



Impact of INCOIS Scientific Forecast Services Towards Improving the Lives and Livelihoods of Fishing Communities Across Tamilnadu and Puducherry



Study by

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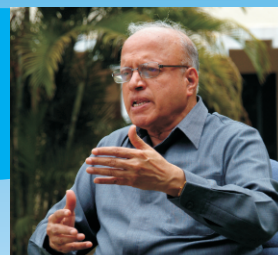
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Content

Foreward	Page
Contributions	
Acknowledgement	
1. Summary	1
2. Introduction	3
3. Methodology	4
4. Study area	4
5. Respondent Profile	6
6. Use of INCOIS Potential Fishing Zone forecast services by fisher folk	10
7. Use of INCOIS Ocean State forecast services by fisher folk	17
8. Conclusion	20

Foreword



The Indian National Centre for Ocean Information Services (INCOIS) is rendering great service by providing timely information on wave heights, location of fish shoals and coastal weather conditions. MSSRF in collaboration with INCOIS has been bridging the gap between scientific know-how and field level do-how in six coastal districts of Tamil Nadu and Puducherry. Studies are being undertaken to assess the impact of the coastal knowledge revolution on the economic wellbeing of fisher families. Nearly 300 individuals who are receiving timely information were interviewed for the purpose of assessing the impact of timely information on their economic well being. The study has been carried out by Ms S. Velvizhi and her team which enabled to get the reaction of fisher families to the work being done on their knowledge empowerment. Ms S. Velvizhi and her team of supporting staff have done a remarkable job in conducting the impact analysis. The following are some of the major results of this study.

- e 94 % of fisher folk have received Ocean State Forecast or Potential Fishing Zone (PFZ) information through their mobile phones as text messages.
- e Small craft fisher folk as a means to improve their livelihood and 40% of them gained increased income between the range of Rs. 10000 and 50000 above.
- e A significant portion (27%) of fisher folk reported that they could prevent loss of life due to timely decision making with the aid of OSF information.
- e Around half of the fisher folk reported to have prevented economic loss with net savings due to such timely information standing at an average of Rs 20000

I hope this impact analysis will help to strengthen the ongoing efforts in taking the benefits of modern science to fisher women and men. I express my thanks and admiration to Ms S Velvizhi and her team and to Ms Nancy J Anabel for her overall leadership. Our particular thanks go to Mr M Nagarajakumar, Dr T Srinivasa Kumar and Dr Satheesh C Sheno of INCOIS for their invaluable help



M S Swaminathan

Contributions

THE CONTRIBUTIONS OF THE FOLLOWING PERSONS HAVE ENABLED THE STUDY TO BE PUBLISHED

Data Processing and Reporting

Ms. Velvizhi S and Mr. Surendran. S

Data Collection

Puducherry

Mr. Lourdhusamy Maleappane, Mr. Jaikrishnan G, Ms. Girija D.S, Ms. Sundari,

Chidambaram

Ms. Sathyasree G, Mr. Elangovan R

Nagapattinam

Mr. Maikandan, P , Ms. Kuyili R, Mr. Mugil Nilavan P, Mr. Saravanan R

Pudukottai

Mr. R. Rajkumar, Mr. Gurumoorthi S, Ms.Kalayarasi

Ramanathapuram

Mr. Arun Maria Jerome S, Ms Sreekirupa R. Mr. Arokiya Kevikumar J, Mr. Abdul Salam,

Kanyakumari

Mr. Mubarak, Mr. Mohamed Bhilal A, Ms. Amutha, Mr. Yesudhas

Editing and Printing Coordination

Ms. Nithya, Ms. D. Suvitha

Designing

Mr. R.Kolappadhas

Acknowledgement

Hub and spokes model of Village Resource Centre (VKC) and Village Knowledge Centre (VKC) of M S Swaminathan Research Foundation has been established and has grown into models to support the information and knowledge needs of fishing, farming community with social inclusive principle to improve their lives and livelihoods. The key factors influencing the success of this model are its community centricity, participatory research, bridging science with society, accessibility to locale-specific, demand-driven information and appropriation of technologies.

The Fisheries sector in Tamil Nadu plays a crucial role in the overall economic development of the State and showing consistent growth during 10th and 11th Five Year Plan period. It is also emerging as a significant sector, contributing to employment generation and food security.

In this context, the strong partnership that M S Swaminathan Research Foundation has with Indian National Centre for Ocean Information Services (INCOIS) facilitated to provide scientific information of Potential Fishing Zone (PFZ) and Ocean State Forecast (OSF), which are crucial for fisher folk to locate the fish colony saving time and fuel and undertake informed fishing safeguarding their life and livelihood assets. The PFZ information enables the fisher folk to gain economic benefit as there are uncertainties in the fish catch due to decline in stocks. These services have been given to the community since 2005.

In order to assess and understand the impact of such services, a study was carried out by Ms. Velvizhi, Senior Scientist and Mr. Surendran, former colleague and brought out significant results about its benefits. I wish to extend my profuse thanks to Ms. Velvizhi and Mr. Surendran for their commitment and involvement to bring out this report, which is crucial for decision making.

I also wish to express our deep sense of gratitude to Mr. S. Senthilkumaran, the former head of Information Education and Communication (IEC), for his valuable guidance towards this study.

I also like to thank and acknowledge the significant contributions made by staff at the field level – Ms. Kuyili, Mr. Lourdsamy, Mr. Mubarak, Ms. Sathyashree and the former colleagues Mr. Maikandan, Mr. Arun, Mr. Gurumoorthy during the data collection process and complete this study.

I wish to extend our gratitude to Mr M Nagarajakumar, Dr T Srinivasa Kumar and Dr Satheesh C Shenoj of INCOIS for their valuable support towards this study and extending the scientific information services to the community.

My thanks are due to Ms. Suvitha, Ms. Nitya for extending the support towards organizing the study report, Ms. Dhanalakshmi for helping the map and Mr. Kolappadhas for helping in design of the report.

Nancy J. Anabel

Director i/c

Information, Education and Communication

1. Summary

- The market study was carried out to assess and understand the impact of INCOIS services such as Potential Fishing Zones and Ocean State Forecast among fisher folk who use such services.
- The study was carried out with selected fishing population across 6 districts in the state of Tamilnadu and in the Union territory of Puducherry.
- Since 2009, M.S.Swaminathan Research Foundation (MSSRF) has partnered with INCOIS to help take forward scientific forecast services among fishing communities. More than 10000 fisher folks are receiving INCOIS PFZ and early warning services through MSSRF Village Resource centres and knowledge centres in the coastal districts of Tamil Nadu and Puducherry.
- Mobiles play a major role in taking scientific forecast services to the fishing communities. About 94 % of fisher folk (who have used or receive Ocean State Forecast or Potential Fishing Zone information), receive it through their mobile phones as text messages.
- Almost all fisher folk who have ventured to PFZ experienced an increase in net income ranging between Rs. 1000- 50000 and above.
- Potential Fishing Zone service is actively being used by small craft fisher folk as a means to improve their livelihood. Among the fisher folk who have benefitted through the use of PFZ, 40 % are small craft fisher folk who have experienced an average (weighted) increase of Rupees 16,000 in income while fishing in PFZ zones with increase in income ranging between Rupees 1000-50000 and above.
- Oil sardines were the most dominant species caught in PFZ zones closely followed by ribbon fish, Carangids, Snapper, Threadfin breams, Goat fishes, Mackerels and Yellow fin Tunas. There is a negative correlation between the expectation of fisher folk in terms of fish catch and the fish species caught in PFZ with only 20 percent reporting to have caught expected fish species in PFZ zones.
- Fisher folk reported strong correlation between Potential Fishing Zones and natural indicators such as water colour and wind speed and direction traditionally used by fisher folk.
- Fisher folk are of the opinion that Potential Fishing zones will not result in over fishing with only a small portion (27%) believing that PFZ will result in over fishing.
- Capture of Juveniles in PFZ is a major concern with 36% of fisher folk reporting that more than 25 % of their catch in PFZ constitutes Juveniles.

