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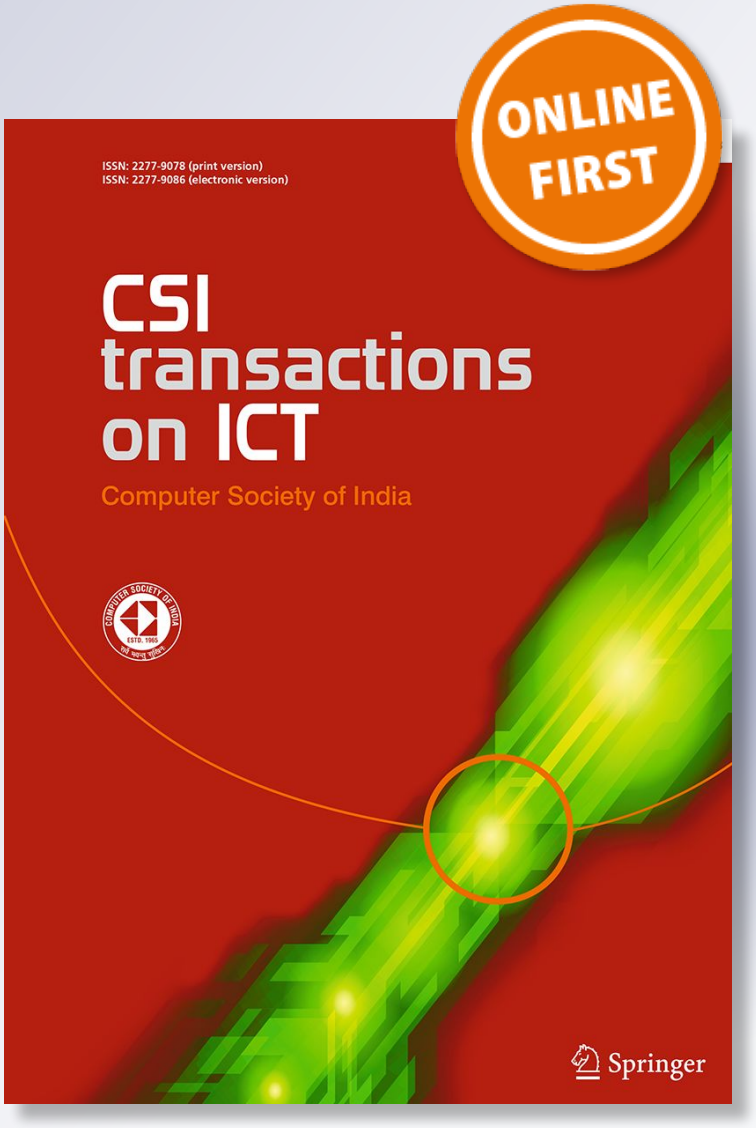

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ORIGINAL RESEARCH

Fisher Friend Mobile Application: a decision support system for small scale fishers in India

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Abstract The development of technology and needs of fishing community in the post tsunami context in India created a demand for the development of mobile applications for fisherfolk. The Fisher Friend Mobile Application (Fisher Friend) was introduced in Binary runtime environment for wireless platform for CDMA in three languages to fishermen in two states in 2007. It has now evolved into an android application with a desirable user interface in nine languages covering fisherfolk in coastal India. A participatory approach involving the fishing community and other key stakeholders was followed at every stage in the development of fisher friend and has been central to its evolution and reach as a decision support system, and its user-friendliness besides accuracy of the information. A total of 1026 fisherfolk across three states Tamil Nadu, Puducherry and Andhra Pradesh participated in the pilot phase. The critical feedback from users in the last four years enabled the existing Fisher Friend to evolve through 40 revisions as a Pan-India application. Fisher Friend is now available with the latest technology interface in the Google play store. Currently over 29,000 fisher folk are accessing Fisher Friend from 576 landing centers of 59 coastal districts in nine states of India. A study undertaken among users in Tamil Nadu and Puducherry revealed that 90 percent of fisherfolk found it an important tool for decision-making in times of critical situation as well as in normal times for informed fishing. The use of the app has resulted in reduction of risk from livelihood asset loss in the event of disaster, increased income per trip, resource saving of fuel, and reduced number of fishing days per trip.

Keywords Mobile application · Fisher Friend · Small scale fisheries · Information communication technology (ICT) · Tamil Nadu · Puducherry · Fisherfolk · Risk reduction

1 Background

The contemporary world is facing increased incidents of natural disasters, and the coastal community is one of the most vulnerable sections of the population. In the aftermath of 2004 Indian Ocean tsunami that struck the eastern coastlines of India, an estimated 10,000 people died. Devastation was massive as waves measuring 10–40 feet in height enveloped shores and surged up beaches, buildings, and entire villages before receding back into the ocean. The worst affected regions were in Tamil Nadu and the Andaman and Nicobar Islands. Over 1.6 million families were affected in these regions. All 13 coastal districts of Tamil Nadu were affected, but the worst losses were recorded in Nagapattinam where 6065 people were killed [1].

The fisheries sector in Tamil Nadu suffered major damage in terms of lives, boats, gears and infrastructure such as harbours and fish landing centres. An estimated 85% of people affected by tsunami came from the fishing community. Initially affected people were in shock at the enormity of the tsunami's impact. Affected villages were alienated from the mainstream due to disruption of

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communication systems and roads, limiting the supply of outside support. The post tsunami scenario witnessed a big struggle among fisherfolk to adapt to the situation and rebuild their livelihoods. In order to build resilience among the fisherfolk, a number of Information Communication Technologies were evolved to help them systematically by providing early warning, emergency preparedness and response [2]. The Fisher Friend Mobile Application (Fisher Friend) of M S Swaminathan Research Foundation (MSSRF) emerged as part of post tsunami preparedness and adaptation strategy, as a tool to disseminate early warning information, and as a decision support system.

Marine fishery contributes significantly to the Indian economy. It also forms an important component of the rural coastal economy by contributing to employment, livelihoods, and food and nutrition security. India is endowed with a vast coastline of 8110 km with around 0.9 million fisherfolk from 3202 fishing villages, depending on the sea for their livelihoods. The majority of them are small-scale fisherfolk fishing in inshore waters. There is dwindling of marine fish stocks, especially from inshore waters. At the same time, the on-going mechanization of fishing enables traditional fisherfolk to move beyond their fishing ground from the inshore water to the outer sea. This has made the open access system crowded and increased competition among fisherfolk besides leading to the overall depletion of fish resources [3].

