CHAPTER 4

CYCLONE AND ITS IMPACT ON SHIPPING INDUSTRY

Transport on rivers and canals were cheaper than road and rail transport. Large navigable rivers are free permanent ways like the sea, provided by nature, involving no construction cost. Their maintenance is also cheap. Francis Day enthused over the desolate sandy strip of land, was granted permission in 1639 for the formation of Fort St. George. It was an open beach, little more than a sandbank, with no harbour at all. Madras crew may have been a narrow peninsula well protected on two sides by river and on the third by the sea, but ships could not sail it during the monsoon months. The Indian Ocean has played a significant role in the Indian Ocean trading world. There has been considerable debate whether to treat the Coromandel coastline as a major trading region of the Indian sub-continent or as a micro region of the Indian Ocean region. But Coromandel played a great role in the development of the economy of the hinterland and therefore historians like Arasarathnam look at the long Coromandel coastline as a distinct major trading region of the Indian sub-continent. The recent researches also prove beyond doubt the significant role played by Coromandel in the economy of the region and the place it has created for itself. The recent studies have opened up a variety of dimensions in the study of Coromandel as a collaborator in trade.

The East Coast of peninsular India was called the Coromandel Coast by the European writers and the European trading companies have adopted it in their official documents. The Portuguese were the first one to apply the term 'Charamandel' to the coast of the present day Tamil and Telugu countries. Barbosa wrote it as ‘Coromandel’ as against the original printing of the term chararamandel, and it stayed during further periods. There were also many minor ports on the Coromandel Coast during the Middle Ages with lesser trading activities which assumed importance from the sixteenth century. Such insignificant ports shot into prominence
for export and coastal trade. At the close of the nineteenth century, there were about 65 ports in the Madras Presidency, many of them were in the coast of Tamilnadu.

MAP: 4 COROMANDEL COAST AND ITS PORTS

(Source: From a map by John Russell, Liverpool, 1814)
They were: Madras, Marakkanam, Cuddalore, Portonova, Kodiampalayam, Velanganni, Toppururai, Point Calimer, Adirampattanam, Muthupet, Krishnajipattanam, Kattumavadi, Ammapattanam, Kottaiyappattanam, Devendrampattanam, Tondi, Namithalai, Mudiamppattanam, Attangarai, Pillaiyarmadam, Emmandalamumkondan, Pamban, Rameswaram, Mandapam, Vedalai, Marakkayarpattanam, Valinokkam, Ervadi, Vaipar, Tuticorin, Kulesekarapattanam, Kayalpattanam and Colochel. Among the above ports Madras, Nagapattanam and Tuticorin were ranked as major ports and the others as minor ports. Porto nova, Nagapattanam, Kilakkarai and Kayalpattanam were also in the main stream of oceanic trade. Karaikal, Pasipattanam, Namithalai, Mudiamppattanam, Attangarai, Pillaiyarmadam, Emmandalamumkondan, Rameswaram, Mandapam, Vedalai, Marakkayarpattanam, Ervadi, Valinokkam and Vaipar ports were reduced to lesser or insignificant trading activities at the close of nineteenth century. Most of the Coromandel ports were located in the mouth of estuary of small rivers. Country vessels could sail into these rivers in favorable seasons to bring hinder land products for export. In 1867, the ports of Nagore and Nagapattanam were merged.¹

**Indian shipping**

Ancient Indian literature furnishes rather meager evidences directly bearing on Indian Shipping and ship building; it abounds with innumerable reference to sea voyages and sea borne trade and the constant use of the ocean as the great highway of international trade and commerce.

Ancient Tamilagam has a rich tradition of sea going culture. The Indian shipping industry developed remarkably by the end of the fifteenth century. By European standards fairly large ships were built in South India. The ships as they have been recorded were of 350 to 800 tons burthen. Some of them were bigger than the Portuguese ships in the Indian Ocean. The Muslim communities of peninsular India had contributed much for the development of shipping in Indian Ocean. The

ships of the Bay of Bengal region were generally built in a sturdier fashion to withstand the occasional cyclones in the area but they were slower to sail and they had to sail in time of favorable wind and weather. The labour and technical skill to operate them also came from the Muslim communities. The Portuguese records speak about the carpentry occupation of the Muslims of peninsular India and Ceylon. When the English appeared in Indian waters in the seventeenth century they found that the Coromandel ships were better than theirs. The English ships were built of Oak tree, fastened with iron nails, the corrosion of which consumed the very metal which was supposed to unite the planks. Hence the English turned to the South Indian technology and began to build crafts with teak wood engaging local craftsmen. In 1821, timber was declared as state monopoly and small boat builders were not able to get teak wood for boat building. Many of the merchants of Kilakkarai also built ships of their own for their maritime activities engaging local carpenters. The Muslim merchants in Nagapattanam and Nagore also built ships of considerable burthen up to 500 tones in the port. The English purchased such vessels from the local Marakkayar merchants and the company also utilized their technical skill. The Marakkayars of Kayalpattanam built ships for own activities and also sold vessels to the English East India Company. The maritime communities engaged in seafaring and fishing activities throughout the stretch of the Coromandel Coast, built ships and boats of their own with the available local skills. They build such vessels with traditional technology.

**Indigenous seafaring traditions**

There is no universal model of survival strategies in the world. It varies from country to country, region to region, community to community and even individual to individual. Actually, during any disaster, people exercise their own coping and survival strategies to respond to the situation before they get outside help. However, local people have some traditionally prepared activities to minimize cyclone effects.

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We are kin to the rivers; the streams and the pools;
We master the wind and the swelling wave;
Weeping, we furrow the well-tilled earth,
Digging swift channels to the sea.

The maritime community of the Coromandel Coast with their long association with the monsoon dominated oceans, have inherited the knowledge and techniques of navigation as handed down to generations by oral transmission. Such knowledge of practical navigational utility include the knowledge of topography of littoral seas and adjoining coasts, sea circulation including tides, waves, currents, sea-life, sky and weather conditions in different parts of the year, cloud typology, wind, foul weather system, star recognition in relation to their movement in the sky etc. Repeated observations of these phenomena over time and space have generated practical tips for use in open sea sailing as handed down from generation to generation. The following observations and remarks highlight the way human related unnatural behavior and phenomena were used to foretell natural calamities.

“Noticing the continuous cry of a dog my elder brother predicted a cyclone and warned us. Then I noticed that the leaves of the cotton tree had turned upside down. I understood my brother is right. At that time there was no radio, no signal, no warning from loud speakers, so we had learned to read the natural sign of the calamity.”

- a 87 year old man

“The wind had been blowing violently … I guessed there would be a Puyal (cyclone), my appa would be saved by God when he is the sea to catch fish.”

-21 year old girl from Thangachimadam (Rameshwaram)

“The wind had been blowing violently from … At that time there was no radio, I guessed there would be a cyclone. My mother told me to tie the cattle beside the pond, she also predicted a flood, and she had closely watched the movements of flies, mosquitoes, and ants. The dogs were also crying mournfully.”

- a 78 year old man
The pigs behave in an erratic and agitated way, 2 or 3 days prior to the arrival of cyclone. Besides this, it is also observed that the marine snakes roll together and float like a ball. When such balls are washed ashore they indicate, the arrival of cyclone and rough weather. Many of them also have observed small bubbles on the surface of the water in offshore areas. Besides all these things, they keep track of clouds. If the dark clouds congregate in large masses with heavy lightning and thunder, it is a sure indication of cyclone. The winds from different directions also become strong, turning into a gale, all these things are collectively considered to predict the arrival of cyclone.\(^3\)

These kinds of information are easily visible and simply disseminated among the rural people, without any special equipment. It is most useful to focus on indicators, which are most widely applicable and can monitor near people’s homes such as those relating to the animal behaviour and the weather patterns.

Much of the experience and skills are common to both open sea and coastal voyages. The safety of the voyage solely depended on the vessels in rough seas and sailors perception of sea environment. Every mood of the sea-men, by experience, have been inherited and conserved. The living experience and guidelines followed by the present day seafaring people are from unpublished folk documents, folk songs and oral traditions which form the main source for this subject.\(^4\)

**Traditional knowledge about wind**

Thomas Fuller observes that

“The wind is not only wild in a storm, but even stark mad in a hurricane.”

