Impact of Sea Breeze on Vernacular Houses: Insights from the Islamic Settlements of 'Tha-Sala' in Southern Thailand

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Abstract

Nakhon Si Thammarat Province in Thailand has an environment reflecting fishermen's way of life. The orientation of its vernacular houses are affected by the direction and speed of the wind coming from the sea. It is assumed that there is a significant influence of the sea in the formation of settlements along the Tha-Sala littoral.

This study investigates the origins of the fishing settlement patterns and housing characteristics in the Tha Sala coastal area. It examines the natural cultural and environmental factors of the coast as significant factors affecting the settlement.

The research examines the life styles of the community, what factors influence the community and the characteristics of the vernacular houses. It looks particularly at the influence of land and sea breeze on the community. The layout and arrangement of the vernacular houses, along with the nature of living in the houses, all affect the life of the fishermen as depicted in the environment.

The paper is based on qualitative research employing a field survey and interviews with the house owners. Three local houses that reflect fishermen's traditions and ways of life have been identified as case studies. The research observes vernacular houses and develops its thesis by analysing the data related to pictorial representations as well as history, economy, social and cultural changes, and integrative theory.

The findings highlight the adaptation of coastal communities in settlements and house planning. They show that the influence comes from the natural environment to cope with the annual monsoon winds, as well as the lifestyles of the relatives. It shows that religious beliefs of the people affect house planning and the changes affect the community expansion of transportation routes. That makes the houses to be oriented toward the road with distinctive features. In fact, the houses are oriented in an East-West direction so that they do not have to resist the sea wind.

Keywords: Vernacular houses, Coastal Sea, Land-Sea Breeze, Nakhon Si Thammarat Province, Thailand

Introduction

Settlements are plentiful in the tropics (Emmanuel,1997), and their locations have many implications for the vernacular architecture of South Asia. The characteristics of southern Thai houses arise according to beliefs and affect the placement of houses, as well as the specific characteristics of architecture and settlement factors such as location, environment, topography, climate, and natural resources conducive to habitability (Harrison, 1976).

Vernacular housing patterns in coastal areas of the Tha Sala District, of Nakhon Si Thammarat Province are significant. First, it is a fishing community. Moreover, a community of Muslims has dispersed around the area and they have made their houses there. It is a community that extends along the coastline. (Emmanuel,2005) raises the question by the similarities and variations in community housing patterns among the settlement sites whether community housing patterns function in a particular microclimate of the coast. The land-sea breeze is a result of the sea, and this has affected the houses. In this context, this paper askes The question: How has the vernacular house changed in appearance?

The study collects data and analyse the origin of Tha-Sala's settlement and its Muslim vernacular architectural characteristics. It includes an analysis of factors influencing the vernacular architecture of houses in the Muslim community along the coast of Tha- Sala. Nakhon Si Thammarat Province is acclimated to the environment for fishermen's way of life.

Therefore, there is an issue in the study of the important factors of geographical location. Wind direction and speed influencing settlement or formation of vernacular house patterns in Islamic communities along the Tha Sala coastline.

Fig. 1: Location of the community area (1), Tha Sala Subdistrict, Nakhon Si Thammarat Province, Thailand.
Source: Tha-Sala District Information, Nakhon Si Thammarat Province accessible from https://en.wikipedia.org/thasala (accessed on September 6, 2022)

Research Objective

To explain the relationship of land breezes and sea breezes affecting Islamic Vernacular Houses: The Settlements of Tha-Sala District Nakhon Si Thammarat Province in Southern Thailand

Theoretical Basis

Background and settlement of coastal communities along the Tha-Sala Coastline

Thailand's East coast along the Gulf of Thailand. This region is situated on a sea transport route between several countries. In Southeast Asia, both the islands and the continent, international trade is one of the primary factors for the expansion of the southern provinces. It is a significant southern state with maritime influence in Southern Thailand and Malaysia.

Before Nakhon Si Thammarat emerged as one of the most significant port communities in the south, there were fewer coastal towns (Ornsiri,P,2000).

Additionally, Tha Sala District is an ancient and historic district. Tha Sala is another senior community in Nakhon Si Thammarat Province with a long history of building houses to divide the city. There was once an ancient community that was over a thousand years old, particularly the ancient community in MoKhalan, which is ancient. Tha Sala has been an old district since 1898, despite the existence of a poem describing an ancient community (Set the ground, set the sky set the grass MoKhalan was set before Mueang Khon) and previously known as Klai District, the district administration was formerly situated on the coast. It is located at the Tha Sung Estuary gauging furnace and Tha Sala village. Tha Sala derives its name from its location on the bank of a tiny canal, a boundary that divides Khlong Tha Sung. The villagers constructed Sala Tha Nam for recreation and boat anchorage, hence the name Tha Sala. Alternatively, refer to the southern dialect as “Tha Lha." (Tha Sala District Community Development Office, NST.)