While fish catch is uncertain, each trip is found to be expensive, especially due to the escalation of diesel price. This is mainly because boat engines are not optimal and consume 12–15 litres of fuel per hour and may cover only 10–12 km (while not dragging the net). Fisherfolk have to spend more time and resources on the sea, and occasionally cross international maritime boundaries for fishing. This makes fishermen incur huge losses as the input cost is very high and the catch is low leading to poverty and indebtedness. Most of the small-scale fisherfolk in the sub-sector are resource-poor witnessing poor economic returns with annual earnings below Rs. 25,000 (US$ 570) [4].

The problem of small-scale fisherfolk is further exacerbated by the growing vulnerability caused by natural disasters in terms of magnitude and intensity. Such exceptional challenges posed by high waves, cyclone, wind speed and sea current make their navigation at sea difficult and challenging, when they move beyond inshore waters for fishing. In a real-time scenario at sea, a fishing boat can often be turned around like a toy during high waves or swell with more than 2 meters and wind speed of more than 20 km per hour.

In general, the coastal fisherfolk are a tradition-bound community in which their traditions and cultures play a strong role in influencing their behavior and regulations, which emerge from a process of collective action and decision making [5]. The transfer of knowledge and information is a basic need to change traditional society to a knowledge society. The introduction of mobile application had changed the conventional trade system of fisherfolk in Kerala allowing for a virtual auction even while at sea [6].

Due to low levels of awareness and exposure to new technologies, lack of technical know-how and phobia to interface technology, which is mostly in English, fishermen have not been quick in adopting latest technologies on a large scale. In the current scenario, fisherfolk have practical "do-how" but demand scientific knowledge for addressing the emerging issues in fishing. Hence, Information communication technology (ICT) interventions have emerged as a felt need of the fishing community for enabling them to access real-time information and undertake informed decisions. The Indian telecommunication revolution and particularly wireless connectivity has made it possible to reach the last mile (fisherfolk) through mobile phones. It has the potential to provide timely information that is affordable, relevant [7] and up to date to fisherfolk. Keeping these factors and needs of fisherfolk in India during the post-tsunami context, MSSRF in collaboration with Qualcomm developed and tested a single window mobile application named "Fisher Friend" to address the dynamic information and knowledge needs of small-scale fisherfolks.

1.1 Fisher Friend—a brief overview

The Fisher Friend Mobile Application (Fisher Friend) is an android application that acts as a decision support system to fisherfolk by offering a package of scientific and relevant information in a single window platform. The Fisher Friend evolved as an offshoot of "Mission 2007: Every Village a Knowledge Centre", a strategic alliance established by MSSRF to bring a knowledge revolution across India. One of the major obstacles envisaged through Mission 2007 was the emergence of 'Rural Knowledge Societies' across India to address a paucity of cost-effective and adaptive technologies for addressing locale-specific knowledge needs of rural communities.[1] It necessitated 'innovation' of new technologies that can work under varying rural conditions.

The destructive effect of the tsunami among the Indian coastal states in 2004 led Qualcomm and MSSRF to jointly evolve the concept of Fisher Friend to support the fishing

[1] Mission 2007: Every village a knowledge centre is a multi-stakeholder alliance formulated by M S Swaminathan Research Foundation to upscale the hub and spokes model of village resource and knowledge centers and the power of ICT for development. The movement brought together many players and facilitated them to spearhead diverse ICT models for knowledge empowerment among farming and fishing communities.

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community. The Fisher Friend was developed in the CDMA platform and officially launched through a seminar on "Three years after Tsunami: A new life for fisher communities", organized by MSSRF. The purpose of the programme was to introduce Fisher Friend to the fisher folk from seven coastal districts of Tamil Nadu and Puducherry for pilot testing the Fisher Friend [8]. The success of the programme followed by evolution of technology and knowledge requirements of fisherfolk led to the redevelopment of the Fisher Friend into an Android platform in 2013. The qualitative impact of the Fisher Friend on the lives of the fishing community has necessitated further advancement in 2016, as a Pan India application to scale up its benefits to the larger fishing community. To reach out fisherfolk across India with instantaneous real-time information flow, an auto porting of the scientific information of Indian national centre for ocean information services (INCOIS) was done in the Fisher Friend in 2017.

1.2 Significance of Fisher Friend in small-scale fisher's development

The uncertainty of life is high for fisherfolk who venture into the deep sea particularly for those who use small and medium boats with small motor engines. There have been many instances where fishermen were lost due to high waves and sudden surges in the sea. No forecast information on these parameters was available to fishermen to assist them in navigation.

A common international issue is that of Tamil Nadu and Puducherry state fishermen crossing the Sri Lankan international maritime borderline (IMBL) and being caught and imprisoned. The fishermen unknowingly cross the IMBL and there are instances of such fishermen returning to India barehanded after their boats and nets are captured by the Sri Lankan Navy. In order to support fisherfolk to cope with such challenges, the Fisher Friend was developed with unique features in respect of access to relevant information, online and offline. Online access to the Fisher Friend on sea is only up to the permissible coverage area of 12 nautical miles. However, the two-day early warning information and prediction of fish colonies given through Fisher Friend helps fisherfolk to get information in an offline mode, provided they accessed it once online before entering the zone without network coverage area. The information provided by Fisher Friend offers the following types of support:

(a) Higher catch and income: Forecasts on potential fishing zone (PFZ) and Tuna locations: Landing centre specific PFZ information generated by INCOIS with key parameters such as latitude, longitude position, direction, bearing angle and distance helps fisherfolk identify the areas with maximum probability of catching fish with the support of GPS. Species-specific advisories enable the fisherfolk to catch high value fish and thereby increase their income.

(b) Informed decision making through Ocean State Forecast (OSF) and early warning alerts: Detailed information of OSF data including high waves, cyclones, winds, sea current and sea surface temperature help fisherfolk in advance to undertake informed decision on whether to go for fishing or stay, to choose the gears based on wind parameter, and decide on the fishing route based on wind direction and sea current. The information is available in intervals of 6 hour, 4 slots per day.