There is an intimate association between winds, weather and direction. The seamen find a strong association with weather since wind brings the weather and sailing is regulated by wind direction and speed. The winds are named in different ways. The feel of the wind gives indications of the direction from which it blows and hence the name of the

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4 Appendix No.9
wind is associated with the direction, the chilly breeze (*Vaadai Katru*) from the north, the pleasant breeze (*Thendral*) from the south, the *Varsha katru* (the wind that brings rain) from the Southwest. Seamen in Ramanathapuram coast name the wind from the sea to land as Chola katru. In some areas the Purakatru and Karaikatru are the names respectively for sea and land breezes. These winds have been traditionally taken advantage of, for sailing out (karaikatru) and in (purakatru) by the fishing crafts. A wind from the west to the east is called Kachan, and the name is associated with Kutch, indicating the direction of its origin. Wind from the east to the west is called Kondal. In some parts of the coast, the east wind is called Eelakatru.

**MAP: 5 MAP OF INDIAN WIND -ROSE**

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Wind from intermediary directions are: from north-east Vaadai-kondal, south east, Chola Kondal. The wind that determines the change in direction is called Theerkatru. The direction of the wind is denoted by the sail of the vessel. The waves are always directed towards the coast. Sea lore associates specific winds with foul sailing weather, for example, the vaadai-kachan is said to lead to capsizing of cargo boats in the Tamil coast. Fisher folk songs describe the huge swell of waves that develop when the Vaadai kachan blows causing the boats to break along their seams and the ship masts to tremble. During this time the change is also an indication in this respect. The cyclone brought about by kondal (wind of cloud) leads to the breaking of the mast and tearing of sails which was felt in the Pandya coast. Further the kondal will bring rains. The foul weather, cyclones and depressions are well recognized with the help of the changes that occur in sea life. It is believed that on the approach of cyclone, fish like Thirukkai appear with its tail upturned, and sea snakes will float like balls.6

Every type of wind has its own purpose and plays a specific role in everyday life.

**Waves and Sea-Currents**

Intimate knowledge of the waves, tides and currents is an empirical acquisition of cumulative experience though sailing off in different months of the year had provided the seamen of the Tamil Coast with a range of ready reckoning rules which are used judiciously and have helped them to steer through difficult and foul weather on the one hand and to avoid adverse weather through reading of premonitory signals on the other. The seamen categorise the sea of the inner self as the Karaikadai, where sailing in and out depends upon the flood and ebb of tide and purakkadal of high waves. The perception of the rise and fall of the tides is familiar to the sea faring communities. The low tide and high tide days are calculated through the new moon or full moon. According to the Muslim fishermen who follow the lunar recurring say that the sea recedes to low tide or kuruneer, during the 3rd, 14th, 17th, 28th, 30th days from the new moon day. To the Hindus and Christians the high seas in the coastal waters are

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6 Ibid. p. 192.
associated with the period of Ekadesi (11th day) to 4th day of the new or full moon day. The common astrological saying according to the Sastras is that if the new moon falls on a Tuesday, and the governing constellation of that particular day (named Kettai) a storm will certainly occur on it. The word “Sastras” here bears the meaning ‘science’ or scientific (i.e. astrological works.) The disturbance in the weather in this instance was held to be due to the conjunction of three causes; viz., the day in question was a Tuesday, and a new moon day; and it was under the influence of the star Kettai. Thus the maritime people had a sound knowledge by tradition about occurrence of high and low tides and their effects and utility.

**Season of arrival from England**

When the southern city was the chief British settlement in Hindustan and the principal mart for European and native goods, the East India Coast and Bay of Bengal, timed their arrival for the middle of the year when fine weather was assured and a constant southerly breeze bore them northward from cyclone. The vessels, heavily masted and armed for defence, sailed in company for the sake of security, and generally reached Fort St. George during the month of July. The Southwest and the Northeast monsoons which the Arabs called “Mawsian al-kows” and “rih al-saba” respectively, divided the calendar into two. From June to August an area of low pressure prevailed in the entire region from the equator to the Himalayan heights and winds laden with moisture traveled in the direction of the vertical sun. The time for sailing in the eastward direction began just as the Southwest monsoon set in, but during the three months from June to August, when the winds were at their strongest, the ports on the western and eastern coasts of India remained closed for shipping. The change over the monsoons roughly coincided with equinoxes, when the sun crossed the equator. The Northeast monsoon extends from October to December, with light winds and fine weather associated with high pressure.7

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The Coromandel Coast lying on the eastern side of Cape Comorin in the longitudinal direction is exposed to the ferocity of cyclones which batter the coast during the Northeast season. The seas of the Indian Ocean had their own timetable for the correct departure and arrivals, which the shipmaster ignored at the peril of the cargoes, ships and the crew. The above was the routine time schedule of the winds and frequently the season of winds became the season of cyclone also. Hence cyclone was a dreaded aspect on the shore.

Land marks for shore

Fixing of location in the open sea is invariably a technique of resection using two or more known positions to fix the unknown. If the vessel is coasting and is within a visible range from the shore, objects can be distinctly recognized either by their prominence and dominance in the local shore landscape. Temple gopurams, churches, minars of mosques, trees etc. are used for identification. The projecting indicates the correct position of the shore in many areas. Most of the minor ports had no light houses. The vessels approaching the shore recognize the particular shore with the help of lights in tall buildings and lights in the adjoining shores and big trees in the particular shore during day time. The use of birds like sea gulls and sea crows to identify shore and land when shores are invisible is a practice that finds references in ancient works. The sailors recognized that the birds would fly at the distance of 15 to 20 miles from the shore. From this it could be inferred that the shore was at a particular distance. Colour of the sea water, types of sea life including snakes and fish also helped to identify the coast and is a well known tradition. Estimation of location away from the shore in open sea in the absence of any identifiable landmark anywhere in the horizon, poses a formidable challenge to the navigator. On such occasions, it is estimated by the direction and distance hitherto travelled. So far as the technique of safe landing was concerned, the ancient mariners had an indigenous mode of operation. Once the vessal approached within sight of the shores, its identifiable landmarks were used to find out the specific port, as every port had a unique situational setting and individualistic features by which it could be located. During the olden days the landing was frequently attended by accidents in stormy weather. Boats were overturned and
valuable cargo was lost. Even if only partially swamped, much damage was done to perishable goods by the sea water. The accidents were often the result of carelessness on the part of the boatmen.\(^8\)

Almost all the maritime Districts were affected by tropical cyclones. But, the coastal areas of Andhra Pradesh have experienced the maximum number of cyclones followed by the maritime states of Tamil Nadu.\(^9\)

**Shipping technologies**

There are great variations between the cultural, economic, geographic and climatic environments of the Indian Ocean region, there was an early and distinctive differentiation of shipping technologies in the age of sail. There was no single or dominant maritime technology, but rather, sub-regional, technological traditions formed by local imperatives and the selective adaptation of other technological traditions.

Local material, environmental conditions, the depth of coastal waters, the strength of winds, the direction of ocean currents and the weight and volume of the most common cargoes were all factors which influenced the design of sailing craft around the Indian Ocean. Politics and war were possibly other factors in encouraging new maritime technologies. The cycles of the monsoons provided the basic rhythms of long-distance voyaging across the Indian Ocean. These winds gave regular and a swift passage across the great distances of the ocean.

Nawab’s Mercantile Marine Bowney, gives an account of the various kinds of ships and boats. The *Massoola Boats*: used in loading and unloading ships or vessels, are flat bottomed and most proper for the Coromandel Coast; for all along the shore, the sea runneth high and breaketh, to which they do buckle and also the ground where they strike.\(^{10}\) The building of the boats all along the coast of India varies according to the localities of the Port which they are destined, and each is peculiarly adapted to the native of the coast on which it is used.

