

Electronic Data Verification module with vessel tracking facility to combat IUU fishing

N.D.P. Gunawardane (M.Phil., ACIM, B.Sc.)

Assistant Director,

Department of Fisheries and Aquatic Resources Development,

New Secretariat Building, Maligawatta, Sri Lanka

ABSTRACT

During the last 15 years, there has been a phenomenal expansion in the size of the fishing fleet, number of persons employed as fishers. Sri Lanka as a country with historical back ground of having fishing as a livelihood option, is no exception. Thus controlling and monitoring of such fleet became a challenge to the fisheries management.

VMS is one of the high tech solution introduced for the high seas fleet and currently practiced by Sri Lanka, which make the management capable of monitoring the vessels on 24/7. Another aspect was the electronic log book system, recently introduced and this unique system facilitate to fishermen to record catch data using a user friendly front-end. The electronic logbook would ultimately build up the management support and the interactivity between all stakeholders. This project supposes a GPS enable mobile-based electronic logbook which automatically gathers all the boat route details and the catch location details. This programme is now in implementation stage as about 2,230 no of tablets are now introduced to multiday vessels with electronic log book system. The multiday fishing vessels operating in the international waters that are installed with transponders numbering 1500 will be mandatory to have this e-log book during the voyages to report catch data. Accordingly data reconciliation with cruise map of transponders and e-log system would provide more accurate and credible data on the fisheries. The regulation will be introduced on the same and the proposed regulation will provides sanctions to the violation related to e log entries.

Ministry of Fisheries and Aquatic Resources Development is having serious concern of vessel monitoring arrangement for the vessels operated within EEZ in order to make the enforcement effective even within the EEZ. This will enhance the quality of the measures carried out by the

management to combat IUU fishing. Since the VMS systems are costly and highly technical, it was proposed to adopt the cruise track which is automatically drawn by the electronic log system based on the location of tables as a vessel tracking tool for fishing vessels. It was also anticipated to develop a methodology to establish an online monitoring system by connecting tablets with satellite services.

Acknowledgement

Author would like to thank Mrs. W M M R Adikari, Secretary of Ministry of Fisheries and Aquatic Resources Development, Mr. M.C.L. Fernando, Director General of, Department of Fisheries in Sri Lanka for the guidance provided from the beginning of this programme. Appreciation and gratitude also extended to Professor. N D Kodikara, Dr. K D Sandaruwan and his team from School of Computing, University of Colombo, Sri Lanka for their assistance on developing the elog book system software. It is also acknowledge the contribution given by the field officers of Department of Fisheries, exporters, boat owners and fishermen for their valuable contribution and continuous support to adot to this new technology driven system.

1.0 Introduction

The fisheries sector plays an indispensable role in the economy of Sri Lanka contributing around 2.0% to the GDP (MFARD, 2015). However the figure really does not highlight the significant contribution of the fisheries sector as the livelihood component which provides direct and indirect employment to around 550,000 people has not been taken into account in computing contribution of the sector to the GDP. Fisheries industry significantly contributes to the food security and foreign exchange earnings of Sri Lanka as well. The Fisheries Sector generated SLR 34,797 Million (US\$ 231.9 Mn) export earnings in 2014 contributing 2% to the total export earnings of the country.

Total fishing fleet of Sri Lanka is about 65,000 boats (MFARD, 2015) and about 93% of the boats are coastal operated boats. About 7% of the boats perform fishing beyond the Coastal sea (MFARD, 2015). Except for a small number of large commercial operators with modern facilities, the fisheries sector in Sri Lanka comprises mostly of small scale operators. The poorest industry workers are the fishermen who use small traditional boats, fish workers, small scale vendors and low-paid workers of associated, often labour-intensive industries.

During the last 15 years, there has been a phenomenal expansion in the size of the fishing fleet, number of persons employed as fishers. Sri Lankan fisheries sector with historical back ground of having fishing as a livelihood option is no exception. Thus controlling and monitoring of such fleet became a challenge to the fisheries management. However the situation was changed dramatically after implementing the road map to revoke EU fish export ban, where most of the ingredients to combat IUU fishing is now in place as management measures after implementing same.

