An android based application to collect catch and effort data from the coastal fisheries of Sri Lanka to minimize the gap of data availability

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Abstract

Coastal fisheries provide livelihoods for millions of people in many countries however are often poorly documented or the data of the same are poorly reported. This issue is critical in many small-scale inshore fisheries operated in areas contain high marine biodiversity, Therefore, Novel and cost-effective approaches to obtain fisheries data are required to monitor these activities and help inform sustainable fishery and marine ecosystem management. Sri Lanka made an effort to achieve the above requirement via am android application, while asking the officers who collect costal data to submit catch and effort data via a simple smartphone interface. The data floor of the software were designed in accordance with the manual data collection process practiced by the fisheries officer in the filed level. The application can be accessed by all filed officers incorporated in the duties of each Fisheries Inspection (FI) Division to submit data from more than 950 landing sites are there in the coastal belt. The application was only tested as a pilot project in order to identify the gaps in the system. Number of adjustments were made according to the findings via the pilot project. However this attempt was heavily affected by the prevailing COVID 19 pandemic. Currently the database structure and the mobile app can be considered as stable and it was expected to undergo another pilot phase after conducting a comprehensive training to the officers.

Key Words; Sri Lanka, Coastal Fisheries, Temporal and Spatial data, catch and effort data, Android application,

1.0 Introduction

Coastal fisheries provide livelihoods for millions of people in many countries however are often poorly documented or the data of the same are poorly reported. Data shortage, particularly needed to be used for the identification of spatial and temporal trends in catch and effort, compounds wider issues of governance capacity. This can obstruct the implementation and effectiveness of fisheries management or conservation processes (Exeter. et. al., 2021).

Small-scale coastal fisheries, especially in the developing regions, often lack the capacity to equip systems such as VMS, AIS or GPS tracking (Dunn et al., 2010; Breen et al., 2015; Kroodsma et al., 2018). Despite being globally distributed, spanning a variety of gear types, vessel sizes, target species, spatial profiles and socioeconomic characteristics (Smith and Basurto, 2019), these fleets mostly lack data on spatial and temporal trends in activity (Selgrath et al., 2018). As small-scale fleets primarily operate in inshore zones (Stewart et al., 2010), the paucity of spatial data on vessel behavior can seriously hinder effective coastal management, impacting both people and wildlife (Ban et al., 2009).

This issue is critical in many small-scale inshore fisheries operated in areas contain high marine biodiversity, such as Southeast Asia. As a result, fleets often operate less-monitored with implications for target and non-target species populations and the wider marine ecosystem. Therefore, Novel and cost-effective approaches to obtain fisheries data are required to monitor these activities and help inform sustainable fishery and marine ecosystem management (Exeter, et. al., 2021).

The collection and analysis of fishery data and information is a costly and timely exercise. To be relevant and cost-effective, also, long-lasting problems of insufficient human and financial resources allocated for data collection often resulted in poor quality of information that further led to non- or limited use of statistics for fishery management and policy development. Consequently only dwindling support was given to systematic

improvement of national fishery data and information collection systems in many cases (FAO, 1999).

2.0 Manual data collection process in the costal sector of Sri Lanka

Catch and effort data were collected via two different systems in Sri Lanka; port sampling and log books. (Maldeniya, 2013). The port data collection programme is carried out as a random stratified sampling programme. However unlike in the multiday sector of fisheries in Sri Lanka, an official log book system is not practiced in the costal sector. Therefore collecting of catch and effort data of the costal fisheries is mainly done via port sampling process. There, the officers of DFAR and NARA visit the fish landing sites including harbours and the small landing sites on random basis to measure and estimate the catch landed at the moment of visiting the site. Total number of craft, details of the fishing gears are recorded. Effort data such as number of days or hours operated area of operated were collected via interviews with boat operators at landing sites. Currently this process is practiced as a manual process where data were recorded in papers with predefined formats. These data were then fed to a central data base to be use in the analysis and reporting process. However this process has the same limitations mentioned above. Therefore coverage of data collection to represent the whole sector was not achieved, resulted many issues and also due to the same reason Sri Lanka categorized as partially complied in IOTC compliance criteria.