This is another factor related to the manner of life of southern homeowners on both the western and eastern coasts. Pratuang Krueahong's research on “Chao-Nam” means of (sea people) in Thailand has revealed the existence of another indigenous fishing community, the sea people. People inhabit both the west and East coasts. Most of those who migrated to the coast were Muslim fishermen and merchants who travelled via waterways. Enter the area within the ground later to cause the expansion of the community that previously inhabited the plains' coastal area. Tha-Sala District is home to the fishery community of Ban Nai Tung. About 200 years ago, the villagers of this community immigrated from Terengganu State, Malaysia. which in the past would have migrated by junk There was a cruise coming during January-February, which was called the "Pow Season" at that time. In that era, the wind would be known as "Pow Wind" if it came from the southeast at 120 degrees. Some vessels set sail from Cape Talumpuk and anchored at the Ban Tha-Sung Community. Before establishing "Ban Nai Tung" in the present, the house in Nai Tung was called "Ban Pak Nam." (Praphon, 2008.)

Now, the coastline is where villagers go to catch fish. A kilometre-long beach protruded into the sea in the past, and a small canal ran through it (legend has it that this canal was used when the Japanese army attacked Nakhon Si Thammarat; another canal passed through this canal). At present, only the degraded coastline remains because of severe tropical cyclones (Eisa Ruhullah et al., 2020)

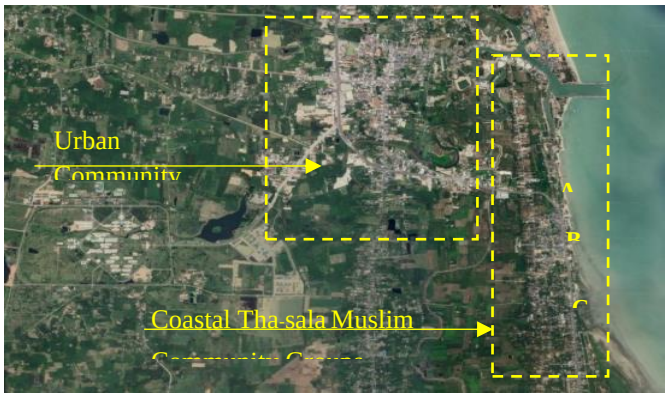


Fig. 2: The location of the Muslim community group, Tha-Sala District, NST.
Source: author (modified from Google map, 2022)

According to the observations, Tha Sala District, Nakhon Si Thammarat Province, is house to a community of Muslims living in groups dispersed throughout the area. Which is the community's location? It is a group formation that stretches along the coast. In addition, there are conveyance routes along the coast. It is a densely populated residential area surrounding the Ban Nai Tung community.

Ban Sa Bua Community, Ban Bang Bai Mai Community, and Ban Nai Tung Mosque B serve as the religious focus. Ban Bang Mai Mosque A and Ban Sra Bua Mosque C highlight the relationships between Muslim community members and their religious beliefs.

Context and Natural Surroundings, the Land-sea Breeze, and the Monsoon Wind

Context and natural surroundings

The state of the coastal lowland areas. In the east, along approximately 20 kilometers of the coast from north to south, sandy beaches are interspersed with mangrove forests. Attractions include types of mangrove forests, namely Samae forests in the Klai Subdistrict, Sa Kaeo Subdistrict, Tha Khuen Subdistrict, Tha Sala, and Pho Thong. Coastal aquaculture fishing in the plains has been used for coconut plantations, rubber trees, citrus trees, and livestock farming. (Nop Sak Naksena,2022)

Most of the coast includes sandy beaches. Approximately 136.95 kilometers, 74.81 kilometers, and 33.22 kilometers comprise mud or collect beaches and rocky beaches, including river outlets. There are silt or muddy shores in the coastal regions of Khanom District, Tha Sala District, Mueang District, and Pak Phanang District. The area resembling a craggy coastline is in Khanom and Sichon.(Tha Sala District Community Development Office,NST.)

Climate and environment are crucial building design considerations. The atmosphere required for human comfort is incorporated into the design of buildings. Convenience refers to a person's physical and mental well-being in the constructed environment (Givoni, 1976). Sunshine This frequently rains throughout the year. In December, there will be significant precipitation. The annual precipitation average is 2,500 cubic meters. There are two distinct seasons: summer from February to June and monsoon season from July to January. (Worapong,2010)

Land- Sea Breeze

It is caused by the difference in temperature between land and water over 24 hours. During the day, the earth absorbs heat more quickly than water. Warming and expansion of the air above the ground propel it upwards. The air temperature above the water is lower due to the air's low pressure. Therefore, (high air pressure) causes the object to descend and move. They push the wind to drift from the ocean onto the coast, known as the "sea breeze" (sea breeze). The earth cools more quickly than water during the night. The frigid air above the ground was sinking. (High pressure) Furthermore, it displaces the heated air above the surface of the rising water. (Low pressure) (Yamanaka, 2018)

Consequently, the wind flows from land to Sea and is called a "land breeze." Land and Sea breeze function in the same way as monsoon winds. (Temperature difference between land and water), only monsoon winds influence regional change, which varies seasonally and daily in coastal areas (Finardi, May 1997).