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There is another kind of boat called the Catomaran, made of four, five, or six large pieces of buoyant timber upon which they can lay 3 or 4 tons of weight. Patellas: great flat-bottomed vessels of an exceeding strength and built very strong. Each of them will bring down 4,000, 5,000, or 6,000 Bengal mounds. Budgroo, a pleasure boat was used by the upper classes. Bajra was a kind of large boat, fairly clean, the centre of which formed a little room. Purgoos, were used for loading and unloading ships. They had to live a long time in the sea, being brought to anchor by the stern, as their usual way is. Booras: - were very floaty, light boats. These carry salt, paper, and other goods from Hugli downwards, and some trade to Dacca with salt.\textsuperscript{11}

F. Baltazar Solvyns, a French man (1811) in his Les HIndous, described about the typical Indian vessels of 19\textsuperscript{th} C. A Pinnace or Yacht was strongly masted ships, the Bangles were the largest Indian boats, some of them carrying four thousand or five thousand mounds of rice. Brigs were ships that came from the coast of Coromandel and Malabar, bringing to Calcutta the produce of these countries. Dony, belongs to the coast of Coromandel. Its deck consisted of few planks fastened on each side. Patlooas, these ships differed from other vessels.\textsuperscript{12}

\textbf{Map making and Survey of the sea beds}

Survey details are highly fragmentary up to 1824 A.D., and only from then on sources are available with continuity. It may be due to the fact that the Marine Board was formed in 1824 and since then recording of events became regular to get the sequence of events with accuracy. Prior to the formation of the Marine Board, the records concerning navigational improvements were kept in the Board of Trade and hence marine matters couldn’t be recorded in full for want of space, time and money. The contribution of James Rennell, whose share in drawing the map of India is commendable. The process of map making, the survey of the sea bed, covering the Gulf of Mannar, done on scientific lines and the compilation of a directory to provide guidelines to the seafarers went a long way in

\textsuperscript{11} H.Bavan, \textit{Thirty years in India} (1808-1838), Vol I. p. 14
rapidly increasing the number of vessels on the Coromandel Coast for trading and passenger traffic purposes. It would not be farfetched to say that the survey of Mannar region alone could bring out the potentials of the Pamban Channel for improved mode of navigation. In fact the Company spent Rs.1,11,688 (1839-1846) towards surveying the coast but the expenditure had a very big impact in improving the navigation.

**Marine Insurance**

The Coromandel Coast, being very shallow shifting sandbars, posed a serious challenge to navigation. The entire coast didn’t have a good harbour excepting for Trinconamalai in Sri Lanka. Hence it was a permanent nautical advice that Coromandel should be avoided during the Northeast monsoon, because ships couldn’t be berthed during unfavourable climate. Yet, the unpredictable nature of voyage couldn’t preclude taking on sea during the monsoon and on many occasions mariners faced the wrath of the sea. At the change of the monsoon in October gale or storm used to hit the shores and hence mariners usually avoided the coast by sailing into the sea. The Marine Insurance companies and underwriters were also wary of the precarious nature of the Coast and insurance cover was not available for voyages between 16th October and 15th December every year if they happened to navigate in the Indian Ocean region.¹³

**The Native Passenger Ships Act 1887**

The Native Passenger Ships Act 1887 empowers the Governor General in Council to declare the ‘seasons of fair weather’ and ‘seasons of foul weather’ during which there will usually be light winds, calm sea and little or no rainfall, while during a season of foul weather storms may probably occur and there would be usually stronger winds with more or less rough sea, and probably more or less heavy rainfall. The season specified in the second and third column, of the schedule are deemed to be

seasons of fair weather and seasons of foul weather on the coasts specified opposite to them in the 1st column of that schedule respectively

**TABLE: 17 SEASONS OF FAIR WEATHER FOR SHIPS**

<table>
<thead>
<tr>
<th>Column 1 (coasts)</th>
<th>Column 2 (seasons)</th>
<th>Column 3 (fair a foul weather)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ceylon (Gulf of Manoor)</td>
<td>1st Jan to 15th April</td>
<td>Fair</td>
</tr>
<tr>
<td></td>
<td>16th April to 31st Aug.</td>
<td>Foul</td>
</tr>
<tr>
<td></td>
<td>1st Sep. to 31st Oct.</td>
<td>Fair</td>
</tr>
<tr>
<td></td>
<td>1st Nov. to 31st Dec.</td>
<td>Foul</td>
</tr>
<tr>
<td>2 Madras (coromandel)</td>
<td>1st Jan to 15th April</td>
<td>Fair</td>
</tr>
<tr>
<td></td>
<td>16th April to 31st July</td>
<td>Foul</td>
</tr>
<tr>
<td></td>
<td>1st Aug to 15th Oct.</td>
<td>Fair</td>
</tr>
<tr>
<td></td>
<td>16th Oct. to 31st Dec.</td>
<td>Foul</td>
</tr>
<tr>
<td>3 Bengal including Orrisa and Arakum</td>
<td>1st Jan to 31st March</td>
<td>Fair</td>
</tr>
<tr>
<td></td>
<td>1st April to 5th Aug.</td>
<td>Foul</td>
</tr>
<tr>
<td></td>
<td>16th Aug. to 30 Sep.</td>
<td>Fair</td>
</tr>
<tr>
<td></td>
<td>1st Oct. to 15 Nov.</td>
<td>Foul</td>
</tr>
<tr>
<td></td>
<td>16th Nov. to 31st Dec.</td>
<td>Fair</td>
</tr>
</tbody>
</table>

(Source: Port Manual p.p.292-293)

**Note:** The whole year shall be deemed to be a season of fair weather for ships plying between the ports of Devipatnam and Pesalai and between Paumban and Vennkalar provided they make the passage north of Adam’s Bridge in the South West and South of it in the North-east monsoon.

**Contribution of Piddington**

Research on tropical cyclones began within the world of Indo-European commercial enterprise in the early nineteenth century. The European knowledge served navigation in the Bay of Bengal, and was meant to offer sailing ships practical ways to avoid rotating seasonal storms. Indian meteorology in this time did not deal with oceanic events. The rules and precepts that constituted indigenous meteorology addressed mainly prediction of the monsoons, and were partially moralistic and astrological. Although based on the experience of mariners, the new knowledge was codified by officers. Meteorology was neither an academic discipline nor an administrative office at 1800. But the form of a scientific exchange and an indirect link with the government were followed. In the early nineteenth century, little was known about these violent tropical storms, except that they wrecked ships on the high seas and caused untold
destruction and loss of life while crossing the coastline. But there was one man who had unraveled their structure and visualized their rotating nature. He was the first British sea captain, and then the President of the Marine Courts of Inquiry at Calcutta. He had made a thorough investigation of a storm that had struck disaster on the east coast of India in December 1789, killing over 20,000 people. By virtue of his duties dealing with the affairs of storm-damaged ships, he had access to the logs of almost all of those that had been caught in a storm and survived. He copied the position, pressure, and wind data contained in the logs, and combined them with observations taken on the coasts. The logs contained a great deal of visually descriptive data. Captains wrote in their reports accounts of waterspouts, the ‘ragged edged’ clouds, and the ‘small storm’, that had a shorter physical and temporal span but with great force. He presented his results before the Asiatic Society of Bengal at Calcutta in 1840, and described the storm as a ‘cyclone’, a name derived from the Greek word. Piddington introduced this newly coined word in the books that he wrote soon thereafter on the laws that governed the tropical storms. Piddington’s book entitled ‘The Horn-Book for the Law of Storms for the Indian and China Seas’, published in 1844 an enlarged version of this book, with the title ‘The Sailor’s Horn-Book for the Law of Storms’and yet another book in 1852, entitled ‘Conversations about Hurricanes: for the Use of Plain Sailors’ was all written in the style of a ship’s captain training an apprentice sailor, about how to deal with storms, how to know that they are approaching, and how to take advantage of them. The books included transparent storm cards with wind arrows that could help the captain of a ship caught in a storm to sail with the wind into safer waters.

It is said that in 1854, Piddington wrote an open letter to Lord Dalhousie that the new port that he was building at Calcutta would not be able to withstand the fury of a tropical cyclone if hit by one. Dalhousie, however, did not heed this advice. Port Canning was built, but it was indeed destroyed by a cyclone in 1867 and later abandoned. By 1875, the name cyclone had gained the official acceptance of the international meteorological community. Today, however, tropical cyclones are called by this original name only in India and the adjoining seas, Arabian Sea, Bay of Bengal, and the Indian Ocean. Over other oceanic basins, they are now commonly known as hurricanes or typhoons.
Between 1830 and his death in 1858, Piddington processed the raw material into more than twenty articles, all published in the *Journal of the Asiatic Society of Bengal*, and named it ‘the law of storms’. Piddington’s mode of analysis proved to be enduring. A later work remembered him as one ‘who has for a number of years conferred so much benefit on the navigation of the Indian seas by collecting facts illustrative of the laws of circular storms and by producing knowledge by which to avoid their dangers. From the 1860s, the set of artisanal guidelines that Piddington had called ‘our new science of Cyclonology’ were beginning to be absorbed within scientific meteorology. The artisanal knowledge had found a vehicle in local journal. Meteorological experts and engineers published articles in the *Royal Society proceedings*. These articles, while still using ship logbooks for basic data, were not primarily addressed to the task of saving practical men from storms and floods, as had been the case in the earlier decades. These were articles written for the scientific community seeking predictive theories of global weather patterns by means of interdisciplinary exchange. Scientific study of clouds and a better knowledge of marine geology joined hands with meteorology in creating this new field. An example of the convergence between artisanal knowledge of storms and the new scientific discipline was the cyclone research conducted by Henry Blanford, the first ‘meteorological reporter’ of the Government of India, and his successor John Eliot. Blanford was a geologist and mining surveyor, as well as teacher at the Presidency College of Calcutta in the year of the Calcutta cyclone of 1864.