2.0 Latest strategies to combat IUU Fisheries in Sri Lanka

International fisheries management scenarios focusing more on controlling unreported fishing as most of the scientist believe that only the accurate data will assist to adopt proper fisheries management especially in multiday fisheries sector to overcome the situation such as fisheries

downfall in year 2050 due to species extinction (Science; The Washington Post; 2008). Non-engaging in proper reporting is considered as a “crime” and as a country signatory to the United Nations Convention on the Law of the Sea (UNCLOS), Sri Lanka should develop strategies to have comprehensive data collection process to avoid negative instances such as EU fish export ban. Un-reporting of fishing is always an issue with the compliance level of Sri Lanka (IOTC, 2014).

Log book and VMS is now become successful elements of fisheries enforcement process of Sri Lanka especially with reporting requirements. VMS system was introduced as a part of rapid road map to revoke EU fish export ban. The system itself capable of identifying and recording the cruise data of the vessels fishing in the international waters. This had huge impact of the behaviours of the fishermen at high seas. Currently about 1,500 multiday vessels equipped with VMS.

Log book system was introduced in year 2011 but it took about 04 years to cover all the multiday fleet. The log book process was enhanced during year 2015 and 2016 under the road map to revoke EU fish export ban. Log data is now linked with the data verification process; which verify the catch location mentioned in the log sheets using the VMS track data. The catch amounts mentioned in the log sheets is checked by the fisheries inspectors during the landing points. Currently there are about 4500 vessels with active log books covering all multiday vessels of Sri Lanka. Log and VMS data are now been used for the data verification system by high seas unit of Department of Fisheries (DFAR). Verification report is now a compulsory requirement for fish exports.

3.0 Challenges to establish satisfactory level of reporting by Fishermen

Although the current fisheries management system linked with log book and VMS verifications is capable of fulfilling the enforcement requirement, it was a costly effort which provide less benefit to the users (both DFAR and the fishermen) due to following shortcomings;

I. Issues on recording fish catch amounts and fishing grounds

- Exact location of fishing cannot be detect as fishermen is manually entering the positions in current paper log books. Most probably the GPS reading is a nearby location to the exact fishing location. There is errors related to the GPS recording and recording by the fishermen.
- Errors on recording of catch data for exact fish species can be occur. (as an example big eye tuna and yellow fin tuna is often mis-identified by the fishermen.

II. Absence of user friendly process

- Since it is required to print the log forms in all three languages (Sinhala, Tamil and English) paper log sheet become complicated and spaces to put data is very small.
- Fishermen are normally not good at paper works. So they tend to fill the log forms carelessly
- Boat departure procedures, log data collection and inspection at the point of landing is currently conducting and reporting through manual and paper based system. Therefore it is not possible to analyze these data effectively through one system.

III. Data collection and analyzing requirements

- Log and VMS data verification is currently been conducted by the officers on manual basis, which might result errors of verification and also a time consuming effort.
- Frequency of the log catch data entering and the VMS location recording data is different. VMS data is normally transmit in 04 Hour time interval. But log catch data is normally entered just after the operation is conducted. Therefore it is not possible to automate the verification.
- Automation of verification is possible if the cruise data can be transmitted in 30 minuet time interval. It will be a costly practice since the charge of transmitting one cruse point is about 0.8 USD. Thus currently the frequency is set to 04 hrs.

IV. Enforcement requirements

- Fining and sanctions has to be adopted with the cases with intended log data entry errors, which is a costly and time consuming process.
- It is possible to acquire vessel cruise data through the VMS system. However there is a need of using VMS track data for a next level of enforcement, such as identifying the exact catch location by analyzing the cruise shapes, speed and cause in a collective manner. This might assist on determine whether the log sheet data of particular location for particular fish type entered by the fishermen are correct or not, taking the verification in to another level. Another important requirement is to identifying possible transshipments instances using the VMS data. Having an improved log data system and VMS system might assist on using indirect evidences for the enforcement in fisheries law.
- Another issue of the current system is the lack of cruise recording system of EEZ operated vessels with no VMS installed. It is possible to determine whether vessels without international fishing license is violating the EEZ boundary if a cost effective can be fixed to record the cruise data of EEZ multiday vessels.

