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# Virtual fisheries through mobile apps: The way forward

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### Abstract
Virtual information was used in ambit of compiling different mobile apps in fisheries sector using google search and virtual product snow ball sampling method. Total of 124 mobile apps were located in fields of Angling, Aquaculture, Aquarium Management, Marine Fisheries and Fisheries Governance, Marketing and Biology out of which 22.58% apps were of Indian origin. Apps providing information on marine fisheries were maximum. It is expected that the software market for precision agricultural tools will grow and there is a need for fisheries organizations to partner with Information Technology providers and come out with solutions which will be visionary for both sustainability and profitability.

**Keywords:** Mobile apps, fisheries, aquaculture, aquarium, angling, ICT

## Introduction
Mobile phones have significantly reduced communication and information costs. More than just hardware, the smartphone has inaugurated a new era for software developers worldwide [1]. Fisheries sector has not been left untouched by this digital revolution. About ten years back FAO (2007) [2] reported that new ICTs are used across the fisheries sector. Ayobami *et al.*, (2013) [3] have reported about the functional requirements of mobile applications for fishermen. As per Amrita and Karthickumar (2016) [4] usage of mobile applications is becoming popular in the fisheries sector in developing countries. However, review of literature reveals that even though significant research has been reported on the use of ICTs in fisheries but there is not much literature related on use of mobile apps in the sector. With this background, this study was done with the objective of analyzing types of mobile apps available in fisheries sector.

## Materials and Methods
Virtual information was used in the ambit of compiling different types of mobile apps in the sector as in non-probabilistic samples it can increase the sample size and its representativeness. To adopt the virtual information, keyword typology method was used and search was done from google and mobile app store. Key words were 'mobile apps in fisheries/aquaculture', 'apps for fisher/s/men/women', 'mobile apps by fisher/s/men/women'. Mobile app store was searched using the key words fisheries apps/aquaculture apps and listings on related apps. A different type of snowball sampling method called as Virtual Product Snowball Sampling (VPSS) was used in this study. When search for apps was done on the internet or mobile app store and visit product page, the widget of the products usually bought together and customers also bought was also visited. This is done through data mining algorithms, produces a memory graph and is called as Art of Affinity Analysis or Market Basket Analysis. Usually this is used by customers and retailers but in this study this was used as a snowball method where one app lead to other and so on. As per Fabiola and Ignasi (2012) [5] when social networks are used, then this technique is called virtual snowball sampling. However, in this study it was not the use of social networks. The method used in this study is thus called as Virtual Product Snowball Sampling. Accordingly, relevant apps were recorded. It is highly possible that there are many other apps in fisheries which could not get extracted and at no point it is being claimed that the information in this paper is conclusive. During the search it was seen that there were many sea weather apps and disaster alert apps. However, the apps which provided information on fisheries only have been discussed in this study. Nevertheless, this is an effort to map the available information on what was the kind of services provided by the apps to address sector-specific issues. The mobile apps which were providing information to

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fishers/users on topics related to fisheries/aquaculture were studied.

**Results and Discussion**
The mobile apps related to fisheries are presented in table 1 to 6. Table 1 gives the total number of apps in fisheries.

**Table 1:** Mobile apps in fisheries sector

| S. No. | Field | Number of mobile apps | % |
|---|---|---|---|
| 1. | Angling | 18 | 14.51 |
| 2. | Aquaculture | 20 | 16.12 |
| 3. | Aquarium Management | 10 | 08.06 |
| 4. | Marine Fisheries | 61 | 49.19 |
| 5. | Fisheries Governance, Marketing and Biology | 15 | 12.09 |
| | Total | 124 | |

A total of 124 mobile apps could be found in the fisheries sector. Out of these highest percentage i.e., 49.19% were from marine fisheries followed by aquaculture and angling. Aquarium management had 8.06% of apps.

**Mobile apps which provide information about angling**
Angling/recreational fishing is a significant revenue generation in many industrialized countries. Millions of people generates billions of dollars worldwide by recreational fishing as per FAO (2012) [6]. In the United States, 29.9 million anglers paid US$ 447 million in 1996 for fishing licenses, down from US$ 30.4 million in 1995 [7]. It is thus expected that mobile apps will be developed in this field. Table 2 presents the mobile apps related to angling.

