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INDIGENOUS TRADITIONAL KNOWLEDGE OF FISHER FOLKS IN MANAGING THE OCEAN STATE CONDITIONS, WEATHER VARIABLES AND FISH AVAILABILITY – A STUDY FROM TAMIL NADU AND UNION TERRITORY OF PUDUCHERRY

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ABSTRACT

This paper explores indigenous traditional knowledge of fisher folks in changing climatic conditions, weather variables and fish availability in the coastal fishing villages of Tamil Nadu and Union Territory of Puducherry. A combination of questionnaires, semi structured interviews with key informants and focus group discussions were carried outto collect the required data. The study found that the fisher folk based on their experiences gained over the years maintained some important traditional knowledge in predicting ocean conditions, abnormalities and availability of fish resources. Thislocal or traditional knowledge can have significant implications for scientific research in strengthening and management of ocean advisory system and forecasting the potential fishing zone informations. Incorporation of indigenous traditional knowledge with scientific ocean modeling systems has tremendous potential to develop reliable scientific forecasts and accurate future predictions.

KEYWORDS: ITK, Indigenous Knowledge, Ocean State, Traditional Practices, Climate Change and Weather Variability.

INTRODUCTION

Indigenous Traditional Knowledge (ITK) is the cumulative body of knowledge generated and evolved over a long period of time and generations of experience (Grenier, 1998). Indigenous knowledge is considered as the social capital of the poor. It is their main asset to invest in the struggle for survival, to catch fishto provide for shelter and to achieve control of their own lives (Senanayake2006). It constitutes the sum total knowledge and practices which are based on people's accumulated experiences in dealing with situations and problems in various aspects of life and such knowledge and practices are special to a particular culture (Wang, 1988). It includes the skills, beliefs, norms, practices and behavior patterns handed down from one generation to the next (Matowanyika et al., 1994). In ITK the information or understanding related to environment, science or technology is local in origin. The resulting experiences and adaptations or techniques and practices differ between social groups and cultures, and are generally in harmony with the environmental conditions and responsive to constraints (Sambo and Woytek, 2001). These enable local people to cope with many ecological processes, and with environmental and other events, and thus survive as societies.Local and traditional ecological knowledge can complement ecological data to augment fisheries management (Neis et al. 1999; Johannes, Freeman, and Hamilton 2000; Drew 2005; Murray et al. 2008).

Small scale traditional fisheries are often set in environments where scientific knowledge is poor and conventional remedies are prohibitively costly. Yet local fishers possess good knowledge about where and when marine animals migrate or aggregate, how they behave and how fishing and marine environmental conditions have changed over time. This knowledge is very essential to fisherfolk since their livelihood directly depends on the ocean, and its conditions; it can be applied for prediction of ocean state and fish abundance. Small-scale coastal fishers observe the local marine environment consistently when fishing, and hence are attuned to changes in abundance of targeted species (Johannes, Freeman, and Hamilton 2000). Fishermen are generally able to track seasonal and spatial variations in weather, fish stock availability and relate it to climatic variability. They are able to detect some of the variables such as speed and direction of wind and current, water mass movement and upwelling, availability of fish resources etc. The knowledge that indigenous and artisanal fishers have accumulated over the course of

their fishing careers is invaluable to marine researchers despite its low scientific repute among methodological purists.Traditional knowledge has led to the "discovery" of ecological or behavioral phenomena previously unknown to scientists. In the Western Solomon Islands, Indigenous peoples pinpointed population changes of bumphead parrotfish (*Bolbometoponmuricatum*) and provided conservation strategies (Aswani and Hamilton 2004).

In general, fisher folk rely and use their traditional knowledge gained from one generation to another right from the day they venture into fishing; they get oriented to this knowledge as they start their fishing. Whereas in the current context, several factors such as the climate change, weather variability, dwindling of fish resources and involvement of younger generation in the fishing activity and their knowledge requirement for timely decision making, scientific inputs are crucial to guide the fisherfolk on the ocean state and availability of fish resources and its location. Greater understanding as to how fishers cope with such situations, act upon and adapt to fisheries with extreme natural variations would assist in developing adaptation strategies for climate change (Vivekanandan, 2011) and also improve the scientific research on strengthening ocean state forecast and advisories.