V. Inability to provide competitive advantages for fishers

- Although the above process can be considered as compatible with legal requirements and enforcement process, it is not capable of provide fishermen with a commercial advantage. Therefore fishermen have to involve with these process only to fulfil legal requirement without having any practical advantages.
- Most importantly, proper storing and analysing vessel cruise data and fish catch data of multiday vessels can assist to establish effective fish forecasting service for fishermen. Also it is possible to identify risk vessels by using cruise data history allowing DFAR to conduct inspections and enforcement process with more focus and in cost effective manner.

4.0 The electronic log system

Sri Lankan fisheries authorities introduced an electronic log system to avoid the issues related to log data. System it a GPS enable mobile-based electronic logbook which automatically gathers all the boat route details and the catch details. During the entire voyage, application records the position, orientation, acceleration and other required information in a given frequency. The skipper should enter the Catch details. However, the relevant catching locations are automatically recorded by the application. (IOTC-2016-WPDCS12-14). The system was developed in collaboration with the University of Colombo of Sri Lanka.

The system is now in place and Department of Fisheries and Aquatic Resources now in a process of introducing and popularizing the system among the fishermen. Up to date, 2,230 tablets, installed with the electronic log system (Skippers application) were distributed among the multiday boat owners. 15 District wise training trainings were conducted to make the system familiar with the boat owners. Training of the skippers is going on at the point of departure. Skippers were provided with a skipper hand book consist of all necessary technical requirement including step by step operational instruction in vernacular languages. Currently the paper log book and the elog system practiced in a parallel manner providing skippers with an adequate time to adopt to the system. Requirement of elog training was made mandatory for the skipper licenses. About 150 successful trips were conducted and the potential of the system to use in Sri Lankan multiday sector is well identified. Accordingly a draft regulation to make the elog system mandatory was submitted to the legal draftsmen department of Sri Lanka.

A description on the functions of elog system was presented and published at 12th IOTC Working Party for Data Collection and Statistics (IOTC-2016-WPDCS12-14).

5.0 Elog system as an enforcement tool to detect IUU activities

A study was initiated to evaluate the benefits of e-log book system using following three aspects;

(1) Reconciliation of e-log track using the VMS data,

It is proposed to employ the e-log tab with vessels with VMS (high seas vessels). E-log track and the VMS track data can be compared by using the latitude and longitude measurements recorded in certain time intervals in both systems.

(2) By developing the new approach, determination of the locations of catches using the shapes of the e-log track

(3) By identifying strategies to provide fishermen with economically benefitted ways of use the e-log book system, to conduct fishing efforts based on the analysis of pervious records.

However the administration realize the elog system can also use as an effective tool of enforcement. Therefore a separate application was developed to use in combine with the skippers application of elog system. This application will be operated by the fisheries officer, where he/she will be able to report the departure inspections as well as the arrival approval data through the same data base used by the elog system. Therefore the same system will support enforcement aspect as well the log data management aspects through following steps;

1. Departure approval with crew and equipment approvals through the system
2. Departure inspection and reporting
3. Cath confirmation at the point of the landing
4. Arrival confirmation with arrival details

Screen shots of front end application of the above application is given below (Figure1 to 3).

However the data fed by the fisheries officers can also use to estimate the overall effort levels by the Sri Lankan Vessels. It is also expected to incorporate the reporting of length weight data collection process with the same system enabling fisheries officers to provide the length and weight frequency data according to the requirements. This will assist to fulfill the sampling size required by IOTC on length weight data collection.

Accordingly it is expected reduce the paperwork's and save time and expenditure of enforcement and data collation. Gaps of data can be reduce due to the automatic information gathering of the catch locations.