(c) Safe navigation using GPS and compass: Both GPS and compass help to decide the fishing route besides laying onward and return journey to save resource in terms of time and fuel. This information helps fisherfolk when they are stuck in a disastrous situation at sea to identify and communicate their current latitude and longitude coordinates to fellow fishers and contacts. There is also facility to undertake participatory mapping by enabling fisherfolk to mark and store danger zones on sea like sunken ships, rocky substance and dead coral reefs.

(d) Emergency assistance: Fishermen have immediate access to emergency contact numbers in case of maritime perils requiring immediate assistance. A multilingual harbour navigation facility in Fisher Friend helps fisherfolk navigate to nearby harbours during emergency situations. It provides the latitude and longitude of all the major and minor harbours in the State and nearby States. During an emergency situation the fishermen use the facility to move swiftly to the shore or nearby fishing harbours to anchor their boat safely. In addition to this the fishermen can communicate with fellow fishermen from within network coverage to seek mutual help while at risk on sea. Similarly, fishermen are warned of the IMBL of Sri Lanka by an alert 5 kms ahead to avoid inadvertent trespassing into international water.

(e) Market and entitlement information: Real time information about prevailing fish market prices in landing centres helps fishermen increase their negotiating power with middlemen and understand market realities.

(f) Government entitlement: Information on government schemes relating to fisherfolk relating to their occupation, education and health, helps to avail such benefits.

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1.3 Participatory approach and evolution of Fisher Friend

The process followed for implementing Fisher Friend showed that stakeholder engagement was an important step in ensuring its relevance and user friendliness. The innovation in product and process development of Fisher Friend was due to stakeholder engagement at different levels right from the internal collaboration between MSSRF and Qualcomm, involving the fishing community, research organizations such as INCOIS and Indian Meteorological Department (IMD), Fisheries Department of the respective states and local traders. The participation of fisherfolk helped identify challenges and needs leading to the conception of Fisher Friend by MSSRF. The alliance between MSSRF, Qualcomm, ASTUTE Technology and Tata Consultancy Services (TCS) led to the development of Fisher Friend; and the coalition of MSSRF, INCOIS, local traders and state governments resulted in this scientific information and knowledge package reaching the last mile.

The situation analysis and series of face to face discussions with the fisherfolk helped to understand their existing challenges and real time knowledge needs. This approach contributed to the identification of key features to be included in the Fisher Friend to support the fisherfolk during fishing. Regular feedback with the fishers and key stakeholders helped in the refinement of the user interface, content architecture, registration process and sharing the application using social media and improving the performance with offline access.

Altogether 1026 fisherfolk participated from 5 states in the process of action research for the development Fisher Friend. As a result, the application has undergone 42 revisions evolving from the package of 6 services in three languages in the CDMA platform to 18 services in nine Indian languages in the Android platform. The provision made in the existing platform Fisher Friend has allowed upgradation of Fisher Friend from time to time in synchronization to technology evolution.

Figure 1 highlights the evolution of Fisher Friend in three phases: At the inception, Fisher Friend was developed in CDMA platform with limited features such as wave height, wind speed, potential fishing zone (PFZ), market information, government schemes, and news flash, catering to 500 users across Tamil Nadu and Puducherry.

In 2013, taking advantage of technological advancements, Fisher Friend was redeveloped in an android platform (version 4.0) offering a variety of enhanced features in relation to fisherfolks' dynamic information needs. In addition to the services offered through CDMA platform in two languages, the new features were Tuna forecast, GPS, International Border Line, Danger Zone, Harbour locations with GPS, My Tracker, Market information, Government schemes, News Flash, Emergency Contacts.

In 2016, given the need for expansion across coastal India, the scalable model of pan India Fisher Friend was developed and placed in Google Play store for easy access.

In 2017 the application was brought out in nine languages: Tamil, Telugu, Malayalam, Bangla, Odiya, Kannada, Marathi, Gujarathi, and English. In 2018, new features of sea current, and sea temperature were added in addition to the existing features in the previous android version 4.0. Autoporting of data on potential fishing zone, tuna forecasting, ocean state forecast, sea current and sea surface temperature was done in collaboration with INCOIS through their integrated dissemination system (IDS).[2]

The bottom up participatory approach followed at every stage of development of Fisher Friend was significant to finalize demand driven features and designing the user interface and successful evolution of Fisher Friend.

2 Methodology

2.1 Evaluation assessment of Fisher Friend

A study was undertaken to understand the role of Fisher Friend as a decision support system for the fishing community. The data captured for the period 2016–2017 by Google analytics in these States is all used as quantitative data on total users. Both qualitative and quantitative data were collected from 100 respondents from 11 coastal districts in Tamil Nadu and Puducherry. Purposive random sampling technique was used to select a total of 100 fisherfolk, who had been using Fisher Friend. Case study and interview methods using checklist, and interview schedule were used to collect primary data. Focus group discussions were conducted among the fisherfolk to understand their experiences before the usage of Fisher Friend to compare and contrast the results.

Among 100 respondents, 71% of respondents had motorized boats (the resource poor category), and the remaining 29% had mechanized boats.[3,4] The respondents

[2] Integrated Dissemination System is a software platform where various dissemination modes will be integrated on a single central server.

[3] Motorized boat-boats or crafts fitted with motorized means of propulsion having engine not more than 15 horse power and length of not more than eight meters. (Eg. Engine catamarans, Thoni, vallam, FRB boats etc).

[4] Mechanized boat: a ship or boat fitted with mechanized means of propulsion having an engine not less than fifteen horse power but not more than one hundred and twenty horse power and measuring in length not less than eight metres and not more than fifteen m (Trawlers, Gill neters, Purse seiners etc).