- Location of PFZ zones far away from their traditional fishing grounds and the non availability of information in time were major reasons cited by fisher folk who have not used PFZ information.
- Almost all fisher folk who had used the OSF admitted to have benefited directly as well as indirectly due to timely forecasts.
- Ocean State Forecasts such as wind speed and direction and wave heights play a major role in aiding fisher folk make effective decision that help prevent life and economic loss.
- A significant portion (27%) of fisher folk reported to have prevented loss of life due to timely decision making with the aid of OSF information.
- Timely forecast provided to fisher folk helps prevent potential economic loss due to hazards at sea. Around half of the fisher folk reported to have prevented economic loss with net savings due to such timely information standing at an average (weighted) of Rupees 20000.
- Fisher folk prefer mobile based voice messages and text messages to receive PFZ information with very few opting for traditional sources such as Television and Newspapers.
- Majority (81%) of fisher folk expect additional trainings to understand and effectively use PFZ and OSF information services.

2. Introduction

India has a vast coastline stretching to 8129 km including the Andaman and Nicobar Islands and Lakshadweep. There are nine maritime states and four union territories with 3827 fishing villages and 1,914 traditional fish landing centres. Tamil Nadu endowed with one of the largest and richest fisheries in India with its vast access to sea has had a healthy fishing industry supplying vital proteins to its population; however in recent times the segment has taken a hit with dwindling stocks predominantly affecting the small fisher folk. In this backdrop comprehensive research is being carried out to enhance productivity per catch of fisher folk using scientific methods. Refining such scientific methods need constant feedback from the fishing community and understanding of traditional fishing knowledge and practices. This is best acquired through participatory engagement with the fisher folk

Since 2009 INCOIS has partnered with the M.S.Swaminathan Research Foundation for building the capacity of fisher folk for using INCOIS services as well as disseminating Ocean State Forecast and Potential Fishing Zone information to fisher folk to selected fishing villages across Tamilnadu and Puducherry. 10000 fisher folk from 101 villages receiving this advisories on daily basis from MSSRF coastal village resource centres and knowledge centres through various communication technologies. Apart from dissemination of information one of the important components of the project is to study and understand in depth the impact and usage of INCOIS services among the fishing communities. In order to achieve the above in a systematic manner, the team at MSSRF decided to conduct market study by using a well tested questionnaire suggested by scientists at INCOIS. The study started in the beginning of 2011, one year after since MSSRF started dissemination of information to fisher folk. For over a period of 7 months between June 2011 –December 2011 staff and volunteers from M.S.Swaminathan Research Foundation traveled wide and met over 292 fisher folk to understand the reach, use and the benefits of INCOIS services in day to day fishing activities.

The study to gauge the feedback from fisher folk focuses on the following key areas ·

- To study the impact of INCOIS Potential Fishing Zone services among the fisher folk in terms of improving their livelihood through improved catch.
- To study the impact of INCOIS Ocean State Forecast services among fishing communities towards securing their life and livelihood assets.
- To understand the usage pattern and application of INCOIS forecast services by fisher folk for improving the efficiency and effectiveness of fishing practices.
- To identify the future needs and requirements of fisher folk toward using INCOIS services in an effective manner.

3. Methodology:

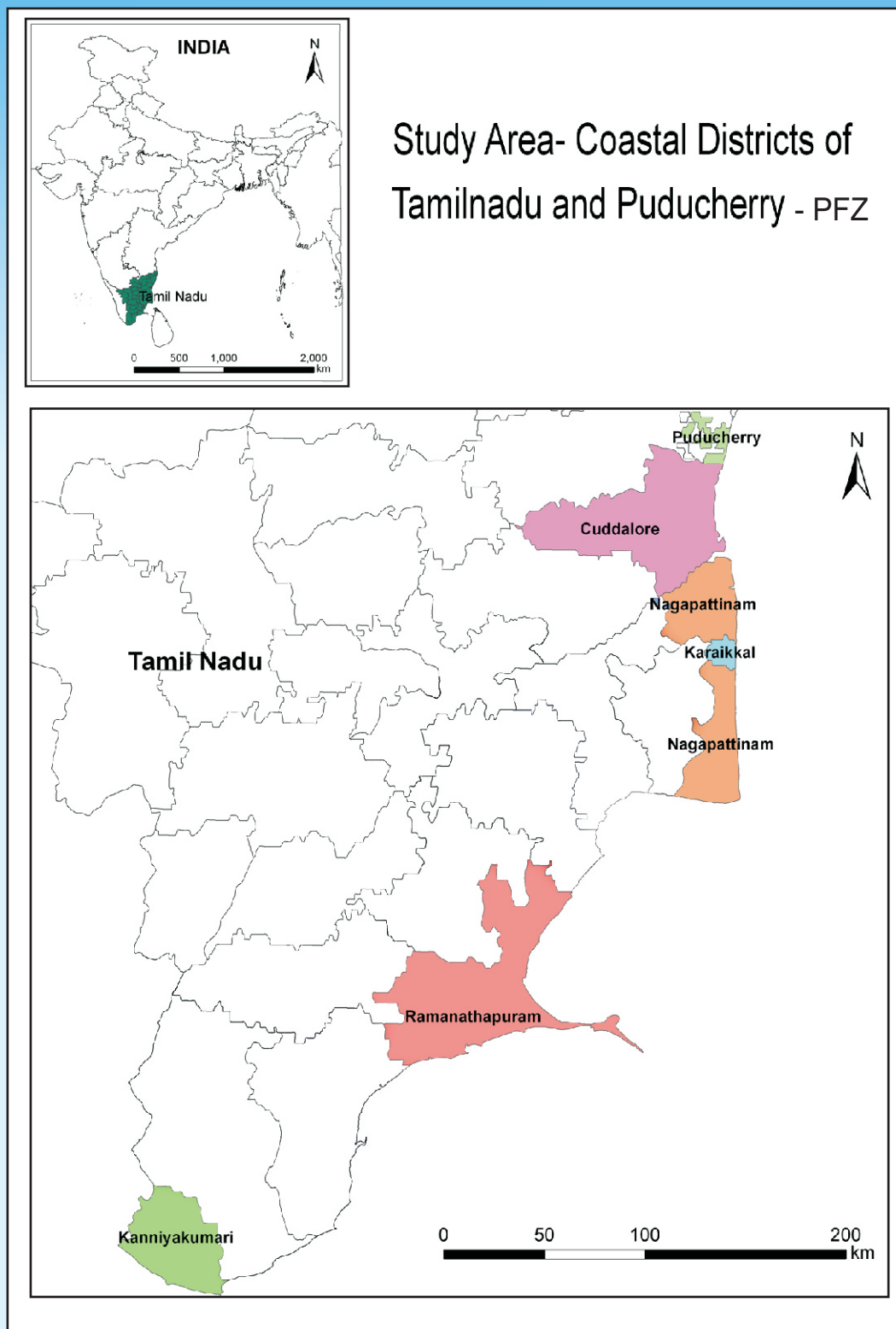
The major objective of the study was to assess the level of benefits and impact both in terms of economic benefits and life saving due to INCOIS services and as well as usage and needs of INCOIS services. In line with this, convenient sampling methods and interview schedule was used, as it allowed to engage with users as well as non users in a targeted manner to explore in depth, the effectiveness and efficacy of scientific forecast services issued by INCOIS.

