Potential Fishing Zone Advisories and Conversion from Bottom Trawling to Gillnetting: Role of MSSRF-INCOIS Partnership in Gilakaladindi Village in Krishna District, Andhra Pradesh-a preliminary study

M S Swaminathan Research Foundation (MSSRF),Chennai
Indian National Centre for Ocean Information Services (INCOIS), Hyderabad

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Concept & Design Ms S Velvizhi
Report preparation Dr L Vedavalli

Research Team

From INCOIS Mr Sourav Maity
From MSSRF Dr L Vedavalli
Ms S Velvizhi
Ms D Suvitha
Mr N Veerabhadra Rao
Mr D Srinivas Rao
Mr K Dhanraj
Layout Mr K Prabhakaran

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Modern information technology has a transformational effect on the lives and livelihoods of rural and coastal communities. Small scale fishing families have now access to a wide range of communication technologies to help them in improving the safety and income of their occupation. The present publication gives information on the role of MSSRF-INCOIS (Indian National Centre for Ocean Information Services) partnership in the Gilakaladindi Village of Krishna District in improving fish catch and thereby the income of small scale fisher groups. Fishers now receive at their door step information on potential fishing zones. Such information is provided through mobile phone and through helplines. This advice has helped the fisher families to engage in Pelagic fishing. Those who have been practicing bottom trawling method of fishing have now shifted to gillnetting. The report clearly shows the uncommon opportunities now available for promoting sustainable fisheries and for shifting from bottom trawling to gillnetting. Such a step leads to gains both in ecology and economics.

The reporting and processing of this publication was done by Dr L Vedavalli. The concept and design were done by Ms S Velvizhi. The other members of the study team are indicated in the report. We owe a deep debt of gratitude to Ms Nancy Anabel, Director, ICT, MSSRF for her guidance and support. Our thanks are also due to Dr Srinivasa Kumar and Dr Nagaraja Kumar from INCOIS for their assistance and advice. The publication indicates that a new chapter in the lives of fisher communities of Gilakaladindi Village has been opened up. I hope the Publication will help to spread this revolution.

M S Swaminathan

Foreward

The strong collaboration between ESSO-Indian National Centre for Ocean Information Services (INCOIS) and M S Swaminathan Research Foundation (MSSRF) is almost one decade old now. The partnership in its initial days was handling downstream dissemination of ESSO-INCOIS services, specifically Potential Fishing Zone (PFZ) advisories and Ocean State Forecast (OSF) services, on regular basis among the fishing community of Puducherry through ICT based Village Knowledge Centre established by MSSRF. Presently, android based Fisher Friend Mobile Application (FFMA) and Fishermen helpline, implemented by MSSRF, are the most recent and effective modes of dissemination popular among the fishing community. Along with several awareness campaign, this mode services almost 90,000 fishermen altogether from 29 districts of Odisha, Andhra Pradesh, Puducherry, Tamil Nadu and Kerala.

Present study elicits the utility of PFZ advisory and confirms the sustainable approach behind the concept. For instance, it has been witnessed that the intervention of PFZ service among the fishing community considerably reduced trawl fishing practice among the fishers of Gilakaladindi village in Krishna district of Andhra Pradesh; they adopted gill netting techniques to fetch tuna fishes based on PFZ advisory provided by ESSO-INCOIS. Following are some of the major outcomes of the study. Majority of the fishers, who earlier used to practice bottom trawling method of fishing, upgraded their fishing technique with gillnetting facility to enable themselves to engage in pelagic fishery depending on PFZ advisory provided by ESSO-INCOIS.

Advantages of PFZ lies in locating large fish shoals without wasting time and human energy and more importantly, brings down the expenses of fishing operation by saving diesel consumption, without damaging see floor that happens to be the spawning ground of several fish species.

I believe this report will mobilize fishing community of other states to adopt the technique to sustain their fishing fleets in long term without creating any adverse situation to the ecosystem. I take this opportunity to thank Ms. Velvizhi, Ms Nancy J Anabel and their team from MSSRF for their initiative to promote use of information generated by ESSO-INCOIS through effective dissemination methods and capacity building of the fisher folk. I also thank my entire PFZ team from ESSO-INCOIS for strengthening and upgrading the advisory generation techniques with recent science and technology. Our Particular thanks go to Dr. Ajay Kumar Parida and to Prof. M S Swaminathan for their endless support and to Dr. S. S. C. Shenoi and Dr. Shailesh Nayak for their continued guidance.

T. Srinivasa Kumar

Preface

M S Swaminathan Research Foundation's Village Resource Centre and Knowledge Centres operate across different states, for over two decades, bringing about a knowledge revolution resulting in transformation of lives and livelihoods. The Centres deliver locale specific and demand driven information benefitting the rural communities. Fisheries interventions through Village Resource Centre and Village Knowledge Centre and Virtual mode have been implemented on a progressive scale across Tamil Nadu, Pudhucherry, Andhra Pradesh, Odisha, and Kerala.

The key intervention among fisher folk is information on Potential Fishing Zone (PFZ) and Ocean State Forecast which functions as an effective decision making support system in venture, navigation, fishing efficiency, and profitability. In collaboration with Indian National Centre for Ocean Information System, crucial information is disseminated through use of best-fit Information and Communication Technologies, in particular, the mobile phone.

In the recent past, fishers have experienced dwindling fish stock caused by unsustainable fishing practices. An emergence of significant transformative change as a result of sustainable fishing practice due our intervention in a project focus village in Andhra Pradesh ignited MSSRF to undertake a study. Fishers who were accustomed to using bottom trawl nets adopted gillnet a sustainable fishing practice, upon receiving PFZ information. This study brings out the key benefits realized by fishers such as cost effective and less labour intensive fishing trade and economic enhancement due to the capture of high market value fishes.

I extend my gratitude and appreciation to Ms S Velvizhi for identifying the change and facilitating a study by designing it, Dr L Vedavalli for capturing the results well through an anthropological lens, and the entire study team comprising Mr Sourav Maity from INCOIS, Dr L Vedavalli, Ms S Velvizhi, Ms D Suvitha, Mr N Veerapathrao Rao, Mr D Srinivas Rao, and Mr K Dhanraj for eliciting results through appropriate methodologies.

I extend my sincere thanks to Dr. Srinivasa Kumar and Mr. Nagaraja Kumar, INCOIS, for their continuous support and advice for enhancing the efficiency and effectiveness of information service delivery to the fishing community to help bring about transformative change.

Nancy J Anabel

Acknowledgement

This is to acknowledge with gratitude the unconditional support and encouragement we have received from Professor M S Swaminathan. It is his constant guidance which has encouraged us to document the socioeconomic impact of our knowledge-connectivity interventions. Our thanks are due to Ms Nancy J Anabel for providing useful inputs for the study as well as for giving all the support we needed. Dr M Nagarajakumar and Dr T Srinivasa Kumar from INCOIS have provided valuable inputs and guidance all through and we are greatly indebted to them. Ms S Velvizhi's contribution to the study has been very significant. Not only did she conceptualise the study but also spearheaded the entire process of conducting the same. Our sincere thanks and gratitude are due to her. Ms Velvizhi, Ms D Suvitha, Mr N Veerabhadra Rao, Mr D Srinivasa Rao and Mr K Dhanraj fromMSSRF and Mr Saurav Maity of INCOIS were engaged in data collection in Gilakaladindi Village for this work. It was their enthusiastic involvement and commitment for the work which enabled me to write this report. I wish to express my sincere thanks and appreciation to each one of them. Mr Saurav Maity's insights were very useful and I wish to express my heartfelt gratitude to him. My special thanks are due to Suvitha for her spontaneous assistance through out. Dr R Rukmani provided critical comments and I am thankful to her. We extend our sincere thanks to Mr K Prabhakaran for designing the layout of this report and Ms N Dhanalakshmi for helping us with the map. Not but not the least, we are extremely thankful to our respondents from Gilakaladindi Village for their active participation and cooperation in sharing their experiences. Without their support and help this study would not have been possible. We are indebted to each one of our respondents

L.Vedavalli

Executive Summary

Enhancing the livelihood opportunities of fishers in the coastal villages is the focus area of the collaborative project of M S Swaminathan Research Foundation (MSSRF) and Indian National Centre for Ocean Information Services (INCOIS). This project provides near real-time advisories generated at INCOIS on Potential Fishing Zone (PFZ) and Ocean State Forecast (OSF) to fishers at their door steps, as voice/text messages through their mobile phones and also through Helpline. This study is an attempt to capture the experiences of fishers in Gilakaladindi Village, a coastal fishing village in Krishna district of Andhra Pradesh with the MSSRF-INCOIS intervention. Gilakaladindi Village has witnessed a rapid change in the fishing practices particularly since November 2011 after the initiation of MSSRF-INCOIS intervention. Majority of the fishers, who hitherto have been practicing bottom trawling method of fishing, upgraded their fishing technique based on PFZ advisory and shifted to gillnetting so as to enable them to engage in pelagic fishing. This preliminary study chiefly aims to understand the specific role played by this intervention in motivating the fishers of this village to upgrade their fishing practice to gillnetting on a larger scale from that of bottom trawling. Our individual interactions with 32 fishers including a woman boat owner and few fisher women in this regard, provided good insights into this aspect of conversion and the utility of the PFZ data (and also OSF) in their day- to- day fishing activity and the benefits of all this in their lives. It is interesting to note that the conversion has happened in such a rapid manner that by July 2013, out of 65 boats owned by our 23 respondents 50 fishing vessels have already been converted (and are under use) and three boats have been newly constructed. The fact that they have the facility to find high yielding fishing grounds has contributed significantly in facilitating the fishers of Gilakaladindi to upscale their fishing practices. Fishing based on PFZ advisory with gillnetting has appreciably contributed to improving the socioeconomic conditions of the fishers. Advantages of PFZ lies in locating large fish shoals witout wasting time and human energy and more importantly, brings down the expenses of fishing operation by saving on diesel. Fishers' efficiency and capacity has been enhanced. Income of the boat owners has increased several folds. This is also same with the wages of fishing crew members. The study clearly brings out the catalytic role played by MSSRF-INCOIS intervention in facilitating the conversion of fishing practice to a more sustainable method- from bottom trawling to gillnetting.

Introduction

Information and Communication Technologies (ICTs) have undoubtedly revolutionised the world. Concerted efforts by the government and non-governmental organisations have resulted in reaching the benefits of ICT to the people of rural India.

Over the last 25 years, M S Swaminathan Research Foundation (MSSRF) has been engaging in improving the lives and livelihoods of farmers and fishers through various initiatives. MSSRF's programmes, in accordance with its mandate, adopt a pro-poor, pro-nature and pro-woman approach. It has widely been acknowledged that information and knowledge empowerment of rural people are necessary to enhance their socioeconomic conditions. By setting up Village Resource Centres /Village Knowledge Centres as well as by using several traditional and modern technologies, MSSRF has been striving towards empowering the rural masses.

MSSRF- Indian National Centre for Ocean Information Services (INCOIS)

MSSRF has been striving to bridge the gap between scientific know-how and field level- do-how in partnership with appropriate government and other agencies. The MSSRF- INCOIS partnership is a step in this direction to improve the socioeconomic wellbeing of fishers inhabiting most of the coastal districts in the East and West Coasts of India.

