2.7.10 Alluvium

During Sub-Recent to Recent time, there has been the deposition of alluvium and coastal sands which are overlying the Cuddalore sandstone. The sediment detritus from the weathering of Peninsular granite are capable of releasing the following heavy minerals: biotite, hornblende, zircon, rutile, garnet, epidote, sphene, and tourmaline. The weathering of charnockites may release the following heavy minerals to the sediments: hypersthene, augite, olivine, garnet, hornblende, monazite, zircon, ilmenite and magnetite (Pichamuthu, 1953; Chatterji, 1974). The Cretaceous formation of the coastal tract of the study area consists largely of the reworked sediments or of chemical or organic origin.

2.8 SOIL

The study area soil is classified by Institute of Remote Sensing (IRS), (1999). According to IRS classification, the soil groups ‘C’ with slow infiltration and moderate runoff potential is found in the 50% area of the Parangipettai Block. The soil group 'B' with moderate infiltration and moderate runoff is covering about 45% areas. The remaining 5% area is occupied by soil group 'A' with high infiltration and low runoff potential. Mangrove soil is frequently flooded by Vellar river. The estuary supports the luxuriant growth of mangroves. The tidal amplitude of sea and freshwater input keeps an ecological balance for the sustenance of this specialized ecosystem along this coast. The composition of mangroves is mainly determined by salinity tolerant species. This in turn determines the dominance of one or various species at a specific site. At present, most of the estuaries and near-shore wetlands along the Southeastern Indian coast are covered by salinity tolerant mangrove.
Fig. 2.3. Geological map of Cuddalore District.