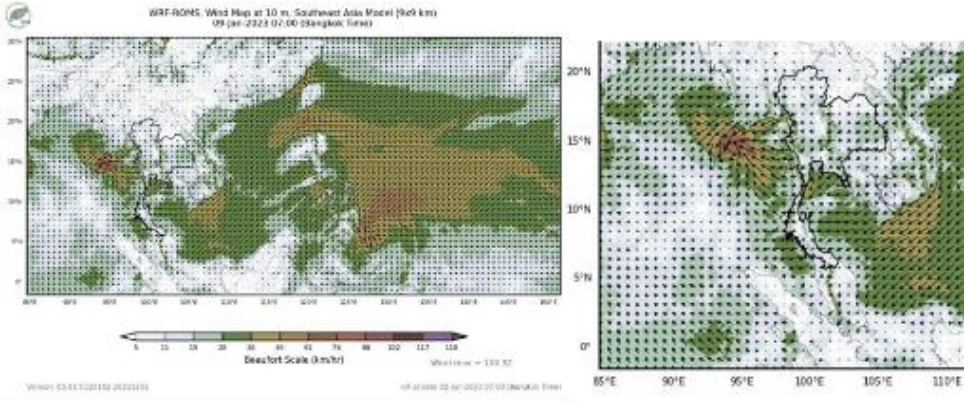


Fig. 3: The image represents the strength and direction of the Gulf of Thailand's winds.
Source: WRS-ROMS Wind maps

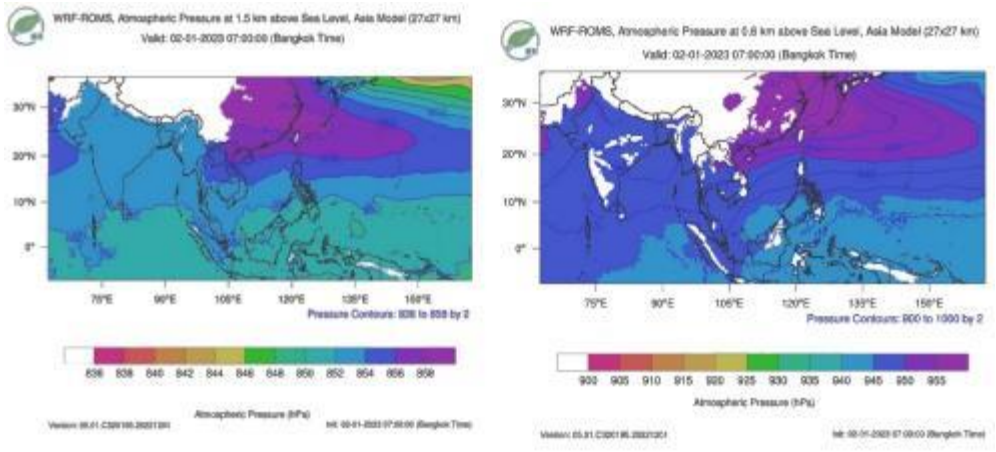


Fig.4: The image represents atmospheric pressure in the Gulf of Thailand.
Source: WRS-ROMS Wind maps

The monsoon winds

From the second half of October through December, the province of Nakhon Si Thammarat is highly susceptible to being severely impacted by tropical cyclones because the cyclone can move into this province during that time. Most of the 15 cyclones that moved from the Gulf of Thailand and through or near Nakhon Si Thammarat Province during the 72 years between 1951 and 2022 were intense storms, according to the statistics. 11 depressions occurred in October 1966, ten in November 1960, 1962, 1964, 1966, 1970, 1977, 1983, 1999, and 2000, and four tropical cyclones occurred in January 2019. Due to the province's proximity to the Gulf of Thailand and its extensive coastline, the months of October (1962), November (1992), and December (1998) pose an elevated risk of severe cyclones more substantial than depressions. Therefore, this province is directly impacted by the cyclone. Moreover, there was a great deal of devastation, as both strong winds and torrential rainfall caused widespread flooding. (Chaijaroenwatana, 2000)

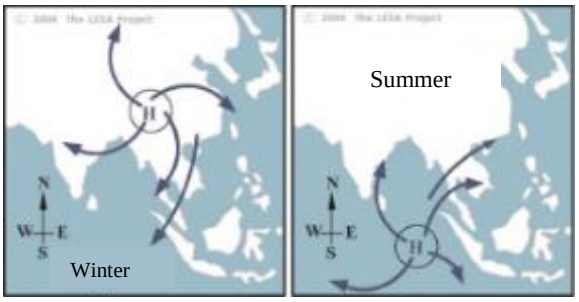


Fig. 5: Strength and direction of the Gulf of Thailand's winds in each season.
Source: Author (modified from Google map, 2022)