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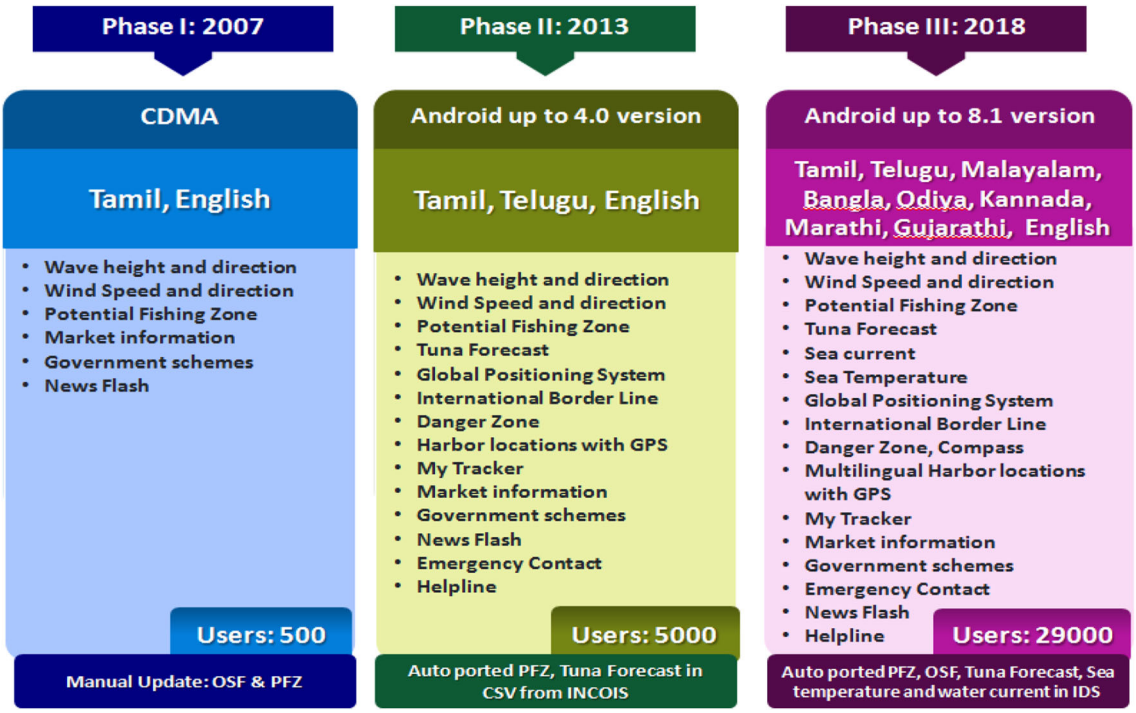

Fig. 1 The evolution of Fisher Friend in different phases, 2007–2018

were found to be a mixed group in terms of occupational pattern comprising 77% fishing vessel owners and 23% fishing labourers. The majority of (62%) respondents fall under the age group between 20 and 30 years, while the remaining 28% of fisherfolk fall between 31 and 40 years and 10% were above 41 years.

3 Results and discussions

3.1 Geographical reach and usage

The data show that 10,109 fisherfolk across 14 districts of Tamil Nadu and Puducherry used Fisher Friend during the last two years. Google analytics recorded a total of 360,633 screen views (2016–2017) of different features of Fisher Friend in these two states. The usage pattern presented in Fig. 2 indicates that Ocean State Forecast, Potential Fishing Zone and Global Positioning System were the most frequently used features. A data shows that the preference of features across different districts changed depending on the season and fishing pattern. The use of OSF was high in Kanyakumari, Nagapattinam and Ramanathapuram districts and it was found that during the assessment period there were frequent disaster alerts of rough sea state, high wind, high wave and cyclones to these districts. Also the use of PFZ and GPS were high in Nagapattinam, Chennai and Thiruvallur districts, which is mainly due to the frequent availability of PFZ to different landing centres of these districts. The fisherfolk in these districts use gillnetting for which information on PFZ and Tuna forecasts is pertinent. Thus, the usage pattern of Fisher Friend is related to the nature, accuracy and significance of content.

The District wise screen views of Fisher Friend shown in Fig. 3 indicates differences in the usage pattern of Fisher Friend across different districts. Different factors contributed to such differences across districts including the ones listed below:

The fisherfolk in Nagapattinam, Ramanathapuram, Kanyakumari, and Cuddalore have accessed it more compared to the fisherfolk in Thanjavur, Pudhukottai, Thiruvallur, and Thirunelveli. The ocean state in terms of frequent disaster, sea current (Nagapattinam), wind action (Ramanathapuram), high wave action and sea current (Kanyakumari and Cuddalore) are more in these districts and hence the small craft fishers refer it often to know the status of the sea for deciding on their fishing trip. Whereas the parameters of ocean state remain calm in the Palk Bay and some of the areas in the Gulf of Mannar. Also the availability of Potential Fishing Zone information is quite rare. Hence there is low usage in the districts of Thanjavur and Pudukottai that comes under Palk bay and Thirunelveli in the Gulf of Mannar.

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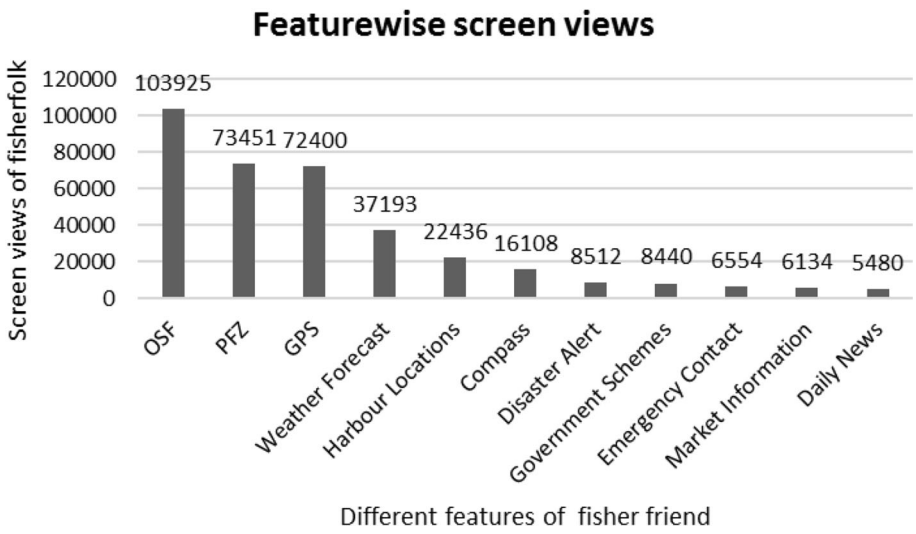