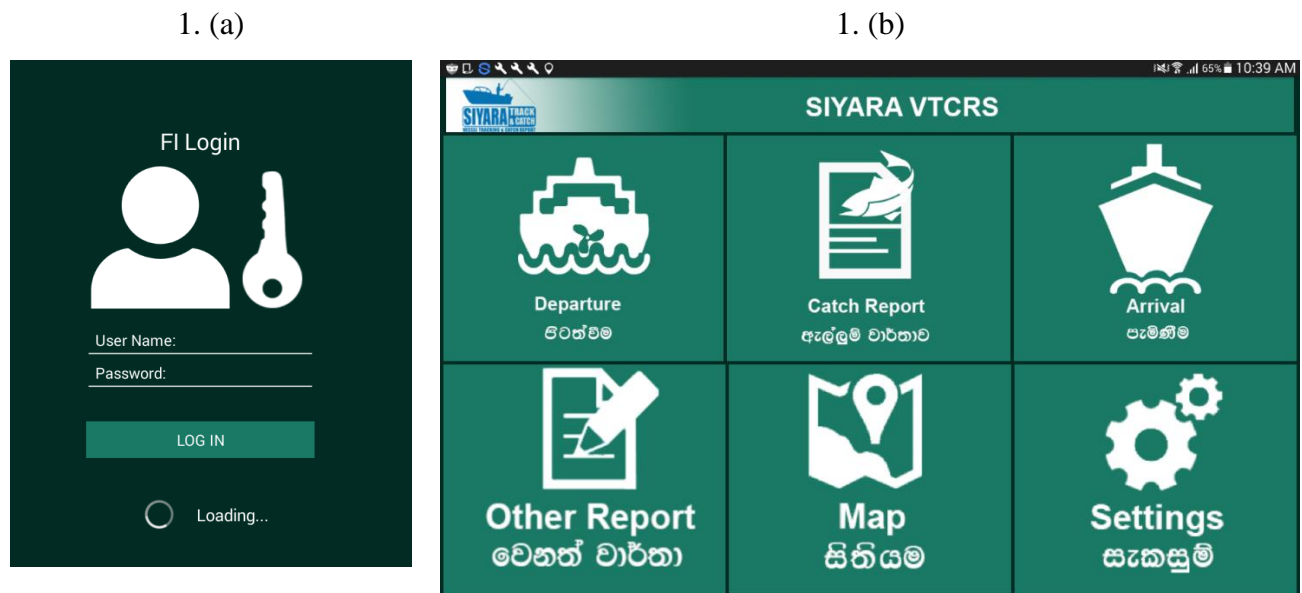
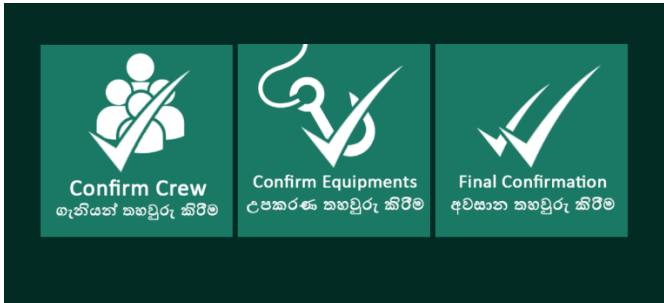
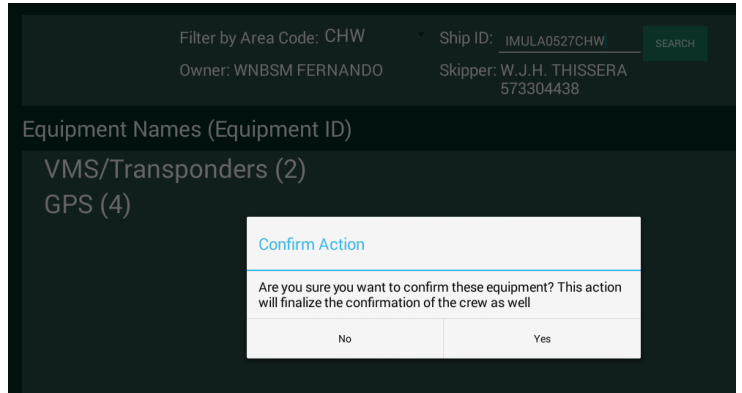


Figure 1: (a) Logging interface
(b) Main window of the FO (Fisheries Officer) application