A total of 292 individuals comprising of OSF and PFZ users as well as non users, who have been receiving the information through various sources were studied. In order to conduct the study effectively the team used the questionnaire method that contained both quantitative as well as qualitative aspects. Subsequently the questionnaire was modified to localize the questions based on the study area and a separate section on Ocean State Forecast was added. Before implementing the exercise, a common understanding was created through an orientation to the staffs who were involved in the exercise. During the above interaction the team suggested ways to simplify the process such as converting the questionnaire into local language, the need for a separate training for staff involved in field level data collection and also involving master trainers for data collection. Based on which field level master trainers and volunteers were identified for carrying out the study in the field. The questionnaire was translated from English to local language in Tamil.

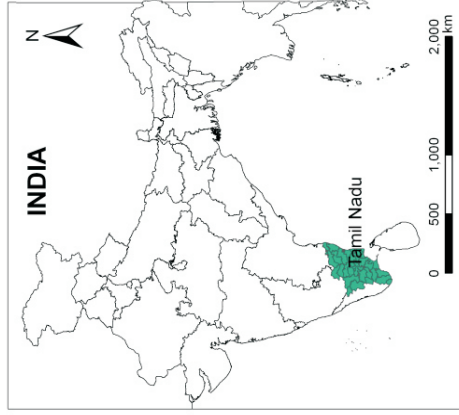
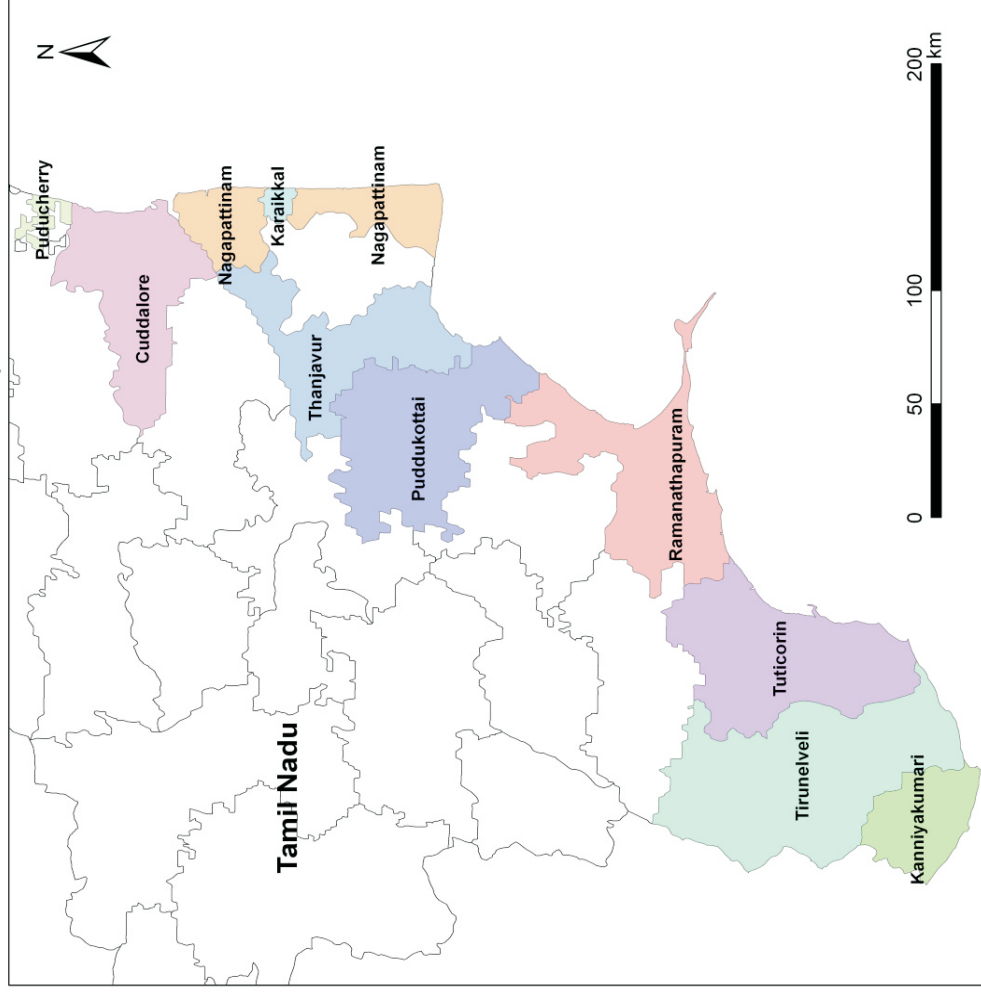
A second level orientation was provided to the field level staff and master trainers on how to carry out the study such as identifying the interviewees and administering the questionnaire in fishing villages. Based on the training, the master trainers and field staff began conducting the study at respective districts. Once the questionnaires were administered they were submitted back and simultaneously compilation of the data took place. The collected data have been cross verified and updated. Subsequently team started first by coding and then compiling the data using statistical analysis tools.

4. Study area

The study was conducted across the Tamilnadu and Puducherry coastline covering four major coastal ecosystems namely the Coramandal coast, Palk Bay, The Gulf of Mannar and the West coast. Across each coastal ecosystem the study was carried out in districts where the MSSRF -INCOIS project is being implemented. For the Coramandal coast the Union Territory of Puducherry, Cuddalore and Nagapattinam were studied, for Palk Bay region Thanjavur, Pudukkottai and northern half of Ramanathapuram were selected while Tuticorin and Southern Ramanathapuram were studied for Gulf of Mannar region. Kanyakumari which is situated in the west coast was also studied. In total the study cover 27 fishing villages and 27 fish landing centers.



Study Area- Coastal Districts of Tamilnadu and Puducherry - OSF



5. Respondent Profile :

A total of 292 samples comprising of OSF and PFZ beneficiaries as well as non-beneficiaries, who have been receiving the information through various sources were identified and studied. Among the respondents were 160 trawler fishers and 132 small craft (FRP, Catamaran) fishers. The study respondents were a mixed group in terms of fishing occupation comprising of 225 Fishing vessel owners and 67 Fishing labourers.

The fisher folk surveyed venture to fishing using various crafts such as Trawlers, FRP vessels and Catamarans. Fish species such as Carangids, Mackerel, Tuna, Cat fishes, Cuttle fish, Crab, Mulletts, Perches, Anchovies, Oil Sardine, Rabbit Fish, Croackers, Silver Bellies, Lesser Sardines, Seer fishes, Gar Fishes, Ray Fish, Snapper, Grouper, Lizard Fish, Prawns, Parrot Fish, Goat Fish, Yellow fin Tuna, Squids, Cuttle Fish have been caught by the respondents across various seasons using gears such as Purse Seine, Pair trawl net, Gill nets with various mesh sizes, hook and line, Trawl net, Long line and shore seine.

It is found that there is significant diffusion of technologies among the fishing population surveyed. Over 70 percent of fisher folk own a mobile handset, 40 percent of them have cold storage facilities while 26 percent of fisher folk use Global Positioning Systems and echo sounders for fishing.

5.1 Profile of PFZ respondents

The market study on PFZ was conducted with 144 fisher folk. This cohort was subdivided into two groups:

- Fisher folk who have received the PFZ information and had reported to have ventured to those zones for catching fish
- Fisher folk who have received PFZ information but have not used the information for fish catch.

S.No	Name of the district	No. respondent distributed village	No. of respondent
1	Nagapattinam	9	49
2	Karaikal	2	2
3	Cuddalore	4	34
4	Puducherry	4	16
5	Ramanathapuram	2	29
6	Kanyakumari	6	14
		27	144

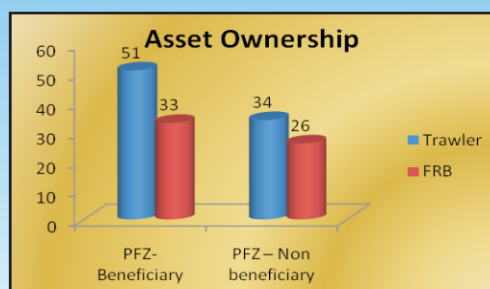
The fisher folk were divided into the above two groups in the ratio of 4:3 in order to derive a better understanding on the nature of benefits achieved and the reasons why the PFZ data is not utilized by a few fisher folk.