MSSRF stands in the forefront in reaching and building the capacities of fishers of coastal Tamil Nadu, Puducherry and of late, the districts of Krishna and East Godavari in Andhra Pradesh with near real-time advisories generated by INCOIS. These advisories cover a range of topics that would help the fisherman to be more productive while simultaneously lowering the risks involved in fishing. The advisories could be broadly classified into three categories:

- Relating to the condition of the ocean, ie, Ocean State Forecast (OSF)-data on wave height, wind speed, wind direction etc ;
- Relating to the location of availability of fish, ie the Potential Fishing Zone (PFZ)- in particular, the Tuna fish;
- Relating to providing of warnings during extreme weather conditions such as high wave, cyclone, Tsunami etc, referred to as 'early warning'.

Provision of scientific advisories is one of the vital interventions carried out by MSSRF in partnership

with INCOIS to safe guard the lives of fishers during their fishing ventures in the sea and to increase the economic worth of fish catch. Since 2009, advisories related to the above mentioned aspects are disseminated through MSSRF to the target fishermen's mobile phone either as text or voice messages. In order to support and strengthen the audio and text advisories, another significant intervention namely, INCOIS-MSSRF Fisheries Helpline Service has been launched by MSSRF in partnership with INCOIS on 7th August, 2011. The multilingual Helpline makes it possible for the coastal fishermen of Tamil Nadu, Union Territory of Puducherry and Andhra Pradesh to access the fisheries services of INCOIS and MSSRF at any time of the day. It may be pointed out that the helpline is a 24/7 service and is the first of its kind in India.

Context

It is evident that the near real-time advisories such as OSF and PFZ generated at INCOIS, and disseminated through MSSRF, play a very critical role in the lives of fishermen. While OSF gives the fishermen and their families a greater sense of security, reduces tension and avoids loss of lives and assets, the PFZ information generated using satellite technology helps the fishers, particularly engaged in pelagic fishing using gillnetting. It may be pointed out here that even small craft fishermen found this advisory to be helpful in getting more catch. It is also learnt that it has, to a great extent, found to be useful in reducing searching time, minimising fuel cost and also human effort. Experiences of fishermen in MSSRF-INCOIS intervention villages in Tamil Nadu, Puducherry and Andhra Pradesh indicate significant socioeconomic benefits of the near real time advisories.

It has been encouraging and interesting to observe significant positive developments in one of the villages in Andhra Pradesh namely Gilakaladindi in Krishna district, near Machilipatnam, where MSSRF-INCOIS intervention was initiated during November, 2011. Since then these fishers in this village have been using PFZ advisories. They could almost immediately see the benefits of using the PFZ data; they find that there is considerable reduction in search time and also in diesel consumption during their fishing operation in the sea apart from better catch of Tuna fish. Interestingly, this village has witnessed conversion from bottom trawling method of fishing into gillnetting in the deep sea in a rapid manner during the last two years. In bottom trawling normally the major catch involves Prawn, Crab and other fish species whereas in gillnetting the fishers could harvest big and shoal fishes like Tuna, Carangids, Yellow fin, Skip Jack, Seer fishes which are of higher economic value.

It is in this context that a study, mainly to look into the factors leading to conversion of fishing practices to assess the performance and also to understand the benefits of PFZ advisory for fishers of Gilakaladindi, assumes significance. Incidentally, this study further assumes significance as MSSRF started giving INCOIS advisories on PFZ and OSF since the last two years. It has been felt that a study of this kind would throw light on the reasons for such conversion in a short span and the role played by PFZ advisory in this. It has also been felt that the results of such an exercise would also indicate

benefits, prospects and problems in applying PFZ advisory.

Indian National Centre for Ocean Information Services

INCOIS is an autonomous organisation of the Government of India, under the Ministry of Earth Sciences, located in Hyderabad, Andhra Pradesh. It provides ocean information and advisory services to different sections of the society such as industry, government and scientific communities based on sustained observations and constant improvisation of its deliverables by way of systematic and focused research.

PFZ advisory is the first service started by INCOIS. One of its missions is 'To make the Potential Fishing Zone Advisories as part of the value chain of fishing community'. INCOIS uses satellite technology for the forecast of PFZ information. Sea Surface Temperature (SST) and Chlorophyll over the Arabian Sea and Bay of Bengal retrieved from thermal infrared channels of NOAA-AVHRR and optical bands in IRS-P4 OCM / MODIS Aqua data are used for identifying PFZs along the Indian coastline and island regimes. These timely scientific forecast advisories have been proved to be very useful by the fishermen engaged in pelagic fishing activities such as gillnetting, ring seining and so on. It has to a great extent found to be useful in reducing searching time, minimising fuel cost and also human effort.

INCOIS generates multi-lingual PFZ Advisories every Monday, Wednesday and Friday and disseminates these to about 500 fish landing centers / fishing villages covering the entire coast line of India under 12 sectors viz. Gujarat, Maharashtra, Karnataka , Goa, Kerala, South Tamil Nadu, North Tamil Nadu, South Andhra Pradesh, North Andhra Pradesh, Orissa, West Bengal, Lakshadweep Islands, Andaman and Nicobar Islands. Multi-lingual PFZ advisories are being generated and disseminated during the non-ban and non-monsoon period to the entire fishermen community situated all over the coast of India and Islands through various modes of disseminations viz. telephone, fax, e-mail, website, *doordarshan*, radio, news media, etc. Advances in Information and Communication Technology have been adapted to improve the coverage and penetration. With the state of art of Technology available, INCOIS designed and installed Electronic Display Boards (EDB) at major fishing harbours which have made significant impact in the delivery chain.
www.incois.gov.in/Incois/advisory_pfz_main.jsp

Study Area

Krishna district is one of the developed districts in the coastal region of Andhra Pradesh. It has 107 kilometres coastline length, across Machilipatnam, Kruthivenu and Nagalanka Mandals. Machilipatnam is one of the most productive traditional fishing areas in the Krishna district. It is also one of the three important trawling landing centres (the other two being Kakinada and Nizampatnam) in the state. Active creek-based fisheries is seen here. The coast is shallow as River Krishna discharges the water. The creek thus formed provides a base for anchoring bigger fishing crafts. Fish and prawns are marine based resources. There is a fishing harbour in Machilipatnam.

Gilakaladindi- study village

Gilakaladindi is a fishing village in Machilipatnam *mandal*. This village is about five kilometres east to Machilipatnam. The village boundaries are Bay of Bengal on east side, Kara Agraharam on south side, Machilipatnam on west side and mangrove patches on north side. The village was known as Gilakaladandi which over the years came to be called Gilakaladindi. The village got its name as there used to be a plant called *Gilakala* (meaning rattle) *chettu* (meaning plant) in large numbers. The dry fruits of this plant when rubbed against each other used to produce a noise reminding one to the sound of a toy rattle. *Gilakala* is the word used to refer to a toy rattle in Telugu language. *Dandi* is the word used by the fishers to denote the meeting point of the river and the ocean ie the river mouth. Crossing this point by the fishing vessels is stated to be a very difficult task for the fishers. Once they cross this point, they heave a sigh of relief by saying *abba dandi dhatem* meaning 'Oh! We have crossed the river mouth'. The village, according to the fishers thus got its name as Gilakaladindi due to the presence of large number of *Gilakala* plants in the village and the significance of *dandi* in the lives of fishermen. Maneuvering their fishing vessels through this particular portion in the waters has been a great task for the fishers.

Glimpses of Gilakaladindi Village

The inhabitants of this village speak Telugu. The village has a population of 3618 (Male 1788, Female 1730) persons consisting of 1534 households. About 92 percent of the villagers are literates. Fishing is a primary occupation of this village. Creek- based fisheries is carried out here which is tide dependent. The fishers in this village have been practicing bottom trawling. Only recently, gillnetting in deep sea fishing has been found to be in greater use. Generally, now-a-days the fishers undertake trawl net fishing during September to November and gillnetting from June to August and December to mid April. The fishermen mentioned that the climatic conditions are not conducive for deep sea fishing after August. As the water current during September to November is high, the fishers opt for bottom trawling rather than gillnetting. The period from April 15 to May 31 is a government declared ban period for fishing. The village has 149 registered fishing vessels. Both mechanised (95) and motarised (54) boats are found in this village. There are 40 boat owners. It indicates that there are fishermen owning more than one fishing vessel. It is gathered that nearly 18 persons have more than one boat. The boat owners employ labourers and boat drivers from this village and also from nearby villages. Fishers from this village go for work as labourers or drivers to other states like Odisha and Tamil Nadu. As a customary practice, owner of the boat releases the rope used in anchoring the boat in the shore. It is only then the driver steers the boat into the sea. Boat owners generally do not go for fishing and they remain on the shore. It is also found that few boat owners own agricultural lands or small fish ponds. Some men are engaged in dry fish and fresh fish/prawn trade. Also, a few of them undertake peeling of prawns in the prawn company situated in the harbour. There are some men who are involved in carpentry work, welding etc.

Women in this village, as commonly found in other fishing areas engage themselves as fish vendors. They also sell dry fish and prawns. Some have stalls in the local fish market where they sell prawns and fish packed in polythene bags. Some of them work for wages by engaging themselves in cleaning prawns in the landing centre where one finds small companies engaged in trading. During July-August, some women go for rice transplanting work for daily wages in the near by localities. Normally, boat owners' wives stay at home taking care of the household activities. A Fishermen's association by name Gilakaladindi Boat Owners' Association has been functioning in this village. It has a membership of 40 fishermen.

Silted creek/river mouth: a common problem faced by the fishers

Fishermen in this village face practical difficulties as the mouth of the creek is silted heavily with sand deposits. It obstructs the free movement of the fishing crafts. It is very difficult for fishing vessels to navigate through the silted canal to go to the sea for fishing. One has to wait for high tide to venture into the sea. The fishermen association has appointed a person to monitor the tide variation and guide the driver of the fishing craft to cross the mouth of the creek and steer the boat in right direction so as to avoid any damage to the fishing crafts. In spite of this arrangement, sometimes the fishing vessel gets stuck in the silt. Retrieving it is a very hard task for the fishermen. It may also damage the boat. The fishermen pointed out that this problem has been taken to the notice of concerned government department several times but no measures have so far been taken to rectify it.

Genesis of the study

As we have already mentioned that fishers in Gilakaladindi Village have been receiving INCOIS advisories on PFZ, OSF and early warning alerts through MSSRF since November, 2011. It may be mentioned here that in all our initiatives, feedback meetings are carried out by the staff of MSSRF to understand the utility and effectiveness of the activities. Feedback meetings are normally done to improve the quality of services to the target population and bring about necessary changes accordingly wherever possible to realise the full potential of the said intervention by the intended audience. Similarly, with this objective in mind, a feedback meeting with fishers of Gilakaladindi was conducted during March, 2013. Interestingly, the response from the fishers was very encouraging. Interactions with the fishers indicated clearly that the economic benefits of fishing by applying PFZ data. In addition to increased income, fishers also felt that they had a sense of security while in the sea because of the availability of OSF advisory on a daily and timely basis. Another significant aspect which we learnt during the feedback meeting with fishers and in a subsequent visit to the village was that many fishers have shifted their method of fishing; it was found that the fishermen who hitherto were using bottom trawling for fishing have been converting into gillnetting; a more profitable one in economic terms and also less harmful to marine ecosystem. The feedback programme also revealed that a greater majority started to take up to gillnetting mainly because of PFZ advisory and TUNA forecast. During the feedback programme, the fishers also mentioned that gillnetting was less laborious and more cost-effective than trawling.