Literature Review

Vernacular Architecture

According to Sthapitanond and Mertens (2012), a settlement refers to the collective housing structure of people living in villages, towns, and cities. The fundamental elements of a settlement are the individuals and the spaces they inhabit. The environment plays a crucial role in human life, encompassing factors such as location, weather, landscape, soil, and plant species. It establishes a relationship between human settlements, enabling people in each area to adapt to their specific environments (Dick and Pitts, 1970).

Human settlements exhibit various types based on factors and components that influence primary settlement patterns. These include linear settlements, cluster settlements, unified settlements, and scatter settlements, as described by Neamsorn (1986). Each type is characterized by distinct spatial arrangements and organization within the settlement.

Thailand's vernacular architecture originated from the rural communities' indigenous knowledge. Depending on the local environments, the local constructors of each region are influenced differently, resulting in distinctive works. However, the objective is to construct a typical functional building rather than an aesthetically pleasing one (Srisuro,2000;Panin, 1999). The home and community create an environment that is conducive to living and cultural conditions that are unique to the region. Vernacular structures unfailingly reflect the culture of the people and are identical in every location. Because it is not a work designed according to an architect's preferences and fancies, it reflects common characteristics of society based on accumulated knowledge, experience, and expertise and passes it on to the next generation (Temiyaphan, 2000).

Suwan-Khiri (1994) highlights the relationship between southern vernacular architecture and climate, specifically emphasizing the influence of monsoon winds from the Andaman Sea and the Gulf of Thailand. The construction of houses in this region must take into account the wind strength and implement measures to mitigate its impact on the villages. According to Walliphodom (2006), the Thai South-East coast communities, Nakhon Si Thammarat, Songkhla, and Phatthalung, have a long history of constructing traditional houses predominantly using wood. These houses feature gable roofs covered with tiles and are typically of small size. The settlements encompass a mix of single and twin houses, with separate kitchen structures. The majority of these settlements are located along the coastal dunes, accommodating both fishing and farming communities.

Wijaya and Dwijendra (2021) have found that vernacular settlements in Indonesia were deliberately situated in relation to prominent natural elements like mountains, the rising sun, and life-giving sources such as rivers and the sea. These settlements were intricately linked to the local economy, as evidenced by fishermen's settlements positioned facing the sea to facilitate their maritime activities, while farmers' settlements were strategically located near rice fields to support agricultural livelihoods.

Buranaut and Seneevong Na Ayudhaya (2014) focus on the development of vernacular houses in the Songkhla Lake Basin. They highlight that these houses are traditionally oriented toward the East, with the placement of the house along the East-West axis. The use of tile roofing, often in a gable shape with a moderate slope, is popular to minimize the impact of wind. Over time, the Hipped Roof style gained popularity as a distinct architectural form, representing the cultural heritage prevalent in the peninsula and islands. To address the challenges posed by the region's highly variable weather conditions, the houses are designed with descending floors. The bedroom is situated on the top floor, followed by the sitting area on the balcony, the terrace floor, and the kitchen on the lowest level. Furthermore, the houses are constructed on stilts supported by stone piers, allowing for mobility and flexibility as they are not buried in the ground. This design feature enables the possibility of lifting and relocating the houses when needed.

The comparative analysis of Islamic vernacular houses at the Tha-sala seacoast reveals shared characteristics that exemplify the wisdom and adaptive nature of these dwellings in harmonious coexistence with the local environment. These characteristics include thoughtful house planning, architectural styles that align with the topography and climate, as well as considerations of occupation, way of life, beliefs, and cultural practices specific to the area.

Research Methods

This research is a qualitative research study. Documentary research is a study of documentary information, including information related to settlement theory. vernacular architecture and characteristics of local Muslim houses in Southern Thailand and have applied the knowledge to define a conceptual framework for analysing and summarizing the research results.

This research examined houses in Ban Nai Tung. Ban Bang Bai Mai Community Ban Sa Bua Community, Tha- Sala District, Nakhon Si Thammarat Province. Houses at least 30 years older from each community were selected for closer examination.

Criteria for selecting a case study house using age criteria for house construction and community context (due to survey Initially found Houses of Thai Muslims aged 30 years and over. According to field surveys, there are not many case study houses left. because the community conditions often change because of monsoons) found that most of them are still houses that in the age range of 1-30 years)

I surveyed a sample of 15 houses (5 sample houses per community), so the house was selected as a sample of 1 house per area from a total of 3 communities. With the condition was that the house was built in the context of a fisherman's society and made a living in fishing. and located at the same distance from the coast.