In order to maximize the spread of the study the respondents were chosen from major coastal districts along the Tamilnadu and Puducherry coast such as Nagapattinam, Karaikal, Cuddalore, Puducherry, Ramanathapuram and Kanyakumari

5.1.1 Craft

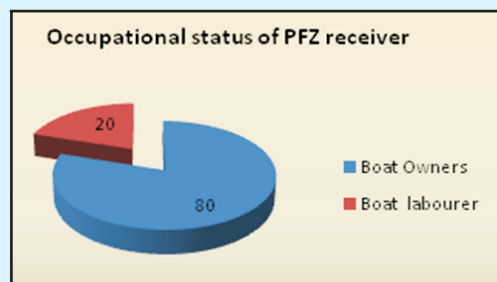
Among the respondents who have received PFZ information 58 percent of fisher folk were operating trawler fishing vessel while 42 percent of fisher folk were operating small craft for fishing.

Type of Craft	PFZ- Beneficiary	PFZ- Non beneficiary
Trawler	51	34
FRB	33	26
Total	84	60



5.1.2. Boat Ownership

During the study it was observed that 80 percent of fisher folk who received the information were boat owners while 20 percent of them were laborers operating onboard fishing vessels.

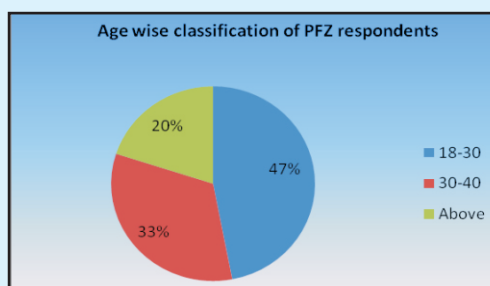


Occupation	PFZ- Beneficiary	PFZ- Non beneficiary
Own Boat	68	47
Boat labor	16	13
Total	84	60

5.1.3 Age

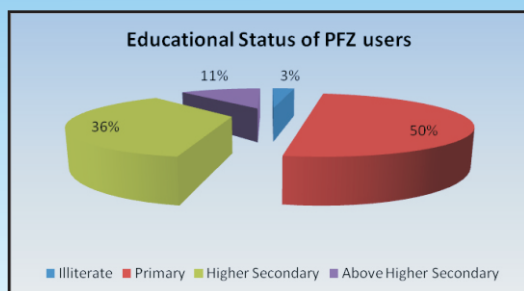
The study indicated that around half of the INCOIS information receivers belong to the age group of 18 – 30 while one third of the receivers belong are middle aged between 30 -40 . Around 20 percent of fisher folk who receive PFZ information belong to the age group of 40 and above.

Age	No. of fisher folks
18-30	47%
30-40	33%
Above	20%



5.1.4 Educational Status

The vast majority (97%) of fisher folks are literates capable of reading the INCOIS information services disseminated through various means, while a very small percentage (3%) of fisher folks who receive the information are not able to read and write, however they are helped by other fellow fisher folks to read and interpret the PFZ information.



Education	No. of Fisher Folks
Illiterate	3%
Primary	50%
Higher Secondary	36%
Above Higher Secondary	11%

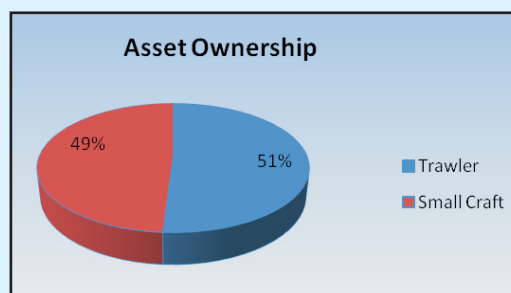
5.2 OSF - Respondent profile

The fisher folk who responded to the study on OSF hail from different districts spread across Tamilnadu and Puducherry. The respondents were chosen from 28 coastal villages across major coastal Districts such as Puducherry, Cuddalore, Nagapattinam, Karaikal, Pudukkottai, Ramanathapuram, Thanjavur and Kanyakumari.

S.No	Name of the district	No. respondent distributed village	No. of respondent
1	Nagapattinam	6	38
2	Cuddalore	3	30
3	Puducherry	4	17
4	Ramanathapuram	2	25
5	Kanyakumari	5	18
6	Pudukkottai	6	17
7	Thanjavur	2	3
	Total	28	148

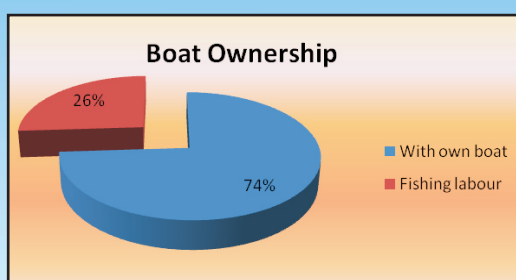
5.2.1 Crafts

Among the respondents who have received Ocean State Forecast information 51 percent of fisher folk were operating trawl fishing vessel while 49 percent of fisher folk were operating small craft for fishing



5.2.2 Boat ownership

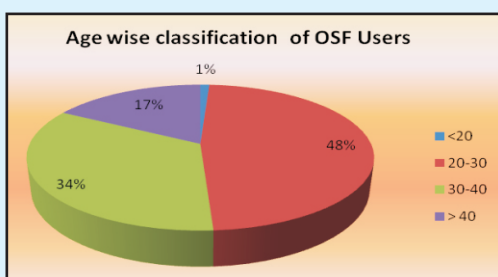
During the study it was observed that 74 percent of fisher folk who received the information were boat owners while 26 percent of them were laborers operating onboard fishing vessels.



Occupation	% of fisher folks
With own boat	74%
Fishing labor	26%

5.2.3 Age

Around half (50%) of the respondents who receive Ocean State Forecast belong to the age group of 20–30 while one third of the receivers are middle aged between 30-40. Around 17 percent of fisher folk who receive PFZ information belong to the age group of 40 and above

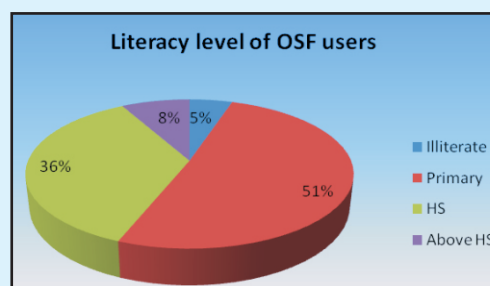


Age	% of fisher folks
<20	1%
20-30	48%
30-40	34%
> 40	17%

5.2.4 Educational status

The below table show that a vast majority (95%) of fisher folks are literates capable of reading the INCOIS information services disseminated through various means, while a very small (5%) percentage of fisher folks who receive the information are not able to read and write, however they are helped by other fellow fisher folks to read and interpret the PFZ information.

Education	% of fisher folks
Illiterate	5 %
Primary	51%
HS	36%
Above HS	8 %



6. Use of INCOIS Potential Fishing Zone forecast services by fisher folk

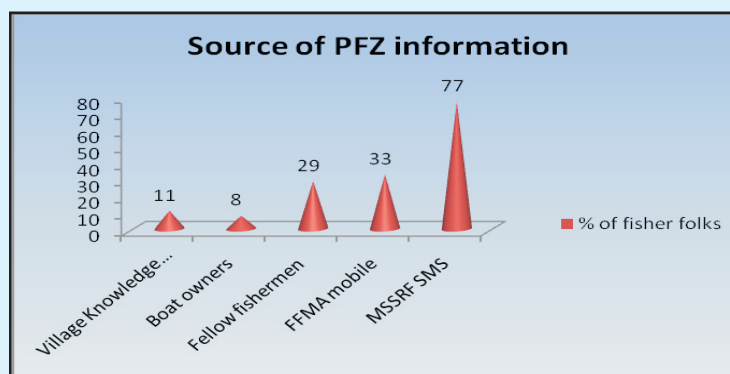
About 7 million people in India are dependent on fishing activity for their primary livelihood support. A reliable and timely short-term forecast on the fish aggregation zones helps them for decision making, benefits in-terms of increasing net profit and reduction in searching time. Indian National Centre for Ocean Information Services (INCOIS) provides this short term forecasts using Remote Sensing (RS) and Geographic Information System (GIS) Techniques since 1980. About 50,000 beneficiaries / users are regularly utilizing these services to effectively harvest the marine fishery resources. Satellite derived Chlorophyll and Sea Surface Temperature (SST) information are the basic inputs for generating this information.