Fig. 2 Screen views presenting the usage of Fisher Friend during 2016–2017

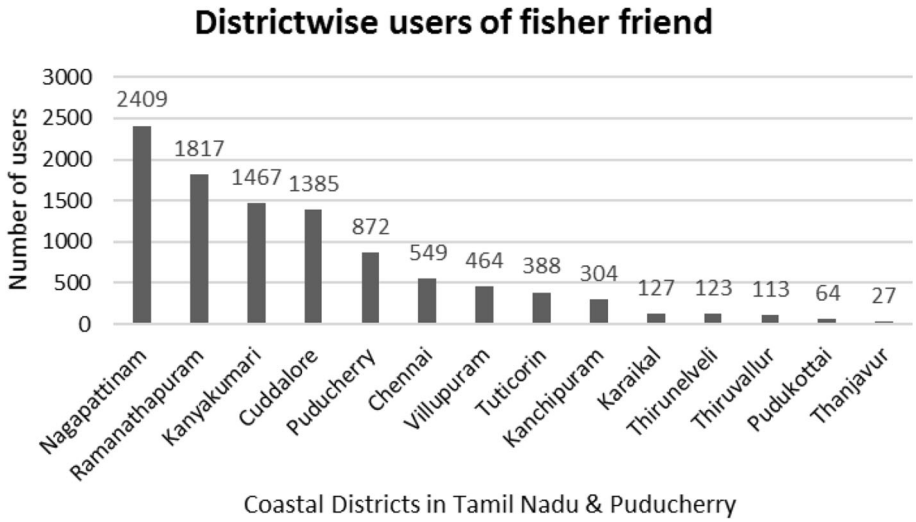

Fig. 3 District wise users of Fisher Friend in Tamil Nadu and Puducherry during 2016–2017

3.2 Benefits realized by fisherfolk

3.2.1 Risk reduction

The qualitative data from the study show that fisherfolk value Fisher Friend as a life saving tool as it has brought down anxiety in periods of bad and uncertain climatic conditions. Murugan, a small craft fisherman from Nagore pattinacherry in Nagapattinam district of Tamil Nadu said that **"**On 18 November 2016 at around 3 o'clock in the morning, three others and I went fishing 35 km off the coast. Suddenly the engine ceased and we were stuck in the middle of the sea. We became anxious as there was nobody around and there were no landmarks close by to inform other fishers of our whereabouts. However, one of my fellow fishers told me about the Fisher Friend GPS facility to mark the boat's current location. This helped me to inform my friends of our current location and get their support in time to rescue us".

The 48 hour forecast information of the ocean state helps fisherfolk to plan their fishing trip well in advance and avoid potential risks to their lives and livelihood assets. The study has clearly brought out the benefits to fisherfolk in terms of safeguarding both their livelihood assets and lives with the help of Fisher Friend.

Data in Fig. 4 shows that overall 67% of fisherfolk reported both life and asset saving due to the use of Fisher Friend, of which 40% of the fishers mitigated life loss, while 49% of them prevented asset loss and 11% prevented both life and asset losses. From the data it can be inferred that of 40% of fisherfolk including 21% of motorized fisherfolk, and 19% of mechanized fishers, could save their lives due to timely information, and navigation facility in Fisher Friend. Similarly, 49% of fisherfolk who prevented

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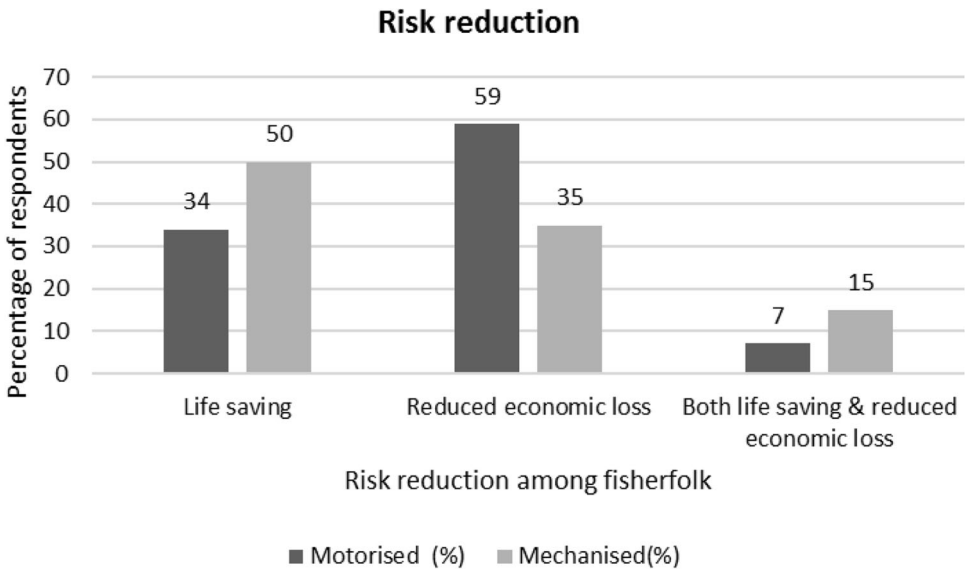

Fig. 4 Fisher Friend's role in life and livelihood asset saving

livelihood asset loss included 13% of mechanized boats and 36% of motorized boats. The remaining 11% of fisherfolk (5% of motorized and 6% of mechanized fishers) had experienced mitigation of both life loss and asset loss. The fisherfolk who used engine catamaran, small boats with sail and fiber boat are constrained to cope with such critical circumstances due to inadequate facilities. These results indicate that the fishers with mechanized boats gained more benefit than those with motorized boats.

3.2.1.1 Life saving The qualitative data captured from the fisherfolk confirms the view that fisherfolk have to face the reality of risks and uncertainties on a frequent basis and found Fisher Friend to be a useful tool for advance decisions and to cope with the current realities. For example, Siva Sankaran of Samathanpettai village from Nagapattinam district said that "… Human life is very precious; it cannot be brought back to life once it is lost whereas one can earn money even [if] he/she loses the entire property. So, we attach high value to Fisher Friend and we feel that it is our moral responsibility to share this app with each and every one of our fisherfolk in our village".

Many fisherfolk stated that the high wave alerts including cyclone warning given in time were of immense help in evading life-threatening perils.

The unforeseen occurrence of natural disasters including cyclone, high wind, high waves and strong sea currents makes their crafts drift on sea. Sometimes, this resulted in crossing the international borderline and a shortage of diesel, which exacerbated their risks and prevented them from reaching their landing centre. Unforeseen boat engine repairs on sea in remote locations threaten survival.