The research conducted photo sessions of the houses and in-depth interviews with local homeowners. It studied the factors such as the environment and ecosystems that have affected the lifestyles and architectural styles. It focused on the wind direction and speed along the Tha-Sala coastline, Tha-Sala District, Nakhon Si Thammarat Province to ascertain if this had any influencing the settlement of the house?

The research analysed and processed the data by referring to the documents and field data to summarize them. It also compared the results with the previous studies taken as the secondary data analysis (Ruhullah & Mutiarin, 2021) The research unravelled the how the vernacular houses have developed in the Tha-Sala District: if it related to the directions of land and sea breezes.

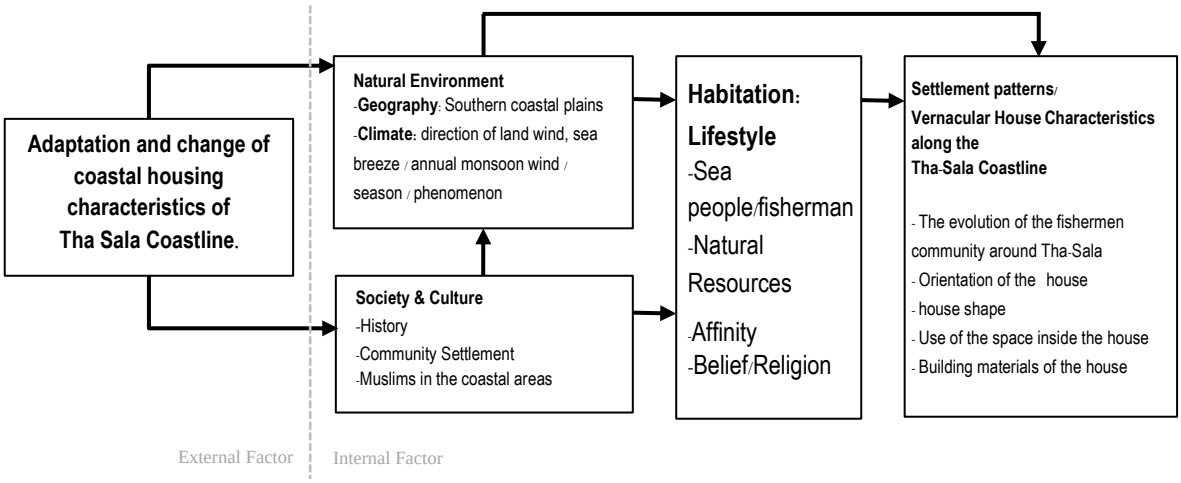


Fig.6: The conceptual framework of research.
Source: author

Research Analysis and Discussion

Characteristics of vernacular houses along the Tha-sala coastline

Study of the Tha Sala community's urban plan and vernacular house design. Analyse and connect the factors involved in forming patterns consistent with the context and natural environment. When selecting a case study from a field survey of 15 houses by selecting a sample house to analyse various building elements. Choose from the depictions of each community structure. They were permitted to enter the survey, which is still in use, with three conducting in-depth interviews after data collection. with the condition that choosing the sampling house was built in the context of a fisherman's society and made a living in fishing. and located at the same distance from the coast. so, the house was selected as a sample of 1 house per area from a total of 3 communities. Photographs and building surveys from Fig.7 the image showing the house's location were used to analyse the data presented in Table 1. You will observe the dimensions of the use and lifestyle of the building's occupants and the architectural features.