Encouraged by this observation and responses of the fishermen, Ms S Velvizhi, the coordinator of the Fisheries Programme of NVA, MSSRF was prompted to conduct a small survey of individual fishermen to know how far MSSRF-INCOIS intervention has influenced them in upgrading their fishing method. As a follow up of this, a preliminary study (on how the INCOIS advisories provided through MSSRF impacted the conversion of fishing practice of fishers) was carried out during the last week of July, 2013 by a team of MSSRF staff in Gilakaladindi Village. It may be mentioned here that a representative from INCOIS also formed part of the team.

Methodology

The study, as mentioned above, was conducted in the last week of July by a team comprising of MSSRF staff and a scientist from INCOIS. The study was conducted during a time when fishers were preparing to go for fishing after a long gap of nearly 10 days due to bad weather. Boat owners, labourers and the drivers were too busy making necessary arrangements to venture into the sea for fishing. However, some boat owners were kind enough to spare some time for us to interview them. We could contact only few labourers and boat drivers. A total of 32 fishers including a woman boat owner were contacted and interviewed using a questionnaire. These 32 respondents were chosen depending on their fishing practices, type of net they used for fishing, occupational pattern , willingness to talk to us and their ability to spare time to provide required information. The interviewed fishers include 23 boat owners, four drivers and five labourers of fishing vessels. The last two categories were contacted mainly to find out about the advantages and disadvantages involved in both type of fishing practices-bottom trawl and gillnetting from their perspective. The respondents were interviewed individually. Attempts were also made to interact with the wives of a few labourers, drivers and also the boat owners in order to find out their views regarding the changes in the fishing practices and related aspects. Prior to this, the study team interacted with a group who were members of a fishermen's association in Gilakaladindi Village. The meeting with the association members was organised by MSSRF staff as a part of this study. The purpose of our visit was explained to the fishers during this meeting. Interaction with fisher participants provided extremely useful insights about the overall impact of the intervention on the community, specific views on the advisories received and few other issues related to their occupation in the village. The meeting in a way helped us to gain familiarity with the fishers which enabled us to carry out the task without much difficulty.

MSSRF-INCOIS Intervention in Gilakaladindi

Enhancing the livelihood opportunities of fishers of coastal villages is one of the focus areas of MSSRF. MSSRF-INCOIS intervention plays a crucial role in this. It has been mentioned earlier that through this intervention, the fishers received near real time advisories on OSF and PFZ at their door steps as voice/text messages. It has, to a great extent, proved to be useful in improving their lives which is also true of Gilakaladindi Village. It is of great interest to learn that this village, has in recent times, witnessed a rapid change in the fishing practice particularly during the last one and a half to two years. It is learnt that majority of the fishers who hitherto have been practicing bottom trawling[1] method of fishing upgraded their fishing techniques and shifted to gillnetting. This preliminary study chiefly aims to find out the role played by this intervention in motivating the fishers of this village to upgrade their fishing practice to gillnetting on a larger scale from that of bottom trawling. Our individual interaction with 32 fishers including a woman boat owner and few fisher women in this regard, provided insights into this aspect of conversion and the utility of the PFZ data (and also OSF) in their day today fishing activity and the benefits of all this in their lives.

Respondent's Profile

Classification of Respondents by Occupation and Age

Figure 1 and 2 provide details of occupation and age of our 32 respondents. Except one woman boat owner the rest are men. The 31 male respondents consist of 22 boat owners, five labourers and four boat drivers. Our youngest respondent is 25years old and oldest 62 years. Of the 31 male members we find two persons in the age group of 25 years and below, 12 persons between 25 to 40 years and the remaining above 40 years. The woman respondent is in the age group of 25 to 40 years.

[1] It may be of use to mention briefly about the two methods of fishing-bottom trawling and gillnetting. Bottom trawling method of fishing involves pulling fishing net through the water behind one or more boats. The boats that are used for trawling are called trawlers. Trawls are non-selective, sweeping up both marketable and desirable fish and fish of both legal and illegal size. Bottom trawling involves rowing heavy fishing gear over the sea bed; it can cause large scale destruction on the ocean bottom including damage to sensitive habitats, coral shattering and removal of sea weeds. The primary sources of impact are the doors which can weigh several tones and creates furrows if dragged along the bottom and the foot rope configuration which usually remains in contact with the bottom across the entire lower edge of the net. Depending on the configuration, the footrope may turn over large rocks or boulders, possibly dragging them along with the net, disturb or damage the sensitive organisms or rework and re suspend bottom sediments.
Gillnetting is a common method used by commercial and artisanal fishermen in the ocean. A fishing net set vertically at specific depths in the water are usually highly selective in terms of fish they catch. Gillnets are series of panels of meshes with a weighted foot rope along the bottom, and a head line to which floats are attached. By altering the ratio of floats to weights buoyancy change, and the net can therefore be set to fish at any depth in the water column. In commercial fisheries, the gillnet meshes are uniform in size and shape. Fish smaller than the mesh of the nets pass through unhindered. The fishes that are larger at the gills than the holes cannot move about once its gills are caught in the holes of the net. This gives gillnets the ability to target specific size of fish unlike other net gear such as trawls, in which smaller fishes as well as larger fishes are captured in the net.

Figure 1: Distribution of Respondents by Occupation

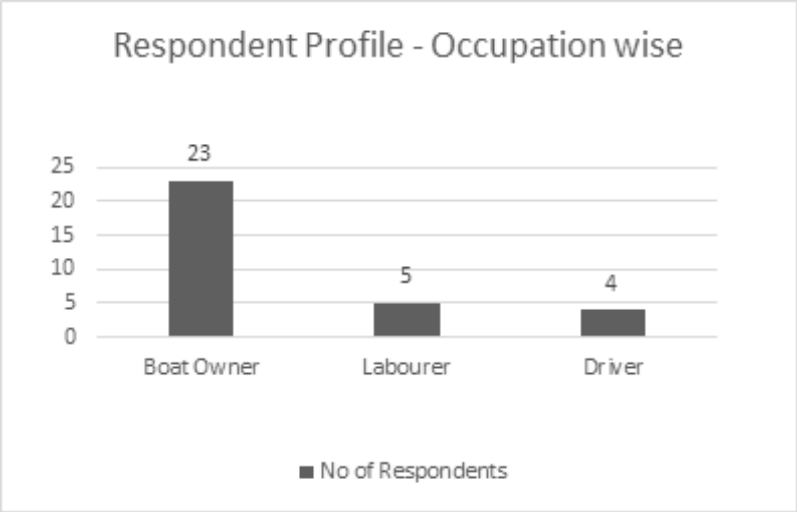
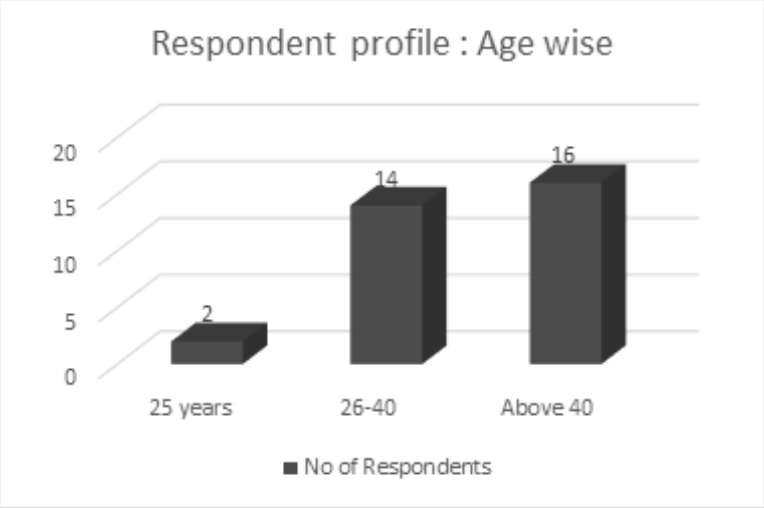


Figure 2: Distribution of Respondents by Age

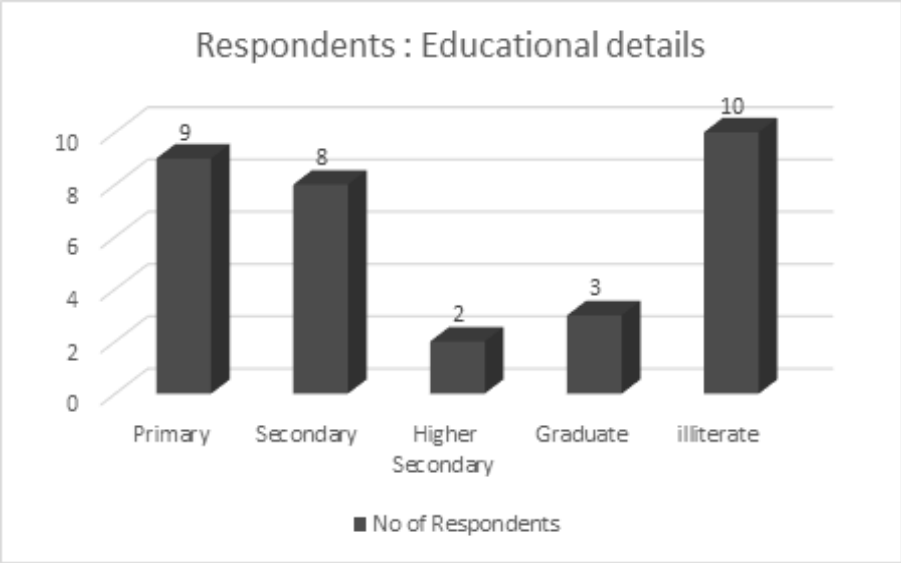


Classification of Respondents by Educational Attainment

Figure 3 shows the educational background of the respondents.

As seen in the Figure below, 9 persons have studied up to primary level, 8 persons have completed secondary level of schooling and 2 have had education up to higher secondary. Our respondents consist of 3 graduates and 10 illiterates. The last category of respondents includes all the 4 drivers, 3 labourers, and 3 boat owners including the woman respondent.

