CHAPTER 6

CONCLUSION

This study thoroughly assessed the design principles employed in simple, durable and eco-friendly vernacular dwellings in the coastal regions of Tamil Nadu and their effectiveness by qualitatively and quantitatively assessing their thermal, visual and aural performance. The new approach launched in this study to evaluate vernacular architecture proves to be effective and adequate and may be employed in the research of vernacular housing in other regions. Nevertheless, necessary modifications would be strongly recommended due to the differences in climate, geographical features and so forth. The result of this study clearly indicates that not all vernacular buildings have perfect building physics (Thermal, Visual and Aural Comfort) phenomena. Through this study, the advantages and disadvantages of these buildings were thoroughly investigated, with the aim to effectively exploit their positive attributes for current developments.

Generally, vernacular dwellings in the coastal regions of Tamil Nadu have adapted fairly well to climatic conditions in different locations by using low energy design principles that basically ensure human comfort and health. Natural ventilation, building orientation, building shape, building envelope, solar shading devices, construction materials and techniques were the strategies that most commonly employed in the traditional buildings of coastal regions in Tamil Nadu.
The traditional architecture in the coastal regions of Tamil Nadu is characterized by proper southern or eastern orientation of the buildings and by the exploitation of the prevailing winds. At a large extent, the buildings are oriented in such a way that the best possible exploitation of prevailing winds to control the humidity prevailing in coastal region. Even though the buildings were oriented towards the eastern or southern direction, the entry of radiation is prevented by the projection of roof eaves from the building outline. Most of these traditional buildings are either facing eastern or southern direction. The houses have very less openings or no openings towards the eastern direction and western direction. The houses have more openings towards northern and southern direction to bring air movement into the building and to prevent their house from undesirable orientation. The number of openings on the facades of the traditional houses directly recognized to climatic or day lighting parameters. Nevertheless large no. of openings and their distribution on the walls and their size (window (0.9m x 1.1m=0.99m²), door (1.2m x 2.1m=2.52m²) courtyard size (2m x 3.5m=7m²), wind catchers (1.9m x 1.7m=3.23m²), clear storey windows (2m x 0.4m=0.8m²) contribute to the improvement of visual comfort conditions and the distribution of day lighting during overcast sky conditions. It was found that the ratio of area of windows to the ratio of area of the room in the traditional buildings of coastal region is found to be 10.35% in wind catcher houses. For a room of size 8.1m x 5.1m =41.1m² with two windows either on west and south facade (0.9m x1.1m =0.99m²), the above ratio is equal to 9%. Whereas in courtyard houses for a room of size (9.3m x 7.1m = 66.03m² with three windows (0.9m x 1.2m = 1.08m²) on the southern facade, and one courtyard opening size (3.5m x 2m = 7m²) the ratios is 15%. And in clear storey houses for a room of size (2.1m x 5m =10.5m²) with two windows (1m x 1.5m=1.5m²) on the southern direction, it is 28%. For a room of size 5m x 5m =25m² with 4nos of clear storey windows (2m x 1.5m = 3m²) at the top, the above ratio is equal to 30%. As a whole the ratio of the area of windows to the ratio of the area of the
room (habitable rooms) in the traditional buildings of coastal region varies from 5% to 30%.

The number of openings on the exterior walls and the number of openings in the interior walls are used for the improvement of summer thermal comfort conditions, as they improve natural ventilation and cross ventilation along with courtyards, wind catchers and clear storey windows etc. The traditional materials were selected based on their thermo physical properties and thermal characteristics (density, specific heat capacity, conductivity, transmittance, u value) are used with great efficiency.

Thermal insulation was used in walls and roofs of the investigated dwellings to improve indoor thermal comfort. All these traditional houses also showed that the shading devices performed quite well. The allocation and arrangement of the openings, doors and ventilators showed improved natural lighting and ventilation. Building courtyard, wind catchers, clear storey windows played a significant role on ventilation flow rate of the rooms. The adaptive responses of the occupants such as clothing insulation, activities, opening controls, use of fans are adjusting to their thermal environment.