The intensive Market study carried out by MSSRF from PFZ user and non user fishermen communities in 23 coastal villages in Tamil Nadu and Puducherry region captured the reach, usage pattern, advantages, benefits and limitations due to the usage of PFZ advisories that are provided by INCOIS and disseminated to the fishing community of Tamil Nadu and Puducherry Coast through MSSRF village resource centres and knowledge centres since November 2010 are presented below.

6.1 Dissemination strategies and their effectiveness in reaching fisher folk

During the study it was found that fisher folk received INCOIS PFZ information from a number of sources such as the MSSRF Village Knowledge Centers in the coastal fishing villages, Boat Owners, Fellow Fisher folk, Fisher Friend Mobile Applications and Mobile SMS services from MSSRF.

It was found that the mobile phones play a key role in reaching INCOIS PFZ services to a large number of fisher folk. More than 77% of the respondents shared that they receive PFZ data through mobile based text SMS provided by MSSRF Village Resource Centres across the coastal districts. About 33 % of the fisher folk received information through mobile based internet services such as the Fisher Friend Mobile Application provided by MSSRF. It was also found that knowledge sharing among the fisher folks plays a significant role in the dissemination of INCOIS PFZ services, nearly 37 % of the fisher folk shared that they also receive PFZ information from other



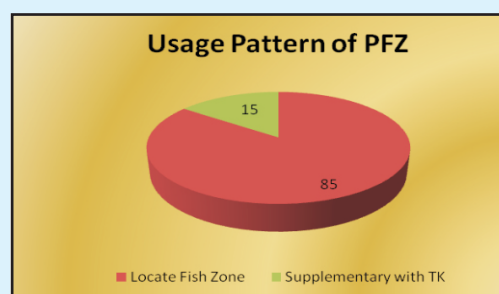
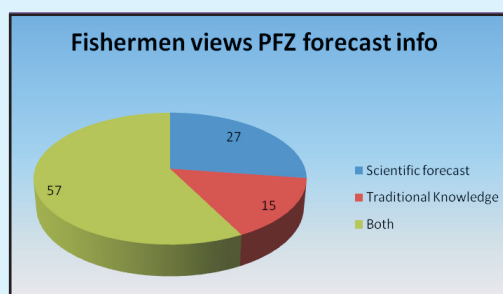
fisher folk. Around 11 percent of the fisher folk received the PFZ data through the MSSRF village Knowledge Centres. Summing up, almost all fisher folk engaged during the study received information from MSSRF programs directly through mobiles and other means, clearly indicating that the reach of PFZ among fisher folk is to a large extent through the MSSRF VRC programs.

Among the fisher folk who receive INCOIS PFZ information 99% of them agreed that they receive the information well before the validity date. During the time of this study INCOIS used to issue PFZ data that was valid of three days. Almost all fisher folk agree that they receive PFZ data well before the validity could expire. Also most (78%) of the fisher folk shared that they receive the PFZ information within 24 hours before it can become valid

6.2 Reliability of PFZ according to fisher folk

During the study it was found that 89% of fisher folk used the PFZ information as the primary source of information to locate areas in sea ideal for fishing. Around 36 % of fisher folk shared that they use the PFZ information as a supplement to their traditional knowledge.

When questioned regarding the reliability of INCOIS scientific forecast, majority (57 %) of the fisher folk expressed that they prefer integrating both traditional and scientific forecast for fishing rather than depending purely on scientific forecast or traditional knowledge alone. Around 27 percent of fisher folk expressed that they find scientific forecast services to be more reliable in helping them to catch When questioned regarding the reliability of INCOIS scientific forecast, majority (57 %) of the fisher folk expressed that they prefer integrating both traditional and scientific forecast for fishing rather than depending purely on scientific forecast or traditional knowledge alone. Around 27 percent of fisher folk expressed that they find scientific forecast services to be more reliable in helping them to catch fish while a small minority comprising 15 percent of fisher folk expressed that they are more inclined to rely on traditional knowledge than on scientific forecast alone. The data shows that more and more fisher folk have started to rely or apply scientific forecast into their regular fishing practices rather than rely purely on traditional knowledge alone thus indicating the reliability and trust of fisher folk on Potential Fishing Zone forecast services.



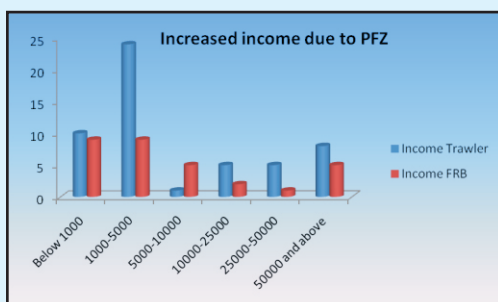
6.3 Benefits of Potential Fishing Zones information:

During the study it was observed that fisher folk who had used the Potential Fishing Zones forecast information benefited directly as well as indirectly. Direct benefits expressed by fisher folk include increase in catch as well as net income while indirect benefits expressed by fisher folk range from savings arising due to reduction in consumption of fuel as well as reduced effort resulting from decreased search time

Within the cohort PFZ information users it is found that 60 percent of fisher folk who have used and benefited from PFZ information were trawlers while the remaining 40 percent were small craft fisher folks. At the onset even though the percentage of small craft fisher folk who have benefited through PFZ is lesser than trawlers, it still represents a significant step forward in the application and use of PFZ information by small craft fisher folk. There is a general notion that PFZ zones owing to the distance in sea at which they are issued is more suitable for Trawler fisher folk and is less relevant for small craft fisher folk, yet still it is significant to find that 40 percent of the cohort were small craft fisher folk who had benefited through the use of PFZ information indicating that PFZ forecast issued by INCOIS is beneficial not only for trawler fisher folks who go for deep sea fishing but equally beneficial for small craft fisher folk as well.

Almost all fisher folk who received PFZ information and ventured to those zones expressed that there was an increase in net income compared to regular catch. Trawler fisher folk experienced that increase in net income ranging from Rupees 1000 to more than 50000 Rupees. Half of the trawler operators who ventured to PFZ zones expressed that they saw 1000- 5000 Rupees increase in income by fishing when compared to their regular income when fishing in non PFZ zones. Around 15 percent of trawler fisher folk expressed that their net income increased by Rupees 50000 and above.

During the study small craft fisher folk expressed that they experienced increase in net income ranging from Rupees 1000 to Rupees 50000 and above. Around 16 percent of fisher folk venturing in small crafts saw their net income due to fishing in PFZ ; increase from Rupees 50000 and above while another 16 percent saw an increase



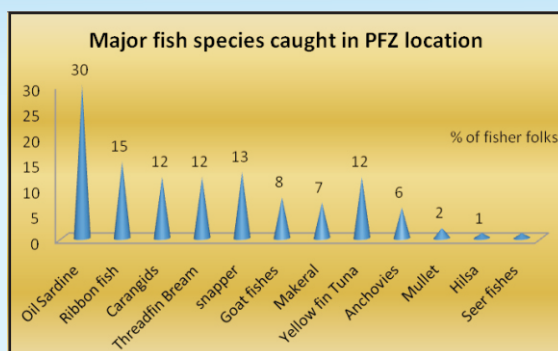
Income increased due to PFZ	Type of craft	
	Trawler	Small Craft
<1000	10	9
1000-5000	24	9
5000-10000	1	5
10000-25000	5	2
25000-50000	5	1
>50000	8	5
Total	53	31

in net income between Rupees 5000 – 10000. Around 16 percent of small craft fisher folk expressed that they saw a major increase in net income increasing by above Rupees 50000.