**Table 2:** Mobile apps related to angling

| S. No. | Mobile app | Features |
|---|---|---|
| 1 | Fishing Lures | • Select a bait to use for the specific fish species being fished for |
| 2 | Fishing Spots - Angling Map | • Find a nearby fishing spot |
| 3 | iFishIllinois | • Seeks to support all levels of fisher men/fisher women when they take part in the activity of fishing, seasoned and novice anglers |
| 4 | IGFA mobile | • A useful guide for a number of game fish species and doubles as a reference for game fish records like the largest catch |
| 5 | NPS - Fishing App | • Connect with anglers<br>• Discover new fishing locations, techniques and what products to use to catch more fish<br>• Connect and learn from anglers |
| 6 | Pro angler | • More than 100 fish species details, guide tips at your place<br>• A GPS based boat guide to help navigate hot spots and reefs<br>• Real-time marine weather alerts<br>• More than 1,000 bait locations and tackle shops. |
| 7 | Fishing Knots Lite | • How to tie a knot properly in your fishing line<br>• Each method of tying is described in detail with illustrations |
| 8 | Knot Wars | • Brings forward forty strongest fishing knots |
| 9 | Knots 3D | • How to tie more than 90 knots, untie and rotate. |
| 10 | My Fishing Advisor | • Freshwater fishing guide<br>• Analyzes the weather, sun and moon position, moon phase and many other factors |
| 11 | Fishing & Hunting Solunar Time | • Best feeding times for fish and wildlife of all kinds<br>• Times of the sun and moon rising and setting, current and five-day weather forecast |
| 12 | Fishing My-Cast | • Plan trip, watch the weather, and record where the 'big ones' are biting<br>• log in your catches<br>• Radar imagery |
| 13 | Trimble GPS Fish Free | • Use GPS to identify dock locations, fishing hotspots, boat drifts, trolling paths<br>• track weather, phases of sun and moon, mileage, directions of compass and other important stats |
| 14 | NZ Fishing Rules | • Provides minimum legal size information, maximum daily limits and area bag limits.<br>• Log catches are displayed. |
| 15 | Fish Anglers | • Helps to find new fishing spots, best times for fishing, records catches<br>• Weather and water conditions |
| 16 | Fish Washington | • Provides interactive map-based rules to help anglers find nearby fishing.<br>• Details on harvest limits and gears that are allowed for fishable species in each body of water. |
| 17 | Fish Legal | • Helps to identify fish, marine protected area maps<br>• Displays california saltwater fishing regulations |
| 18 | Fish Smart app | • Information about FADs, artificial reefs, recreational fishing havens and marine park zones is provided. |

It is clear from table 2, that there are 18 mobile apps related to angling. None of these apps have originated in India even when recreational fishing in India dates back to the pre-historic period [8]. With no mobile apps originating from India in the field of angling/recreational fishing, it seems that Information Technology (IT) and the fisheries sector has not realized its potential. It is noteworthy to state that there are many mobile/computer games related to angling which are

successful and significant revenue generators.

**Mobile apps which provide information about aquaculture**
In the field of aquaculture, mobile apps provide information about inputs, new advancements, market prices etc. Table 3 presents apps related to aquaculture.