3.0 Possibility to improve the costal fisheries data collecting process in Sri Lanka.

Development or improvement of any fishery data and information collection system requires a logically structured approach. The structured approach includes a sequential pathway, starting from the understanding on “Why data are needed?” through the clarification of data requirements (What data need to be collected?), and the

consideration of “How data will be collected?” (FAO, 2005). Accordingly it was decided to seek an effective way to improve the way of data collection in the costal fisheries sector of Sri Lanka.

4.0 The software

It was decided to develop the data floor of the software in accordance with the manual data collection process practiced by the fisheries officer in the filed level. There the officers are tasked to visit the landing sited based on a tentative work plan, where they need to do minimum of 12 inspection per month. During the inspection, a fisheries officer first record the details of boats that are being arrived to the landing site at that particular period of the day. Boats with categories of, IMUL (Multiday Boats), IDAY (inboard day boats), OFRP (small Fiberglas out board motor engine boats), MTRB (Mechanized traditional), NTRB (None-mechanized traditional) are count and record with the basic fishing gear types such as longline, gillnets, surrounding nets, traps etc. Then randomly selected boats to represent the sample were inspect in details with catch (species wise) and effort data (specifications of the gears, number of hours and days operated). Then the length weigh data of randomly selected fish of the landing were recorded via a separate sheet. All these details were recorded in tabulated sheets and submitted to the head office of DFAR. These data were manually processed and used for the further analysis and reporting.

The same above process were incorporated with an android based application where the officers can log in and submit the data online. Data floor of the software are as follows.

Table 01- types of data handled by various types of user levels in the system

User type	Interface details	Data to be deal with
DFAR officer NARA officer	Mobile application interface 01- Login	Login details/ authentication
DFAR officer NARA officer	Mobile application interface 02- Overall data	• Date and time (automatic detection) • Landing site location data (automatic detection) • Total number of boats operated (based on the category) • Fishing gear data of the above boats
DFAR officer NARA officer	Mobile application interface 03- Sampling boats	• Date of landing • Geographic area of operation • Gears used with specifications • Target fish species • Species wize catch of retained catch and bycatch
DFAR officer NARA officer	Mobile application interface 04- Sampling of fish	• Length and weight data of the selected fish
District assistant director NARA Supervisor	Web application dash board	• Recommendation that the submitted data are in accordance with the sampling plan
Head office level	Web application dash board interface 01- basic data	• Review of total inspections per day
Head office level	Web application dash board interface 02- Technical data	• Inspection of each and every or random basis data submitted by the fisheries officers and confirmation of the submission
Head office level	Web application dash board interface 03- Reports	• Of catch and effort data on temporal and spatial basis • Length and weigh data of selected fish

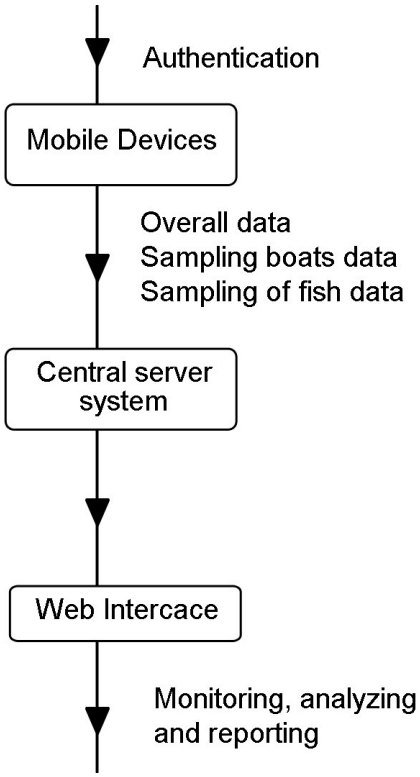

Figure -1; Data floor of the software

Simplified ER diagram for the database and interfaces of the software is given below