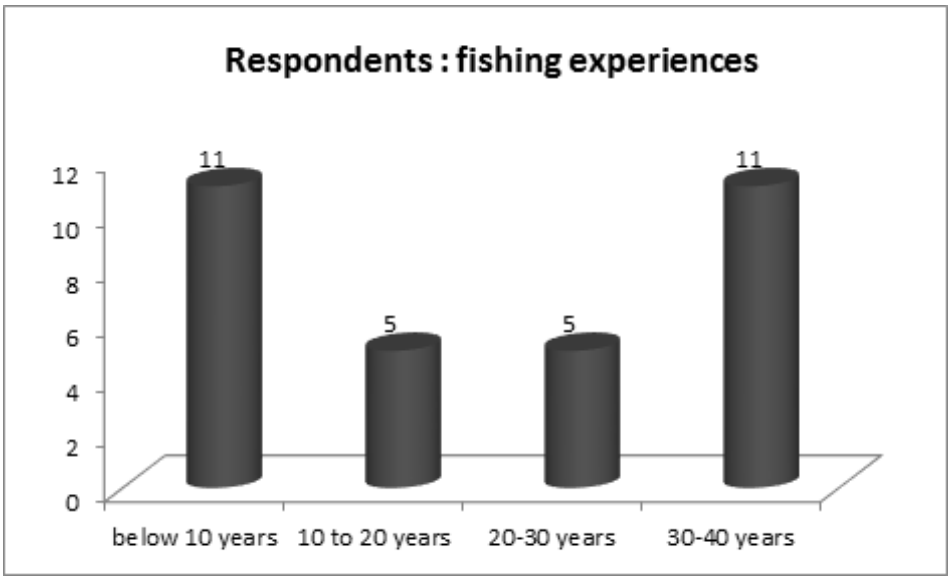
Figure 3: Distribution of Respondents by Educational Attainment



Classification of Respondents based on no of years of Fishing Experience

Fishing experiences of our respondents range from five years to 40 years. As seen in the Figure below 11 persons have less than 10 years of fishing experience, 5 have 10-20 years of experience and another 5 persons have 20-30 years of experience and there are 11 persons who have fishing experience ranging from 30 to 40 years.

Figure 4: Distribution of Respondents based on no of years of Fishing Experience



Classification of Respondents based on Ownership of Currently Used Fishing Craft and Fishing Gears

The Tables 1 and 2 show the ownership details of fishing craft and the type of fishing gear currently used by the fishers. Of the 23 boat owners 20 persons (including the woman boat owner) own trawl boats. One person owns only a fibre boat while there are two fishers who posses both fibre boats and trawlers. Fishing through bottom trawling is decreasing and it is practiced only during certain periods of the year. Of late, gillnetting has gained greater popularity and recognition among the fishers of this village. From the Table 6, it can be seen that 16 persons using largely gillnet and 7 using both trawl and gillnetting.

Table 1 Distribution of Respondents* based on type of Fishing Craft Owned

Type of Craft	No of Respondents
Only Trawler Boat	20
Only Fibre Boat	1
Fibre Boat and Trawl	2
Total	**23**

*This includes only Boat Owners

Table 2 Fishing Gear Currently used by Respondents*

Currently Used Fishing Gear	No of Respondents
Both Trawl and gillnetting	7
Only Gillnet	16
Total	**23**

*This includes only Boat Owners

Reaching fishers with near real time advisories-efficacy of MSSRF-INCOIS intervention in Gilakaladindi Village

MSSRF identified Gilakaladindi as one of the fishing villages in Krishna district to disseminate INCOIS real time advisories during the year 2011 and the process of sending the same to the fishers stared sometime during November, 2011. Though two years is a short period to arrive at the outcome of the intervention we have tried to assess its effectiveness in the overall fishing activity particularly focusing on the shift from bottom trawling to gillnetting by fishers in Gilakaladindi. As we have mentioned earlier we have been motivated to take up this preliminary study after a feedback meeting conducted during March 2013 regarding the utility of PFZ and OSF advisories with fishers of this village.

Classification of Advisories provided through MSSRF-INCOIS Intervention

Table 3 indicates the different types of advisories generated at INCOIS which are made available through MSSRF to the fishers as voice SMS or text SMS via one's mobile phone. While OSF is provided on daily basis PFZ and Tuna forecast is given based on the availability of the data (PFZ data cannot be generated if there is cloud cover. It can be ascertained only in a cloud free situation). It may be pointed out here, that since inception of the intervention, 49 advisories (as on July 31,2013) related to PFZ/ Tuna forecast have been made available to the fishers. Interestingly, while fishers take efforts to share OSF information to the fellow fishers, they keep PFZ information to themselves. As an elderly man of 62 years jokingly said, **'OSF is (made) public and PFZ is (kept) secret'**. Other than these two advisories, the fishers get rainfall information and cyclone and Tsunami alert. All these advisories which are reliable and timely are very crucial for fishers in their day to day fishing activity which is their primary source of livelihood.

Table 3 Advisories provided through MSSRF-INCOIS Intervention

Details of Advisories
Potential Fishing Zone
Tuna Forecast
Ocean State Forecast (Wave Height, Wind Speed and its direction)
Rainfall Information
Cyclone and Tsunami Alert

Almost all were unanimous when they said that OSF is 80-90 per cent accurate while the accuracy of PFZ is rated at 70-80 per cent right. They acknowledged that these advisories have come to play a very critical role in their lives; OSF enables them to plan and make decisions regarding their fishing activity while PFZ advisory facilitates them to deploy their nets in an appropriate location to catch fish resources. The fishers value the OSF as they see it as life saving one. According to them, it has considerably brought down the anxiety and uncertainties previously experienced by the entire family members during bad and uncertain climatic conditions. As they have access to OSF, they can plan their fishing activity accordingly; if the forecast is not conducive for venturing into the sea, the fishers stay back on the shores and also take necessary precautions to safe guard their fishing vessels and related gadgets. Thus, they are able to avoid loss of human lives and damages to the fishing gears. One of the fishermen pointed out that "… human life is very precious; it cannot be brought back to life once it is lost whereas one can earn money even he/she loses the entire property. So, we attach high value to the OSF advisories and we feel that it is our moral responsibility to share this information with the entire village".

While the OSF gives fishers a sense of security and confidence at the psychological level PFZ data enables them to improve their economic conditions. They were happy to share with us that ever since they started using PFZ information, they have been able to see the advantages of this service of MSSRF-INCOIS. They are of the view that though 70-80 per cent of the data provided is accurate it is still valuable and profitable for a fisher man in his fishing activity. As the PFZ data is generally useful for persons engaged in surface fishing, the fishers in this village have been motivated to take to gillnetting, suitable for such fishing. Boat owners have also remodeled their fishing boats appropriately for such fishing activity. Fishing through gillnetting has been proved to be very profitable for the boat owners and also to the boat drivers and labourers (It may be mentioned that this process of conversion has begun more or less the same time when MSSRF-INCOIS intervention was initiated in this village). It is exciting to find that within a short period, most of the boat owners took to gillnetting. We shall be discussing in the subsequent pages the factors responsible for conversion into gillnetting from their earlier practice of bottom trawling, the process of conversion and the associated socioeconomic benefits of gillnetting for the fishers.

Fishing method upgraded

A significant development that has been witnessed in the post MSSRF-INCOIS intervention period in this village has been that fishermen began to upgrade their fishing method. The fishers, who until then undertook fishing by using bottom trawling, started to show inclination towards gillnetting and the adoption of the same happened in a faster manner in the post intervention period. The fishers of Gilakaladindi have been engaged in fishing using primarily bottom trawling for three or four decades (It is said that prior to this they used vessels propelled by sails for fishing in the sea). The catch generally included prawns and small fishes such as Carangids, Ribbon fishes, Mackerels, Clupeids, Silver bellies, Cuttle fishes, Anchovies, Pomfrets and so on. Physical strain was more in this type of fishing. Once they venture into sea for fishing both the driver of the boat and the labourers had to be engaged in work continuously for hours with no or less leisure. The health of the crew also gets affected in this kind of fishing. However, fisher women had greater scope to earn money under this system as they earned income by selling prawns, fresh fishes and dry fishes. This was the general scenario that prevailed until one and half-year to two years ago.

It has been mentioned earlier that we had an interactive meeting with the members of Gilakaladindi Boat Owners' Association. During that meeting we had an opportunity to interact with many fishers.

This provided a good platform for us to get a fair idea as to what people thought about the utility of the intervention involving various aspects of the fishing community and how it has impacted their lives. When we enquired as to how and why the idea to change their fishing method occurred, it is said that a fisherman namely Mr Husain from this village first started to convert one of his boats for gillnetting. This person seemed to have been influenced by his counterparts in Chennai who were using gillnetting. As he heard that gillnetting helps in getting more fish catch of commercial value, he contemplated reconstructing one of his boats which had been stranded on a low tide. As the boat was damaged, he decided to reconstruct it for gillnetting during late 2009. The reconstruction got completed during 2011 and his maiden venture into the sea with gillnetting took place sometime during the month of July, 2011. After Husain's venture into converting his fishing gear, only three persons showed interest in converting one of their fishing boats/gears during 2011. Husain said his other fellow fishermen in the village were apprehensive of his new venture; it did not seem to encourage the other boat owners to adopt gillnetting because of the heavy investment involved in this. Not only new nets have to be bought or made even the fishing boat has to be altered (like increasing fish holder size) appropriate to the fishing method which means heavy financial investment. It may be pointed out here that of the three persons who were influenced by Husain to convert one of their boats for gillnetting, two happened to be our respondents. One of the respondents said that out of five boats that he owned, he converted one into gillnetting and the other respondent stated that he modified one of his two boats suitable for gillnetting. However, it is said that by the time these three persons started to go for fishing with their newly converted fishing gear (ie through gillnetting), MSSRF-INCOIS intervention has been initiated (November 2011) in Gilakaladindi Village. It is evident from our interactions and interviews with our respondents that until this time except for Husain and three other persons, , a great majority of the boat owners did not evince interest in immediately changing into gillnetting. **A change in the attitude and behaviour of fishers towards the conversion began to be expressed only after they experienced the economic benefits subsequent to applying PFZ data. This data, mostly found to be very useful in surface fishing, yielded good harvest of fish resources like tuna and other fish resources which have high market value. They found all the more profitable as they started to receive species (Tuna) specific information The boat owners who were not comfortable with the idea of changing their fishing gear, slowly started to convert their boats for gillnetting one by one. It is interesting to note that the conversion has happened in such a rapid manner that by July 2013, out of 65 boats owned by our 23 respondents, 50 fishing vessels have already been converted (and are under use) and three boats have been newly constructed. The**

fact that they have the facility to find high yielding fishing grounds has contributed significantly in facilitating the fishers of Gilakaladindi Village to upscale their fishing practice.

Classification of Respondents by number of boats owned and number of boats converted in to gillnetting

It is found that 9 persons own one boat each and 8 of them have converted their boats. The remaining one person is our only woman respondent who was earlier a small fish trader and has recently become a boat owner by constructing a new boat with gillnetting. It is seen that 5 persons have 2 boats each and out of the 10 all except one boat has been converted. Five persons own 3 boats each; of the 15 boats owned by them 12 have been converted while one boat has been constructed newly by one of them. Only 2 are yet to be changed into gillnetting. It is found that an owner of 5 boats has converted all the boats while another person with 6 boats constructed a new boat last year and modified all his 5 old boats with gillnetting. A fisherman who owns 9 boats has converted 4 boats and another owner of 11 boats has remodeled all his boats except 4. As already mentioned it is interesting to mention that out of 65 boats owned by our 23 boat owner respondents, 50 fishing vessels have been modified for gillnetting and 3 new boats have been constructed recently. All the boats are fitted with GPS (Global Positioning System) and Ecosounder. Almost all the boats have also been registered with MPEDA (Marine Products Export Development Authority)

Table 4 indicates that the conversion to gillnetting has happened between 2011 -2013. 3 persons have taken to gillnetting during 2011, 18 fishers in 2012 and one person in 2013. Our woman respondent chose to go directly for gillnetting with her first boat which she constructed during 2013.