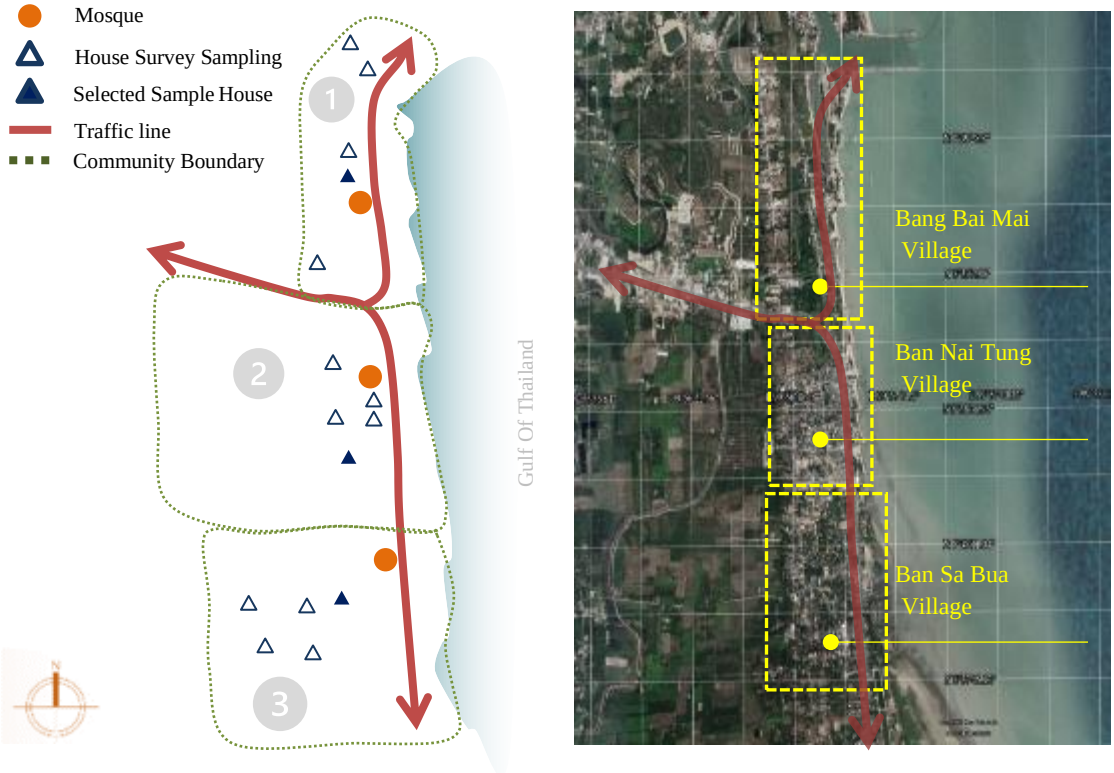
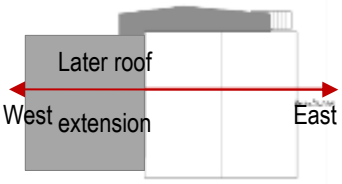
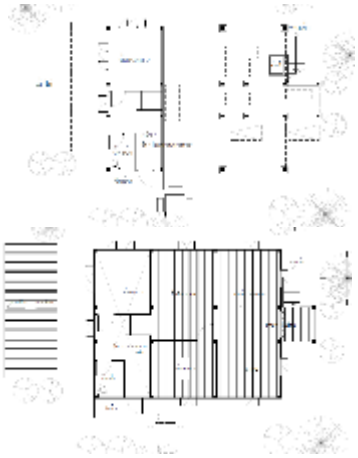
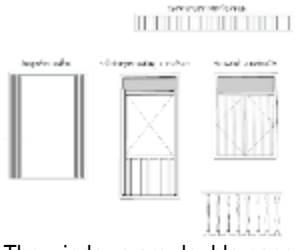
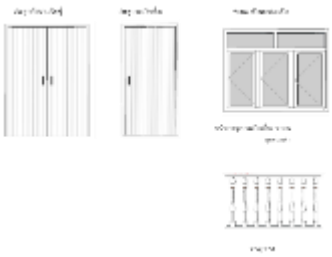
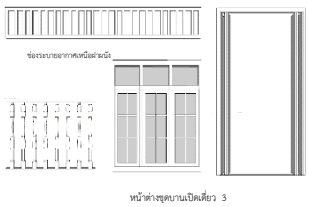


Fig. 7: The location of the case study houses and the boundaries of each community.
Source: Author (modified from Google map, 2022)

Table 1: The relationship of house characteristics. General house and physical data
Source: Author

Physical Data of the 3 Vernacular Houses			
	1.Ban Bang Bai Mai community	2.Ban Nai Tung community	3.Ban Sa Bua community
Form Of House	front porch Beneath the House High 1.80 m. concrete column base top with wooden pole	There is a balcony at the entrance to the house.	Beneath the House High 1.80 m.
Lay Out Plan	Main Entrance Sub Entrance	Main Entrance Sub Entrance	Main Entrance N

Orientation Plan	 gable roof East-West orientation	 gable roof East-West orientation	 gable roof East-West orientation
Floor Plan / Beneath the house	 The original plan of the house was a wooden house, later added with a concrete wall structure at the back of the house at the West. A kitchen Area /1 bathroom Beneath the house used as a storage area for fisheries. The main entrance is still East. **Upper floor** Open planning for the Living area. 1 bedroom	 The original plan of the house was a wooden house, later added with a concrete wall structure at the back of the house at the East. Beneath the house used as a storage area for fisheries. A kitchen Area /1 bathroom/1 toilet The main entrance is West following the traffic. **Upper floor** Open planning for the Living area. 1 bedroom	 The original plan of the house was a wooden house, later added with a concrete wall structure at the back of the house at the West. Beneath the house has no function. A kitchen Area /1 bathroom/ 1 toilet The main entrance is North following the new structure. **Upper floor** Open planning for the Bedroom
Element Of House	 -The windows are double panes with wooden frames. -The size of the long bloom to the floor with railings to ventilate -The top of the wall has wooden slats for ventilation. -The main entrance door is a folding wooden door. -The wooden railing is a vernacular style. Southern -Thailand	 -The windows are double-pane, wooden frame, and a set of 3 single-pane doors, wooden frame, and glass panes. -The main entrance doors are single-leaf wooden doors. -The wooden railing is a vernacular style. Southern -Thailand	 -The windows are double-pane, wooden frame, and a set of 3 single-pane doors, wooden frame, and glass panes. The top of the wall has wooden slats for ventilation -The main entrance door is a folding wooden door.. -The wooden railing is a vernacular style. Southern -Thailand