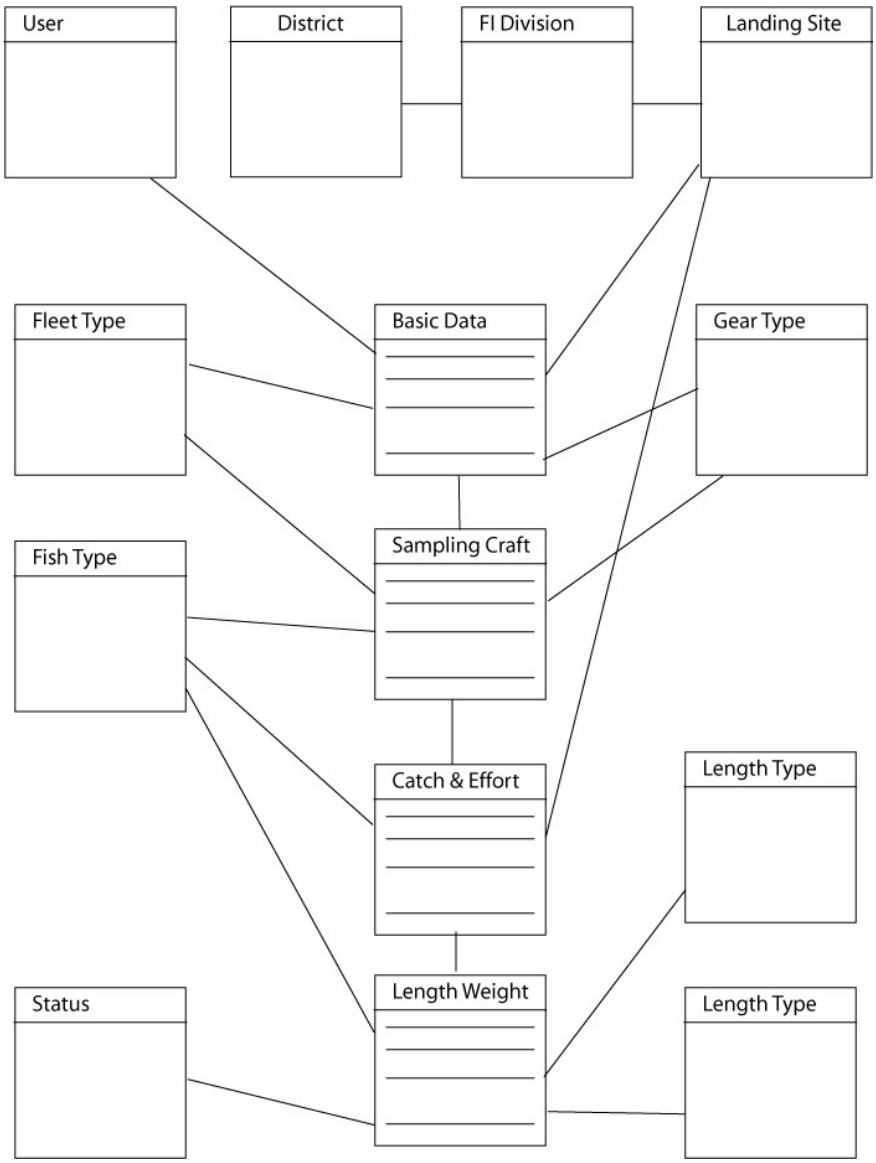

Figure- 2; Simplified ER diagram for the database

Screen shots of the above interfaces are given in Annex-1

5.0 Result and discussion

The application can be accessed by all filed officers incorporated in the duties of each Fisheries Inspection (FI) Division. There are about 145 FI Divisions in Sri Lanka and more than 950 landing sites are there in the coastal belt. Summary of the nature of landing sites are given below. Here each and each and every landing site was categorized as High, Mid and Low priority for sampling based on the boats operated and the average daily harvest landed.

Table 2- Landing sites available for sampling

Fisheries Administrative District	Total Number of Landing sites	Low prioritized Landing sites	Mid prioritized Landing sites	High prioritized Landing sites
Batticaloa	148	2	112	34
Chilaw	66	1	37	28
Colombo	16	0	6	10
Galle	75	10	40	25
Jaffna	108	58	0	50
Kalmunai	61	0	41	20
Kalutara	51	0	23	28
Kilinochchi	22	11	0	11
Mannar	58	45	0	13
Matàra	32	4	16	12
Mullaithivu	25	12	0	13
Negombo	80	14	42	24
Puttalam	78	3	50	25
Tangalla	55	13	19	23
Trincomalee	71	3	30	38
Grand Total	**946**	**176**	**416**	**354**

Here a sampling plan was adopted after providing weights for sampling and number days for the inspection was then determined according to the sampling strategy prepared with the technical support of NOWAY (Under Norway – Sri Lanka bilateral programme on fisheries data management). However the applications were only tested as a pilot project in order to identify the gaps in the system. This attempt was however heavily affected by prevailing Covid19 pandemic situation. There total number of 128 inspections were conducted and mentioned below is summery the results of the data received.

