



A MOBILE APP FOR SUPPORTING SUSTAINABLE FISHING PRACTICES IN ALIBAUG



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Insights

- The mobile app has empowered the fishers rather than regulated their practices.
- Competition among the fishers makes practices fragile and complicates support for collaboration.
- Design for sustainability requires a long-term sociomaterial perspective.

In the span of a few decades, information and communications technology has transformed the ways in which we work, interact, and comprehend our surroundings. Most of this transformation has been experienced in retrospect rather than through forward-looking planning. Consequently, it is difficult to design and introduce technology for sustaining existing sociomaterial networks because they may be as sensitive to the emergent side effects of the technology as to its intended effects. If the network is fragile, important

to people's livelihood, or both, then these difficulties call for caution. At the same time, technology is believed to hold the potential to improve many people's lives, not least in developing countries. This double bind has spawned considerable research interest in the design and use of technology for developing countries [1,2].

In coastal Indian villages, fishing provides jobs and income for nearly a million fishers. More than 60 percent of them are below the poverty line and earn less than \$1,000 a year; about one-third are



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Figure 1. The landing center in Alibaug.

illiterate. Apart from employing the fishers, fishing also provides the livelihood for several million people in the processing and marketing of the landed fish. Every fishing trip incurs costs in terms of, for example, ice and diesel fuel, but no guarantee of any catch. For the individual fishers, this asymmetry increases their vulnerability to poverty. For fishing as a sector, it means a substantial consumption of environmentally unfriendly fossil fuel. In addition, the dynamic weather conditions at sea make fishing an unsafe profession. High wind speeds and large waves may not only damage equipment but also sink fishing boats.

Alibaug is a coastal fishing village and district headquarters in India. The district's coastline

stretches southward for about 220 kilometers from Mumbai in the north. Two of the authors have for a long time been involved in developing an app for supporting the local fishers in their work; the other authors visited Alibaug for a one-day field trip in September 2017. The field trip consisted of a) a meeting with fishers and chairpersons of the fishery societies to be introduced to the app and the project, b) five interviews with small groups of fishers to inquire about their use and experience of the app, c) a visit to the landing center to see the fishing boats arrive to offload their catch, and d) a final meeting at one of the fishery societies to hear about the sociomaterial organization of the fishery practices. Figure 1

shows the Alibaug landing center. The day after the field trip, we met for a workshop at the INTERACT conference in Mumbai to discuss our field data and reflect on our experiences.

THE MOBILE APP

Almost 90 percent of the fisher families have mobile phones with basic features. On this basis it was decided to develop the app, mKRISHI® Fisheries [3], for Android phones. Its development has been a decade-long collaboration between Tata Consultancy Services (TCS), the Indian Council of Agricultural Research (ICAR), the Central Marine Fisheries Research Institute (ICAR-CMFRI), the Indian National Center for Ocean Information Services (INCOIS), and the local fishery societies in a consortium led by the Indian Agricultural Research Institute (ICAR-IARI).

While some of the big fishing boats have equipment such as sonar for locating fish, most of the fishers rely on their traditional knowledge and any leads provided by peer fishers. For them fishing is to a large extent trial and error. The app

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improves this situation through a map showing locations predicted to have high concentrations of fish; the map is updated four times a day and four days in advance using satellite data about the sea-surface temperature and water color. For example, the water color indicates the presence of plankton, a crucial food source for many fish. Synchronized with thermal data, a large amount of plankton can help predict the location of fish. To refine and validate the prediction model, the fishers have, over a four-year period, delivered data about their location and catch; this data has then been compared with model predictions.

The second main feature of the app is weather forecasts, which deliver wave height, wind speed, and wind direction. Like the predictions of fish location, the weather forecasts are also derived from satellite data. Weather forecasts are key because tropical storms are common in the area; many of the fishing boats are small and have little or no safety equipment. As recently as the last storm before our field trip, two local fishers drowned. To make the information in the app easily perceivable, it is presented graphically (Figure 2). The graphic presentation reduces the need for reading skills. In addition, the project has organized training sessions to explain the content and use of the app.