Material &	- Roofing material thatched with double corrugated roof - The wall of the house has a wooden structure on the upper floor. Connect the vertical wall, mix the horizontal hit, overlap the scales below and addition to the back of the house with the reinforced concrete structure.	- Roofing material thatched with double corrugated roof - The wall of the house has a wooden structure on the upper floor. Connecting to a horizontal wall overlapping sheets.	- Roofing material thatched with double corrugated roof - The wall of the house has a wooden structure on the upper floor. Connect the vertical wall, mix horizontally, stack the bottom plate and the first floor is a reinforced concrete structure.

General information about the Vernacular houses			
Age	70Years	42 Years	30 Years
Occupy	Employees/ Local fishery	Making a fish raft	Employee/gardener Local fishery (in the past)
Function	- is a residential house -Entrance to the main house is on the East -The basement of the house is an old storage area. And the area is used for fishing nets .	- is a residential house -Entrance to the main house on the East - Underneath of the house is used to store fishing equipment and make nets.	- is a residential house - Entrance to the main house is in the East after adjusting to the North - The open basement area is used only for parking motorcycles and litter for sitting and relaxing.
Orientation	- Does not obstruct the wind direction from the coast	- Does not obstruct the wind direction from the coast - Traffic route from the main road before cutting the sub-road within the community	- Traffic route from the main road before cutting the sub-road within the community

Vernacular Houses of the Tha Sala Coastal Community

Context pertains to both identity and lifestyle.

Each community's vernacular architecture consists primarily of residential structures. Buildings are constructed by the villagers and artisans of each community without relying on architects as designers. Therefore, they are vernacular architectural design. Various characteristics are based on cultural, environmental, and climatic factors (Kitchai, 2007). Most houses are placed according to the sun in the East and the West.

Characteristics elated to geography

The coastline climate is characterized by relatively high air humidity levels, which influences the houses. The large opening can be opened to enable the wind to blow the moisture away from the house and prevent moisture from the bathroom and the kitchen from entering the resting area. This has resulted in the positioning of the bathroom and the room. The fence faces the South or the West, which is opposite to the direction of the marine breeze.

Ventilation

In coastal climates, in addition to high humidity levels, there are also high temperatures and saline sea mist. Consequently, articulated ventilation is essential for coastal communities. This results in large ventilation-promoting openings such as windows, doors, and openings above the walls and windows, and vertical wooden railings.

UV and thermal protection

Most of the houses have thatched gable roofs. This is a characteristic roof shape that is suitable for tropical climates and helps prevent heat and rain. Double-corrugated tiles are a popular tiling option too. The roof slopes downwards in proportion to the usable area, the gables are elongated, and many houses are elevated on a high foundation. Beneath the house, a space measuring between 1.50 to 1.80 meters that can store equipment related to residents and transfer heat to the floor.

Architectural characteristics, habits, and cultures

According to field studies and joint analysis with the documentary sector, it was found that the vernacular house in Bang Bai Mai and Nai Tung communities.

Most of them are houses that are mainly used for local fishing. The nature of traditional fishing is to use small boats and nets to catch fish.

Living is reflected in the vernacular style of houses with open spaces in the basement used for storing fishing gear and equipment. Collect various fishing nets and use these materials to divide the area or divide the space in the beneath the house.

Ban Sa Bua Community Area It will be a community that makes a living and trades processed raw materials from caught marine animals such as Making dried fish, dried shrimp, shrimp paste, etc. In addition, in the area next to the seacoast, Tha Sala is often cultivated, gardening and raising animals. reflected in the construction of houses between coconut plantations There are areas for raising animals for agriculture.

In addition, the survey revealed that residential construction in the Tha-Sala coastal community is declining. This Muslim community with adjacent houses frequently expands its ancestral settlements without obstructing the house's boundary.

Existing factors affecting the architectural style of the housing

Due to the following factors, it is evident from the above study that characteristics of communities and vernacular houses along the Tha Sala coast continue to exist and manifest themselves in relation to the context and natural environment with the settlement or house orientation:

1) Climate in coastal lowlands Wind direction over land; sea breeze; annual monsoon
2) The familial structure and lifestyle of local fishermen

Style adjustments & modifications to the Tha-Sala coastal community housing

Two factors influence the condition of the community along the Tha-Sala coastline: The external factor is urban physical development, with the development of transportation routes along the primary road. Parallel to the main road, a road has been cut into the area nearby to a secondary community's route. Consequently, the houses continue to be oriented in a Western-style layout with a gable roof directed to the coastline. This shows that it determines the direction of the house so that it does not block the monsoon winds and the sea breezes from the East coast. This is another external factor that influences the house style or layout in the Tha-Sala community.