Table 3- results of the pilot programme

Aspects of data received	Number of data submissions	%
Login details/ authentication successfully conducted	228	100%
Overall data of the landing site	228	100%
Basic data of boats selected for sampling	225	99%
Species wise catch data	218	96%
gear wise effort data	213	93%
Length weight data	32	14%
Total	228	-

Number of adjustments were made to the dropdown menus of the mobile app and the script to extract the report were made in order to make the system more user friendly. Attending to collect the length weigh data were reported minimum due to the restriction imposed by coved 19 pandemic situation.

6.0 Conclusion

However it was found that the database structure and the mobile app are now stable and it was expected to undergo another pilot phase after conducting a comprehensive training to the officers. It is also expected to implement the above mentioned sampling strategy by overcoming the issues occurred related to the Covid 19 situation.

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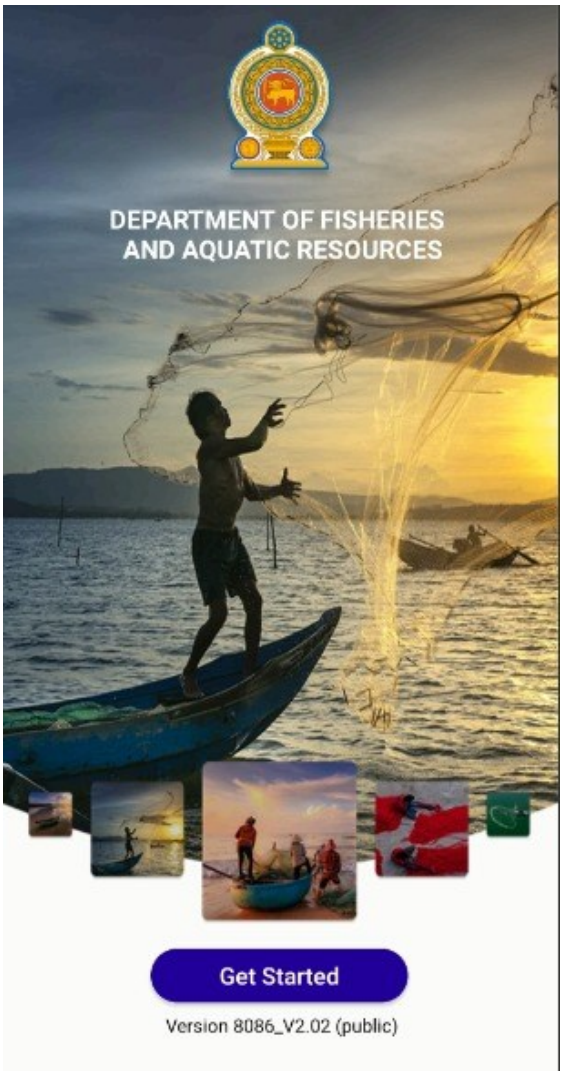
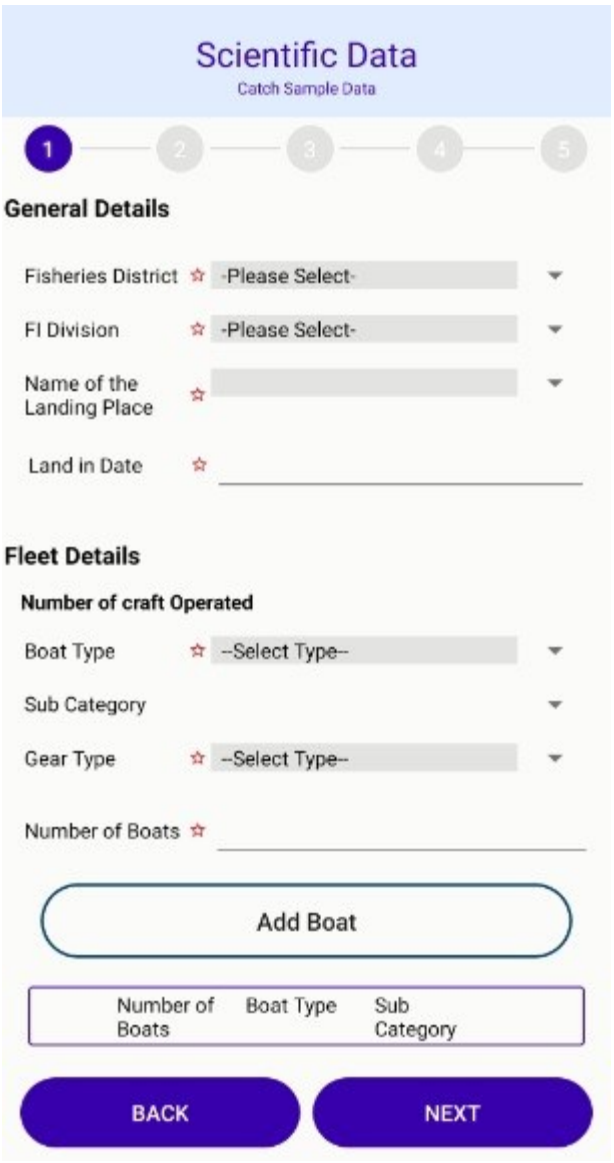
Annex- 1
Screenshots of the application interface related to the various phases of data floor