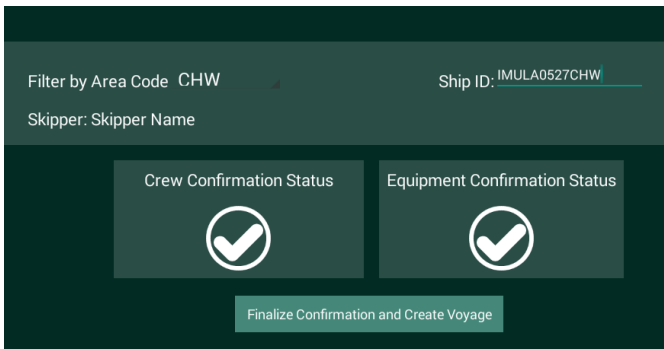
2. (a)



2. (b)



2.(d)



2. (c)

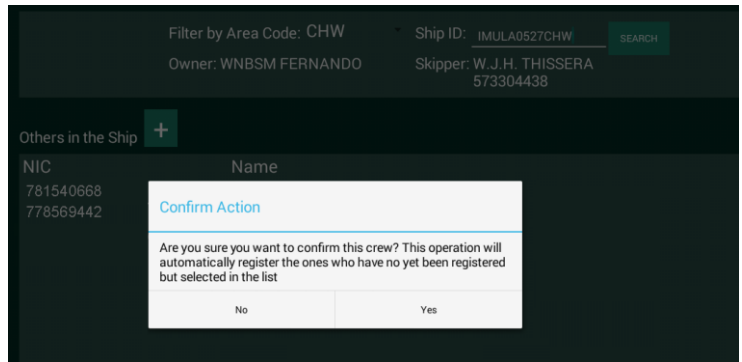


Figure 2: (a) Crew and equipment confirmation window
 (b) Crew confirmation prior to the departure
 (c) Equipment confirmation prior to the departure
 (d) Final Confirmation before departure

3 (a)

Area of Fishing: EEZ

Prohibited Fishing Gear on Board/නහනම් ආම්පන්න

Fire Extinguishers/ගිනි නිර්මම උපකරණ

Line Cutter & Dehookers/මසුන් නිදහස් කිරීමේ උපකරණ

Boat Insurance/මෝටර් රථ ජීවිත සහතිකය

Extra Fuel/අමතර ඉන්ධන ප්‍රමාණ දැනගත යන්නේද?

Displaying Registration Number/ලියාපදිංචි අංකය ප්‍රදර්ශනය කර තිබීම

Skipper Licence Number/නියමු බලපත්‍ර අංකය

Local Operation License/ලියාපදිංචි මෙහෙයුම් බලපත්‍රය

High sea Operation License/ජාත්‍යන්තර මුහුදේ මෙහෙයුම් බලපත්‍රය

Fishing Log book/බිටර් ලොග් පොත

Radio Call Sign/ඉ. වී. සංඛේත සටහන් කිරීම

VMS/යාත්‍රා නිරීක්ෂණ මානිෂ්ට්‍රය

Life Jackets/නියමිත ජීවිතාරක්ෂක කබා සංඛ්‍යාව

Gear Marking/පන්ත සලකුණු කිරීම

Other Actions Taken:

3 (b)

Set Arrival Details

District: Matara

Port: Devinuwa..

Date: 19-OCT-2017

Time: 11:34:48

3 (c)

SIYARA TRACK & CATCH				
CONFIRM CATCH				
Filter by Area Code CBO		Ship ID: MULA0114CBO	Voyage Number: 1	<input type="button" value="SEARCH"/>
Fish Type	Number of Fish	Weight of Fish	New Number/	New Weight/
මාළු වර්ගය	මාළු කුරි ගණන	මුළු බර(Kg)	නව ගණන	නව බර
Big eye tuna/ඇස්ගෙඩි කෙලවල්ලා(2)	15	899	15	899
Yellow fin tuna/කහවරල් කෙලවල්ලා(3)	63	2444	63	2444
Blue Marlin/නිල් කොප්පරා(7)	1	40	1	40
Sail Fish/කලපකා(10)	2	37	2	37
Spot Tail Shark/බාකළුමා(15)	1	20	1	20