Indian National Centre for Ocean Information Services (INCOIS) played a major role to bridge such gap by providing scientific forecast information on Ocean State Forecast and Potential Fishing Zone information. The experience that M.S. Swaminathan Research Foundation (MSSRF) had in taking these scientific inputs to the fisher folk across the different coastal states evinced good results. However, during the process, MSSRF could relate well the synchronization between the scientific forecast of Ocean state and Potential fishing zone and the wealth of traditional prediction by the elderly fisherfolk and also some middle aged persons. Also it identified the gap that there has to be a blend of science based forecasting and traditional indigenous knowledge based prediction to strengthen the research output for a larger purpose and at the same time validating the traditional knowledgefor getting better scientific outputs. In this backdrop the study on the documentation of indigenous traditional knowledge of fishers from the coastal villages of Tamil Nadu and Union Territory of Puducherry was carried out and the results of the study elaborated in this paper.

Study Area

The study was carried out in 43 marine fishing villages in seven districts of Tamil Nadu and Union Territory of Puducherry. (Fig. 1) Fisherfolk from five coastal districts of Tamil Nadu such as Chennai, Kanchipuram, Nagapattinam, Ramanathapuram, Kanyakumari and Puducherry and Karaikalin UT of Puducherry coastline were surveyed. The coastal districts and villages were selected based on the type of fishing and the total fisherfolk population in fishing.

Fig. 1: Map of Study Area.

METHODOLOGY

The data collection was carried out from April 2018 to December 2019adopting personal interviews and group discussions, semi-structured schedules with open ended questions. Focus group discussions consisting of 8-10 fishermen were also held. Criteria used for selecting the fishermen were based on age and fishing experience. All the respondents were males and engaged in traditional fishing activity including active and aged fishermen with immense experience gained over years and currently not going for fishing. The focus of data collection includesthe prediction methods in relationship between wave, wind, colour, current pattern, cloud movement, star placement, fish availability andlocal terminologies. The collected data have been cross verified and documented and also presented in tables for easy reference and understanding.

Respondents Profile

Age wise distribution: Totally 150 fishermen from 43 coastal villages of the two states were interviewed. Fishermen aged above 45 years were selected for the study. Out of 150 fishers 42 of them were between the age group of 45 and 50, 48 of them between the age group of 51 and 55 and 60 between the age group of 56-60 years.

Occupational stratification: The fishermen interviewed for the study comprised of motorized and mechanized fishing categories. Out of 150 fishers 74 % of them come under the category of motorized fishers and 26 % belong to mechanized fishers.

Demographic distribution of the respondents: Seven coastal districts from the two states were selected for the study. In each district a group of villages was selected for the documentation of ITK. The names of the districts selected and villages covered for the study is given in table: 1.

Table 1: Districts and Villages Selected.

District	Village
Chennai	Kasimedu, Nagurarthottam
Kanchipuram	Kovalam, Chemmencherry, Sadras, Pudupattinam
Nagapattinam	Pazhaiyar Keezhamoovarkarai Pudukuppam Poompuhar Samanthanpettai Nagore Keechankuppam Akkaraipettai Seruthur Vellapallam
Kanyakumari	Chinnamuttom Kovalam Arockiyapuram Kanyakumari Colachel Puthurmandaikadu Kurumbanai
Ramanathapuram	Thondi Pamban Lighthouse PambanKunthukal Soosiayapparpatinam Rameswaram Dhanuskodi Olaikuda Mandapam
Puducherry	Moorthipudukuppam Panithitu Nallavadu Pudukuppam Veerampattinam Kurusukuppam
Karaikal	TR pattinam Kottucherrymedu

	Mandapathur Karaikalmedu Kilinjalmedu Akkampettai

RESULTS AND DISCUSSION

The traditional fisherfolk of Tamil Naduand Puducherry perceive several traditional methods and knowledge to predict the ocean status while fishing in normal and hazardous situation. These indicators are diverse and are followed in many of the coastal villages of the selected states. From the study it was found that in olden days (before the advent of scientific modern technology) the fisher folk depended only on their traditional indigenous knowledge learnt from their ancestors and from their own experience but later they have shifted into technology oriented fishing practices along with the traditional knowledge. They are using multiple traditional methods for the prediction of cyclone, water current, high wave, high winds, and availability of fish resources and navigating their boats. Terminologies, they have used for these parameters vary from region to region

Traditional knowledge for Prediction of Cyclones: The fisherfolk are using several methods for the prediction of cyclones which can be broadly classified into two categories (i) using animal behaviors and (ii) observing the ocean conditions.