Mobile application interface 01- Login and access

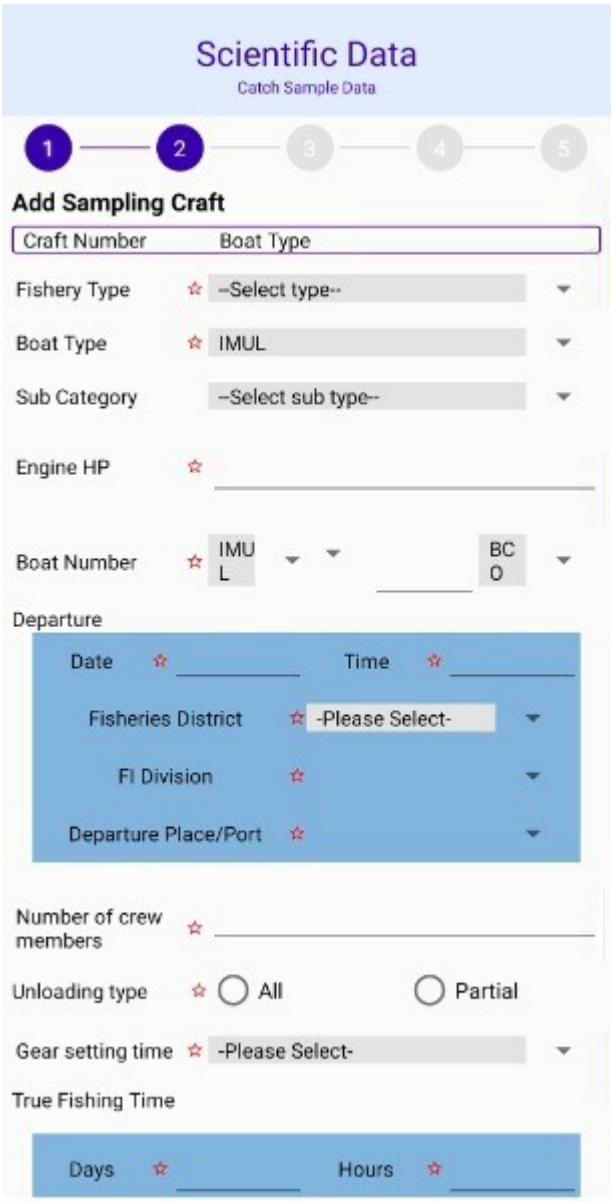


Mobile application interface 02- Overall data

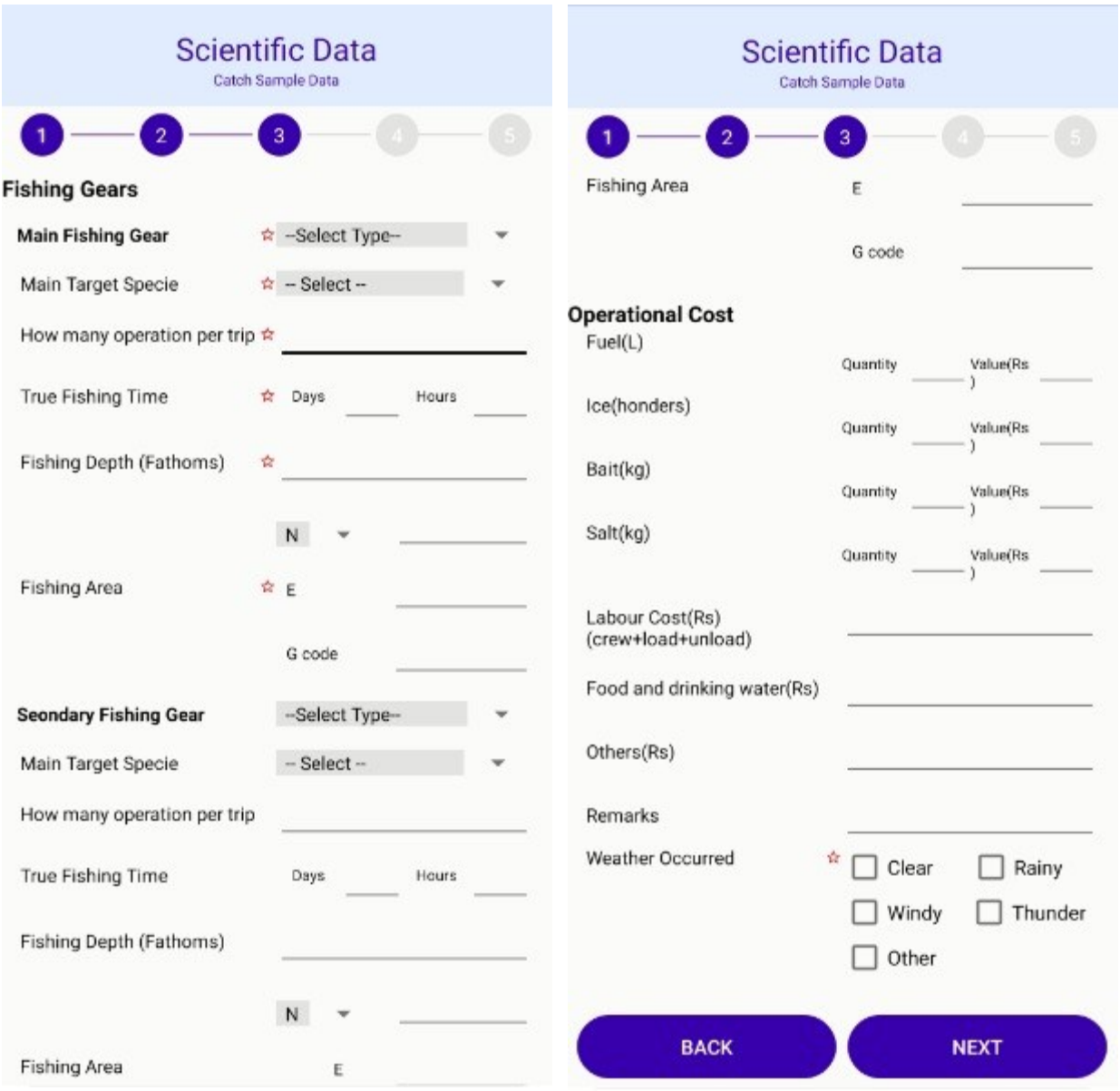