**Table 3:** Mobile apps related to aquaculture

| S. No. | Mobile app | Features |
|---|---|---|
| 1 | Aqua app | • Locate manufacturers of feed<br>• Statistics about weather<br>• New advancements in aqua culture<br>• Up-to-date market prices |
| 2 | Aquabrahma | • Connect farmers and suppliers<br>• Information on suppliers, hatcheries |
| 3 | Aqua deals | • Information on feed, health care, machine and equipment like aeration tubes, aerators, blower, paddle wheels, pipes, pumps, testing kits, hatchery machinery, and fish cages<br>• Deals for seed, feed, health care, machinery and farm equipment |
| 4 | Aquaimate | • Has a collection of freshwater and saltwater fish, corals, invertebrates and plant speciesRecord parameters test results<br>• Customize parameters and calculate the required dosing<br>• Create husbandry tasks and set up reminders for them with an advanced scheduling system<br>• Monitor activities integrated with tasks and reminders |
| 5 | Aqua Plant | • Identification and management of pond vegetation<br>• Treatment options which includes biological, mechanical and herbicide controls |
| 6 | Aqua Reef | • Includes pond filling time<br>• Pumping rate equivalents<br>• Discharge rates from standpipes<br>• Net mesh sizes for grading fish<br>• Length/weight relationships for fish |
| 7 | Aquatic Log | • Ability to log water parameters<br>• Record dosing additives and supplements |
| 8 | Fish Advice | • Education app contains various picture of fish disease, symptoms, preventive measures, fish culture methods<br>• Information on fish feed sellers, fish medicine sellers, fish farm owners, local extension agents |
| 9 | m Fish | • Set of mobile applications for fishing and aquaculture that educates and connects fishers to market prices<br>• Gathers information directly from the fishermen<br>• Access to information such as weather data, fish prices at port, fish handling and best practices for safety |
| 10 | m-KRISHI Aqua Service | • Alert remote farmers to cloud formation, rainfall and temperature<br>• Scientific information on water parameters in tanks, feed supply, growth of shrimp and atmospheric condition<br>• Tool for book-keeping, advisory and weather information services |
| 11 | Pescare | • Insight into diseases that commonly occur in fish and shrimp aquaculture<br>• Brief description of their symptoms, aetiological agent, diagnosis, and treatment<br>• Tool to diagnose and prevent the occurrence of diseases in cultured fishes and shrimps |
| 12 | Pondcalc | • Determine accurate area and volume of the pond for application of chemical treatments and herbicides |
| 13 | Source Trace ESE™ Aqua solution | • Aquaculture operations and supply chain<br>• Real-time business intelligence<br>• Better resource management and pond health monitoring systems<br>• Geo-referenced farm data |
| 14 | Texas Farm Pond Management Calendar | • Digital pocket calendar to keep private pond managers up-to-date with the activities required to manage their pond for the best possible fishing |
| 15 | Vanamei shrimpapp | • Information on the Better Management Practices of shrimp farming in the form of Frequently Asked Questions |
| 16 | Aquall App | • Aquall is a one-stop place for seeds, feeds, chemicals, aerators as well as hardware products. |
| 17 | Fish Disease advisory | • The app gives information about diseases, causative agents and remedial measures. |
| 18 | Fish Names | • Gives information about fish varieties and names in different Indian Languages |
| 19 | Ind Aqua | • The app has technology modules for different fishes, the database of stakeholders, FAQs, updates, discussion forum. |
|  | Aquatic Disease Field Guide app | • Helps to know about diseases that affect finfish, crustaceans, molluscs, and amphibians in Australia |

It is clear from table 3, that there are 20 apps in the field of aquaculture. Out of these there are 10 apps which are of Indian origin. These are Aqua app, Aquadeals, AquaBrahma, m-KRISHI Aqua Service, Pescare, Vanamei Shrimp app, Aquall app, Fish Disease Advisory, Fish Names and IndAqua.

**Mobile apps which provide information about aquarium management**
With wholesale value of the global ornamental fish trade estimated to be in billion dollars there is a huge potential of mobile apps in this field. Table 4 presents the mobile apps

related to aquarium management.