Animal behaviors: The fisherfolk in the selected areas expressed that they have predicted the cyclones by observing fish and other animal behavior in the sea prior to the hazardous situation like cyclone.Fisherfolk stated that if they observe few sea snakesare bundledtogether and rolling or floating on the sea surface, it is one of the indicators for heavy cyclone. Likewise if they have noticed turtles with their heads peeping out of the sea water and float at the surface frequently is also a signalfor an upcoming cyclonic condition. Manta ray jumping along the sea surface in deep sea areas is also a symptom of heavy cyclone. Sudden reduction in fish catch and accumulation of grass and sludge in the sea surface, and also observing large shoals of lessor sardines near the shore are some of the indicators for impending cyclones.

Ocean behaviors: The study reveals that the fishers traditionally have used more than one symptom or indicator in forecasting the impending cyclone or heavy storm. The heavy cyclone is traditionally predicted by fishers using some of the changes observed in the ocean behaviors such as foam formation with bubbles, calmness of the sea, sound of the waves, deposition of black sand near shore, flow of wind etc. Fisherfolk by observing the cloud formation, colour and the direction of passing clouds use them as indicators to predict rainfall, cyclone and storm (SyamSalim et.al 2019). Fisherfolk who were interviewed mentioned that if they observe complete reduction in wave action and the sea becomes calm it is a strong indicator for the upcoming cyclone. Likewise,the wind that flows during the months of October-December is generally towards northeast direction; in case, during this period the wind direction changes to southeast direction the fishers perceive it to beone of the symptoms for cyclone or high wind and waves; changing direction of the wind is an unusual occurrence to happen during this time.It is also learnt that the fishers use few other indicators to predict cyclone and high winds such as formation of dark clouds and unusual calmness of the sea accompanied by cool breeze. The blowing of cool breeze would trigger heavy wave action and it is normally followed by rain. This was also stated by Santhanam, 2012 and he has reported that fishers based on the movement of clouds and colour of clouds plan their fishing operations and calculate time of reach to their fishing grounds. The fishers based on their experience and knowledge also use certain other indicators to predict approaching cyclone; a week prior to the cyclone there will be foam or bubbles in the surface of the sea; similarly, if black colour sand comes to shore then there is a chance of a cycloneoccurrence in a week's time;during summer if lightning (*minnal)*strikes straight above the horizonit is an indication of cyclonic formation.

Traditional knowledge on sea water currents and high waves

Water current and waves play important role in the livelihood of fishermen in carrying out their fishing activities in a safe and secured manner. Based on the wave action they take a decision either to venture into sea or postpone it and the direction of water current they can decide the direction of steering the boat and accordingly nets can be flowed or haul for fishing. It is mentioned by the fishers that the direction of water current could be predicted by themusing multiple ocean behaviors. It is learnt that by observing the speed of the boat they can assess the speed of the current. When nylon nets hauled for fishing is pushed or move with force on the ocean surface in the opposite direction it indicates strong and heavy water current. Fishermen distinguish mainly two types of sea water current (*neervaadu or vellam*)(i) *vaanvaadu* (towards west) and (ii) *sonevaadu* (towards east); the water current types change from time to time.Based on the looseness and tightness of the soil on the shore, they can assess the prevalent water current in the sea. If the sand on the shore is loose, they can say that it will be*vaanvaadu*; on the other hand if the sand is tight, it indicates the prevalent water current is *sonevaadu*. Fishermen also expressed that the direction of the water current should keep changing; then only they can harvest good fish. If the water current remains the same for a long time, it is not advantageous for fishing.

Fisher folks are using multiple indicators for the prediction of high waves. Almost all the fishers expressed that while venturing in catamaran, if they feel that the oar is pulled with great force without putting any human effort then there is a chance of high waves. If group of Dolphin is spotted near the shore –about 50 metre from the shore-and their movement is from south to north it also indicates occurrence of high waves. Fishers also stated that if they observe water current movement from east to west direction along with dusty foam appearing near the shore it is perceived as an indication for high wave occurrence in the coming days.