Mobile application interface 03- Sampling boats/ Craft and catch/ effort data

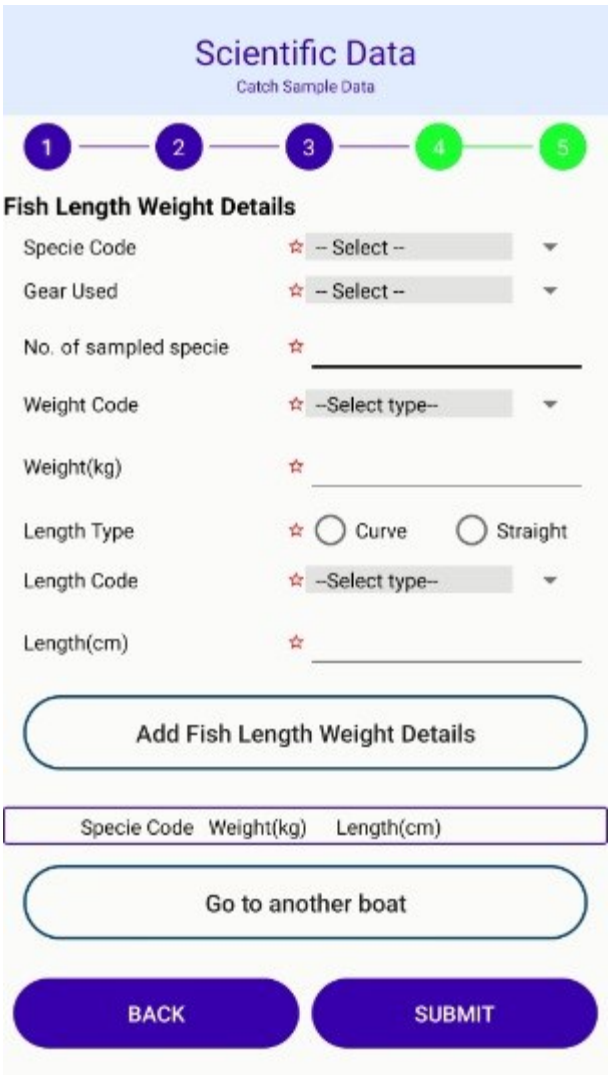
Adding sampling Boats



Fishing gear and effort data

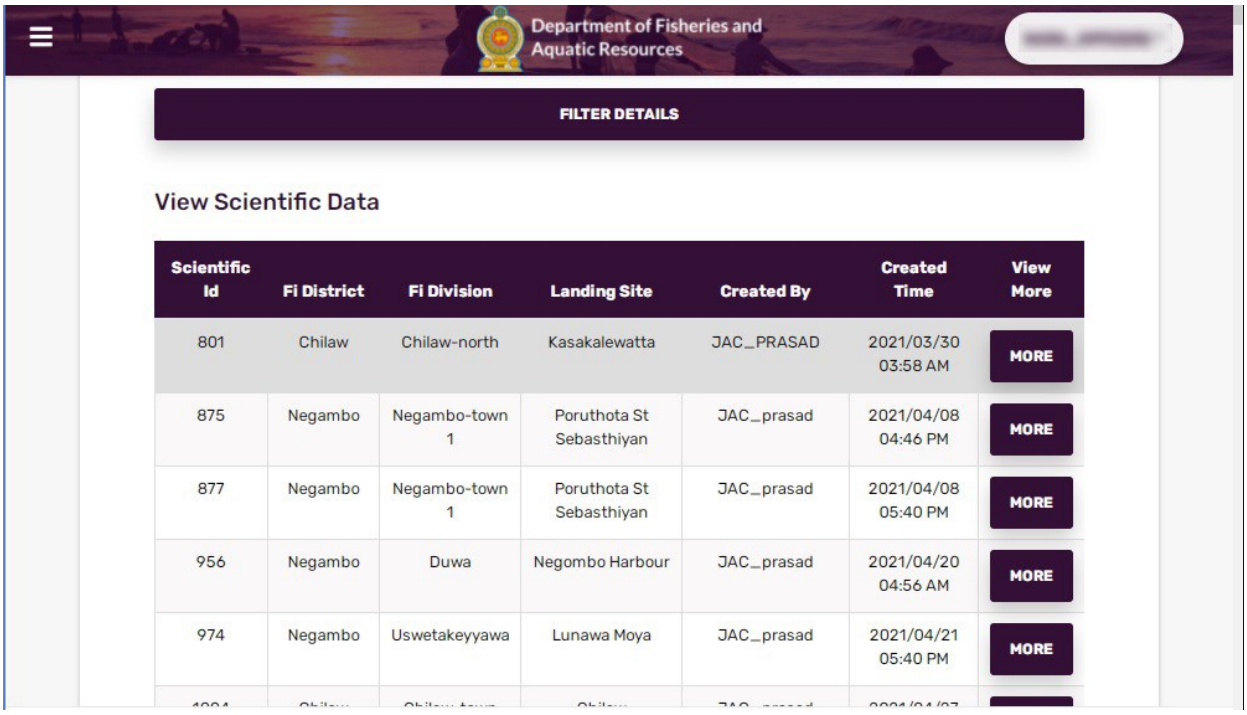