**Table 4:** Mobile apps related to aquarium management

| 1 | Ammonia Calc | <ul><li>Calculate ammonia concentration</li><li>Un-ionized ammonia calculator</li><li>Resource for on the go aquaculture producers and managers as well as home aquarium hobbyists.</li><li>Allows users to instantly calculate the un ionized ammonia concentration by providing water chemistry measurements such as pH and temperature</li></ul> |
|---|---|---|
| 2 | Apex Fusion | <ul><li>Monitor the health of aquarium based on current and past water parameters</li><li>Control aquarium equipment (e.g. turn on or turn off light and pumps, adjust lightning spectrum, and change pump modes)</li><li>See how fish and plants are doing via IP web cams</li><li>Can remotely feed fish, enter crucial water testing parameters</li></ul> |
| 3 | aquaPlanner | <ul><li>Maintenance and scheduling with notifications, water test logging, calculators and equipment log</li><li>Allows to adjust parameters and time intervals for aquarium</li><li>Let know when it is time to change the water, filter, carbon, fluorescent bulbs, add medication, and other supplements</li></ul> |
| 4 | Aqua Planner Pro | <ul><li>Task alert system</li><li>Attend to all fish tank maintenance duties such as changing the water, checking water chemistry, adding medication and various supplements on time.</li><li>Can log key water parameters, and monitor parameter changes on graphs</li></ul> |
| 5 | Aquaria Pro | <ul><li>Aquarium management</li><li>Manage multiple aquariums,</li><li>create to-do lists for various tasks and testing</li><li>Monitor water parameters</li></ul> |
| 6 | Aquarimate | <ul><li>Manages both saltwater and freshwater aquariums</li><li>Library contains information on saltwater fish and freshwater, invertebrate, plant and coral species</li><li>Variety of tools such as tank parameters tracking and livestock tracking</li><li>Task reminders, tank parameters and activity analyzation with graphs</li><li>Advanced unit converters and dosing calculators.</li></ul> |
| 7 | Coral Tank Pro | <ul><li>Saltwater fish tank management</li><li>Track 7 chemical levels with graphs</li><li>Notifications and a countdown timer displayed on the home screen</li><li>Store records of fish and coral</li></ul> |
| 8 | Reef Tank | <ul><li>Built-in tests: Calcium, Ammonia, Carbonate Hardness, Phosphate, Magnesium, Nitrate, Nitrite, Total Dissolved Solids Specific Gravity (Salinity), Temperature, and pH</li><li>Chronological view of the data and track water parameters</li></ul> |
| 9 | The Fish Room | <ul><li>Information about reef tank</li><li>Set and log custom chemistry goals for PH, Calcium, dKH, Nitrites, Nitrates, and more</li><li>Keep track of fish and when to change lights and water</li></ul> |
| 10 | Aquarium Note | <ul><li>Record information of aquarium and count days from setup date, calculate expenses, log 24 water parameters and view trend with graphs.</li></ul> |

It is seen from table 4, that there are 10 mobile apps which provide information on aquarium management. The Indian ornamental fish sector is a small but vibrant segment, but there are no apps developed which are of Indian origin.

**Mobile apps which provide information about marine fisheries**

Marine capture fisheries have developed significantly over the years but there are huge challenges like overfishing, habitat loss, climate change and pollution. As per FAO (2016) [9] global total capture fishery production in 2014 was 93.4 million tonnes, out of which 81.5 million tonnes from 0providing information on marine fisheries apps will be more. Table 5 presents the apps in marine fisheries.

**Table 5:** Mobile apps related to marine fisheries

| 1 | Blue Chart Mobile | <ul><li>Weather information and buoy reports</li><li>Land or marine zone forecasts</li><li>Sea-surface temperatures, surface-wind grids,</li><li>Sea-state forecasts and surface-pressure and</li></ul> |
|---|---|---|
| 2 | Boating US | <ul><li>Nautical charts</li><li>Sonar charts</li><li>Routes, distance, markers and wind forecasts</li></ul> |
| 3 | Deeper | <ul><li>Temperature and sea depth, reveal new fish spots, PFZ.</li><li>Solunar forecasting</li><li>Downloadable maps</li></ul> |
| 4 | Drop hook | <ul><li>Logs for catch, bait and tackle</li><li>Position and meteorological details</li><li>Functions to store date</li><li>Forecasts and conditions</li></ul> |