Apart from direct economic gain fisher folk who ventured to PFZ areas also perceived intangible benefits due to fishing in PFZ areas. Around 27 percent of fisher folk experienced reduction in effort due to reduced search time as well as economic savings due to reduced diesel consumption

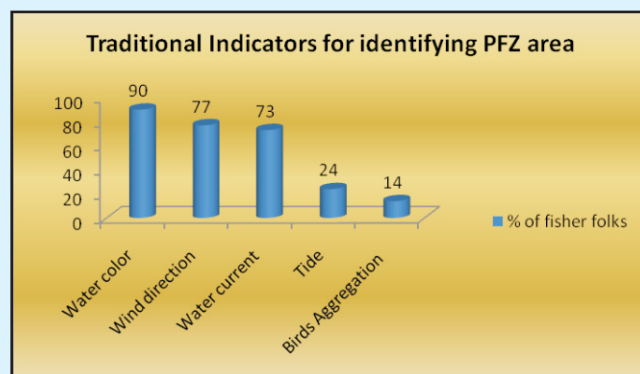
6.4 Types of fishes caught in Potential fishing zone areas:

During the study around 20 percent of fisher folk expressed that they were able to capture desired fish species in PFZ zones while the rest shared that they captured economically important fish species. Fish species such as Oil sardines, Carangids, Prawn, Thread fin bream, Squid, Anchovies, Goat fishes, Mackerel, Tuna, Mullet, Yellow fin Tuna, Seer fishes, Snapper, Cuttle fishes, Croakers and Flying fishes were caught majorly in the PFZ areas.



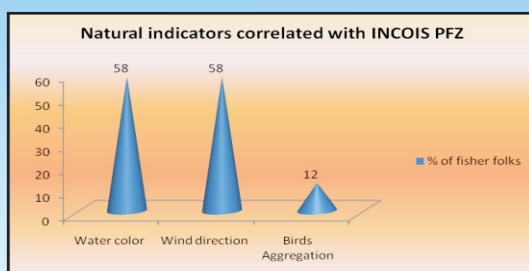
6.5 Integrating Potential Fishing Zone with traditional knowledge

Traditionally fisher folk in the subcontinent have been using a number of natural indicators such as water color, wind speed and direction, tide, bird aggregation, smell and reflection of light to identify fishing areas in sea. During the study it was found that vast majority of fisher folk use water colour, wind speed and direction and water current as the primary indicator for identifying fishing zone in sea. Apart from water colour and wind few fisher folk also use parameters such as tidal fluctuations and bird aggregation as natural indicators to identify fishing zones



Indicators	% of fisher folks
Water color	90
Wind direction	77
Water current	73
Tide	24
Birds Aggregation	14

Among the fisher folk who have used the PFZ information for fishing it was found that there is a very strong correlation between Potential Fishing Zone information and natural indicators used traditionally by fisher folk. Almost all fisher folk expressed that the potential fishing zone areas match with natural indicators such as water colour and wind speed and direction. A few fisher folk expressed that along with wind and water colour, Potential Fishing Zones correlate strongly with natural indicators such as Bird aggregation.



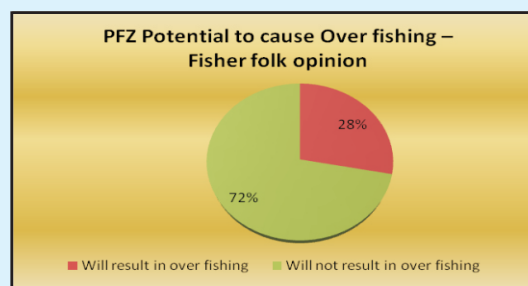
Natural indicators correlated with PFZ of INCOIS	% of fisher folks
Water color	58
Wind direction	58
Birds Aggregation	12

6.6 Sustainable use of Potential Fishing Zone information:

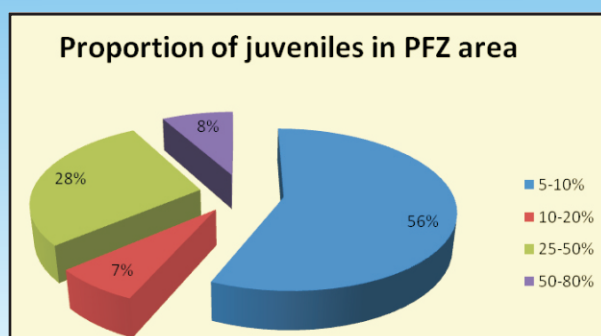
One of the major issues faced by fisher folk is the prospect of dwindling of fish catch in near shore areas due to over fishing and unsustainable fishing practices. During the study it was found that a vast majority comprising of 70 percent of fisher folk felt that in general fish species such as Spotted Croackers , Hilsa, Cat Fish, Barracuda, Flying fish, Mackerel, Goat fish, Pomfrets, Flat fish and Ribbon fishes have depleted significantly over a period of time affecting their livelihoods.

One of the major criticisms in general on Potential Fishing Zone Forecast is its potential to cause over fishing and capture of juveniles resulting leading to unsustainable fishing. However when asked on fisher folks opinion on whether Potential Fishing Zone forecast will result in over fishing around two thirds of fisher folk were of the strong opinion that fishing in PFZ zones will not result in over fishing since it providing pelagic shoal fishes while 27 percent of fisher folk believed that fishing in PFZ zones will result in over fishing. The study also tried to find out the capture of juveniles in PFZ zones in order to prevent the capture and exploitation of Juveniles in PFZ areas. More than half of the fisher folk who ventured to PFZ zones expressed that the proportion of juveniles in fish catch in PFZ areas range

PFZ Potential to cause Over fishing – Fisher folk opinion	
opinion	
Will result in over fishing	28%
Will not result in over fishing	72%



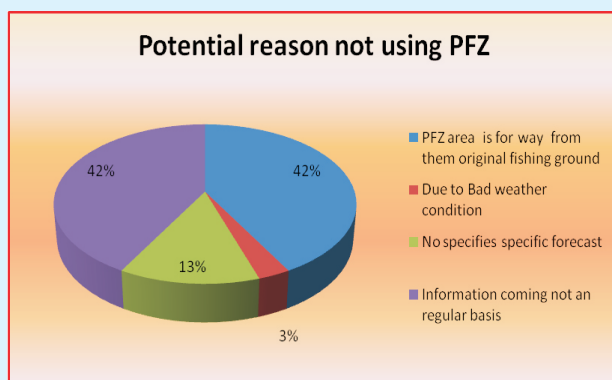
between 5 – 10 % of the overall catch. However around 36 percent of fisher folk expressed that the proportion of Juveniles when fishing in PFZ zones is significant at over 25 percent and up to 80 percent in some cases. The above raises serious questions and needs to be explored in an in depth scientific manner.



6.7 Reason for not using PFZ forecast information:

Apart from the objective of understanding the benefits and effectiveness in fishing due to fishing in PFZ areas, one of the main goals of the study was also to understand why fisher folk who receive PFZ information do not tend to use them. Analyzing the above question will yield insights into the behavior patterns and will provide better insights into how best to make large number of traditional fisher folk adapt to scientific forecast services.