Piddington wanted to teach mariners how to avoid the storm’s full-on winds, how best to sail within them when unavoidable, and how to profit from the tempest by using its fringe winds to speed the ship onward. To do so, the captain must ignore compass direction and think in terms of the quadrants of a circular storm. The book included two transparent horn cards, one for counter-clockwise winds for the Northern Hemisphere, one for clockwise winds for the Southern Hemisphere, that had wind arrows drawn on them indicating which wind direction would be blowing around the storm. The captain placed the card on his chart, matching the chart’s wind arrow with the currently observed wind direction. The card now indicated the wind directions relative to the storm’s center. With these cards, mariners had the hurricane in their hand. ‘The Sailor’s Horn Book’
became an immediate and lasting success; for many years, the only recognized textbook on marine storms.

The law of storms

The Law of storms offers a kind of knowledge to the seaman regarding storms. First, the best chance of avoiding the most violent and dangerous part of a hurricane, which is always near the centre of it; next, the safest way of managing his vessel, thirdly, the means of profiting by a storm.

On ships at sea passing through tropical cyclones, changes in direction and force of the wind are fully understood. Knowledge of the law of storms is an essential part of the education of ships officers. To the landsman who experiences a tropical storm, the direction from which the wind blows, in relation to the position of the storm center, is sometimes puzzling. After the wind blows from one general direction for a considerable time, increasing in force, a calm succeeds, followed by a violent wind from nearly the opposite quarter. It simply means that the storm centre has passed over the place. Nevertheless, it is frequently said that the “storm came back.” When the wind blows from northeast toward the southwest, the conclusion is that the storm is coming from the northeast and moving toward the southwest. When the southwest wind succeeds the calm, the conclusion is that the storm has come back and is now moving from southwest to northeast. Such conclusions are altogether erroneous. In order that seaman might easily understand and anticipate the changes in wind during the rather complex combined movements of ship and storm, Piddington used the “horn card”. In the Southern hemisphere, of course, the winds turn in the opposite direction. To apply the principle of the “horn card” to the landsman’s purposes is very simple.14

The dangers to a vessel in a hurricane storm (cyclone) are three, the veering of the wind; the excessive violence of it near the centre; and the sudden calms and shifts and awful sea at the centre. All these involve, damage and loss by dismasting, straining, leaks, and distress of various kinds.

Conditions observed during initial stages

While the causes of storm genesis in the tropics are imperfectly understood, the conditioned surrounding some of them in incipient stages are fairly unknown. Observations indicate that when a storm is born, unsettled and squally weather sets in over a considerable area, generally involving thousands of square miles of ocean surface. At first there is no definite center; the barometer falls gradually take on a cyclonic circulation. Progressive movement of the disturbances begins; a definite center forms; and then it some times grows rapidly in intensity, becoming a dangerous storm. On the weather map it is seen as a change of the wind from its prevailing direction or as a slight fall in the barometer which causes irregularities in the lines of equal pressure drawn on the map. From that time on, it is closely watched for a lowering of the pressure and a definite wind circulation about a center. Many of these slight disturbances fail to develop further; others eventually become a fully fledged cyclone.

The surface of the sea exhibits signs of disquietude, becoming confused and uneasy, and crossed frequently by long swells from other than the quarter of the prevailing wind. His first duty is to find the centre of vortex and its bearing from the ship. To do this he should note the direction of the wind, and with his face to it, eight points to the right, if in the open sea, which we will first consider thus with wind at North the centre is East, with wind East Centres., wind S. centre W, wind W. center N., and so with intermediate points-wind N.E., storm S.E., wind S.E., storm S.W., wind S.W. storm N.W., wind S.W., wind S.W. storm N.E. and ; when near land or on the road sides, these bearings require modifying, as will be explained hereafter. Having determined the direction of the storm, the next consideration is his position with regard to it. All knowledge and seamanship should be directed to avoiding this enemy, and the saving of life and property. The accompanying diagrams will show better than any verbal description both the nature of the evil and the remedy to be adopted. The outside circle represents the shape of the storm; the arrows and letters of the direction of the wind; the small circle, the centre; the dotted lines, the path on which the storm is advancing; the compass points are also indicated.15

15 I.bid p.p 82,83
In this diagram all the ships are shown having the wind on starboard quarter so that if the storm was stationary, sending in that position would always ensure safety. It does in fact do so in all cases, except with the wind easterly, when great care and judgment are requisite, and the value of preliminary observations becomes apparent, the direction of the storm, whether northward or westward of the average track, being of vital importance.

**FIGURE: 8  RULES FOR LAYING SHIPS DURING HURRICANES**

(Source: Henry Piddington, *The Sailor's Horn-Book for the Law of Storms*)

A careful study of books of reference and of logs and facts drawn from extended experience justifying the conclusion that the best course with the wind at East or to the north of east is to run to the North West, changing your course as the wind veers to the northward, keeping it on the starboard quarter until it reaches North West, when if bound to the
North East. You can bring it right and sail round the storm until your course is reached, or continue the track if bound southward; much depends, however, upon the direction of the storm as indicated by phenomena and veering of the wind if any have taken place.

With the wind from East to East South East, carry on as long as possible to North North East, North East, making all possible easting, then heave to on starboard track. With wind at South East; to South, if bound to southward or westward, you will be standing straight into danger, until weather improves, then lie on starboard track. With wind from South round to North West, must be behind the storm, and should have no difficulty in keeping clear of it. In fact the only risk with common management and tackling in time is wind from East-north-east to South-east. When it suits best to heave, choose the port track on the west side of the storm, and the starboard on the east side, for the wind in each will shift by the storm. The foregoing remarks apply to the open seas, of Bengal and Arabia, and the ships are supposed to have sea room. They comprise all that need to be said to advise and encourage the mariner. But on the coasts of Coromandel and Orissa and Ceylon, when the storm approaches the land, a modification of its form takes place, to which it is necessary to draw attention. The bad weather always commences a point or so on either side of north, although the centre may be East -south-east or even South-south-east. This proceeding allows the careful navigator time to run to the southward and having secured a position of safety, return behind the storm to his anchorage, taking care not to overtake it. The shape of the land also favours this maneuver, for even in Madras a run of a few hours to the southward gives room to let the ship off to the westward, or run down to Pondicherry. Standing out into the offing is merely exchanging one danger for another, and is directly proposed to the law of storms. Run at the earliest intimation of danger, following the advice given with all the advantages knowledge, of experience, of the study of example and practice, and the aid of the instruments and the Electric Telegraph and given all attention to the ship knowing that your conduct will meet with approval.

When compelled to lie in severe weather, when shifts of wind are dangerous, it will be well to keep ready a large stone anchor, like Chinese, stone. It is however, advisable not to navigate if possible during the bad-weather months, injury to a vessel will cause much greater detention, and
involve direct expense, and no ship-owner of common humanity or honesty will send a vessel to render herself so unworthy that the advent of one of these storms to be expected at any moment must ensure destruction to property and grievous loss of life. The safety of a ship in a hurricane is when she has room to veer away to any extent. In a violent gale or hurricane the water rises considerably in the Bay of Bengal.

**Shipwrecks**

Tropical cyclones on the open sea cause large waves, heavy rain, and high winds, disrupting international shipping and, at times, causing shipwrecks. Piddington remarks

“For I know that many forget that, a hurricane at sea is like a battle in a campaign; an important, but frequent occurrence, for which it is wise to be well prepared. And, rarely looking at works like the present till they want assistance from them, are thus very liable to mistakes in a moment of anxiety.”