The experience of fishermen during the Vardah cyclone in December 2016 illustrates the role of Fisher Friend in life threatening situations. The Vardah cyclone that was designated on December 6, 2016 had progressed to its intensity into a severe cyclonic storm with winds of 80 mph (130 km/hour) on 12th December 2016. Most of the fisherfolk were on sea during this critical phase and due to the support of Fisher Friend, many fisherfolk returned safely to shore. Fishermen (Satish, Alex, Jalesstin, Kamalesh and Anbu) from Chennai reported that almost 70 fisherfolk in ten vessels were stuck at sea during this cyclone and consumed by panic as the intensity of the cyclone was found to be increasing. When they were clueless about a secured place to land, the respective owners of these boats who were on shore began to communicate to them through very high frequency (VHF). The owners of boat referred them to Fisher Friend and instructed them about the status of the cyclone movements and its intensity through VHF. The owners also confirmed the progress of the cyclone with the 24/7 basis helpline in MSSRF using Fisher Friend. Based on the instantaneous real time information, the owners guided fisherfolk at sea to come to Chennai, provided they could reach by 10th December 2016 and if not suggested other landing centres either in Guntur or Nellore districts, located in Andhra Pradesh. This information helped the fishermen to decide and come directly to Chennai harbour safely using GPS in Fisher Friend. However, one of the mechanized boats with eight fishermen, despite warning from the owner and fellow fishermen in the other boats directed their route to Puducherry assuming that they could land safe there. Unfortunately, they could neither cross Pattinapakkam landing centre, which is 6 km away from Chennai nor reach Chennai harbor, and their boat drifted on sea taking all their lives".

The fisherfolk used Fisher Friend to mark their latitude and longitude positions to identify their current location

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and lay a navigation route to the nearest harbor locations. When they reached the network coverage area, they communicated to the Indian Coast Guard, Fisheries Department and MSSRF's helpline by using the emergency contact features in the Fisher Friend rather than communicating to their fellow fisher folk and family members.

3.2.1.2 Guarding of livelihood assets The forecast information of OSF, cyclones and high wave alerts disseminated by Fisher Friend helps fisherfolk to take informed decisions and thereby safeguard their livelihood assets. During the period of assessment 2016–2017, 72 alerts were disseminated through Fisher Friend. In all, 49% of the fisherfolk indicated that they could undertake informed decisions and were able to protect their livelihood assets from damages and losses. Only 17% of the fisherfolk could value the probable estimation of loss (based on the current conditions of their crafts and gears), and the same is presented in Fig. 5. Of them, 76% are motorized fishers and 24% are mechanized fishers.

As shown in the Fig. 5, the estimated value of assets saved ranges from less than rupees twenty thousand and more than fifty thousand rupees.

Of the total respondents who realized benefits, 13 fisherfolk who owned motorized boats could estimate the cost for the loss prevented in the ranges of Rs. 20,000–51,000. In all, three respondents who owned motorized boats claimed that they could save Rs. 60,000, Rs. 2.5 lakhs and Rs. 5 lakhs respectively by mitigating the loss to their livelihood assets. Similarly, four fisherfolk who owned mechanized boats could value the cost of loss mitigated between Rs. 30,000 and 50,000. One respondent who owned a mechanized boat could realize a saving of Rs. 6 lakhs worth of fishing assets during the cyclone.

It is significant to note that there were fisherfolk who ignored the caution of early warning and lost their fishing assets. In all, five respondents stated that despite warning, they had gone out to sea and incurred a loss as due to damage to their crafts and gears. One of the fisherfolk had to shoulder a damage worth of 10 lakhs, while the remaining mentioned losses between Rs. 4000 and 20,000.

3.2.2 Resource saving

Fisherfolk are able to save time, fuel and protect their livelihood assets due to timely early warning information from the application.

3.2.2.1 Reduction in fishing days Due to the PFZ information services and navigation facility of GPS in the application, fisherfolk were able to reduce number of days per fishing trip. An incident reported by Vijayakumar, a fisherman from Chennai is as follows "In regular practice, on most occasions, we wander on sea to locate fish shoals relying on our experiential/traditional knowledge by observing the colour of the water, wind direction, and sea current. We stayed long hours and days to locate the fish zones, which also led to high use of fuel. Whereas now the PFZ information in the application helps us to know the fish colony and locate it with the support of GPS facility in the app by laying navigation route for fishing to and from the PFZ zone without any deviations. Thus it has reduced the number of days of fishing and helped conserve fuel".

A few fishermen like Arumugam, Nandan, and Sivashankaran said that "The assured catch replenishing the storage capacity of our craft induces us to return to the shore within a fewer number of days than before". The

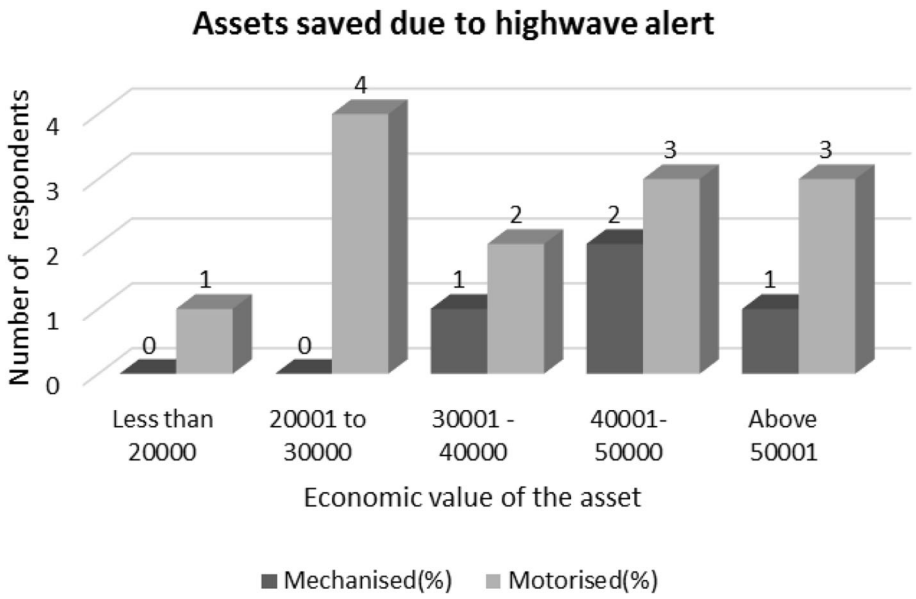

Fig. 5 Indirect cost estimated as savings due to early warning

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information on PFZ coupled with GPS and My Tracker facility in Fisher Friend helped the fishers to reduce the number of days at sea by navigating to the location precisely and returning ashore, which is evident from Fig. 6.