Table 4 Year wise Details of Fishing Gear Conversion to Gillnetting by Respondents (Boat Owners)

Year of Conversion	No of Respondents*
2011	3
2012	18
2013	1
Total	**22**

*The woman respondent who was earlier a small fish trader has constructed a new boat with gillnetting during this year

Classification of Boat Owners by Money spent for Boat and Net conversion

Upgrading fishing technique/method into gillnetting involves reasonably high financial investment for the boat owners. That's the reason the boat owners initially did not show eagerness or interest to change the fishing practice when Husain converted one of his boats into gillnetting. The shift in fishing method demands buying a new net which approximately costs around Rs 5, 00,000. In addition, a sum of Rs 50000-75000 is required for modifying the old boat convenient for fishing with gillnetting. Some adjustments and modifications have been carried out by the boat owners in their respective boats. For example storing space has to be increased; space to keep the nets has also to be larger than before and so on. It is learnt that size of the fish holder has been increased from one tone to maximum of 12 tonnes by the fishers. Edukondalu, aged around 40 years, mentioned that he increased the fish holder size from one to five tonnes capacity while Nagarjuna said that he increased the fish holder size from five to 12 tonnes. Some have shifted their cabin to the front portion to accommodate more storing space. These facilities can support longer fishing time at sea and can greatly affect output during the high yield period. It is mentioned that conversion of a boat costs minimum of Rs 5, 00, 00 and that of a net cost Rs 5, 00,000. Following two tables give us some idea of the expenses involved in changing into new fishing net (gillnet with increased mesh size) and modifying the existing fishing boat. From the Table 5 it is seen that for a boat conversion 7 persons spent Rs 5, 00, 00 to Rs 6, 00, 00, 1 person Rs 60000-Rs70000, another person Rs 70000-Rs 80000 and there are 13 persons who had spent Rs 80000 and above each for converting their respective boat. It is clear from the Tables 5 and 6 that investment for conversion of fishing net into gillnetting seemed to be on higher side when compared with boat alteration. We understand from the Table 6 that 5 fishers have spent Rs 500000- 600000, another 3 persons Rs 600000-700000 while 14 persons have invested more than Rs 8,00,000 on net conversion. As we have mentioned earlier one of our respondents constructed a new boat suitable for gillnetting. From a small fish and prawn trader she has been able to own a boat because of her hard work. She said she had to spend more than Rs 20, 00,000 for constructing a new boat and buying the net.

Table 5: Distribution of Respondents based on the money spent for Boat Conversion

Amount Spent for boat Conversion	No of Respondents
Rs 50000-60000	7
Rs 60000-70000	1
Rs 70000-80000	1
Rs 80000 and above	13
Total	**22**

Table 6 Distribution of Respondents based on the amount spent for Net Conversion

Amount Spent for net Conversion -	No of Respondents
Rs 500000- 600000	5
Rs600000 - 700000	3
Rs700000-800000	14
Total	22

It has been seen that conversion of fishing gear means huge investment; a minimum Rs 5 to 6 lakh is required for conversion a boat and fishing net. Because of the heavy investment involved the boat owners irrespective of number of boats they owned chose to start modifying initially with one boat suitable for gillnetting. We come to understand from our interviews and interactions with the boat owners that they managed to mobilise the required amount from the available resources at their disposal. Interestingly, not many approached banks or money lenders for this. One young fisher man by name Nagarjuna mentioned that he used a loan amount of Rs 4.5 lakhs to buy a new net which his mother got under Sahar Lakshmi Scheme provided by Indian Overseas Bank. Another person by name Odunga Rengarao aged 50 years also said that he took a loan from a nationalised bank for rebuilding his fishing assets. Most of them were able to raise a major portion of capital either by selling gold jewelry of their spouses and daughters or by pledging them. Apart from this they had used whatever savings they had in the bank and few took loan from their kith and kin. Subsequently, considerable increase in the income through fishing based on PFZ and Tuna advisory motivated the boat owners (having more than one boat) to convert the other boats one by one. It was encouraging to know from our respondents that the source of income for further conversion of fishing gear came from the fish resources caught by them applying the PFZ/Tuna advisories. They pointed out that three to four fishing trips in a month is sufficient to carry out conversion of one boat into gillnetting; such is the turnover. Nagarjuna stated **"…*rendu* PFZ advisories *kalichi osthe chalu oka* boat convert *chese ochu*"** meaning one would have sufficient money to convert a fishing boat just from two trips of fishing carried out based on two favourable and accurate PFZ advisory. This will help one to understand the usefulness of PFZ advisory in improving fishers' lives and livelihood.

Research team with the respondents

Benefits of PFZ Advisory and Gillnetting in Fishing Pursuit-Fishers' Perspective

The study reveals that fishing in the Potential Fishing Zone with gillnetting is of far greater worth to the fishing community. Their fishing efficiency has improved and their fishing capacity increased. Investing in the nets and remodeling the boats or constructing new boats suitable for deep sea fishing is considered worth the trouble as it almost ensures reasonable economic returns to the boat owners and also to the crew members. Fish yield has increased and they are able to harvest quality fish resources that have considerable market potential. Time is saved as search time has significantly reduced. More importantly, investment on inputs such as diesel has come down drastically. The boat owners, drivers and the labourers of fishing vessel were able to experience the advantages instantly. The impact has been felt not only in the economic front but on social side as well.

Bottom trawling versus gillnetting in Gilakaladindi

A cursory look at the functioning of both the methods of fishing-bottom trawling in non PFZ and gillnetting based on PFZ advisory- in Gilakaladindi Village would help one to understand better the benefits and advantages of the latter as against the former, predominantly practiced in the pre MSSRF-INCOIS intervention period. When bottom trawling method has been in operation in a big way in this village, a fishing trip would normally extend atleast to a period of five to six days. It is referred to as stay in fishing wherein the crew with fishing vessels would remain in the sea for few days at a stretch. In this method, the fishers carry out their fishing activity within 100 metres depth. Mostly their fishing operation is carried out within the 50 metres depth as fishing beyond this yields only prawns of less commercial value. The crew consists of five to six labourers and two drivers. In bottom trawling method, a lot of time and human energy is invested; labourers are engaged in continuous dragging of the nets and a lot of time is spent in finding fish shoals. In this mode of fishing, most of productive fishing time is spent on bottom trawling once main fishing grounds have been found.

Normally, in both the types of fishing, the frequency of fishing trip in a month undertaken by the fishers ranges from three to five times. It is found that a majority (18 persons) of our respondents undertake three fishing trips in a month and one person four times a month; while four respondents mentioned that on an average they undertake five trips in a month.

In bottom trawling method, a minimum of five-six fish hauls are undertaken in 24 hours; time taken for each haul is normally three to four hours. If it is during day, the hauls would be four times and if it is during night, three hauls would be made. In this method of operation, the major harvest would

be prawns and also fishes of different varieties like Croakers, Carangids, Ribbon fishes, Mackerels, Clupeids, Silver bellies, Cuttle fish, Anchovies, Pomfrets, Crabs and so on. Big and medium sized prawns are normally available within 30 – 50 metres depth. Nearly 50 per cent of these fish resources are normally converted into dry fish and the rest are sold as fresh fish in the local market. However, as we have mentioned earlier, a shift in the fishing practice/method has taken place recently ie during the post MSSRF-INCOIS intervention period; because of the availability of PFZ advisory there has been a preference for surface fishing using *Panduvala (*gill net) (with increased mesh size 140 mm and more number of rows) wherein the fishers go beyond 200 metres from the shore to catch fast swimmers like Tuna, Seer fishes, Sword fishes, Sharks etc. Fishing operation with gillnetting is undertaken during night time when the gears is released and haul in before sun rise around 4-4.30 which means one haul per day is made in gillnetting. Here, net releasing would take more than one hour and net pulling also takes more or less the same time. As the PFZ advisory is mostly species–specific, Tuna and related fish resources which have great market potential are harvested in gillnetting. In bottom trawling, the marine resources caught are generally prawns, crabs and juvenile fishes and possibility of wastage of fish and prawns is higher. The fishers mentioned that it is generally difficult to ascertain the market value of the yield of the prawn and crab resources.

Table below gives us the details of fish resources caught in both the fishing operations

Table 7: Details of Major Fish Resources Caught through Bottom Trawling and Gillnetting

Major Fish catches under different fishing operations	
Bottom Trawling	**Gillnetting**
Prawn, Silver bellies, Carangids, Croakers, , Squids, Cuttle fishes, , Pomfrets, Sharks, Rays and Crabs	Tunas, Yellow fin Tunas, Seer fishes, Carangids, Ribbon fishes, Anchovies Sail fishes, Croakers, Clupeids, Oil sardines, Skip jag, Sword fish and Pompino

PFZ advisory reduces search tim e and also saves human energy & fuel

It has been heartening to listen to our respondents talking about various advantages and benefits of fishing operation carried out in potential fishing zone with gillnetting. The respondents were unanimous when they said that PFZ advisory enables the fishermen to locate the fish shoals with less time and also with less human effort. According to them locating fish shoals has become much simple and effortless. They do not have to spend long time; search time has significantly come down. Now, they have information by which they are able to reach the specific location without any unnecessary

wandering in the sea. As a result of this, there is substantial reduction in diesel consumption per trip by which a lot of money is saved. "We have the right information. Straight away we are going to the location. A lot of time is saved and most importantly we are avoiding diesel expenses", pointed out Nagarjuna, a young graduate. Jarasandudu, a 62 year old man who has nearly 40 years of fishing experience,asserts that fishing based on PFZ advisory is very useful and profitable. It is encouraging to note when he said, "*Mileage kalisi osthunthi and oil kalisi osthunthi. Idhi pedda labham maaku*" meaning "there is lot of saving in terms of mileage and fuel. This adds to our profit in a big way". It is not just Nagarjuna or Jarasandudu who have felt like this; all our respondents affirm to what these two men have stated above.

Quality and quantity of fish catch improved

From the current study it is evident that the utilitilisation of of PFZ advisories for fishermen of Gilakaladindi Village has enhanced their fishing capabilities and thereby improved the economics of fishing operations. Since the inception of MSSRF-INCOIS intervention, the fishers have been regularly using the PFZ advisories to locate pelagic fish shoals and effectively exploit the fish resources. There has been a sizeable increase in the fish catch; it is certainly more than twice the quantity of what they used to get previously. Most importantly, as we have mentioned earlier, the fishers are able to catch fish species like Tuna, Yellow fins and Skip Jack which has greater market potential. It emerges clearly from our study that that fish harvest through gillnetting in the PFZ area is comparatively higher than in the non PFZ where bottom trawling method of fishing is undertaken. By using PFZ advisory, the fishers were able to catch 200-500 kg of Tuna fish in one haul.

When we asked them about the catch details per fishing haul, around 5 persons said that they are able to obtain 200-300 kilograms of Tuna and other related species and 17 of them mentioned that they get around 400-500 kilograms of fish resources per haul.

Moka Gopalakrishna, V Srinivas and Odunga Venkateswara Rao stated that, not only they have been able to save on diesel expenses but also they have been able to get a good yield of Tuna and other varieties of commercial value; their income from fishing has more than doubled now owing to the PFZ advisory. According to Srinivas, "…earlier, we used to catch less than 1 tonne of fish, but after we started using PFZ advisories we have been able to harvest easily 2 to 3 tonne of fish (mainly TUNA and its related species) per trip". He added to say that owing to good yield of fish resources like Tuna his monthly income has increased; he gets Rs 50000 to 1, 00,000 per month after the expenses. Previously his income used to be less than half of what he gets now. During peak season the income goes up to one lakh, mentioned Srinivas.