| | | |
|---|---|---|
| | | ▪ Auto calculator for size-to-weight numbers<br>▪ Sea-surface-temperature charts |
| 5 | eObS | ▪ Electronic observer data application for vessels<br>▪ Data will be uploaded to national and regional databases |
| 6 | First Mate | ▪ Weather forecasts and Weather radar<br>▪ Tide charts<br>▪ Color, barometric pressure and feeding times |
| 7 | Fish Brain | ▪ Fishing forecast news feed<br>▪ Information on new fishing locations<br>▪ Check accurate catch position |
| 8 | Fish finder | ▪ An app for identifying reef fishes.<br>▪ Identify reef fishes on the east coast and south west of India using prominent characters and colour |
| 9 | Fish Hunter | ▪ Advanced Tracking and Mapping<br>▪ Hardware device for finding fishes<br>▪ Fishing Trip<br>▪ Crucial Planning Tool-kit |
| 10 | Fish rules | ▪ Illustrated guides to regulated species, log their catch<br>▪ Share images of their catch |
| 11 | Fish track | ▪ Chlorophyll, SST, and satellite imagery, Bathymetry, Sea surface heights, currents<br>▪ Create and save routes and way points tides and isolunar tables |
| 12 | Fish Alerts | ▪ To view all available Marine Protected Areas, National Marine Sanctuaries and their restrictions<br>▪ Marine Weather and Tide information<br>▪ To pinpoint location relative to marine protected area boundaries |
| 13 | Fisher Friend Mobile Application (FFMA) | ▪ Potential Fishing Zones (PFZ)<br>▪ Ocean State and Weather Forecast, Global Positioning System (GPS)<br>▪ Danger zone Alerts, Disaster Alerts, Market realities<br>▪ Emergency contact numbers |
| 14 | Fishidy | ▪ Information on species data<br>▪ Tips and more on waterways<br>▪ Using interactive fishing maps that include contour lines<br>▪ Fishery facts and boat ramps |
| 15 | Fishing Calendar | ▪ Best fishing times for current location<br>▪ Track and share catches<br>▪ Integrate the app with maps |
| 16 | Fishing Deluxe | ▪ Fishing Times Calendar<br>▪ Plan fishing trips |
| 17 | Fishing Knots Lite | ▪ Detailed instructions with pictures on how to tie a variety of fishing knots |
| 18 | Fishing Log | ▪ Information like the type of fish, size and at what depth it was caught, weight, number of ones<br>▪ caught, etc. |
| 19 | Fishing Points GPS Navigation | ▪ Best time for fishing, tide prediction<br>▪ Forecasts weather, Mapping facility<br>▪ Helps finding fish location with GPS navigation |
| 20 | Fishing Times | ▪ Provides solunar tables to determine the best fishing times for any date, any location<br>▪ Easy to read solunar fishing calendar<br>▪ Tide times and sun/moon information to plan your fishing trips |
| 21 | Fishing Times Pro | ▪ Calculated time to go for fish based on factors like tides, moon, sun, time of year and location |
| 22 | Fishing Weather | ▪ Preferred weather conditions for temperature, rain, wind and a fish icon is displayed if the weather is within those parameters, a house icon is displayed otherwise |
| 23 | Fishing & Hunting Solunar Time | ▪ Based on the solunar tables theory application, gives information about best fishing times |
| 24 | Go free hooked | ▪ GPS location, save fish photos<br>▪ Fish details, and notes about each catch |
| 25 | IFISH | ▪ Depth of the water, the weather and also informs you of the fishing season of various fishing destinations |
| 26 | iNavX | ▪ Real-time navigation on marine charts, waypoint selection, creation and editing, real-time instrument support, route editing, track logs, anchor alarm, points of interest and weather overlay support |
| 27 | Isolunar | ▪ Movement of the sun, moon and tides to predict the most active feeding or movement of animals |
| 28 | Knot guide | ▪ Information about more than 100 knots, divided into 18 categories, including binding, climbing and sailing knots, and fishing knots |
| 29 | Marines Tide Planner | ▪ About tides, their depths, the currents, the sunrise and sunset times, the moon phases |
| 30 | Minute cast | ▪ Provides buoy data, tide information, animated weather radar, sea-surface temperatures and anomalies, wave heights, and surface-wind data, plus a detailed, precipitation forecast for up to two hours |
| 31 | mKrishi@Fisheries | ▪ INCOIS generates Potential Fishing Zone (PFZ), predicts information of fish shoals based on the remote sensing data received from NOAA satellites, sea surface temperature and the presence of phytoplankton.<br>▪ The app consolidates this information and provides advisories in local language |
| 32 | mkrishi@aqua | ▪ Information on Potential Fishing Zone (PFZ), sea surface temperature, weather and the presence of phytoplankton |