Traditional residential buildings of these regions are an expressive sample of ecological architecture. Old architecture in warm and humid region is in accordance with region and regional factors: some important elements in vernacular houses of coastal regions are desired and undesired wind, humidity, sun, etc. The houses of courtyards with wind catchers, clear storey windows, thick external walls, verandas and sloping roofs are clear examples of eco friendly and climate responsive architecture. In warm humid coastal regions of Tamil Nadu, the materials with heat resistance like mud, mud-brick and brick are used which are very effective in cooling and heating of internal spaces. The use of natural and passive means in vernacular houses of Nagapattinam was very effective in providing a thermally comfortable space,
which was warm in winter and cool in summer. In coastal regions of Tamil Nadu, the buildings are arranged in a linear pattern separated only by narrow shaded streets. The street orientation ensures that the building facades are shaded by overhangs or sloped roofs. Due to the shadow patterns; the building receives minimum radiation from direct solar exposure, which results in reducing peak heat flux into the building. The greater ceiling height increases the volume of the enclosed space, taking more time for the internal air to get heated up. The verandah served as a buffer space between the interiors and the outside environment. The absence of time lag in the traditional buildings of Nagappattinam and Tharangambadi between indoor and outdoor temperature can be attributed to the highly insulative wall preventing conductive heat flow and due to continuous airflow maintained inside the building. The courtyard system ensures ventilation through the building even during the calm outdoor conditions.

It is clear from the study that an appropriate use of materials, spatial organization, construction techniques and passive design features could bring about the much-desired comfortable thermal environment inside the house. The principles of good thermal design used in vernacular architecture are still valid today and it would still be possible for modern designers and architects to incorporate these design principles in modern buildings, which are suitable for modern day living to conserve energy and provide better thermal comfort. Incorporation of such techniques would certainly enhance the energy efficiency and reduce our dependency on artificial means of comfort.

This would help us in reducing the energy consumption level at national and global level. In coastal regions, vernacular buildings utilized the sea breezes for achieving thermal comfort. These rows of buildings face the sea and have wind catchers at the top of the courtyard and many large
apertures in the sea-facing walls. The houses are separated by a distance of about 4m to 8m so as to allow the breeze to reach all of them.

The study investigated the indoor Thermal Comfort parameters, methods and techniques adopted in the traditional residential Architecture of coastal regions in Tamilnadu and found that the main reason for thermal discomfort for summer season in coastal region is the increase of minimum atmospheric temperature and the presence of excess moisture. In such a climatic conditions, the best way to achieve good thermal comfort is to provide a highly insulative Building envelope while maintaining a restricted and uninterrupted airflow inside the building.

Hence it is essential to take the wisdom of the past and evolve a built form, which will be more humanized, much climate responsive and more environmental friendly buildings of tomorrow. This research raised the awareness of the importance of the traditional wind-catcher and helped to open up the possibilities for improving the performance and widening the applicability of wind catchers. This will bring new opportunities for using this old heritage passive cooling system in today’s world. The new interest for wind catchers have a lot to learn from the heritage, but purely traditional solutions seems rather hard to apply and to be accepted by contemporary architects. The present study has limitations as the quantitative assessment has been carried out only in four typologies of houses. A larger investigation is therefore needed. Besides, further study to include comparative assessments between vernacular and modern architecture is necessary to better evaluate their performance and provide recommendations for climate responsive housing in the coastal regions of Tamil Nadu.

In conclusion, this study has emphasized the importance of climate conscious appropriate building design for the living environment without excessive use of natural resources. From the quantitative and qualitative
analysis of four different typology of houses like wind catcher houses at Nagappattinam, courtyard houses at Tharangambadi, tiled roof houses at Parangipettai and clear storey houses at Thoothukudi, it was observed that the wind catcher houses slightly outperformed the rest of the building typologies studied. The wind catcher houses were functionally efficient in thermal and visual comfort parameters when compared to the tiled roof houses, clear storey houses and courtyard houses. Vernacular housing in the coastal regions of Tamil Nadu is an evidence that humans can live in harmony with nature stressing the need to preserve vernacular architecture.