During the study it was found that a significant proportion of the fisher folk who did not use PFZ information felt that it was difficult for them to venture to PFZ areas as the given zones were far away from their traditional fishing grounds and an equal number of fisher folk expressed that they did not use PFZ as the information was not available to them on a regular basis. A small proportion of fisher folk expressed that they did not venture to PFZ Zone as they were unsure of the type of species that will be available as well as the nets to carry on board. Few fisher folk also expressed that they did not venture to PFZ areas since they did not own GPS device to help them to navigate to PFZ zones.

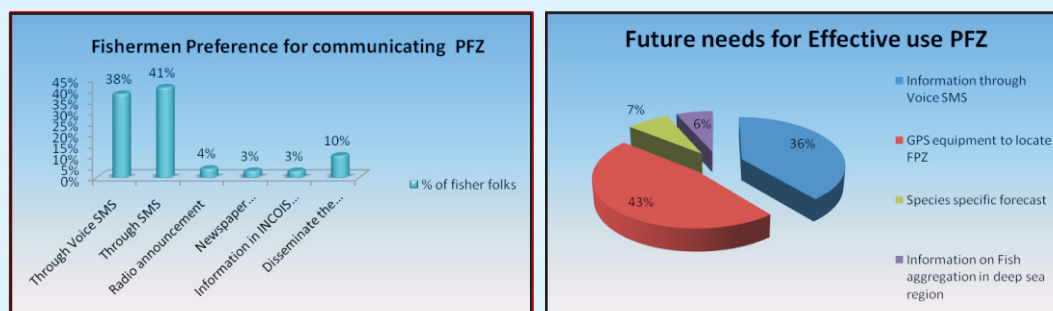


Reason for not using PFZ	% of fisher folks
PFZ area is far from original fishing ground	42%
Due to Bad weather condition	3%
No specific forecast	13%
Information coming not on a regular basis	42%
Lack of access to GPS systems	15%

6.8 Facilities needed for Effective use of INCOIS information:

One of the main aspects of the study was to understand from fisher folk the various facilities, technologies and trainings required for them to use PFZ in a more effective manner.

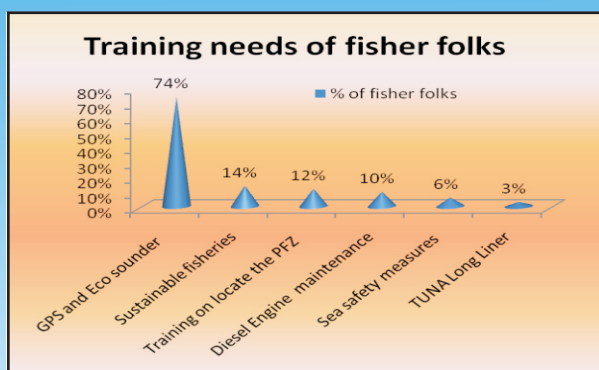
One of the key factors that affect the use of PFZ forecast is the ability to receive forecast in time before fisher folk can venture to sea. Several communication tools ranging from news paper announcements to mobile based voice messages can be used to communicate PFZ forecast. When asked regarding communication tools that fisher folk prefer to receive PFZ forecast in time around 41 percent of fisher folk suggested mobile based text messages to be an ideal platform to receive information in time followed by 38 percent of fisher folk requesting the information be sent as mobile based voice messages. Around 10 percent of fisher folk requested that information be passed through their boat owners.



Apart from ability to receive information services in time the fisher folk also requested additional facilities and information services to effectively use and benefit from INCOIS PFZ services. Around 43 percent of fisher folk requested Global Positioning Systems, eco sounder devices and satellite phones in subsidized price in order to locate PFZ areas effectively and 38 percent of fisher folks expressed audio advisory of INCOIS services through mobile phones. Few fisher folk requested species specific forecast as it would help them to carry the right kind of nets when fishing. Interestingly few fisher folk expressed the need for providing PFZ information for deep sea areas.

Around 78 percent of fisher folk expressed the need for additional training in order to use the PFZ information in an effective manner. The trainings requested by fisher folk range from those that help them reach and locate PFZ effectively such as interpreting PFZ information; using GPS and echo sounder to navigate to PFZ areas to those that complement and supplement their livelihoods such as boat engine maintenance and mechanism, marine conservation and others.

Among the fisher folks surveyed vast majority comprising of 74% fisher folks requested to be trained on using GPS for navigating PFZ, 14% of fisher folks expressed on Sustainable



Fishing Practices, 12% of them requested training on locate the PFZ information. Diesel engine repair and maintenance, sea safety measures and TUNA Long Liner training is also other training needs requested by the fisher folks during the survey.

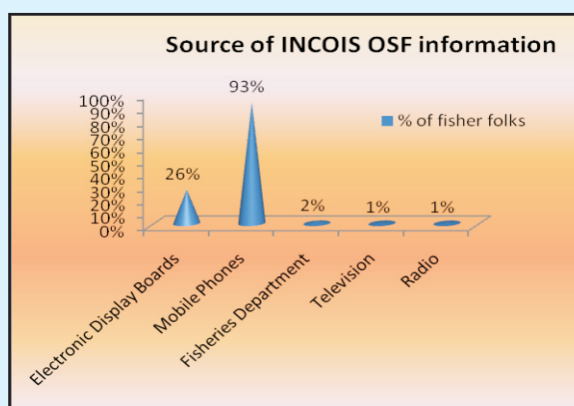
7. Use of INCOIS Ocean State forecast services by fisher folk

Having more than a quarter of the population residing along the coastlines of India, information on the state of the ocean surrounding the subcontinent is vital for the well being of the countrymen as well as for the socio-economic development of the country. Our marine activities ranges from conventional fishing to high-tech oil and natural gas exploration; transportation of goods to search and rescue operations in the high seas. Prior information of the state of the ocean would highly benefit these activities and ensure the safety of all those who venture into the sea. In short, forecasting oceanographic parameters at different time scales is extremely important for a wide spectrum of users ranging from fishermen and to the off-shore industries.

In this back drop the intensive Market study carried out by MSSRF from the fishermen communities in 23 coastal villages in Tamil Nadu and Puducherry region captured the reach, usage pattern, advantages, benefits and limitations due to the usage of OSF advisories that are provided by INCOIS and disseminated to the fishing community of Tamil Nadu and Puducherry Coast through MSSRF village resource centres and knowledge centres since November 2010 are presented below.

7.1 Dissemination strategies of OSF and their effectiveness in reaching fisher folk

During the study it was found that 97 percent of users receive INCOIS OceanState Forecast such as Wave height, Wind speed and direction on a regular basis from MSSRF coastal village resource Centre and knowledge centre on daily basis.

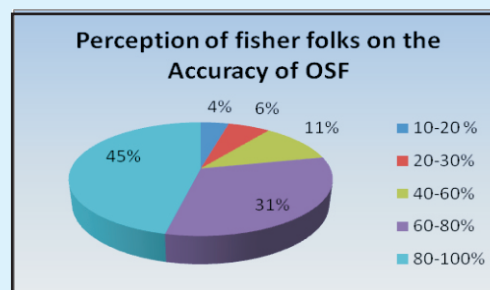


Mobiles play a major role in reaching Ocean State Forecast services to the hands of the fisher folk. A vast majority (93%) of fisher folk receive Ocean State Forecast through their mobile handsets as voice messages, text messages and mobile internet data through MSSRF. Besides mobile phones, the Electronic Display Boards installed by INCOIS play a significant role in disseminating Ocean State Forecast information to fisher folk. A significant portion (26%) of fisher folk reported to have accessed the INCOIS Electronic Display Boards located in MSSRF Village Knowledge Centres to receive Ocean State Forecast. A very miniscule portion (2%) of fisher folk reported to have received OSF through other means such as the fisheries department, Television and Radio.

7.2 Accuracy of Ocean State Forecast

Accuracy and reliability are two most important factors that define Ocean State Forecasts such as wave height, wind speed and direction and high wave alert. As fisher folk take key decisions as to weather or not to venture into sea based on such predictions it becomes much more imperative for OSF to be more accurate.