Fish catch data

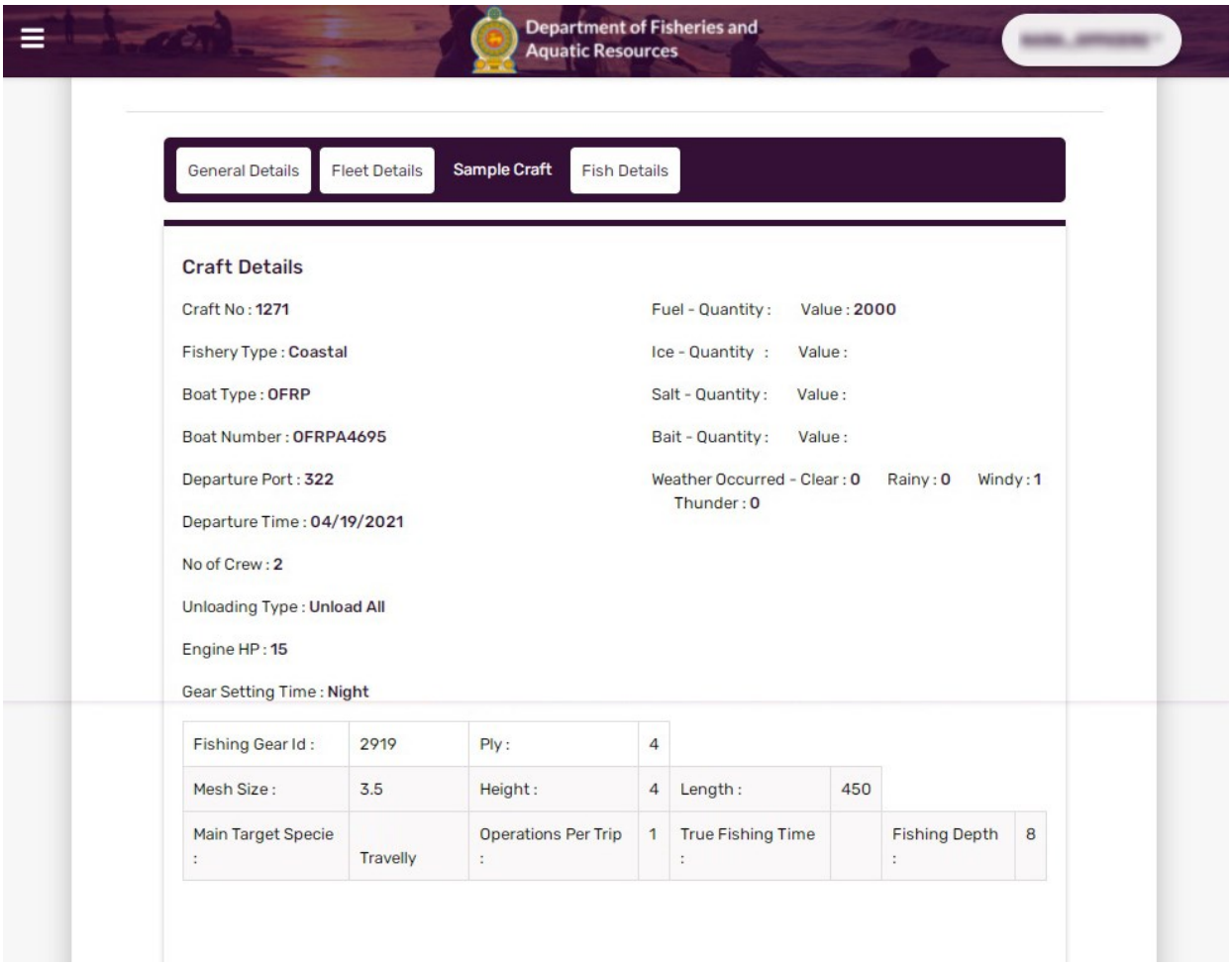


Mobile application interface 04- Sampling of fish/ Length weight Data

Web application dash board interface 01- basic data



Web application dash board interface 02- Technical data



Fishing Gear Id :	2919	Ply :	4				
Mesh Size :	3.5	Height :	4	Length :	450		
Main Target Specie :	Travelly	Operations Per Trip :	1	True Fishing Time :		Fishing Depth :	8