It may be of interest to mention here that many a times the fishers had been able to harvest a good catch of fish resources that they had returned to the shore before the scheduled period of stay (multiple days fishing) in the sea. Some fishers mentioned that there were days when they had returned to the shore within two days as they could harvest more than three and a half tonnes of Tuna fish within that period.

Fishers like Ramana, Jarsandudu and Husain pointed out that there were days when they had got more than 3 1/2 tonnes within two days and their fishing vessel could return to the shore earlier than the normal expected time. Moka Govinda, who has been encouraged to convert to gillnetting, started using 140 mm mesh size net like many others in the village stated that he is contented and happy about the improvement in his livelihood. He mentioned that he has always got a good yield of Tuna and other fish resources of high economic value such as Sword fishes, Sail fishes, Rays, Sharks and occasionally Pompano whenever fishing is carried out based on PFZ advisory. He added to say, "…a lot of time is saved consequent to using PFZ advisory; 10-15 hours is saved in a day and the crew is able to take rest in the mid sea".

Number of days/time spent in the sea per trip reduced

It is stated that number of days/time spent per fishing trip has come down. Around 4 persons said that one fishing trip in bottom trawling used to consist of 6 days (144 hours) and 18 mentioned that their trip used to be for 7 days (168 hours). In gillnetting, it is found that fishing operation of 2 persons comes to 4 days (96 hours) per trip and 20 persons said that they undertake fishing for 5 days (120 hours). Out of the 20 respondents who said that their fishing trip generally extends to five days also mentioned that they may extend their stay by a day if there is scope for further fish catch and if there is sufficient storage space.

Gillnetting in PFZ is cost effective and profitable to fishers

We could understand from our discussions with our respondents that, in bottom trawling, if the expenditure per trip is around Rs 70000 in gillnetting it would be nearly Rs 50000 only. A major expense as regards fishing operation in sea is diesel. According to the fishers of Gilakaladindi Village, for bottom trawling, the average diesel required for a trip is approximately 1000 litres while for gillnetting it is 400 litres (60 per cent lower than in the earlier practice) only. Wages of the labourers and the drivers is fixed based on the total catch of the fish/prawn resources. Twenty percent of the total value of the fish catch is shared among the labourers as wages. Driver of a boat gets extra five percent as his wages from this amount. In gillnetting, it has been raised to 24 per cent for the labourers and the driver gets an additional five per cent from this amount. Generally, as it has been mentioned earlier, six labourers

and two drivers are employed in a fishing vessel engaged in bottom trawling and also in gillnetting. An analysis of the cost involved in fishing operations done previously by bottom trawling and fishing operations carried out by gillnetting using PFZ data it is obvious that economic returns are much higher in the latter fishing activity than in the former. The Table shown below would give us an idea about the operating cost which includes diesel, ice for storage of fish resources, wages and food to the crew related to both kind of fishing operations. From the Table we can have an idea about the number of crew employed in both the fishing operations and number of days spent in the sea per trip. It is important to note that diesel constitutes to a major expense as regards fishing in the sea. As it has been mentioned above around 1000 litres of diesel is required in the case of trawl fishing per trip where as in gillnetting less than half of it is sufficient per trip. Other expenses such as ice, food and wages for the crew are much less when compared with the diesel cost. We can also understand from the Table that other expenses remain more or less the same in both the types of fishing.

Table: 8 Cost-Benefit Analysis of different Fishing Operations

Particulars	Bottom Trawling (per trip)	Gillnetting (per trip)
Diesel	1000 litres @ Rs. 44	400 litres @ Rs. 44
Ice	25 boxes @ Rs 250 per box	25 boxes @ Rs 250 per box
No of Crew	5-6 labourers + 2 drivers	6 labourers + 2 drivers
Days spent in the sea	5-6 days	3-5 days
Food expenses for crew members	Rs 2000	Rs 2000
Wages for crew members	20% of the total value of the fish resource harvested (shared among the crew) Rs 20000	24% of the total catch Rs 24000)
Expenditure	Rs 72250 (approximately)	Rs 49850 (approximately)
Income (for the Owner)	approximately Rs 27750 per trip	Approximately Rs 51000 per trip

Note: 1At the time of our field work the diesel price was Rs 55/-It may me mentioned here that boat owners with registered boats get 19.8 per cent subsidy per litre. A boat owner is eligible to get subsided diesel up to 3000 litres.

2. The expenses are calculated keeping Rs 100000/- as the total value of the fish caught

It may be stressed again here that the marine resources harvested through gillnetting has great economic value and easily marketable size where as the catch through trawl does not fetch have market value and scope for wastage is more here.

Reduction in diesel consumption a major economic gain

It is quite apparent from our interactions with our respondents that their expenditure on fishing inputs particularly diesel has considerably been reduced as a result of MSSRF-INCOIS intervention. It is worth mentioning that a major gain has come to them by way of decrease in diesel consumption. As one of the fishermen pointed out, reduction in diesel expenditure itself is considered as a major economic gain by the fishers. Diesel expenses used to cause a heavy economic burden on the fishers. Due to this, fishing operations through bottom trawling proves to be very expensive and less remunerative for the fishers. In trawl fishing, even if they are able to harvest fish worth rupees of one lakh it is not profitable as the diesel expense alone would come to Rs 45000-50000 and for gillnetting it is around Rs 18000- 20000.There is a gain of nearly Rs 25000. While talking about the advantages of PFZ advisory and gillnetting one Srinivas brought out this very effectively when he said "trawl *nettinglo nashtam anedhi gillnettingki marinappudu labanga marindhi* " meaning what has been a loss (due to diesel consumption) in the bottom trawling has been converted into profit in gillnetting. Many pointed out that this is the main reason which facilitated the conversion of their fishing method.

Reduction in diesel expenses has made a lot of difference in the livelihood of the fishers of Gilakaladindi emerged very clearly during our study in this village. Whosoever we contacted whether it was a boat owner or a fishing labourer or a boat driver, all pointed out that a major gain they experience in the post intervention period is reduction in diesel expenses. This significantly affects the profit or earnings of the fishers. Through bottom trawling operation, even if one gets a fish catch worth of Rs one lakh diesel expenses would cover a major portion of that leaving little earning to the fishers. In the case of gillnetting, if a fisherman gets one lakh worth of fish yield, it makes a lot of difference to him in terms of profit earned by him. As we have mentioned earlier, diesel expenses have come down by nearly 60 per cent in gillnetting. It is obvious that diesel is a major expense as regards the bottom trawling which has a direct bearing on the income of the fishing vessel owner. Considering the amount of money spent on diesel the economic returns one gets out of fishing operation is very little, feel the fishers. After deducting the expenses related to wages and food for the crew what is left behind for the owner of a boat is less. In this context, it will be interesting to mention about a comment made by a driver namely P Venkateswaralu, 45 years of a fishing vessel "…trawl *nettho vetaki poi laksharoopayalu thechina owner moham thippukoni theesukonevaru. Ippudu adhe oka laksha theesukoni poi isthe chala santhoshanga theesukontaru. Maku snathoshanka untundhi*!" (Even if we get one lakh rupees worth catch in bottom trawling the owner would take it by turning his face, without any enthusiasm. Now if we get catch worth the same amount owner would take it happily. We also feel happy!)

PFZ advisory accurate to a great extent

All of our respondents are of the view that the advisory is reliable and useful for the fishers; very rarely one may not get good catch as predicted. It is learnt that 70 – 80 per cent of the data is accurate. Ramana, Navin Kumar, Edukondalu, Nagarjuna and many others feel that PFZ advisory is 80 per cent accurate. They mentioned that they do not normally face losses in deep sea fishing carried out based on PFZ advisory. In this context, one Mr Hussain pointed out that though one may not get expected catch on few occasions, the concerned fishermen do not normally face any loss on those days. According to him, "… there may not be any gains. But there won't be loss either; because we would be able to recover whatever we invested. Our fish catch would support us to meet our expenses. I am telling this from own experience"

PFZ advisory has come to occupy an important place in the fishing activity of Gilakaladindi fishers. Respondents are unanimous in acknowledging the vital role played by the PFZ advisory in enhancing their fish yield of commercial value. They very eagerly wait for the SMS. In case they do not get it they immediately call MSSRF fisheries Helpline to know the PFZ advisory for that day. Persons like Nagarjuna and Srinivas are regular users of this service. They call to confirm the PFZ advisory received and to get any clarifications. In case they do not receive PFZ advisory on a particular day, they do not hesitate to call the helpline number. Nagarjuna says he attaches a lot of value to the advisory, that he always calls the helpline service to confirm before his fishing vessel ventures into the sea. In case the vessel had already left before getting the advisory he would later communicate it to the driver.

As all boat owners receive PFZ advisory we wondered whether it would create any friction among the fishing vessels engaged in fishing in potential fishing zone. We were told that there is an understanding among the fishers that they maintain two kilometre distance between two boats. Whoever reaches the location first they can choose to throw their nets in a location which they feel would be suitable for fishing. So it does not cause any friction among the fishermen going in different boats belonging to different boat owners.

Advantages of PFZ and gillnetting-views of drivers and labourers of fishing vessel

As part of the study we also met and interacted with few drivers and labourers of fishing boat. These two categories of people were earlier involved in bottom trawling method of fishing and presently employed in trawler/mechanized boats using gillnetting for fishing in the deep sea. Going through the information gathered shows that both drivers and labourers find that their lives have improved reasonably well. Apart from economic gain there are social benefits that have contributed to the well being of the fishers. According to one Venkateswaralu, aged 33 years, who has been a labourer

in trawler boat for 15 years and presently employed as a labourer in gillnetting it (gillnetting) is less laborious in terms of physical work and more gainful from economic point of view. As regards bottom trawling it involves lot of physical work, labour and time. Bottom trawling method of fishing causes body pain and other health problems as the net has to be dragged along for a longer time. In trawl netting several varieties of fishes in different sizes are harvested. Once the catch is brought to the boat the labourers have to sort, segregate and grade the fishes and prawns. He mentioned his hands used to get hurt and bleed while sorting and grading particularly prawns. Experiences of other labourers working in bottom trawling would also be same, said Venkaterswaralu. He added that they have to bend to cast the net in the waters and once the net is cast it has to be dragged along by the labourers atleast for two to three hours which causes body pain. Whereas in gillnet fishing vessel, the nets are suspended into the waters vertically for six-eight hours from a more or less stationary boat. The nets are then hauled to the surface and emptied onto the deck of a fishing boat. Once the nets are cast the driver and the labourers are free until the time when the nets are hauled back to the deck of vessel. The driver and the labourers get five- six hours rest. As gillnetting is species specific and mostly targeting big fishes it does not involve any sorting or grading work. In this method, wobbling of fishing vessel causes body pain to the crew but it is much less than in the bottom trawling. In gillnetting labourers get some good rest time of five to six hours. The views of Venkateswaralu were corroborated by other labourers who we met and discussed this aspect. In the case of drivers of trawler fishing boat it demands continuous steering. Like the labourers, he also does not get rest. Engine maintenance of fishing vessel is comparatively easier in gillnetting than in the bottom trawling. Also, many a times the driver may not know the route to the location. Due to this, a lot of time is spent in searching fish shoals resulting in high fuel wastage. It is said that the harvest of fish resources depends greatly on the driver's skill and ability skill of the driver. As finding a fish shoal largely rests on a driver he undergoes tension. Lack of sleep, tension causes health problems.