Shipwrecks are common with the passage of strong tropical cyclones. Over the centuries mariners termed their own phrases for portions of tropical cyclones to help with navigation and self preservation. A tropical cyclone was split into two halves, based on its direction of motion. They avoided the right half of the cyclone and termed it the dangerous semicircle since the heaviest rain and strongest winds and seas were located in this half of the storm. The other half of the tropical cyclone was called the navigable semicircle since weather conditions are less extreme in this half of the storm. The rule of thumb for ship travel when a tropical cyclone is in their vicinity are to avoid them if at all possible and not to cross their forecast path (crossing the T). Those travelling through the *dangerous semicircle* are advised to keep to the true wind on the starboard bow and make as much headway as possible. Ships moving through the *navigable semicircle* are advised to keep the true wind on the starboard quarter while making as much headway as possible. The danger to vessels within the harbour in a cyclone would arise from the winds as well as from the waves, probably more from the former than the latter, and prudent commanders, on those occasions, would prefer getting out to sea to remaining inside the harbour.
The loss of a large vessel in these roads during the gale of 18th October 1810, several of the Massulah Boats have been destroyed by the violence of the weather. Nineteen Boats were broken entirely to pieces in the gale and ten which were much injured but not repaired and a large ship lost in the gale. The hurricane on 2nd of May 1811 the ‘Dover’ frigate and ‘Chichester’ store-ship remained in the roads; they parted and were lost. Ninety country vessels went down at their anchors. Only two vessels that were in the roads when hurricane set in were saved. Several dhonies and native craft had parted and put to sea previously, but the English vessels were in great danger. A tremendous sea capsized her and having subsequently taken the ground, she went to pieces, and not a vestige of her remained. Between 6 p.m. and 8 p.m. the gale was at its height, and the wind tending to the southward of east showed that the vortex had reached and passed the meridian of Madras. The English ships ‘Serampore’ of 878 tons, ‘Lutchmee’ 432 tons, all drifted on shore between the high court buildings and the Royapuram terminus, and became total wrecks.

The severe storm which happened in the morning of the 24 October 1818, commencing at an early hour from the North West and terminating in a violent hurricane from the south, the whole of the ship in Madras roads quitted their anchorage. On 24th October the ships in the roads went to sea between 7 am and 8 am. The weather came on thick shortly. It was impossible to sway the vessels. It was blowing very hard from the North ward at that time and so continued for 2 or 3 hours when the wind chopped round to the southward and blew a hurricane. The ship put to sea between the hours of sea at 8 am were 3 trader ships Castlereagh, Hunslead, Backworth, Cornwall and 2 Country Ships – Harriott and Chartotto. The ship Lady Castlereagh had arrived off Sadas, She had lost her main masts.

The Board of revenue suggested the warehouse keeper and the Deputy Master Attendant be deputed on the purpose of duty of taking the command of the ship. The Chief officer reported and suggested that the Lady Castlereagh must have proceeded immediately to Tinconamalie to refit.


17 Ibid
and to restore her Cargo. At last ship Lady Castlereagh was sent to Cuddalore for delivering the Cargo. Added to that, the Chief Officer of the Lady Castlereagh mentioned that five members and one child was lost in the gale.\textsuperscript{18} The 3 Country Brigs Ruby, Lark, Fily had came to shore a short distance, south of Port St. George. Harriett returned to the roads from the North on Oct. 26\textsuperscript{th} 1818 dismayed, three masted vessels foundered about 8 miles to the southward and there is reason to suppose that the ship was chunked and no intelligence has yet been received of the four private traders. The ship which sailed from Madras roads to Bengal on 15\textsuperscript{th} of October 1818 was wrecked off in Royapuram on the evening of the 24\textsuperscript{th} October 1818\textsuperscript{19}. In the hurricane, masulah boats were broken into pieces and 10 of which are much injured. A large ship was lost in the gale and 16 to 17 men were drowned in the hurricane\textsuperscript{20}

During the storm of 1818, the Ferry boats stationed on the Adyar River near Bredie castle was so much damaged that it is in the present state unfit for use. During the hurricane of 30\textsuperscript{th} Oct 1836, the post of the flag staff was carried away at 8 feet from the bottom, and the staff of the top broken away of 6 feet\textsuperscript{21} The signal yard was broken into 3 pieces, all the masulah Boats belonging to the port were totally lost, so that the port was left perfectly destitute.\textsuperscript{22}

The British Brig \textit{Ten} was wrecked on the Corommandel Coast three miles to the North of Madras. The vessel was wrecked on the Coast of Coromandel about three miles to the Northward of Sadras in the gale which occurred on the 24\textsuperscript{th} Oct. 1842\textsuperscript{23}. Six native craft founders had their anchors in Madras roads and fifteen drifted on shore and were lost. In May 1858, Norwegian ship \textit{Eclipse}, the British ship \textit{Godavary}, the American ship \textit{wales} drifted on shore on the beach, and became totally wrecked. In Oct. 1863 and Nov 1864 Minor gales occurred, in which the ships \textit{Punjanb, Potri, Ama, and Eva} all drifted on shore and got wrecked. On the 24\textsuperscript{th} November 1865 no less than 34 vessels lay at anchor in the roads, and were

\textsuperscript{18} \textit{Public consultation}, dated 30/10/1818, Vol. No.459 , p..3275-3277


\textsuperscript{20} \textit{Public Consultation}, dated 29/10/1818, Vol. no. 459, p.p.3268,3269


\textsuperscript{22} \textit{Marine consultation}, dated Aug. 1842, Vol. No.20

\textsuperscript{23} \textit{Marine consultation, dated Dec.1842. Vol. No.21}
they put to sea on the usual signal from the master attendant office on the 25th November. On the evening the vortex was steering in for the land between Madras and Cuddalore, and the unfortunate shipping with the N.N.E. gale under heavy stood out and drifted into the more violent portion of circle and met with severe disasters. Of the whole number, sixteen returned to Madras injured and damaged. The ‘Great Britain’ of 522 tons was never heard of again with all her crew. Six vessels were abandoned at sea; four were dismasted and put into Trinomallee for repairs.

A cyclone occurred on the 25th and 26th of November 1865 when there were thirty-one vessels at anchor in the roads, one the Polly remained and was burnt at the waters edge; of the thirty which put to sea, the Great Britain has not since been heard of, three were abandoned, five were dismasted, eleven were severely damaged, and ten were almost uninjured. The Madras pier sustained some damage during the cyclone of the 25th and 26th November when the sea was exceedingly heavy. The French ship Rawmur put to sea from Pondicherry in the cyclone of 25th and 26th November was wrecked off the Coleroon River.

On Nov. 23, 1865, Madras, this particular day, the ship slipped from Madras to avoid an approaching cyclone which unfortunately overtook the ship on the 26th and to save the ship from foundering, they cut off the masts, after which the sea broke over the ship in terrible fury. Severely injuring a great portion of the crew with the remainder of crew they erected jury masts and made the best of other way towards lane.

At Tuticorin the sea rose to the level of the road, damaging it considerably. Several country craft were driven from their moorings, and came ashore. The Government Schooners Pearl and Emily and the master Attendant’s reported that the boat broke from their moorings and suffered considerably. The steam ship Margaret Northcole having proceeded to Columbo with treasure, rode out the gale in safety.

In the 15th and 16th of November 1869 Paumben and Tuticorin, and the Coasts adjacent, were visited by heavy gale of wind accompanied by a large downfall of rain. Six native vessels were lost off the coast of Ceylon.

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24 Revenue department, dated 7/12/1869, G.O.NO.103.
25 Public Work Department, dated 6/12/1869, G. O. NO.3939
and many small craft were blown ashore at Tuticorin. The flag staff at this port was also injured and the light house on Hare Island totally annihilated.26

The next hurricane to be placed on record is the memorable one of May 1872. The usual night signal was made at midnight to warn the shipping of an approaching gale, the first warning from the astronomer having only then been received at daylight it was discovered that none of the vessels had left and the signal was made by flag to cut or slip. About 1 a.m. on the 2nd May, a dhony ran ashore of the granary, followed shortly afterwards by two more, both of which struck the pier on the shore on its North side without causing much damage, just at dawn two country vessels drifted on to the pier, both of them causing a breach and passing right from north to south. Shortly, after this the storm increased the force and a heavy and tumultuous sea was breaking all over the roadstead about 6 a.m. On 2nd May 1872 Barque Kingdom of Belgium, when the Commander William Charles Smith was anchored in the Madras Roads, during a cyclone parted from her anchors, and drifted on shore. A Court of Inquiry was held, and being satisfied that the commander adopted some precautions on board of his ship and having regard to all the circumstances of the case, it resolved to return Captain Smith’s certificate.

