3. Study Area

There was an outbreak of chikungunya fever in Andaman Islands during the period from June to December 2006. During this outbreak an attack rate over 60% was observed in the study conducted by the Regional Medical Research Centre (ICMR). More than 10 subjects had clinical features suggestive of chikungunya fever had acute flaccid paralysis, among which only 4 could be confirmed to be suffering from chikungunya infection. As chikungunya has varied clinical spectrum, therefore in order to understand this the centre had followed up a cohort of over 300 people. Preliminary observations indicated that over 20% of the people who had suffered the disease progressed to chronic arthropathy. However, a long term follow up of this cohort was not possible, because of frequent movement of subjects within the islands as well as the mainland. Far flung and remoteness of the islands limited us to follow the subjects.

Coincidentally, an outbreak of febrile illness suggestive of chikungunya started in January 2008 in the Dakshina Kannada district. By August 2008, it was estimated that about 40,000 people were suspected to have suffered CHIKF based on a surveillance case definition laid down by the National Vector Borne Diseases Control Programme (NVBDCP). Therefore, we have carried out a cross sectional survey in the Adyanadka PHC jurisdiction area, among a sample population of 1,174 living in 300 households drawn from all the four sub-centres of the PHC. Serological testing was carried out in a subsample of 360 selected randomly. Of the 360 subjects tested for the presence of anti-CHIKV IgM antibody, 237 had suffered symptoms specified in the case definition between March 2008 and September 2008. Of the 237 subjects, 210 tested positive for anti-CHIKV IgM antibody. Fourteen subjects who did not suffer from the symptoms specified in the case definition also tested positive for anti-CHIKV IgM antibody.

Therefore, this outbreak provided an opportunity to form a cohort which could be followed up on a time scale to understand the pathogenesis. Hence, the present study had two study areas viz., Andaman and Nicobar Islands and Dakshina Kannada district, Karnataka. The former study area was restricted for isolation of CHIKV and for molecular characterization while the latter study area, served for following a cohort of individuals who had tested positive for anti-CHIKV IgM antibody.
3.1 Andaman and Nicobar Islands, India

**Topography:** Andaman and Nicobar Islands, a Union Territory in India, is an archipelago of over 500 islands/islets big and small in the bay of Bengal between (92° to 94° East and 16° to 14° North), 1200 km away from peninsular India. These islands stretch over 700 km from North to South and there are 38 inhabited islands. The total land area of the territory is approximately 8,249 km² and Port Blair is the head quarter (www.mapsofindia.com).

**Climate:** The climate of Andaman and Nicobar Islands is tropical, influenced by the South-West monsoon during May to October, and the North-East monsoon from November to January. The average annual rainfall is around 318 cms. The average temperature ranges between 22.5°C and 29.9°C. Mean between annual relative humidity recorded is 80.3% and monthly average ranges between 74% in January, February & December to 87% in July, August & September (www.and.nic.in).

**Demography and socioeconomic conditions:** The total population of Andaman and Nicobar Islands is 379,944 with several ethnicities, which includes several indigenous tribes (www.populationindia.wordpress.2011). Population of these Islands are constantly increasing due to the immigration of people from mainland. Population is mainly dominated by settlers from mainland. Tribal population constitutes less than 10% of total population and major tribes are Jarawa, Onge, Sentinelese, Great-Andamanese, Shompen and Nicobarese (http://forest.and.nic.in/frst-island1.htm).

Agriculture, animal husbandry, fishing, forestry and plantations, construction, transport, trade and commerce contribute the economy in these Islands. The common languages spoken are Hindi, Bengali, Malayalam, Tamil, Telugu, Punjabi, Nicobarese and English. Regular ship and air services connect the island and mainland sectors. Inter-island travel is connected through regular ship and helicopter services (http://forest.and.nic.in/frst-island1.htm).

**Conditions favourable for Chikungunya transmission:** There has been a note on the existence of *Aedes aegypti* in Andaman Islands (Nagpal and Sharma 1983). Subsequently it was understood that this species has wide prevalence, with variation in
spatial distribution, infestation levels and larval ecology within the urban agglomeration of Port Blair (Shriram and Seghal 2000). Quite recently this species are showing signs of infestation into peri-urban rural areas of South Andaman (Shriram et al., 2008). Demographic changes, most importantly rapid urbanization and population growth, necessitating water storage in containers, leads to increase in Aedes aegypti population densities facilitating transmission. Finally, increased air-travel serves transportation of CHIKV between endemic locations on the mainland. All these prevailing situations facilitated the upsurge of CHIKV in 2006 and subsequently in several parts of South Andaman (Shriram et al., 2009).

3.2 Karnataka state, India

*Topography:* Dakshina Kannada (Erstwhile South Kanara) is the south coastal district of Karnataka State spanning an area of 4866 km². The district lies between 12.57° and 13.50° North Latitude and 74° and 75.50° East Longitude. It is about 177 kms, in length and 40 kms in breadth at its narrowest and about 80 kms at its widest part ([http://www.kar.nic.in](http://www.kar.nic.in)).

*Climate:* It is characterized by excessive humidity (78%) during the greater part of the year and there are four seasons *viz.*, 1) June to September are wettest months. 2) October and November are damp months. 3) December, January and February cool months generally prevail with dry conditions. 4) Remaining three months are March, April and May is the period of high temperature (Subrahmanyam *et al.*, 2008).

*Demography and socioeconomic conditions:* The District Dakshina Kannda has a population of 2,083,625 ([www.census2011.co.in](http://www.census2011.co.in)). The study area of Adyanadka PHC has a population of 13,861 people living in 3,000 households ([www.census2011.co.in](http://www.census2011.co.in)). The District is rich and biodiversity *viz.*, land, forest, water, livestock, flora and fauna. The economy of this district is dominated by the agricultural processing and port-related activities. Boat building and fishing industry have been core businesses in Mangalore for generations. There has been a note on the existence of Aedes aegypti in Andaman Islands (Nagpal and Sharma 1983).
Conditions which favoured Chikungunya outbreak: The recent past (2008) epidemic of CHIKF in the nearby states such as Kerala, Andhra Pradesh and Tamil Nadu favoured the chances of spreading CHIKV to the Dakshina Kannada district (Ravi 2006). Stagnated water for construction use in the rapidly developing area of this district could have supported breeding of the *Aedes spp.*, mosquito vector. All the above conditions could have facilitated the spread of CHIKV outbreak in this region.
Figure 3: Andaman and Nicobar Islands, India.
Figure 4: Dakshina Kannada District of Karnataka State, India.