Role of labour and driver in bottom trawling and gillnetting and associated socio economic advantages and disadvantages are given in Table 9

Table: 9 Salient Aspects of different Fishing Operations w.r to Labour and Driver

Labour		Driver	
Bottom Trawling	**Gillnetting**	**Bottom Trawling**	**Gillnetting**
Net Operation- Releasing & Pulling (Hauling time: 3 hours per haul) minimum of 5 hauls per day	Net Operation Releasing & Pulling (Hauling time: 6 to 8 hours per haul) Only one haul per day	Steering the boat to reach the fishing ground	Steering the boat to reach the fishing ground

Sorting & Grading of prawns and fish, cleaning the boat, net repairing	Minimum work in sorting & Grading , cleaning and net repairing	Continuous steering (Helps labourers in sorting the fishes and net repairing)	Continuous steering not required (helps the labourers while releasing the net and pulling it)
Icing	Icing	Engine Maintenance	Engine Maintenance
Anxiety is more as they are not sure of fish/prawn harvest (this determines their wages)	Minimum anxiety as they have prior information on possible location of fish shoals	Tension to reach the fishing ground, though high diesel consumption, not aware of fishing route	No Tension to reach the fishing ground as we know the distance, fishing route and fishing zone
Rest time: 1 and half hours per day	Rest time: 6 to 8 hours per day	Rest time : 1 and half hours per day	Rest time: 6 to 8 hours per day
Health: Body pain due to continuous dragging of net; hands get hurt, cleaning of prawns and other fish varieties	Health: less body pain as it does not involve dragging	Health: Body pain due to continuous steering & lack of sleep	Health: less body pain as it does not involve continuous steering
Wages: Rs 2500/trip	Wages: Rs 5000/trip	Wages: Rs 3000/trip	Wages: Rs 5500/trip
Asset creation: Not possible as wages would be just sufficient only to meet the household expenses	Asset creation: Able to buy colour television, cooking vessels and able to save some money	Asset creation: Not possible as wages would be just sufficient only to meet the household expenses	Asset creation : Able to buy two wheelers, Television, cooking vessels, gold jewellery & savings in the banks
		Unable to pay school fee on correct time	Able to pay school fee on correct time

It is learnt that a labourer engaged in bottom trawling used to get around Rs 2500 as wages per trip (three trips in a month 3*2500=Rs7500). Income of a labourer employed in a boat using gillnetting has increased and he gets nearly Rs 5000 per trip (three trips per month- 3*5000=Rs15000) now. In case

of a driver employed in trawling he would get roughly Rs 3000 (three trips in a month 3*3000=Rs 9000) and in gillnetting he would get around Rs 5500 per trip (three trips in a month 5500*3=Rs 16500). Our interactions with the labourers and drivers revealed that it is not just the increased wages that has motivated them to work in boats with gillnetting; the other important factor that influences them is the rest time (6-7 hours) they get in gillnetting. They hardly get to sleep in bottom trawling. As one of the labourers by name Balu pointed out "…definitely our income has increased. But main thing is we get a lot of rest in gillnetting". One of the driver's wife also mentioned that she and her children get to spend time with her husband; his health also improved now. She added to say that earlier, after returning from fishing he would again immediately set out to the sea.

Moka Venkateswarao, who owns one boat, says that due to several advantages like less work, more rest time and increased wages fishing labourers and boat drivers prefer to go for work to fishing vessels with gillnetting. When he was still practicing bottom trawling he found it difficult to retain the labourers. The labourers who used to work in his trawler left to find employment in boats with gillnetting. This and the economic gain through gillnetting encouraged him to convert his one boat into gillnetting. Now the old labourers have come back to work for him, he mentioned.

The labourers and drivers like the boat owners are all praise for PFZ and OSF advisories. According to them PFZ advisory is almost accurate; **reaching the location with fish shoals has become less complicated and this also gives hope to the family members of the crew that their men will come back to the shore with sufficient income** and quality fish for household consumption. More importantly, it is said that family members feel secure because of prior knowledge of OSF. According to them, due to OSF and PFZ information, family members feel very secure both at psychological and economic level. These advisories safeguard lives and improve livelihoods.

Enhanced income and utilisation pattern

i. **Boat owners**

Conversion from bottom trawling to gillnetting has increased the fish catch both in quantity and quality wise and thus resulting in enhancement of boat owners' income (and also that of the crew of the fishing vessel). In most cases the profit is used to invest in a new boat, converting steadily all their fishing vessels for gillnetting, restructuring or brining some alterations in the fishing vessel and so on. Another common form of asset creation is through investment in gold. It is also learnt that they are able to send their children to better schools and colleges and arrange for tuitions from good qualified teachers.

Odunga Rengarao owner of five boats and Vice President of Boat Owners association mentioned that he used 50 per cent of the earnings to repay his loan for converting his fishing vessel; he had taken a loan of Rs 100000. He is able to meet the educational expenses of his two sons who are doing Engineering course. Edukondalu who is 49 years old has been very happy and satisfied with the income he earns from fishing through gillnetting. He is one of the earlier persons to convert into gillnetting. Though he gained considerable income he did not try to invest in another boat or invest in gold like many of his fellow fishermen. He is utilizing this income mainly to educate his son who is abroad pursuing his higher studies and another son doing second year B. Tech. He says he is happy and comfortable with what he gets. According to him "If I am able to educate my sons it is mainly because of this (fishing through gillnetting in PFZ). I have not bought any property or gold. However, the income I earn from fishing is very helpful and supportive to educate my sons. I have sufficient money for boat maintenance. I have a two wheeler. I do not have to depend on any one. I have been able to mobilise my own resources due to this (MSSRF-INCOIS) intervention".

ii. **Drivers and labourers**

Previously, in the case of fishing labourers and the drivers the income would just be sufficient to meet the day to day expenses of the household. Sometimes they were forced to borrow from friends and relatives. They found it difficult to pay their children's school fees on time. There was little or no scope for saving. In the present scenario, they are able to buy two wheelers, colour television set for the house, cooking vessels and gold jewellery. They are able to provide better education for their children by sending them to good schools and arranging tuitions for them to perform well in their studies.

We had an opportunity to meet one Mrs Bujji, a boat driver's wife during our field work in the village. She is happy that her husband is fishing in a gillnet boat. She says she could see a lot of difference between the two types of fishing. There is improvement in her husband's health now. He does not have to continuously engage in steering the boat now. This has reduced his body pain to a great extent. There is more rest time and can sleep during the fishing trip in the sea. She adds to say that since the wages has fairly been increased they are able to lead more or less a comfortable life. They are able to spend for children's education. Also, they have been able to carry out some repair work in their house. We also learnt that they were able to conduct their daughter's wedding with her husband's earning. They spent more than two lakhs on the wedding. She was happy to share with us that if they were able to do it without borrowing from any one it is mainly because her husband is employed as a driver in a gillnetting boat. She added to say if her daughter's marriage had taken place when her husband was working in trawler boat they would have definitely been forced to borrow money from others (*appudu aithe apputheesi pelli chesi untam. Koncham konchanga thirigi ichi untam. Ippudu appu theeyakunta pelli chesesamu)*. The boat drivers and fishing labourers are much satisfied with the present state of affairs both at home as well as at work front. This is because they are experiencing a vast positive difference in their economic and social lives in the post intervention period.

Benefits to the society at large

The study illustrates that there is positive returns to the community consequent to conversion from bottom trawling to gillnetting. Gillnetting method of fishing allows for more fish production. Juveniles are not caught contributing for increase in fish productivity. It has been encouraging to find that the fishers realise the implications of this for sustainable fishing. This significant aspect came out very clearly during the interactive meeting with the members of boat owners association. It is stated that this larger mesh not only reduced the destruction of juveniles, but also increased the catch per haul of big size and commercial value fish resources. This has been possible due to deep sea fishing in the PFZ. The bottom trawls may remove or damage biota of the sea bed and disrupt sedimentary structures, altering important habitat features. It is also pointed out that the recent conversion to gillnetting has benefitted small craft fishers. As more boats are engaged in gillnetting in deep sea this allows more availability of fish resources within the 50 kilo meters from the creek when compared to the earlier days, mentioned the fishers.

Reduction in diesel consumption (as a result of PFZ advisory and gillnetting) is important not only from fishers' point of you but also highly valuable from a larger perspective; lot of energy is conserved and carbon emission is reduced.

The fishers recognise the critical role played by MSSRF-INCOIS intervention so much in enhancing their social and economic conditions that some fishermen volunteered to note some specific details of PFZ (latitude, longitude, time and date) and the quantity of Tuna fish and the other fish caught by them to INCOIS. The scientist from INCOIS explained to them the purpose for expecting such information: as INCOIS encourages pelagic fishing from sustainable angle such information/feed back would be useful to validate the programme and develop the same. This would enable INCOIS to do research more on this and predict specific area for sustainable exploitation of deep sea fishery resources. It was heartening to see that few young fishermen came forward to do this exercise.

The fishers mentioned that if advisory is available on daily basis it would be helpful to plan their fishing activity more efficiently. When some of the fishers pointed out that they cannot take the message when they are in the mid-sea the INCOIS representative said that if the boat has VHF system the advisory can be disseminated. He added to say that efforts are being taken to develop a system whereby the fishers can see the advisory on the screen and the fishermen can go for fishing from one PFZ zone to another without while in the sea itself.

The changes that have been witnessed during the last one and half years to two years in the fishing practice can be largely attributed to MSSRF-INCOIS intervention. According to the fishers, it has somewhat transformed the way one operates. Though gillnetting involves heavy investment, the fishers are confident that they would make profit. "The only big problem now is the (river) mouth problem. Otherwise it is going on well", said one Sheikh Bhasha.

Concluding Remarks

True to M S Swaminathan Research Foundation's mandate of 'Linking Science to Society' along with Indian National Centre for Ocean Information Service's mission- 'To make the Potential Fishing Zone Advisories as part of the value chain of fishing community-' the joint intervention by MSSRF-INCOIS has brought about enormous positive changes in the lives of rural coastal fishermen. The MSSRF- INCOIS partnership considerably contributes to improve the socio-economic wellbeing of fishers inhabiting some of the coastal villages of Tamil Nadu, Puducherry and the districts of Krishna, East Godavari and Guntur in Andhra Pradesh. MSSRF-INCOIS partnership aims to help fishers to be more productive while lowering the risks involved in fishing. Provision of scientific advisories such as Potential Fishing Zone (PFZ), Tuna forecast, Ocean State Forecast (OSF) and early warning during extreme weather conditions is one of the vital interventions carried out by MSSRF in partnership with INCOIS.