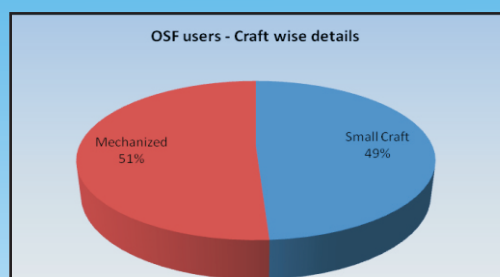
During the study it was found that nearly half (45 %) of the fisher folk perceived that the Ocean State Forecast issued by INCOIS was accurate for most of the times (80-100%). Around 30% of the fisher folk perceived OSF to be accurate only during 60 -80 % percent of time while 25 % of fisher folk perceived Ocean State Forecast to be less than 60 % accurate.



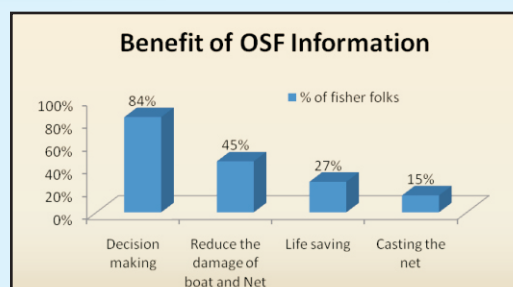
7.3 Benefits due to use of OSF

During the study, the fisher folk shared insights on as to how they have used and benefited through Ocean State Forecast service. It is found that fisher folk have used Ocean State forecast services for a number of purposes such as a tool to decide on whether or not to venture for fishing, casting their nets, anchoring their vessels and to understand the conditions of the sea. Among the users of Ocean State Forecast Services, it is found that nearly half (49 %) of the fisher folk who used OSF services were small craft fisher folk while another half were Trawler fisher folk, indicating that irrespective of crafts deployed, the vulnerability faced by fisher folk remains the same, thus the usage of Ocean State Forecast by both small craft and mechanized fisher folk.

All fisher folk who were engaged in the study agreed to have benefited and used the Ocean State Forecast in their routine fishing. Majority (84%) of fisher folk shared that Ocean State Forecast issued by INCOIS helps them take better decisions regarding fishing, decisions such as whether or not to venture into sea, when they should return back, how



to anchor their vessels, deciding the number of crew per fishing trip etc. Nearly half (45%) of the fisher folk shared that they were able to reduce economic loss due to damage of boats and nets by avoiding rough conditions in sea as predicted by INCOIS. A significant portion (30%) of fisher folk agreed that Ocean State Forecast issued had helped prevent life loss and personal injury at sea. A few (15%) of fisher folk also shared that they have used OSF parameters such as wind speed and direction to cast their nets in sea.

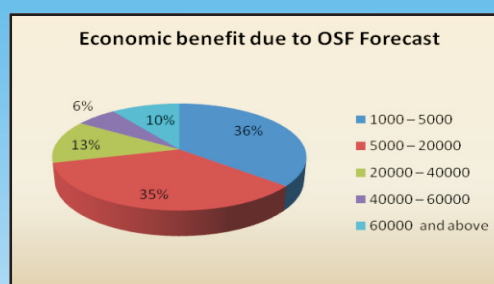


Benefits of OSF	% of fisher folks
Decision making	84%
Reduce the loss of boat and net	45%
Life saving	27%
Casting the net	15%

loss and personal injury at sea. A few (15%) of fisher folk also shared that they have used OSF parameters such as wind speed and direction to cast their nets in sea. loss and personal injury at sea. A few (15%) of fisher folk also shared that they have used OSF parameters such as wind speed and direction to cast their nets in sea.

As seen above Ocean State Forecast has become a key factor in the decision making process of fisher folk. Such aid in effective decision making holds the potential for significant economic savings such as prevention of asset loss such as damage to nets, vessels and other gears, loss due to wasted effort such as labour, diesel cost and time. During the study fisher folk were asked to attach a perceived economic value to such economic savings. Around 36% of fisher folk agreed to have attained net economic savings between Rupees 1000-5000. Around 35% fisher folk agreed to have attained net economic savings between Rupees 5000 – 20000, A significant portion (20%) of fisher folk attached a value between 20000 – 60000 in terms of economic savings while few (10%) of fisher folk experienced economic savings upward of Rupees 60000. As seen above all fisher folk were able to attain net economic savings due to the use of Ocean State Forecast.

Economic benefit	% of fisher folks
1000 – 5000	36%
5000 – 20000	35%
20000 – 40000	13%
40000 – 60000	6%
60000 and above	10%



8. Conclusion

One of the major conclusions that can be drawn from the study is the potential of INCOIS scientific forecast services towards improving the lives and livelihood of fisher folk. Overall it can be observed that almost all fisher folk who had applied PFZ or OSF in their regular fishing practice attained significant benefits ranging from economical to saving their lives and livelihoods. There is immense recognition of INCOIS and their services among the fishing communities, fisher folk have started looking up towards INCOIS as an authenticated source of vital fisheries forecast and have started valuing their service along their traditional knowledge. The above aspects could be observed in areas where targeted intervention to reach the fishing communities have taken place. However such intervention needs to be expanded across the coastline in order to reach the larger fishing community.

Thought the study it could be observed that there is a wide adoption of PFZ among fisher folk who have been till now using traditional knowledge for fishing. Such adoption indicates slow behavior change among fisher folk towards adopting high technology information services. With dwindling fish stocks in near shore areas, increasing labor costs, increased investments required for crafts and gears, fluctuating market prices and rising fuel prices fisher folk have started to actively look at areas beyond their traditional fishing grounds. Despite the notion that PFZ is suited for large craft fisher folk, the study indicates that more and more small craft fisher folk have taken to using PFZ for fishing, with depleting fish stocks many small craft fisher folk have started exploring fishing grounds beyond their traditional areas making them adopt PFZ in order to reduce distance, time and fuel.

It was observed that there is a gap between the expectation of fisher folk in terms of species presumed to be available at PFZ areas and actual catch. This is much more important especially for small craft fisher folk as they usually carry species specific nets for fishing. It is understood that INCOIS has already started working in species specific forecast for Tuna, however there is demand to receive species specific forecast for many fish species such Mackerel, Carangids, Oil Sardines, Seer fishes etc among the general fishing population. In this context INCOIS needs to expand their research and scope for such economically

important fish species in order to provide species specific forecasts. It is also observed that factors such as distance and timely availability of forecasts deter fisher folk from using INCOIS PFZ effectively. The above issues need to be explored by INCOIS.

Irrespective of crafts, across the spectrum all fisher folk who had received Ocean State Forecast reported to have benefited using the service. It is observed that Ocean State Forecast is a vital aid in the decision making process of fisher folk. Such decisions have proved to be life saving as shared by several fisher folk during the study. It is to our understanding that the OSF provided by INCOIS has been validate extensively and is found to be highly accurate, however during the study fisher folk perceived OSF to be relatively less accurate compared to the accuracy levels suggested by INCOIS. There could be many reasons as to the above such as perception of Ocean State Forecast variables and their meaning and understanding by fisher folk, genuine issues with the accuracy of forecast issued by INCOIS or general misconception.

As field level implementing agency MSSRF needs to focus more on training and capacitating fisher folk to effectively use INCOIS information services, such training may include areas such as in depth awareness on PFZ and OSF, navigation to PFZ using GPS, Demystifying Ocean State Forecast parameters and possible exposure visits. Since the use and potential of PFZ and OSF services have been proved beyond doubt, it is high time the service reaches the hands of each and every fisher folk throughout the Indian Subcontinent. Along with training, new information dissemination tools such as mobile based voice messages can be explored as they hold vast potential in reaching a large number of fisher folk rapidly. On their part INCOIS needs to explore ways and means to integrate traditional knowledge of fisher folk in their research towards improving scientific forec