MAKING PERTINENT INFORMATION OPENLY AVAILABLE

During the interviews, we asked the fishers about their understanding of the map with marks indicating the predicted location of fish. One interviewee explained that “you can go and catch fish everywhere but the marking shows: more fish here!” While the fishers had no conception of how the map was generated, they had firsthand experience with its predictions, creating a high degree of confidence in the map. That is, the map was perceived as a fairly accurate depiction of where to go to get a good catch. In this sense, the app, which was free, made pertinent information openly available. Previously this information had not

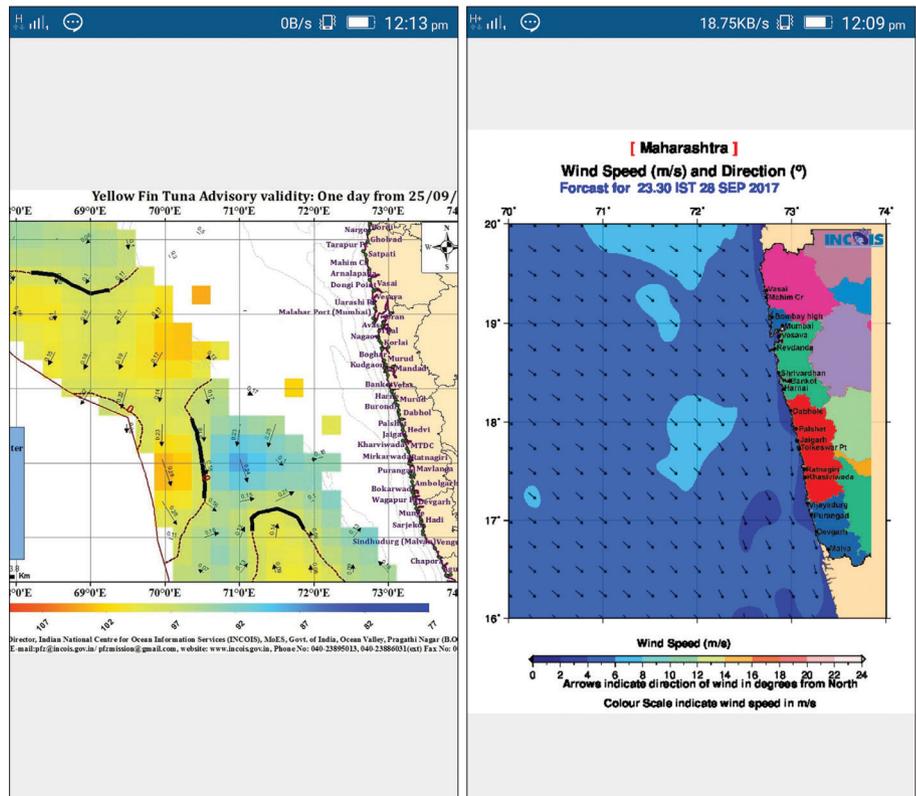


Figure 2. The mKRISHI® Fisheries app showing the map of the predicted location of fish (left) and the weather forecast with indicators of wind speed and direction (right).

been available at all, or individual fishers had to rely on their own intuition—and would often keep such hunches to themselves in order not to lose a good catch to someone else. The chairperson of the Alibaug fishery society considered the equal access to information a benefit; individual fishers may agree or disagree. With the app it is more likely that the fishers cluster at the same locations. Thus, they have an increased need for coordinating who goes where. At the same time, the app allows for individual practices because each fisher can access the map independently of the others.

By making the predicted location of fish openly available, the app accentuates a tension between traditional fishers with boats for one-day trips close to the coast and industrial fishers with big boats for multi-day trips farther away from the coast. The industrial fishers catch large quantities of fish at the most attractive locations on the map, which are often not reachable within one-day trips. These fish will not come close to the coast; hence, there are fewer fish for the traditional fishers to catch. While the app merely brings out

this tension, the project works to help regulate it in other ways. For example, TCS and ICAR-CMFRI have officials at the landing centers several days a month to monitor the amount of fish landed by traditional versus industrial fishers. This monitoring feeds into long-term efforts to support sustainable fishing practices.

SUSTAINABLE PRACTICES

The app also supports sustainable fishing practices. At a very concrete level, its forecasts of the wave height and wind speed promote safety. One interviewee recounted a situation in which the fishers who had already set out were called back: “They think it was a loss because they had to come back without fish, but at least the boats were saved.” An additional 50 fishers never set out on that day, thereby adding to the savings in boats and, possibly, human lives. However, the interviewee’s statement also illustrates that not landing any fish was a considerable price to pay for avoiding high-risk weather conditions.