| 33 | My Fishing Advisor | ▪ Analyzes the weather, sun and moon position, moon phase |
|---|---|---|
| 34 | Net fish | ▪ Fishing Forecast App<br>▪ Guides when, where, what fish to catch<br>▪ Predicts the best fishing spots by utilizing millions of data points from thousands of sonar.<br>▪ Advanced algorithms to provide most up to date fishing spots |
| 35 | On Board | ▪ Electronic log sheet application for collecting catch and effort data<br>▪ Can be used by fishers on long liners<br>▪ Dynamic user interface and data validation capabilities |
| 36 | Pacific islands fisheries forum agency | ▪ Database and information management<br>▪ Vessels compliance index |
| 37 | Plan2Nav | ▪ Marina charts, dynamic tides, currents and aerial photos |
| 38 | Potential Fishing Zone Advisory (PFZA) | ▪ Used for disseminating PFZ zone advisories |
| 39 | Precision Trolling | ▪ Information to target fish at specific depths<br>▪ Fishing method that allows anglers to accurately predict the running depths of lures and diving devices |
| 40 | Regional Information Management Facility (RIMF) | ▪ Integrates with the countries portal and offers the Boarding Officer's Job Aid Kit (BOJAK), with access to vessel monitoring, reference list, license list, transshipment monitoring checklist and departure clearance |
| 41 | Sagar Vani | ▪ Disseminate the advisories, directly from the lab to the end user<br>▪ Multi Lingual SMS, Audio Advisory, International boundary crossing<br>▪ Market information<br>▪ Facilitates private social community for information sharing via audio / video live streams and pictures |
| 42 | SONA. r Ball | ▪ Sonar View, Fish View,<br>▪ Water depth, Water Temperature<br>▪ Analyses the environment and increase the fish catch, detects the PFZ |
| 43 | Su FishIn T | ▪ Displays fishing rules and regulations in a particular area and lists all fish species that are legally permitted to catch<br>▪ Biological data of particular species, which includes habitat requirements, abundance, spawning season and the best time to catch them.<br>▪ Effective realtime tracking of all fishing vessels in the region using GPS and vessel surveillance systems to help the local fishing agency deal with illegal, unreported and uncontrolled fishing. |
| 44 | Tail | ▪ Fisheries monitoring application for collecting Commercial Long Lining<br>▪ Port Sampling Data and artisanal fisheries data |
| 45 | WISE | ▪ Improves safety at sea by providing daily weather information and navigational resources to chart a safe course to and fro from fishing zones<br>▪ If the fishermen are lost in the ocean, they can communicate their position to rescue teams<br>▪ Access to training and educational resources |
| 46 | Chile es Mar | ▪ Collecting local catch data from artisanal fishermen and communicating with buyers of seafood. |
| 47 | SOpHIE (The Surface Ocean pH Interactive Explorer) | ▪ Delivers daily metrics of ocean acidification for those working in aquaculture, fisheries and ocean monitoring |
| 48 | Fish Landing App | ▪ Helps buyers to monitor captured fish species and size, frequently used<br> o fishing spots, and local fishermen's profiles. |
| 49 | Fishency | ▪ Records total number of fishes caught, duration spent and distance covered for each fishing trip. |
| 50 | Time Zero | ▪ Display real time location, weather forecasts, navigation data, satellite photos, tides and currents. |
| 51 | GRI Bview | ▪ Includes wind speed, sea-surface temperature, barometric pressure, air temperature, precipitation, significant wave height, period and direction. |
| 52 | ISD App | ▪ Gives updates on weather conditions, cloud coverage, the best time for fishing and wind speed. |
| 53 | Infish | ▪ Give information for over 150 inland waters including directions, current warnings, fishing news, fishing advice, fishing regulations, and methods. |
| 54 | INCOIS | ▪ Provides information services such as PFZ, TUNA PFZ for benefit of fishermen community of India |
| 55 | SARAT (Search and Rescue Aid Tool) | ▪ Used for conducting search and rescue operations in the sea |
| 56 | Sagara | ▪ Monitors fishing crafts and crews going for the fishing operation. |
| 57 | Pac Fish ID | ▪ Recognizes pacific marine fish species |
| 58 | Odaku | ▪ It provides tools and technologies that help fishermen on their daily activities |
| 59 | Fish Locator | ▪ Features includes map locations, catch details, solunar forecasts, tides. |
| 60 | Navisea | ▪ Designed for voyages planning and tracking.<br>▪ Includes traffic, ports, docks navigation and weather data |
| 61 | Sea Status Marine Weather | ▪ Delivers marine weather data |