On 2nd May ship Ardbeg, Commander Thomas Hopson Laden with coals was anchored at the port of Madras, and during a cyclone drove and parted from her cables, and striking in the outer surf broke up almost instantaneously, nothing could be done to save those on board. Eight hands, including the captain, were drowned, and 12 swam or drifted on shore. On 2nd May the ship Burlington, Commander Thomas R. Mowat was taking in cargo at Madras, and during a cyclone parted from her cable, and striking well out broke up in fragments. The Court of Inquiry held considered the commander was to blame for having remained on shore despite the grave signs of threatening weather, and suspended his certificate for 10 months.27

26 Report on the administration of the Madras Presidency, during the year 1869-70.p.p70-71
27 Report on the administration of the Madras Presidency, during the year 1872 to 1873 p. cxix
Sir Robert Seppings, with 271 emigrants for the Mauritius, was wrecked at Madras in the cyclone of May 1872, but no lives were lost, and the emigrants were dispatched in another vessel.28

In the ship Hurkaru, Master C. Convil with tonnage of 576 was loading cotton, sugar, and skins at Madras for London, on the 22nd November 1872. She was next heard of as being wrecked on the coast near AlamParva, 55 miles South of Madras. The ship Hurkaru was on the 24th November standing in for the land. A Court of Inquiry was held on the case and it considered the master was to blame for not having given more definite instructions to the Officer left in charge of the deck with regard to the lookout to be kept for land, having the lead, and the time at which he should be called, as the vessel was standing in for the land, with weather not very clear on the currents. The commander’s certificate was suspended for 6 months. The Court considered and exceedingly careless lookout was immediate cause of the disaster. Consequently the certificate of Mr. Macnamaro, who was the Officer of the watch, was likewise suspended for 6 months. In 1872 the brig punch, Master Logan Mathews, with tonnage 158½ was loading rice, and turmeric at Madras for Colombo, and on the first May the weather being stormy, left the roads, running to the Southward along the coast, and from the course she was steering it appeared very probable that she overtook the cyclone on the 2nd May, which was approaching Madras, and foundered with all hands on board, 14 in number, including the master. The cargo was valued Rs. 3808. 29

The Madras port was again visited by a cyclone in May 1874. The appearance of the weather was very suspicious and threatening, the warning signal was hoisted in the evening and during the whole night communications were constantly passing by wire between the master attendant’s office and observatory. At 3 a.m of the 5th of May the wind being north westerly and its direction being well suited for gaining and offing, the signal was made for the ships to be put to sea, not having at the time any data for estimating the probable distance of the danger. On hoisting the warning signal on the previous evening the cyclone code came

28 Report on the administration of the Madras Presidency, during the year 1872-73 part I, p. 35.
29 Report on the administration of the Madras Presidency, during the year 1872 to 1873 p.p. cxxiii, cxxv
into operation, and all the necessary precautions were duly taken, and the various departments held themselves in readiness in accordance with the code. At daylight the streamers in the roads left and were put to sea, but observing delay in the other vessels in obeying the signal, the usual notice was repeated by the guns from the port and some urgent special signals from the commercial code were also added to induce the sailing ships to take their departure.

The beginning of May 1874 Brig *Shree Audicesawaswamy* with the tonnage of 187 while on the voyage to Nagapatnam and Madras was overtaken by the cyclone of the 5th May and driven ashore. She was laden with timber, oil etc, and carried 59 passengers, three of whom died on the passage, the cargo and passengers were safely landed at ports.30

On 8th May 1875 Barque Bengal, Master Jouhsa Gritlihts tonnage of 784 was anchored on the Madras Roads and on the 5th May owing to threatening weather, the signal to proceed to sea was made to the shipping. She stood to sea, and having encountered the violence of the cyclone sprang a leak of the quantity of water, it continued to increase, and the vessel not being able to reach Madras bore for Cocanada in distress. Court of inquiry and an official enquiry was held on the loss. The court was of the opinion that the master erred in judgement in endeavoring to enter at night, a port to which he had no sailing directions, appears to have been ignorant even of the number of lights there were in the port, without primarily trying whether he could anchor; but considering that there was 9 feet water in the hold, the vessel unmanageable, and laying over on her beam end, with an increasing leak, without the means of removing the water from her hold, the crew exhausted from previous exertion to keep her afloat, which ultimately proved the total destruction of the vessel. 31

About 35 boats belonging to private individuals were either completely lost or considerably damaged in Pulicat by the Cyclone of 21st November 1884.32

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30 Report on the administration of the Madras Presidency, during the year 1874 to 1875. Vol. 111 p. clxviii
31 Ibid. p.clxix
32 Board of Revenue, dated 19/121884 ,G.O. No.12021 Mis
Wreck Arrangements

When the Presidency Port Officer deems that imminent danger of wreck has arisen, he has to order the signal

i. **By Day** - A cone apex downwards

ii. **By Night** - A red light at the mast head of the Flagstaff.

According to the signal Port department, Transport department, Police Department, military department, Ordinance department, Medical department, should make arrangements.

Marine department

Port officer was instructed to hoist the cyclone warning signals to the main mast and to take all other necessary precautionary measures such as alerting the captain of the ship, if any alert arises all the coastal villages and hamlets particularly fishermen were warned about the impending natural calamity and asked not to venture into the sea till the calamity-free signal is given. Action was taken to safeguard boats and fishing craft belonging to government as well as private persons. Boats were send to save people in inundated areas. Damages to boats and fishing implements etc were assessed.

The Engineer should supervise the safety measures in the port area, to safeguard the machineries, floating crafts etc. They took adequate precautionary measures for the safety of towing launch and dredger. The condition of the dredgers berthed at the wharf will have to be continuously watched so as to avoid any damage. They should take necessary safety measures to protect buildings and other properties of port, ensure that any occurrence of damage of buildings and godowns roofings. In the year 1899, when hurricane hit Nagapattanam the port officer sent two telegrams to the port office of Madras and Simla. A very thick driving rain prevented the shipping being seen: there were in the roads the evening before, the S.S. “Vita” the S.S. “Kohinur”, and a native brig; and the S.S. Merkara was expected to arrive. The barometer fell so rapidly, and the wind rose with such frequent furious gusts that sent off a Second telegraphic communication which was stopped and has not yet been resumed (2.P.M.13th). At 10th the barometer was 29.67, and by 11th, it was down to 29.34, the wind blowing with perfect hurricane force”.

Port department

The life saving apparatus is to be taken to the beach and worked either independently or in co-operation with the Royal Artillery rocket parties under arrangements to be made by the Presidency Port Officer. On receiving intimation of the wreck signal hoisted, the Assistant Adjutant-General should fire two guns in quick succession from St. George’s Bastin (which will be twice repeated at intervals of three minutes) and send intimation to all Military Departments concerned. On these guns being fired, the following arrangements were made:—A working party of 1 officer and 50 men, made up from the Royal Artillery and the British Regiment garrisoning the Fort was promptly dispatched to the scene of action and placed at the disposal of the Presidency Port Officer. A second working party of the same strength was kept in readiness in case of additional assistance being required by the Presidency Port Officer. A non-commissioned officer and two troopers of His Excellency the Governor’s Body Guard should proceed to the Fort and place themselves under the orders of the Assistant Adjutant-General. They were used as orderlies as occasion may require. The Native Infantry in garrison was restricted to their respective lines to await further orders.

The Officers Commanding working parties should consult with the officers of the port Department on the spot as to where and how the services are to be fully employed, and the advice of the officers of the Port Department. Arrangements should be made for the relief, food, and of working parties of the departments concerned. The Officer Commanding Troops in Garrison would make emergent requisition on the Ordnance Officer in charge of the Arsenal for such tents as may be required to shelter shipwrecked people. As many parties of the Royal Artillery stationed in Fort St. George, in case of necessity, (with a proper complement of officers) will proceed as speedily as possible with the life-saving apparatus including boat or fire hooks, ropes, grappling iron, to the point or points where their services are most urgently required. They are intended to be used for the conveyance of rocket apparatus, hawsers and should any wreck or wrecks take place at a distance from the Fort, such as St. Thomas or Adyar; for any other necessary case connected with wreck work. The Officer Commanding Royal Artillery, Fort St. George were responsible for three sets of the life-saving apparatus, with rockets, boat or fire hooks,
ropes, grappling irons, lanterns for night work, are at all times kept packed in carts ready for use in the most convenient part of the Fort, and the officers, non-commissioned officers and men under his command were instructed and periodically drilled to the practical use of the whole apparatus.