Another important improvement in the sustainability of the fishing

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practices is that the fishers now use less diesel, which has both financial and ecological benefits. It has been possible to document this reduction for the Alibaug fishing community because the local fishery societies distribute the diesel and keep careful records. The reduced diesel consumption is tied to the app in two ways: First, it indicates that with the support of the map, the fishers do less searching to find fish. Second, the weather forecasts support the fishers in selecting routes with a favorable wind direction to balance the loaded boat and reduce drag on the way back to the coast. It is notable that the reduced diesel consumption has been obtained by providing the fishers with an improved overview [4] of the weather conditions and the location of fish. The fishers have been empowered rather than subjected to regulations and prohibitions.

Among the fishers, especially the traditional fishers, there is some concern that the amount of fish may be declining. This would adversely affect the fishers and, in turn, the entire Alibaug society. The project has engaged this concern by working to produce data about the number of fish. One source of the concern is that the traditional fishers see fewer fish because more fish are caught before they get close to the coast. The TCS and ICAR-CMFRI officials who monitor the amount of fish landed by traditional and industrial fishers contribute data about this issue. So far, the data indicates no change in the number of fish, but the number of fishers is increasing. In benefiting the fishers, the app probably also attracts more people to this profession. It is a dilemma that the app may decrease the sustainability of the fishing profession—by increasing competition for the fish—for the very reason that it is useful and usable.

DISCUSSION

The project consists of more than the app. It includes a number of other activities that extend over a longer period of time. This way, mKRISHI® Fisheries has infrastructural characteristics [5]: It is better characterized as a gradually evolving organism than as a product with fixed features. For example, the app has been shaped by the data fed back about the fishers' actual catches at any given location and supplemented by the monitoring of the amount of fish landed by traditional and industrial fishers. In addition, the app has shaped fishing practices by reducing the trial and error needed to locate fish, by informing decisions about when it is unsafe to go fishing, and by improving the fishers' route selection for return trips. None of these changes have happened overnight. Rather, they have evolved—and continue to evolve—through repeated interactions among fishers, fish, project members, satellite data, fishery societies, the app, and the various other components of the sociomaterial infrastructure. It is the long-term perspective and participatory approach of the project that enable it to support sustainable fishing practices. Unfortunately, longevity and participation are frequently mentioned as challenges for research into the design and use of technology for developing countries [1], for example because it conflicts with more fast-paced, detached approaches to research.

The project is also about more than individual use. While this is clearly reflected in the project at large, support for collaboration is notably absent from the app, which instead focuses on feeding information to the fishers. To some extent, the absence of support for collaboration in the app reflects a belief that collaboration is better

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served by other components in the sociomaterial infrastructure. However, it may also reflect limited awareness of the needs and opportunities for collaboration support via the app. For example, when the fishers have secured their catch, some of them phone peers on land to have them inquire about the price of different fish at the nearby landing centers along the coastline. On a particular day, a buyer may be interested in a particular kind of fish and therefore willing to pay extra for fresh fish of this kind. Consequently, it has been proposed to extend the app with real-time pricing information. Such information could evolve into directly collaborative features. At the workshop on the day after the field trip, it was, for example, proposed to turn information about fish prices into a facility for buyers to order fish of a particular kind.

Increased support for collaboration should, however, be assessed relative to other design decisions and requirements. For example, the maps with the predicted location of fish are images that are downloaded on the phone when it is online. Thereafter, the maps are also available to the fishers when they do not have Internet access because they are too far from the coast or because they cannot afford to be online continuously. Designing for offline use has been key to making the app a sustainable option for the fishers. This design requirement probably shifts support for collaboration from the app toward the other components of the sociomaterial infrastructure, at least until the fishers have Internet access throughout their fishing trips. Currently, when fishers lose Internet due to their distance from land, they rely on radio communication with peers on, or closer to, the coast for information about changes in the app information. Designing for offline use also shows the importance of integrating interaction design with human-work interaction design [6]. The fishery societies are central to the human-work interaction design

because they are an important collaborative component in the sociomaterial infrastructure. At present, the interaction design of the app makes more information available to the fishers independently of the fishery societies. In the further evolution of the project, it might be worthwhile to consider supplementing the app with shared, stationary, whiteboard-like devices, which in addition to providing information also create a physical place to meet for collaborative and coordinative purposes. Sustainable fishing practices are just as much about such social issues as environmental ones.

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