Traditional knowledge in predicting high wind and rains

Traditional forecasting of high wind and rains include indicators such as typesof cloud formation and its colour in the sky. Fishermen expressed that during October-November months if there is a change in the cloud formation particularly in the southwest or northwest direction, it is sure that there will be a heavy wind within three hours of time. The cloud formation will have a unique pattern which fishers locally refer to as *varimegam* (streaky rainy clouds or clouds formed in line pattern). Cotton like cloudy patterns will appear like step by step in the horizon and then there is a maximum possibility of high wind. The wind speed may be lowbutwave action is high (*Ukkal*) one can anticipate high wind or cyclone. Fishers also stated that if one notices smoke like clouds on the horizon- where the sea surface and the sky appear to meet it can be perceived as a warning for increased wind speed upto 45 to 50 km per hour. During evening hours or sun set if sky is seen in bright yellow colourand cloud movement is observed from northwest direction it is also an indication of high wind. Another important interesting observation mentionedby the fisherfolkis that if moon is with*vattapura*(formation of a circle around the moon during the night) one can predict that wind speed would be above normal and heavy; similarly clouds formed in rows (*varimegam and keetrumegam)*indicate possibility of rain accompanied by heavy wind.

According to the fisherfolk if they observe bearing dark clouds in the north side of the sea, they expect rains. Similarly, if the wind blows towards the shore and if there are dark clouds in the western direction, the eastern side will receive rains. If the clouds of this type called *irulmegam* (very dark clouds) accompanied by slightly cool breeze, then they can expect it would rain any time. There is another type of cloud which is locally referred to as*panjumegam* (white or grey clouds always on move but slowly);white patches of clouds can be seen slowly moving from one direction to another. In case this type of clouds remains static and in whichever direction the clouds remain, it can be said that windwill blow from that direction. Based on the movement of the mass of *panjumegam*when there is no wind, one can expect rain. If the clouds are dark and the wind starts blowing, this will affect or obstruct the rains. It will not rain much. During November-December if they observe lightening striking over the ocean from a distance, it is certain that 1-2 hours heavy wind will take place. It used alert the fishers to return to the shore at once.Likewise, in deep sea if they observe the formation of dark clouds, it is an indication that it is going to be difficult and warning for them to speed up their fishing operation and proceed to the shore.

Traditional knowledge to predict high and less probability of fish catch

The sea status always changes from transparent to turbid water. When the water is transparent, the fisherfolk believe that the fish catch will be less and during turbid, there will be heavy catch. In the shallow region, if the sea condition is rough, the fish catch will be heavy, and when the deep sea is calm the fish catch will be huge. If sea water appears in muddy colour (*kalakku*) they will catch fishes like Prawns, Crabs, Croackers and Sole fishes plenty. In case sea water appears in slight muddy colour (*thelivu*) it augurs well for availability of fish such asPomfrets, Anchovies and Pony fishes. Fish like Tuna and Seerfish catches are more on new moon days. In *vandathanni* (Turbulence water), fishwill be in a state of lethargy or in giddiness so it's easy for them to harvest huge fish catch. If water colour is dark blue and the direction of water current is towards north it is an indication for harvesting good fish shoals. Oil sardine fish jumping behavior indicated that the shoals come to the surface of sea. With the presence of jelly fishand if the water colour is slight turbid, fishermen can expect a huge harvest of Seer fishes in that area. If water colour is slightly white (*poonthelivu*) with normal wind speed it is an indicator for availability of Tunafish. Similarly, if water is clear and *kondalkattru* (wind towards east) occurs is a sign of availability of Ribbon fishes. Likewise, appearance of *Vedan* or *Ongi* (Dolphin) is an indicator for shoals of Sardine and Mackerels. Aggregation of birds like gulls over the sea surface indicates the availability of small pelagic shoals. These responses were also described by Syamsalim et al., 2019, Lakhmi et al., 2016 and Raja et.al 2014.