Overall, 39% of the fisherfolk responded, of which 51% of the motorized fisherfolks stated that they could reduce each trip by less than 3 days, while 31% of the mechanized fisherfolks said the number of days reduced was between 3 and 6 days per trip and 8% of both motorized and mechanized fisher folk accepted that there was a reduction in the number of fishing days, but did not quantify it. However, 10% of the mechanized fisherfolk indicated that there was no effect on the number of fishing days. These data indicate that in all, 90% of the respondents were able to reduce time at sea, and spend more time with their families and gain adequate rest and relief from their heavy workload. An earlier study also recorded similar results and showed that the number of days spent on sea per fishing trip had come down on an average between 4 and 7 days for small-scale fishers due to information from Fisher Friend [9].

3.2.2.2 Fuel saving The study found that the expenditure on fishing inputs, particularly diesel consumption, was reduced as a result of Fisher Friend. This was possible due to the reduction in time spent out at sea. The fisherfolk recorded decreased diesel consumption due to the PFZ/Tuna forecast information and usage of GPS for navigation. As one of the fishermen pointed out, the reduction in diesel expenditure itself is a major economic gain by fisherfolk as in recent times, such expenses used to cause a heavy economic burden.

In trawl fishing when fisherfolk harvest fish worth of Rs. 1 lakh per trip, it becomes non-profitable, as the diesel expenses alone come to Rs. 45,000–50,000. A study undertaken in Andhra Pradesh indicates that diesel expenditure has come down by 60% in gillnetting after using PFZ (MSSRF 2014). The current study also found that 22% of fisherfolk among the respondents realized energy economy by saving diesel due to the PFZ, and GPS facility of Fisher Friend. Among those who benefitted, 59% of them reported a reduction of 31–60 litres, 27% of 15–30 litres, 9% of 61–90 litres, and 5% of reduced consumption by 91 litres per trip, as shown in Fig. 7.

3.2.3 Economic benefit

Our analysis suggests that the Fisher Friend has played a significant part in increasing the income of fisher folk, especially due to PFZ information and GPS interface. The PFZ enabled fisherfolk to decide on and navigate to the specific location of a fish colony with the support of GPS. They were able to gain a better catch than their earlier route, which increased income. The benefit was also shared with labourers.

The fish catch which earned them income includes yellowfin tuna, skipjack tuna, hilsa, sailfish, gur fish, pomfret, carangids, mackerel, oil sardine, seer fish, mural, barracuda, red snappers, parrot fish, silver bellies, and croakers.

3.2.3.1 Direct income The increase in fish catch was reflected in the income of both owners and labourers. Overall, 54% of the fisherfolk said that they gained an economic benefit, of whom 80% were boat owners and 20% were labourers. Of the boat owners, 67% of them owned motorized boats and the remaining 33% owned mechanized boats. The results presented in Tables 1 and 2 indicate the vast difference in income between the motorized and mechanized group of fisherfolks who used Fisher Friend. Intensification in fishing as measured by distance of

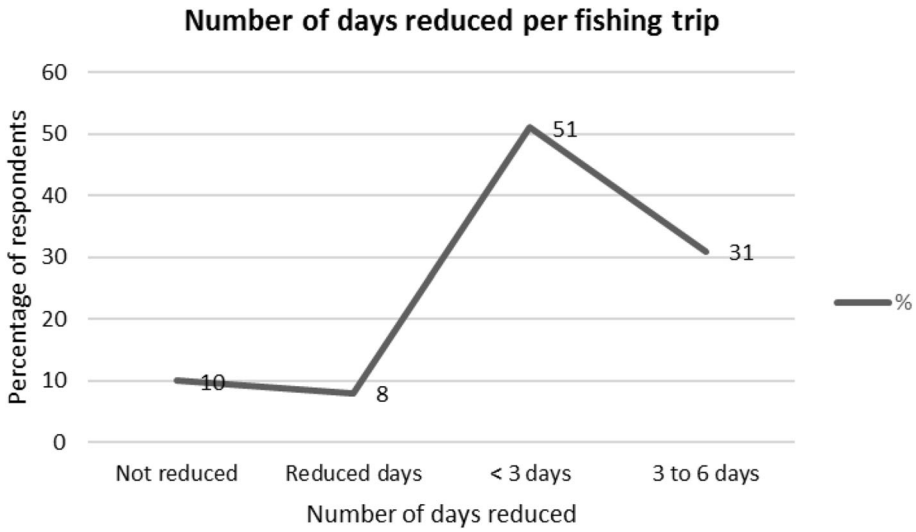

Fig. 6 Time consumption due to precise PFZ

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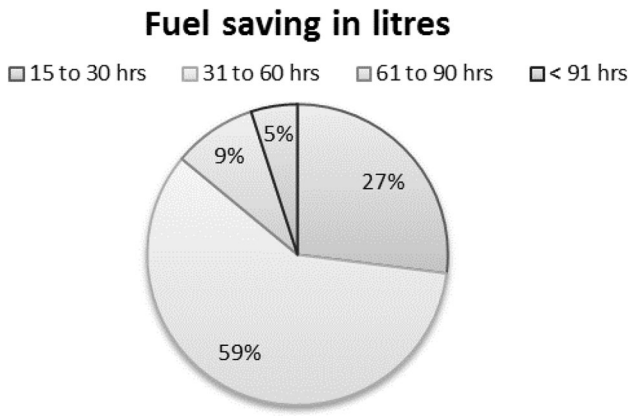

Fig. 7 Fuel efficiency in liters caused by navigation aids

Table 1 Additional income due to PFZ and tuna forecasts

Motorized boat		
S. no.	Profit range (Rs.)	No. of owners in %
1	< 10,000	38
2	10,001–30,000	24
3	30,001–60,000	28
4	60,001–90,000	3
5	> 90,001	7
	All	100

Table 2 Additional income due to PFZ and Tuna forecasts

Mechanized boat		
S. no.	Profit range (Rs.)	No of owners in %
1	< 100,000	21
2	100,001–200,000	36
3	200,001–300,000	36
4	> 300,001	7
	Total	100

fishing ground, number of fishing days, storage capacity of the boat and other facilities account for differences in the income. Motorized fisherfolk reported a profit in the range of Rs. 6000–60,000 per catch.