The Ordinance Officer in charge of the Arsenal promptly complied with emergent requisitions for tents for the shelter of shipwrecked people, without waiting for sanction from any superior authority. In case the officer in charge be absent from the Arsenal, the same power may be exercised by the Warrant Officer in charge of Camp Equipage.

**Commissariat and transport department**

On intimation being received from the Assistant Adjutant-General of imminent danger to shipping, or on the ‘Wreck signal’ being heard, two trollies drawn by mules should immediately proceed under a Staff Sergeant to the Main Guard Room, Fort St. George, and there await the orders of the Officer Commanding Royal Artillery. The other trollies, drawn by mules, each under care of a warrant or non-commissioned officer, and each containing an assortment of blankets, towels, flannel banians, flannel drawers, biscuits, brandy, water and drinking vessels, would be taken in the first place to the Port Officer, to the scenes of shipwrecked persons under the orders of the directing Medical, Military or Port Department officer present. The Chief Commissariat Officer would attend to the instructions as per rules laid down for the Medical Department. Whenever the warning signal was hoisted, a certain number of Transport attendants were sent on duty in case of need, and these men remained at the transport Depot at night as long as a storm-signal is displayed. The Chief Commissariat Officer dispatched a supply of bullocks with drivers and as many ambulance tongas as are available to the officer Commanding, Royal Artillery Fort St. George.

The Inspector of Beach Police seeing the wreck signal, or being informed by the Port authorities of imminent danger would promptly send intelligence to the Commissioner of Police.

The Policemen mainly restricted to their own proper duties of order; provide conveyance of the shipwrecked crews and passengers to the nearest shelter if necessary; bring back the hammocks, doolies, and sick-
carts; remove the dead. They were not to be employed in hauling wreckage or cargo saved in emergent circumstances, when there are other working parties on the spot.

Medical department

The Assistant Adjutant General sent intimation to the Principal Officer, Madras District, and the Fort Surgeon. On hearing the guns of the “Wreck signal,” or on receipt of intimation the District Staff Officer, and the Medical Officer took a portion of their establishments with the medical appliances which had been detailed by their departmental head, proceeded to the beach, and, in consultation with the senior Port Department and officers on the spot, distributed themselves to the various scenes of work. The Physician and Resident Surgeon of the General Hospital institution, and the Surgeon, 1st District, at the Monegar Choultry, gave medical aid to all such as may be sent there from the beach for treatment. The Chief Commissariat Officer should dispatch to the beach as many as are available, doolies, muncheels or dandies.

Construction of Madras Harbour

Madras Port before the construction of Harbour

There was no harbour at Madras, but an open roadstead but there was generally a heavy swell from seaward, especially if the wind remains long at east. The only time of danger in the Madras roads was during a hurricane, which happen about once in 8 or 10 years and also when it blows hard for any length of time from about East-north-east, which was rare, but on these occasions so heavy a sea sets in that few vessels can ride it out; and the wind being dead on shore, it was not easy to clear the surf. Many vessels and lives have been lost in these short easterly gates which seldom lasted for more than 12 hours and did not affect the barometer at all, whereas that instrument always gave timely notice of a hurricane.

In fine weather, the surf breaks about 300ft from the shore, and in the monsoon, or in squally weather about 450 ft when it blows hard from the eastward it breaks nearly 1000 ft from the beach but on these occasions it used to be difficult to distinguish the break of the surf from that of the sea. In the ordinary weather the surf wave was not above 3ft high, in rough weather about 6, and during the gale, 12 or 14, where the land wind
blows dead off shore. However, nine out of ten lives were lost and the preponderance of damage at the coast result from inundation by the hurricane tide which commonly rose more than 4m above mean sea level. At open exposed shorelines, damage, and destruction began with erosive scour and battering from large breaking waves, which may remove as much as 35m$^3$ of beach. The average annual loss sustained by the owners of large vessels alone, exclusive of their valuable cargoes, amounted to about 1¾ lakhs of rupees.\textsuperscript{33}

Considering the extent of Coromandel Coast, and the frequent storms that swept the Bay of Bengal, Madras as the capital of the Presidency, and the most important town on the coast it was here that such a harbour should be formed. The Chamber of Commerce had under consideration a proposal to form a break water about 1 ½ miles long, in a depth of 6 or 7 fathoms of water, parallel to the shore of Madras, the effect of which would be to make a safe and commodious anchorage for ships, and to render the shipping operations of this port independent of uncertain aid of surf boats. Lord Napier said” we want calm water, safe anchorage, secure landing places facilities for docking and repairing ships: facilities for embanking and disembarking troops, stores, and munitions of war, uninterrupted communication, and exoneration from the exclusive service of a skilled and privileged class of boatmen". The roads of Madras, defended by a break water would not only form a convenient local commercial port, they would also open a port of refuge for all vessels navigating on this coast of India, both against the sustained violence of the north east monsoon, and foreseen attaches of the rotatory storms, which from time to time traverse these seas with destructive power. The chamber of commerce has justly remarked that there is nothing deserving the name of harbor of refuge on the Coromandel Coast. There is in fact, no place of real safety between Trincomalee and the Hooghly. The most costly establishments like the Railway Terminus, the sailors Home, the commissariat Office, and Depot, the Custom House, the stamp office, the Office of Government in the Civil and Military Department at the fort, the

Government House, the Senate House, the Revenue Board, the Engineering College, the Public works Department, and the Presidency College are in naked array upon the shore. The direction of traffic will not be determined by the cost of transport to the sea board only; it will be governed by the convenience, safety, accessibility, and charges of the maritime terminus.\textsuperscript{34}

**Need of constructing Madras Harbour**

The danger of a defenseless roadstead lead was, however, not only a weather danger, it is also a war danger. The old works in Madras towards the sea were rather a source of risk to the city than of safety. Without a break water not only the trade of Madras must ever be insecure and its establishments, inhabitant, and property must be at the mercy of a maritime adversary, but without a break water all trade of Madras may cease to exist altogether.

The Commission was embodied by Government to frame plans and estimates for fortified break water at Madras. The enquiries and the reports of the commission were not to be limited to the preparation of plans. They were requested to deal with the subject in all its bearings including the agency by which the execution of the work may most properly be undertaken, and the provisions by which it may be made profitable as a financial investment.

**Objection for the construction of Madras Port**

The great objection, then, to the port of Madras were:

1. That it is an open roadstead, destitute of shelter, which renders it necessary, on the approach of a gale, for ships to put to sea for safety; or if out of trim or ballast, and unable to put to sea, to incur the imminent risk of dragging their anchors, or of parting from them and going ashore, complete wrecks.

2. That owing to the communication between the shipping and the shore being for the most part by Masoolah boat only, carrying one

\textsuperscript{34} *Construction of the Madras harbour*’ Selection of the government of India, public works Department. No. CCVI-papers connected with the Calcutta, (Madras: Government press 1885). P.103
and a half tons at a time, the delay in loading and unloading is so great as to deter many ships, to which a preference would be given from coming to the port at all.

3. That the actual cost of landing and shipping cargo, even at legal rates, is needlessly great: while the much higher rates which the mercantile community pays on demand enhances the cost so much as to become a formidable addition to the changes of a port otherwise regarded as a cheap one.

4. That, notwithstanding the skill of the boatmen, the damage to goods from spray and from shipping seas in crossing the surf, is a very serious one.

Under the old system the ship was anchored at a mile or upwards from the shore to a signal anchor, so that she swung with her head to the wind or the current, whichever might be stronger, and rolled to the swell which generally comes from a third quarter. A more “uneasy” position for a ship, even in ordinary weather, it is difficult to imagine, and all around her, while subject to the conflicting disturbances, the cargo boats had to crowd. These boats again were subjected to yet another disturbance, the wind waves, which would scarcely affect the ship except indirectly by constantly driving the boats against her sides. Under these circumstances cargo had to be transferred to and from the boats. Then the boats had to be rowed out and back by manual labour (11 men to a boat carrying two tons) over the mile, and through the surf. The whole operation was one of little danger but of great cost, both in the labour employed, the damage done to goods, and the detention of the ships.

According to the system prevailing during late 19th century, the ship ought be brought to within a quarter of a mile of shore; she is completely out of current, and being moored head and storm was not affected by the wind, her head faces the swell. The wind waves which toss the boats outside the harbour are much reduced, so that the latter are far more manageable. The details show that the advantages afforded by the harbour are by no means confined to a reduction of the on shore swell. Of course, it is fully admitted that the more the swell can be reduced, the better, but to make this one object paramount is altogether to represent the case.
With regard to the loading and discharging cargo boats at the shore, the advantage gained so far is simply that due to the reduction of the waves, whatever that may be, the existing screw pile pier was made for open sea work, and it has inconveniences which are inseparable from such work. The principal one of these in its great height (about 18 feet) above water with constant smooth water a height of 6 feet would be sufficient and obviously much more convenient.