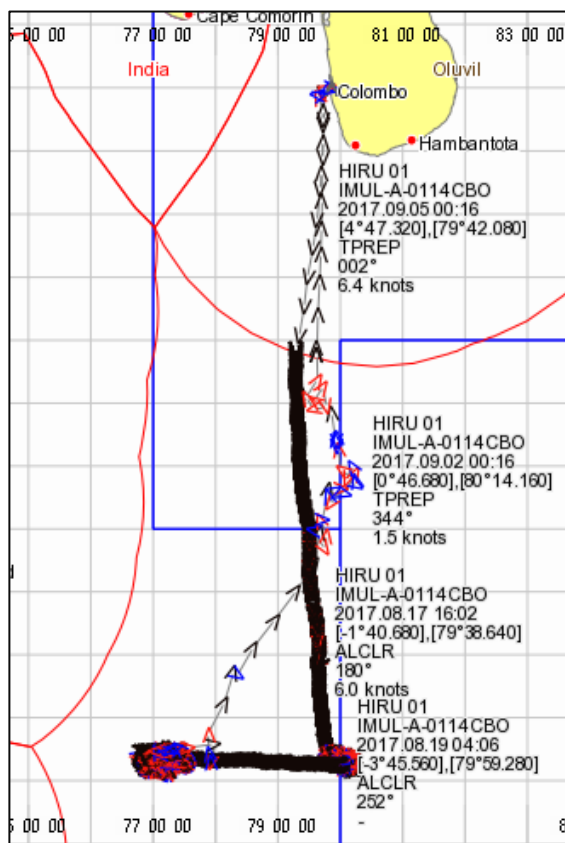
Figure 3: (a) Departure inspection reporting interface
 (b) Arrival Confirmation interface
 (c) Catch Confirmation at Arrival interface

The software of the fisheries officer application was developed by University of Colombo, Sri Lanka.

6.0 Electronic log system as an alternative to VMS

There is a concern about reducing the cost of enforcement. Overall cost of a system such as VMS is relatively high for a middle income sector such as fisheries. On the other hand there is a need of having a backup system to use as an alternative to VMS especially when the transponders/transceivers on board is malfunctioning and during the system failures as well. It was proposed to use the map generated by the elog system to identify the cruise of a vessel. Here; unlike the current VMS system elog cruise map uses the high frequency recording of the location though GPS readings. Frequency is 30 minutes capable of generating a smoother map that the VMS which gather information in 04 Hrs time intervals (Figure 4).

4 (a); VMS Track



4 (b); E log Track

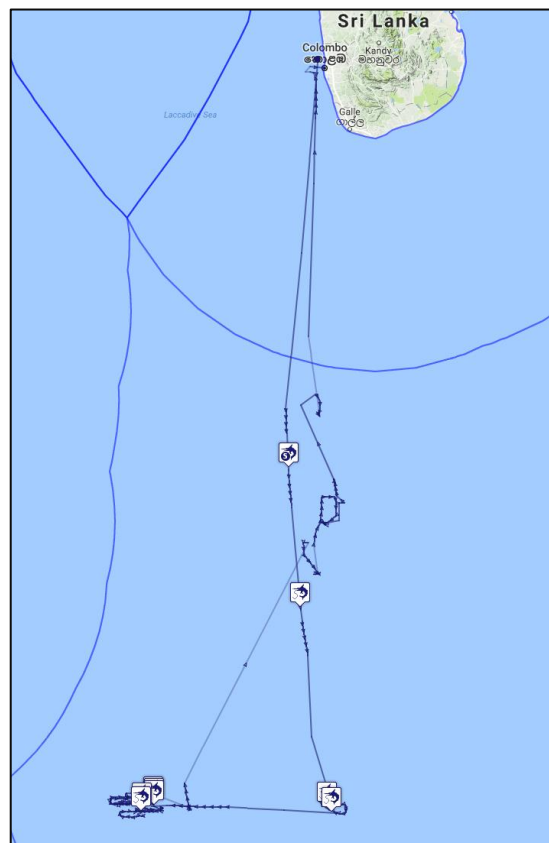


Figure 4: Compression of the cruise tracks (of IMUL-A-0114-CBO) generated by (a) VMS and (b) elog system of a fishing trip.