The scientific advisories have been proven to be very useful by fishermen in carrying out their day -to -day fishing activities and in enhancing their fish harvest. These advisories, disseminated as short text or voice messages through mobile phones of the fishermen, have transformed the way they operate. Gilakaladindi in Krishna district of Andhra Pradesh is a case in point where one can observe a shift in the fishing practices from bottom trawling (carried out near the shore) to that of gillnetting engaged in deep sea/surface fishing. Fishermen in Gilakaladindi have been practicing bottom trawling for nearly four decades. Since the inception of MSSRF-INCOIS intervention during November 2011, there has been a definite improvement in the fishing efficiency and capacity of the fishers of this village. It is in this context a study was under taken in Gilakaladindi (where creek- based fisheries is carried out and which is tide dependent) during the last week of July, 2013 (by MSSRF staff and a scientist from INCOIS) mainly to look into the role played by this intervention in motivating the fishers to switch over to gillnetting from bottom trawling and the results experienced by the fishers fishing with gillnetting using PFZ data. A total of 32 fishers including a woman boat owner were contacted and interviewed using a questionnaire. The interviewed fishers include 23 boat owners, four drivers and five labourers of fishing vessels. One could see positive changes and improvements in the socieconomic lives of fishers of Gilakaladindi subsequent to receiving and applying the INCOIS advisories particularly PFZ. It is learnt that the PFZ advisories have become part of the value chain of the fishing community and improved their quality of life. OSF information is found to be quite useful in timing departure and sequencing on shore activities and avoiding extreme weather-related emergency situations. A significant impact of this intervention is conversion of fishing practices from bottom trawling to gillnetting.

MSSRF-INCOIS intervention was initiated at a crucial time when diesel prices went up drastically and also at a time when one of the fishers had just started to use gillnetting in one of his two boats. Three

other persons who had just converted one boat each were yet to venture into the sea for fishing. However, it is learnt that the real push came through MSSRF-INCOIS intervention which facilitated this faster conversion from bottom trawling to gillnetting. It is amazing to know that conversion into gillnetting has taken place within a period of less than two years. The very boat owners who were earlier apprehensive because of the heavy investments involved in conversion of fishing gear, gained confidence to change into gillnetting once they started receiving PFZ and also Tuna forecast in frequent intervals of time. PFZ advisory is for pelagic fishing and it is mostly species specific. Advantages of PFZ lies in locating large fish stock with out wasting time, energy and more importantly with less diesel consumption. Getting PFZ information played a critical role in conversion as it reassured the catch of fish resources enabling them to get more monetary benefit. "…this intervention was timely which definitely supported and facilitated the process of change", says Mr. Hussain who pioneered conversion into gilnetting from bottom trawling.

Conversion of fishing gear means huge investment; a minimum Rs 5 to 6 lakh is required for conversion of a boat and fishing net. Due to the heavy investment involved the boat owners, irrespective of number of boats they owned, chose to start modifying initially with one boat suitable for gillnetting. The boat owners managed to mobilise the required amount from the available resources like gold, savings in the banks and a few took bank loans. Subsequently, considerable increase in the income motivated the boat owners (having more than one boat) to convert the other boats one by one. It is encouraging to know that the source of income for further conversion of fishing gear came from the fish resources caught by them applying the PFZ advisories. They pointed out that three to four fishing trips (carried out in PFZ) in a month is sufficient to carry out conversion of one boat into gillnetting; such is the turnover.

The fishing boats have been modified or remodeled appropriately to the fishing technique/gillnetting as one could confidently expect more catch of marketable fish resources in PFZ. Alterations and modification in the old fishing vessels such as increasing the storage capacity for fish resources and accommodate space to keep the nets and use of gillnets for surface fishing in PFZ have definitely improved the efficiency and fishing capacity of the fishers. When they were assured of economic returns their hesitation vanished and they enthusiastically took efforts to convert their boats for gillnetting. The boat owners, drivers and the labourers of fishing vessel could experience the advantages instantly. The impact has been felt not only in the economic front but on social side as well.

The study reveals that fishing in the PFZ with gillnetting is of far greater worth to the fishing community. As it has already been stated, advantages of PFZ lie in locating the large shoals of economically valuable fish resources. The fishers are able to save time and energy in locating the fish concentration. Possibilities of reduction of search time assume great significance as it brings down investment on diesel

which in turn brings down the cost of fishing operation. The fishers consider reduction in consumption of diesel itself as a major economic gain.

When bottom trawling has been in operation in a big way the fishers used to be in the sea atleast for a period of five to six days. In this method of fishing, the fishers confine their activity within 100 metres depth. In bottom trawling operations, most of productive fishing time is spent on bottom trawling once main fishing grounds have been found. From our interactions with the fishers, it is clear that fishing based on PFZ advisory using gillnet number of days spent in the sea has come down. It is mentioned by fishers that there were days when they had got more than three and a half tonnes within two days and returned to the shore. By using PFZ advisory, the fishers are able to catch a minimum of 500 kg of Tuna fish in one haul. In bottom trawling the catch would include prawns and different types of fish of lesser commercial value and it is difficult to calculate species wise information regarding the quantity of different fishes. Possibilities of wastage are more in this type of fishing as small fishes are harvested. Even if Rs one lakh worth prawn and fish are harvested a major amount goes towards diesel expenses. After meeting his expenses, a trawling boat owner gets around Rs 7500-10000 where as the gillnet owner makes Rs 15000-20000 per fishing trip. For bottom trawling the major expense is diesel; it requires approximately 1000 litres per trip while for gillnetting it is roughly 400 litres-nearly 60 per cent lesser than the former method. The earnings, according to the boat owners, thus gained is 2-4 times more than the amount they got previously in bottom trawling method of fishing.

The labourers and the drivers of the fishing boat get their wages based on the total value of the fishes caught. In bottom trawling, twenty percent of the total value of the fish catch is shared among the crew as wages. The driver of the boat gets five percent extra as his wages from this amount. In gillnetting the wages of the crew have been raised to 24 per cent. Due to the increased harvest of fish resources of good market potential, there has been rise in the wages of the fishing crew of the boat.

Drivers and labourers of fishing boats who were earlier involved in bottom trawling operations and presently engaged in gillnetting experience some advantages apart from monetary benefits. The drivers and labourers find that their general lives have improved. According to the labourers, who are presently working for wages in gillnetting method, it is less laborious in terms of physical work and more beneficial from economic point of view. In bottom trawling, it involves lot of physical work, labour and time. Bottom trawling fishing method causes body pain and other health problems as the net has to be dragged along for a longer time. As there is continuous work they do not get rest for more than two hours in a day. In bottom trawling several varieties of fishes in different sizes are harvested; the labourers have to sort, segregate and grade the fishes and prawns. Labourers' hands used to get hurt and bleed while sorting and grading particularly prawns. Their health gets affected

a lot. In gillnetting, labourers get a rest time of five to six hours. As gillnetting is species-specific and targets bigger varieties, it does not involve any sorting or grading work. Thus drudgery has come down considerably as result of species specific PFZ and gillnetting.

In the case of drivers of bottom trawling it demands continuous steering. Like the labourers he also does not get any rest time. Also, many a time, the driver may not know the route to the fish location. Due to this, a lot of time is spent in finding concentration of fish resources resulting in high fuel wastage. As finding a fish location largely rests on a driver, he undergoes tension. Lack of sleep, tension causes health problems.

As it has been mentioned earlier there has been a substantial enhancement in the income levels of boat owners, labourers and drivers of the fishing boats. In most cases, the boat owners use the profit to invest in a new boat, converting steadily all their fishing vessels for gillnetting, remodeling or brining some alterations in the fishing vessel and so on. Another common form of asset creation is through investment in gold. It is also learnt that they are able to send their children to better schools, colleges (also for higher studies abroad) and arrange for tuitions from good qualified teachers. Previously, in the case of a fishing labourer, the income would just be sufficient to meet the day- to- day expenses of the household. Some times they were forced to borrow from friends and relatives. They found it difficult to pay their children's school fees on time. In the present scenario, they are able to buy two wheelers, colour television set for the house, cooking vessels and gold jewellery. They are able to provide better education for their children. Some of them are able to save some money now which was not possible earlier. The drivers of the boats have also expressed similar views as that of the labourers. The families of the labourers and the drivers and boat owners also feel secure about their men's safety while at sea as they get regularly OSF and early warning advisories.

Gillnetting involved in pelagic fishing operation is more sustainable way of fishing when compared to bottom trawling method. The later method causes harm to the marine ecology and prevents scope for more fish production as juveniles are also caught. The cod end mesh size is so small that even juvenile fishes get caught; it directly hits future production. It is also important to mention that reduced search time can considerably reduce the carbon emission.

It has been encouraging to know that educated youth with degree qualifications have opted to follow their traditional occupation. We came across few young fishers with college education who have preferred to take up fishing rather than salaried employment. This is mainly because they see the advantage of fishing based on the PFZ advisory and possible further improvement or refinement in delivering the advisory while at sea itself and development in fishing technology which would suit their needs.

Another significant and interesting feature is that the recent conversion to gillnetting has also benefitted small craft fishers. As more boats are engaged in gillnetting in deep sea this allows more availability of fish resources within the 50 kilo meters from the creek when compared to the earlier days, mentioned the fishers.

It is learnt that a majority of the boat owners do not share the details of the loss or gain or the details of the fishing activity. It is also mentioned that women would come to know about the gain or loss from the facial expression of their respective spouse. Most of the men said that a greater part of the major decisions are taken by them. They may or may not inform their spouses about them. Men have control over spending of money. Women are provided with money to manage the day -to -day expenses of the household. However, few men pointed out that women (mother or spouse) of the household do have a major role to play when it comes to spending money (even to invest in a net or modification of a boat) or taking any decision. Nothing would be carried out with out her consent or knowledge; she handles the cash and men of the household take from her for their expenses. Interestingly, in the case of labourers and drivers of fishing the women seem to have greater control over the money matters and taking any important decisions.

It is significant to note that this intervention has reached beyond the project area the fishers in the surrounding villages of Gilakaladindi have also been motivated to shift to gillnetting from trawling.

It may be of interest to point out here that, in Tamil Nadu, despite Fisheries Department's effort to encourage the fishers to convert to gillnetting it is not making much headway. The government also offers subsidy to the fishers for converting into gillnets. Though not much effort has been taken in Andhra Pradesh in promoting conversion to gillnetting if Gilakaladindi fishers have opted for gillnetting it is obvious that it is primarily due the MSSRF-INCOIS intervention. It may be pointed out here that MSSRF-INCOIS intervention has recently been expanded to the districts that are not earlier covered in the states of Tamil Nadu and Andhra Pradesh and to the states of Kerala and Odisha.One should also remember that fishing activity has an impact on marine ecosystems. However, if these impacts are risk-assessed and managed well, fishing can also result in significant economic and social benefits for the community. It is hoped that this intervention of MSSRF-INCOIS would help create more sustainable fisheries to the benefit of both the marine environment and the communities that depend on it. It is important that the whole community benefits from the exploitation of the resources it owns.

List of Abbreviations

Abbreviation / Acronym	Description
INCOIS	Indian National Centre for Ocean Information Services
MSSRF	M S Swaminathan Research Foundation
GPS	Global Position System
PFZ	Potential Fishing Zone
OSF	Ocean State Forecast
Lat.	Latitude
Long.	Longitude
VRC	Village Resource Centre
VKC	Village Knowledge Centre
SST	Sea Surface Temperature
EDB	Electronic Display Board
AVHRR	Advanced Very High Resolution Radiometer
NOAA	National Oceanic and Atmospheric Administration
OCM	Ocean Colour Monitor
IRS	Indian Remote Sensing
MODIS	Moderate Resolution Imaging Spectrometer