Traditional Knowledge forNavigation of boats

Appearance, location and movement of certain stars or *velli*in the sky aided fishers in their navigation during night fishing, pointed out the fishers from the study villages. Stars played a major role in knowing the direction and the distance from the shore. They acted as their compass and clock in the earlier days. A star, namely *vidivelli* which appears around 4 or 5 clock in the morning indicated the time and distance for the fishers. Fishermen when they had set out for fishing using boat with sails if the *vidivelli*is on the front side of the boat it means they have to go deep into the sea.In case the *vidivelli* is on the rear side of the boat it means they have to navigate towards southern side.If *dhuruvavelli* (pole star) is facing the front side of the boat it means that they have to steer the boat towards southeast.In case *sanguvelli*(sangustar) is on the front side of the boat,

it has to be steered towards southern side. And if the same star is on the rear side of the boat one has to navigate towards north.

Local terminologies for waves, tides, wind and sea currents

Local terminologies of various ocean parameters used by fisherfolkare given in the table 2. Fig 2 & 3.Based on the direction of wind andsea current the fishers have phrased the name locally. These names are different from region to region and district to district.

Table 2: Local terminologies for various ocean parameters.

Ocean Parameters	English Name	Vernacular Name (Tamil)	Regions/districts
Waves	High waves	*Uyar alai*	Nagapattinam Chennai Kanchipuram Karaikal
		Maarsa	Nagapattinam Ramanathapuram Karaikal
		Kadalezhumbuthal	Ramanthapuram Kanyakumari
		Madakkadi	Ramanthapuram
Swells	Swells	*Kadalperukku*	Nagapattinam Karaikal ChennaiKanchipuram
		Kooththumaarsa	Ramanathapuram
		KadalOottu	Ramanathapuram
		Perukkeduthal	Pondicherry
		Kadalsurappu	Pondicherry
Tides	High tide	*Vellam*	NagapattinamKaraikal ChennaiKanchipuramRamanathapuram
		Vellapaasal	Pondicherry
	Low tide	*Vatham*	Nagapattinam, Karaikal ChennaiKanchipuramRamanathapuram
		Vellavathal	Pondicherry
Eddy	Eddy Current	*Karakkumeli*	Ramanathapuram
		Suzhikaattru	Ramanathapuram
Sea current	Towards N	*Sony Vellam*	Nagapattinam Karaikal Pondicherry
		Thendi	Chennai, Kanchipuram
		Sozhaneer	Ramanathapuram
		Sony vaadu	RamanathapuramKanyakumari
	Towards S	*Vannivellam*	Nagapattinam Karaikal,Chennai Kanchipuram Pondicherry
		Vadaneer	Ramanathapuram
		Vaanuvaadu	Kanyakumari
	Towards SE	*Vannimelmuri*	NagapattinamKaraikal
		Vannimemmeri	ChennaiKanchipuram
		VaadaiKattchaanneer	Ramanathapuram
		Vannimemmara	Pondicherry
	Towards NE	*Sony melmuri*	Kanyakumari
		Thendimemmeri	NagapattinamKaraikal
		SozhaKattachaanneer	ChennaiKanchipuram
		Sony memmara	Ramanathapuram
		Sonuvaadukaraiyaachi	Pondicherry
	Towards NW	*Sony kariyeruppu*	NagapattinamKaraikal
		ThendiOlini	Chennai,Kanchipuram
		SozhaKondalneer	Ramanathapuram