However a standard VMS should be capable of transmitting data on a real time basis, while the current e-log system is capable of transmitting the cruise data only after reaching to the GSM range which is about 25-30 Kms away from the land. Therefore it is proposed to link the e-log tablet with a satellite service enabling the same to transmit data through a communication channel. Encoding and decoding process can be incorporated with the data ensuring the security.

Here also the two way communication can be created allowing the boat owner to communicate with the vessels and to communicate with exporter or sellers using the filtered information provided by the main data base through internet.

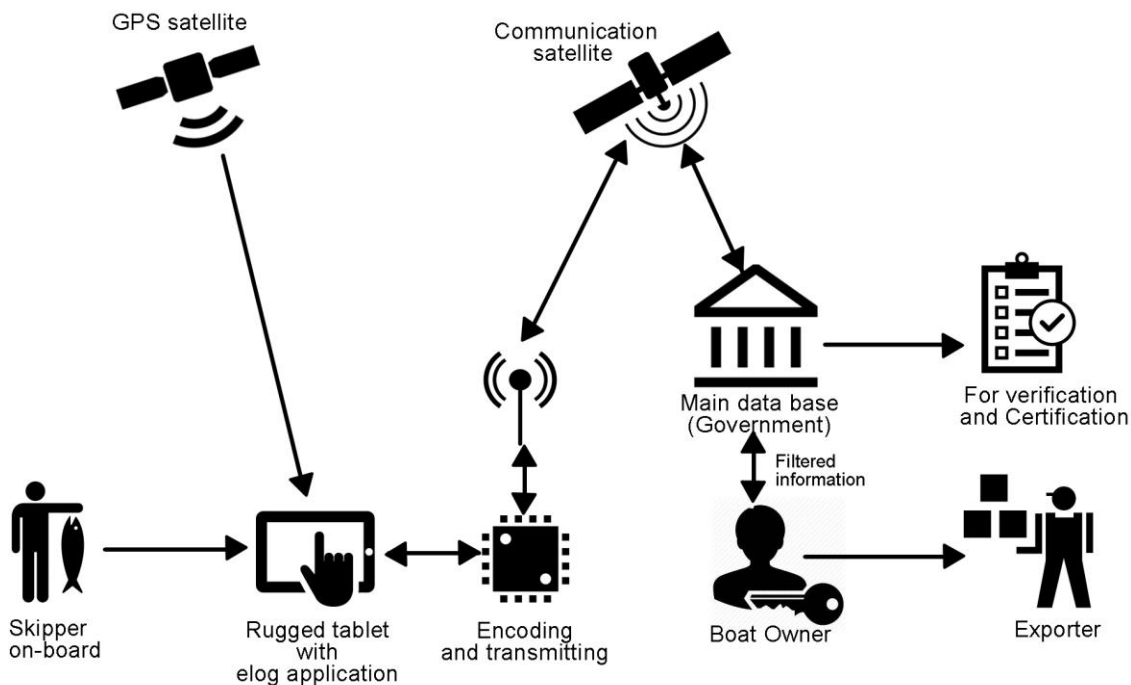


Figure 5: Proposed communication methodology to use the e-log system as an alternative to VMS.

7.0 Conclusions

“IOTC-2016-CoC13-Inf08” document provided details of 05 aspects of a comprehensive vessel monitoring system. It was noted that the system developed by Sri Lanka is capable of fulfilling most of the requirements (Table 1). However keep on board of the tablet during the fishing should make compulsory by adopting the proper regulation.

Table 1; Potentials of the elog system to fulfil the requirement of comprehensive VMS

Aspects	Capability of elog system
Real-time monitoring	Capable; if the system is integrated with a satellite service (Figure 4)
Electronic catch reporting (e-logs)	Capable; with automatic information gathering on the fishing location
Integrated catch documentation schemes	Capable; Can be incorporate with point of landing catch verification methodology through Fisheries Officers application
Product traceability	Capable; Since the data base is linked with the export and import verification procedures under the quality control division of DFAR
Management of observer programs	Potential; via linking the electronic observer system with fisheries officer application
Support for catch share or quota monitoring	Capable; via monitoring the catch history and linked with a departure restriction based on the pre-defined limits

It was also observed that the issues and shortcoming of the current system mentioned in the section 3.0 of this paper can also be overcome using the elog system (Table 2).