The safety Measures

Ships have a refuge at sea, but this is not available for local craft. If they cannot safely side at anchor they must be hauled up on the beach. Masula boats carrying 2 tons can be breached even when loaded. The cargo boats carrying 12 tons, which were introduced after the screw pile pier was built, can be breached empty, and were formerly so placed in safety during the two bad weather seasons of the year; but for lightens of 60 to 100 tons which are essential to an economical system of landing and shipping cargo, for a steam tug, per floating derrick for lifting heavy articles, and for other craft for which a demand is sure to arise, breaching for purposes of safety is not practicable; safe floating berths must be provided. The crafts might have safely lain at anchor within the harbour even in the worst weather. It may be modified by further experience of future storms. When the break waters are more efficient and the opening for the entrance of the waves reduced; on the threatening of a cyclone, the present area of the harbour must be cleared by the sea going ships, going to sea and the local craft in another direction.

On November 12, a severe cyclone visited Madras, portion of the works, which had then progressed nearly to the pier heads, was almost destroyed.

J.H. Taylor recorded that “from the exceptional bad weather caused by hurricanes or cyclones, no break-water would offer real security for ships”. The storm is thus described in the official Meteorological Report issued by the Government Astronomer on November 23rd 1881, 'A cyclone visited Madras on Saturday and Sunday the 12th and 13th 1881. It appears to have exhausted its greatest force while crossing the Bay before reaching the coast of Southern India, which would account for the high and destructive sea, far beyond what might have been expected from the
meteorological indications accompanying its progress. The centre of the
storm must have struck the coast considerably southward of Madras. The
lowest reduced reading of the barometer was 29-51 at 4 pm on Saturday;
and the strongest wind was experienced between 11 pm and 2 am Sunday,
during which time it averaged 32 miles per hour in velocity, equivalent to
a pressure of about 5 lb. per square foot. Rain commenced at 1 am on
Saturday and continued until 8 pm amounting in all to 8-19 inches the
twelfth heaviest fall on record at Madras since 1800. No single hour was
extraordinarily excessive, but the persistence of both wind and rain was
remarkable. The veering of the wind was as usual for cyclones southward
of Madras\(^{35}\).

The damage produced by this storm on the Madras Harbour Works
was greater in its extent than that of any similar disaster on record, but it
must not be concluded that this is due to an unusual degree of weakness in
the work. It is due rather to the fact that at Madras the maximum force of
sea is not, as is practically the case on the coasts where most of our
experience has been gained, an event of almost annual occurrence, but it
occurs only at intervals of several years, and in one such interval of more
than usual duration a great extent of work had been completed.

"The design of the work as executed at Madras was the result of a
careful investigation into the causes of damage to previously
executed works. Much material that appeared to be superfluous in
them was dispensed with, but additional strength was given to the
parts that were retained. The latest additions to the section were
based on the experience gained at Kurrachee. The great bulk of the
damage however is of a totally different kind, and is due to the
direct force of the waves on the superstructure".

To prevent a recurrence of the damage, additional strength must be
given to the vulnerable part. But it must be understood that all such
precautions are necessarily tentative as to their sufficiency. The force of the
sea cannot be estimated in figures, and we are unable to say, when a work
has stood successfully, what margin of stability it possessed, or when it has

failed, by how much the destructive force was in excess of its stability. The strength of an iron girder or the capacity of a water channel may be definitely calculated in figures, but the stability of a sea barrier is a question to be decided by precedent, guided by judgment and experience.

The question of whether ships could safely ride out a cyclone in the harbour arises. In the opinion of this Government, it is left to be decided by the commanders of such vessels. In most cases sufficient warning is given of the approach of a cyclone. It is impossible to entertain doubt that a vessel in the harbour would have a much better chance during a cyclone if the eastern entrance were closed, than if it were open. It should, moreover, be remembered that the main object of the harbour is not to provide a refuge for vessels during the brief period of cyclonic storm, but to secure smooth water for landing and shipping operations in ordinary weather, and to protect the jetties and other appliances necessary thereto from the destructive effects of a cyclone to which they are liable so long as they are exposed to the direct influence of the sea from the east. Every convenience of this sort was wrecked in 1881; and unless the proposal to close the eastern entrance is accepted, it will be useless to attempt their reconstruction. All commanders of vessels who have been consulted, and that includes nearly all that have visited Madras since the accident approves entirely the alteration from every point of nautical convenience.36

**History of the Buckingham Canal Project**

The Buckingham Canal is a salt water canal, 262 miles in length, running 196 miles north, and 66 miles south of the town and seaport of Madras, along the East, or Coromandel Coast of Southern India, locked in from constant tidal flow for some 218 miles in length, and tidal, when sea bars are open, for the remaining 44 miles.

The grand total mileage of the main line of navigable waterway, from Cocanada to the Mercanum backwater, is thus 451 miles. The construction of the Buckingham Canal has placed the town of Madras in cheap and easy communication with no less than five districts, and with the large and important towns of Cocanada, Bezwada, Masulipatam,

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36 Ipid .Mackenzie. p.45
Ongole and Nellore, besides numerous smaller trade centers; and has entirely superseded the uncertain and precarious coast traffic, which formerly existed at numerous minor ports along the coast. The 196 miles of canal north of Madras town is of far more importance than the portion south of Madras. The former carries annually about six times the bulk and value of goods that the later does; It is a more efficient line of navigation; is commonly used by boats of 3 feet draught and of as much as 40 tons burden; and has had, until recently, an increasing trade.

The principal goods carried by the canal are firewood and salt, which travel in large quantities on both the North and South canals; and food-grains, cotton, coal, and building materials, which are almost confined to the North canal. The canal throughout its length usually runs less than half a mile from the sea, and in a few parts has been carried so close to the sea that high tide water washes up to its east bank. It passes generally through a dreary waste of sand, but much of this barren and arid country has been greatly developed and improved owing to the remarkably cheap means of communication, afforded by the canal; cultivation has been brought into existence or extended owing to the facilities given by the canal for the drainage of low-lying land; numerous casuarinas and other plantations made possible; and a great increase in the wealth; and prosperity of the population has taken place.

Heavy rainfall along the canal line is almost confined to the north-east monsoon, i.e., to the period from 15th October to the end of December. The heaviest burst of the monsoon is usually in November or late in October, and occasional heavy falls of rain may be looked for in December. Cyclonic rainfall occurs, however, at long intervals, in other months, usually in the month of May and the short portion of 36 miles of canal, north of the Manneren river mile 160, North canal, is partially under the influence of the South-west monsoon as well as the north-east monsoon, and considerable falls are sometimes registered during the former monsoon. The annual rainfall varies, of course, considerably over such a length of canal, but the average annual rainfall is from 40 to 50 inches, of which about two-thirds fall during the two and a half months of the north-east monsoon.

In some parts, these sandy dunes border the coast line, and where this is the case, disposal of surplus water from the canal has presented
special difficulties in regard to keeping tidal water off cultivated lands, upkeep of banks, and drainage. The canal throughout the greater part of the year is subject to heavy winds, and at times to severe cyclones, and its very exposed situation deserves particular notice, since it is not only liable to the full force of cyclones and of storm waves rolling through the open bars of centauries and rivers; but also crosses the entire drainage of the East Coast in the Chingleput and Nellore districts, and runs through no less than 20 considerable rivers and backwaters, besides numerous minor drainages. During the prevalence of heavy upland floods, a very considerable extent of country on both sides of the canal, and more particularly on the western side, is under water, and the passing of such floods, as well as the controlling of the floods of the numerous rivers crossing the canal, has proved a most difficult problem.

Monsoons are considered as a boon for maritime trade as they help in navigation. But at the same time they are viewed as a bane since monsoons in the form of cyclones, bring bitter tales. Monsoons quite often produce inclement weather, which is mostly disastrous when cyclones are formed. The most dangerous is the early break of the Northeast Monsoon, which often begins with cyclonic storms for which Coromandel is an easy target. The mariner lives in intimate contact with the waves of the sea and is able to reckon better than others the speed of the winds on the basis of climatic changes. As the cyclone remains a major hurdle to shipping, any forecast of it is considered to be a boon.