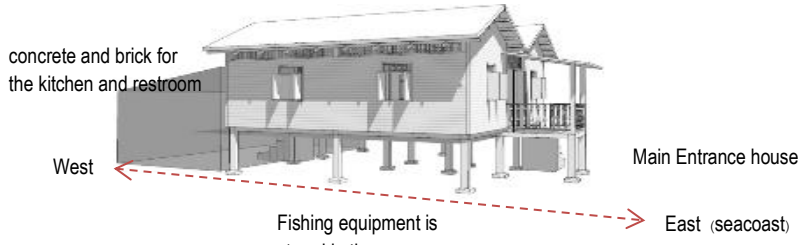


Fig. 8: layout of the Ban Bang Bai Mai house Style
Source: Author

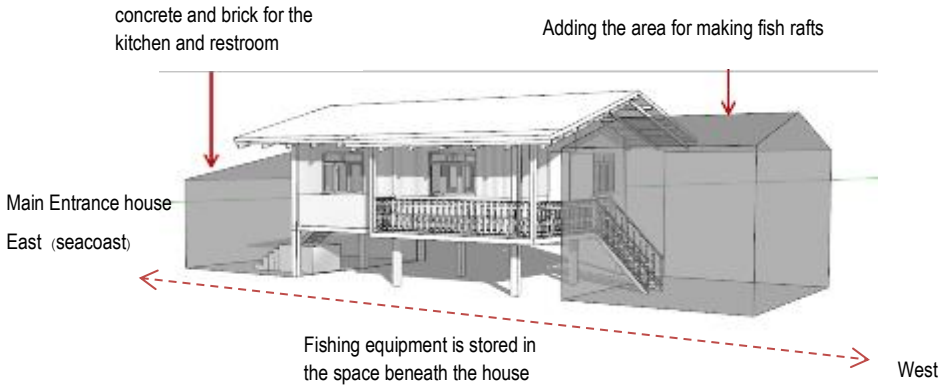


Fig. 9: layout of the Ban Nai Tung house Style
Source: Author

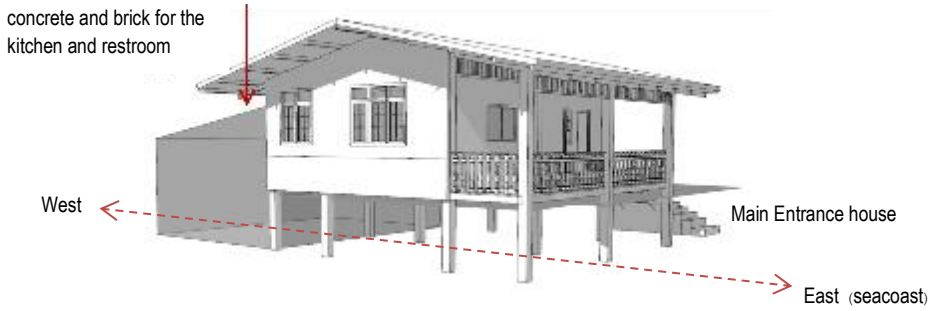


Fig.10: layout of the Ban Sa Bua house Style
Source: Author

In addition, it was discovered that house floor is elevated approximately 1.50–1.80 m. for ventilation and to allow the wind to pass through the house to reduce humidity and heat. Therefore, fishing or net-making equipment is stored in the space beneath the house, which has been later expanded with a structure made of concrete and brick for the kitchen and restroom. From the case study and at a reduced level, the house's entrance was on the Eastern side. The bathroom and the kitchen are located to the West or the East, in response to the topography and the direction of the wind, revealing the relationship between air ventilation and the function of spaces in vernacular houses.

Conclusion

This research answers research questions on land-sea and monsoon winds that influence the orientation of the Tha Sala vernacular house in Thailand. It was found that the sample houses in all 3 communities were established in the form of a gable roof to help ventilate hot air, along the East-West direction. That is because it is in a direction that does not obstruct the sea breeze and the monsoon winds on the East coast. All 3 communities have a basement raised about 1.50-1.80 m high to be used as a storage area for fishing equipment, and to ventilate hot and humid air in accordance with the ventilation characteristics of tropical regions in the region as well as prevent moisture and heat from the sea breeze with a long overhanging roof to protect from the sun and rain.

In addition, the Muslim settlement of Tha Sala relied on family and ancestral expansion. This is consistent with the factors of kinship settlement and ancestral expansion. This is the traditional way of Muslim fishermen expanding the community of each neighborhood with religious places.

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