Table 2; capability of the elog system to address the issues of current fisheries management and enforcement

Aspect	Capability of elog system
Issues on recording fish catch amounts and fishing grounds	Capable; with the nature of automatic location recording
Absence of user friendly process	Capable; The interface of elog system is user friendly as the images and symbols incorporate with the data entering through skipper application (Ref; IOTC-2016-WPDCS12-14)
Data collection and analyzing issues	Capable; Since the database can be used to access the data through internet.
Enforcement issues	Capable; with the smooth cruise track available and the system is capable of act as an alternative VMS if the same can be incorporated with the satellite service to gather real time data
Incapability to provide competitive advantages for fishers	Facilities such as view the cruise details for the owners and to sell the fish through the web based component of the system is available. Additionally comprehensive analysis of the data can use as a fish prediction practice to reduce the cost of operation.

In conclusion; it can be determined that the elog system with a great potential to assist Sri Lankan authorities to combat against IUU fishing.

References

Beke, M., and Blomeyer, R., 2014. ILLEGAL, UNREPORTED AND UNREGULATED FISHING: SANCTIONS IN THE EU. Rafael Centenera, Policy Department Structural and Cohesion Policies, European Parliament.

Gallaway, B.J., Cole, J.G., , Martin, L.R., Nance, J.M. and Longnecker, M., 2002. An Evaluation of an Electronic Logbook as a More Accurate Method of Estimating Spatial Patterns of Trawling Effort and Bycatch in the Gulf of Mexico Shrimp Fishery, North American Journal of Fisheries Management. 787-809 pp.

Gunawardane, N.D.P., 2016. Electronic Logbook and Electronic Data Verification Module to enhance the standards of High Seas Fisheries Management process of Sri Lanka, 12th Session of the IOTC Working Party on Data Collection and Statistics. IOTC-Seychelles.

Gunawardane, N.D.P. and Fernando, M.C.L., 2016. Significant modifications of the administrative structure and procedures to revoke the EU Fish Export Ban. Symposium on Sharing Best Practices in Public Administration for Public Administrators – SLIDA (2016).

IOTC, 2016. Vessel Monitoring Systems and their Role in Fisheries Management and Monitoring, Control and Surveillance, 13th Compliance Committee of IOTC, IOTC-2016-CoC13-Inf08.

IOTC, 2014. IOTC Compliance Report for Sri Lanka. IOTC-2014-CoC11-CR25 Rev1[E]. IOTC Compliance Committee- 2014.

MFARD, 2015. Sri Lankan Ministry of Fisheries and Aquaculture Resources Development- Fisheries statistics-2015. Cited on 20th September, 2016. Available online at: <<http://www.fisheries.gov.lk/content.php?cnid=ststc> >

Nisansala, A., Kodikara, N., Keppitiyagama, C., Sandaruwan, K.D., Dias, K., Senadheera, R., Weerasinghe, M., Buddika, I., Lakshika, C., Dammika, N., Herath, H., Liyanage, N., Nirmal, I., 2015. ICT SOLUTION TO MINIMIZE ILLEGAL, UNREPORTED AND UNREGULATED (IUU) FISHING. International Journal of Research- Granthaalayah- A Knowledge Repository. Vol.3 (Iss.10): October, 2015

Robert Navigs, 2005. Fishing Vessel Monitoring Systems : Past , Present and Future," The High Seas Task Force, Paris, 2005

Sri Lankan Department of Fisheries and Aquaculture Resources, 2016. National Plan of Action to prevent, deter and eliminate Illegal, unreported unregulated Fishing. Cited on 20th September, 2016. Available online at: < http://fisheriesdept.gov.lk/v3/en_US/2016/02/10>

Youen Vermarda, Etienne Rivotb, Stéphanie Mahévasc, Paul Marchala, Didier Gascuelb, 2010. Identifying fishing trip behavior and estimating fishing effort from VMS data using Bayesian Hidden Markov Models, *Ecological Modelling* 221(2010)1757–1769.