It is clear from table 5, that there are 61 mobile apps which provide information on marine fisheries. In this field maximum mobile apps were found. Out of the above listed apps, 9 mobile apps are of Indian origin are

mKrishi@AFisheries, mkrishi@aqua, Fisher Friend Mobile Application (FFMA), PFZA and Sagar Vani, Sagara, Odaku, Search and Rescue Aid Tool (SARAT) and INCOIS

**Mobile apps which provide information on fisheries governance, biology and marketing**

Table 6 presents the mobile apps which provide information on fisheries governance, biology and marketing.

**Table 6:** Mobile apps in fisheries governance, biology and marketing

| S. No. | Mobile app | Features |
|---|---|---|
| 1 | Abalobi | • Working towards good governance and adopting a fisheries approach based on human rights<br>• Enabling small-scale fishing communities to be integrated into information and resource networks from fisheries monitoring and maritime safety, local development and market opportunities<br>• Enabling social justice and poverty alleviation in the small-scale fisheries chainResilience building in the face of climate change |
| 2 | Fish Base | • Information on biodiversity for all world fish covering more than 32,000 species<br>• Includes biology, ecology, taxonomy, life history, trophic features and population dynamics |
| 3 | Xiaoliu Online Fish Market | • Foreign seafood exporters can list their products on this app<br>• Allows buyers to track seafood volumes and prices for product nationally, while also bidding for lots |
| 4 | Aqua Pulse | • Shrimp purchase mobile app and acts as a bridge between companies and sellers |
| 5 | Daily fish India | • It is an online seafood store, available in Ernakulam and Trivandrum. |
| 6 | Healthy Fish | • Online marine fish, farm freshwater fish, Dry fish, Crabs, Shrimps, Lobsters delivery app |
| 7 | Marine fish sales | • The app facilitates direct sales between fisherfolk and customers. |
| 8 | Matha Fresh Fish | • Online seafood store |
| 9 | Nallameen | • The app delivers fresh fish from the daily catch in and around Kochi |
| 10 | Smart fish | • Online fish delivery app |
| 11 | Fish.qa | • Qatar online fish purchase app |
| 12 | Sydney Fish Market Supplier | • This app allows the registered suppliers access to daily auction prices |
| 13 | Fish.me | • The app allows to shop directly from fishermen in market |
| 14 | Fresh Fish Cart | • Delivers all type of fish and sea foods with freshness |
| 15 | Fish Stop | • Online fish market |

A total of 15 mobile apps were found which provided information on governance, information and resource networks from fishery monitoring and maritime safety, resilience building, biodiversity information, listing of seafood exporters, track seafood volumes, prices and online marketing. 9 are of Indian origin and are Aqua Pulse, Daily Fish India, Healthy Fish, Marine fish sales, Matha Fresh Fish, Nallameen, Smart fish, Fresh Fish Cart and Fish Stop.

## Conclusion

Fisheries sector has its own set of mobile apps. More research is needed to know how many apps are successful by way of their downloads as well as user engagement and feedback. The software market for precision farming tools is expected to grow by 14% in the United States alone by 2022 in agriculture [10]. In this background, it has to be realized by the policy makers that big data is moving into every field and fisheries cannot be left behind. Big data can revolutionize the fish-to-fork food chain. With mobile apps being the way of life, there is an urgent need that fisheries sector partner with Information Technology providers and come out with sustainable solutions using mobile apps. This will be visionary for achieving sustainability and profitability

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