In contrast, the mechanized fisherfolk (Table 2) earned between Rs. 70,000 and 300,000 as profit per catch. Of the fishing labourers, 55% of them reported a gain of an income between Rs. 20,000 and 30,000 per catch, while 27% gained between Rs. 10,001 and 20,000 and 18% of labourers below Rs. 10,000.

3.2.3.2 Navigation aid to traditional fishing ground Taking advantage of the facility of my tracker in Fisher Friend in the application to mark, save and navigate to the traditional fishing ground, fisherfolk could use it as a reference for their subsequent trips without any anxiety.

Though all the respondents stated that GPS was useful for locating and saving the latitude and longitude of fishing ground and, 27% of motorized fisherfolk responded that they have gained income using GPS facility to navigate to their traditional fishing ground. Among the respondents 58% of fisherfolk realized Rs. 10,000 and below, 31% between Rs. 10,001 and 20,000, 4% between Rs. 20,001 and 30,000 and the remaining 12% gained above Rs. 30,000. The details are given in Fig. 8.

4 Conclusion

The summary of some of the lessons that emerged from the 11 years' of engagement with Fisher Friend has shown a need for consistent engagement with other key stakeholders including fisherfolk, at different stages of the development of the mobile application. This has allowed the fishers to get access to real-time information, as the application had the scope to deliver the needs of the fisherfolk. Fisher Friend brought in the grassroots experience of applying mobile technology and building capacities iteratively incorporating community feedback has led to a wealth of learning in overcoming bottlenecks and in reaching out to the community with last-mile connectivity. Compared to other sectors where not many applications have been brought out in the field of fisheries, Fisher Friend is the first of its kind to support fisherfolk to better cope with uncertainties by providing relevant and dynamic information.

A user-friendly application includes demand driven and location-specific information and other packages of services in local vernacular, is paramount for creating a positive impact on small-scale fisherfolk. The major conclusion drawn from this study is that Fisher Friend has brought out clear benefits to the fisherfolk. All fisherfolk who has used and applied Fisher Friend during their fishing practices have benefited in terms of increased income and reduced risks.

As the vulnerability of the fisherfolk across coastal India remains uniform, given the proven results of Fisher Friend and to maximize its benefit, the government has to play a significant role to reach the last mile by taking it forward through their fisheries extension programme.

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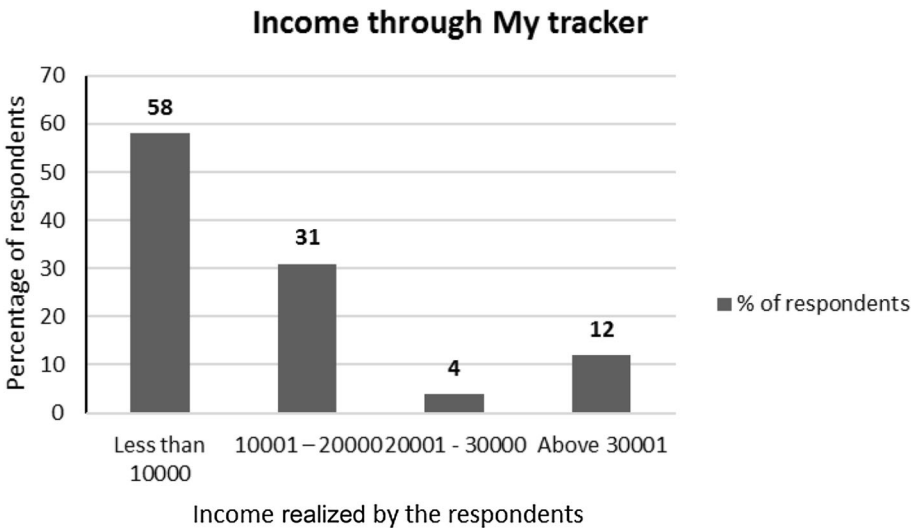

Fig. 8 Income realized due to saving option of traditional PFZ

References

1. NGO Coordination and Resource Centre (NCRC), Nagapattinam (2006) Understanding vulnerabilities of agricultural communities to frequent disasters and coping mechanisms—a sample study of tsunami affected agricultural villages in Nagapattinam. NCRC report, pp 1–30
2. Julian Gonsalves, Priyanka Mohan (eds) (2011) Strengthening resilience in post-diseaster situations, stories, experience, and lessons from South Asia. Academic Foundation and International Development Research Agency, New Delhi
3. Devaraj M, Vivekanandan E (1999) Marine capture fisheries of India: challenges and opportunities, special section: fisheries-science & technology. Curr Sci 76(3):10
4. World Bank Report (2010) India marine fisheries issues, opportunities and transitions for sustainable development agricultural and rural development sector unit. South Asia Region report No 54259
5. Coulthard Sarah (2008) Adapting to environmental change in artisanal fisheries—insights from a South Indian lagoon. Glob Environ Change 18(3):479–489. https://doi.org/10.1016/j.gloenvcha.2008.04.003
6. Jeffrey Robin, Doron Assa (2013) Cell phone nation: how mobile phones have revolutionized business, politics, and ordinary life in India. Hachette Book Publishing India, Gurgaon
7. Ramamritham K, Bahuman A, Duttagupta S (2004) aAqua: a database-backended multilingual, multimedia community forum. In: Conference proceedings of the ACM-SIGMOD, International conference on management of data, Chicago, 784–786 June 27–29. https://www.researchgate.net/publication/221213474_aAqua_A_Database-backended_Multilingual_Multimedia_Community_Forum. 10.1145/1142473.1142589
8. M S Swaminathan Research Foundation (2008) Annual report (2007–2008), Chennai
9. M S Swaminathan Research Foundation (2014) 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. MSSRF report, pp 1–32