		Thembaozhini	Pondicherry
		Sonuvaadu	Kanyakumari
		Velengoduthaneevaadu	Kanyakumari
	Towards SW	*Vannikariyeruppu*	Nagapattinam,Karaikal
		VanniOlini	Chennai Kanchipuram
		Vaadaikondalneer	Ramanathapuram
		Vaadaaozhini	Pondicherry
	Towards W	*OliniVellam*	Chennai Kanchipuram
		KondalNeer	Ramanathapuram
		Near eduthaozhini	Pondicherry
	Towards E	*Memmeri*	Chennai Kanchipuram
		KachanNeer	Ramanthapuram
		Neereduthamemmara	Pondicherry
Wind Direction	East	*Kondalkattru*	Nagapattinam Karaikal Ramanathapuram
		EranKatthu	Chennai Kanchipuram Thiruvalluar
		Nerkondalkattru	Pondicherry
	West	*Kodaikattru*	Nagapattinam Karaikal, Chennai Kanchipuram Pondicherry
	North	*Vadaikattru*	Nagapattinam Karaikal, Chennai Kanchipuram Ramanathapuram Pondicherry
	South	*KatchanKaarru*	Nagapattinam Karaikal, Chennai Kanchipuram Pondicherry
		Thendralkattru	Nagapattinam Karaikal
	South East	*KatchanKondal*	Nagapattinam Karaikal Pondicherry
		Sozhakondal	Nagapattinam Karaikal Ramanathapuram
		KachanErankathu	Chennai Kanchipuram
	North East	*VadaKondal*	Nagapattinam Karaikal Ramanathapuram Pondicherry
		VadaiErankathu	Chennai Kanchipuram
	North West	*Kunnuvadakathu*	Nagapattinam Karaikal, Chennai KanchipuramPondicherry
	South West	*Kachankodaikathu*	Nagapattinam Karaikal, Chennai Kanchipuram Pondicherry

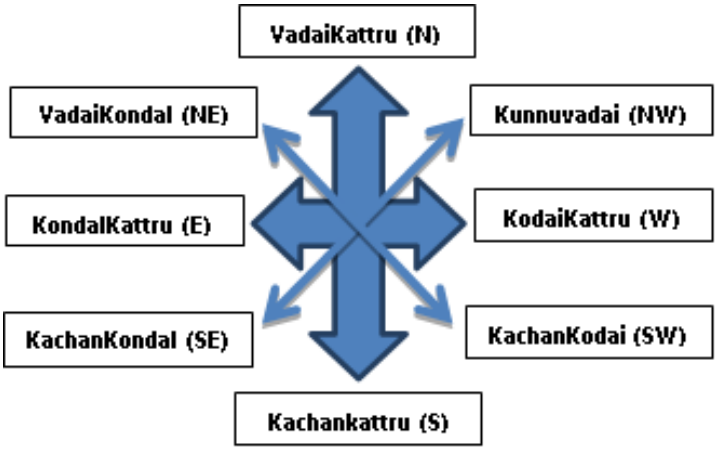

Fig. 2: Local Terminologies for the direction of wind.

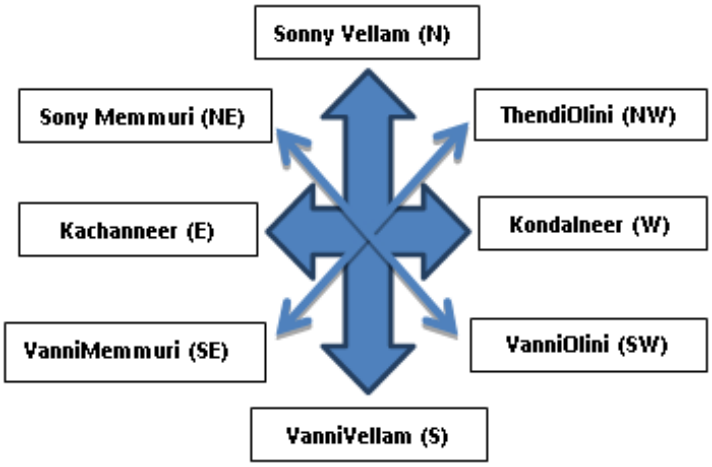

Fig 3: Local terminologies for the Sea current.

CONCLUSION

The documentation of the indigenous traditional knowledge is extremely important to understand the ocean behaviors and its variations. Traditional weather and climate forecasting is used by the local fishers as a guide in making crucial decisions concerning their fishing activity. Based on their experience, the fishers have gained sound knowledge to predict the ocean state conditions, weather and fish availability. The common and traditional indicators used by themare based mainly on the water current, wind direction, cloud movement, star position, water sound and colour of the water. Incorporation of indigenous traditional knowledge with scientific ocean modeling systems has tremendous potential to develop reliable scientific forecasts and accurate future predictions for ocean state and potential fishing zone advisories. Therefore, it is important that this precious knowledge is not lost; it should be promoted among the local fishermen particularly the younger generation as it is showing signs of fading due to development of technology. However, preserved knowledge of fishers needs the scientific validation and the validated knowledge could be disseminated for public use.

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