

**Pilot Project on Electronic Monitoring System (EMS) for small
fishing vessels operating in Sri Lanka(2018-2021)**

Department of Fisheries and Aquatic Resources

Sri Lanka

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Introduction

The resolution 11/04 on Regional Observer Scheme (ROS) is adapted by the Indian Ocean Tuna Commission (IOTC) "to improve the collection of scientific data, at least 5% of the number of operations/sets for each gear type by the fleet of each Contracting and Cooperating Non-Contracting Parties (CPC) in the IOTC area of competence of 24 meters overall length and over, and under 24 meters if they fish outside their Exclusive Economic Zone (EEZ)". Accordingly, the Department of Fisheries and Aquatic Resources (DFAR) initiated the National Observer Scheme in Sri Lanka for vessels over 24m in length in 2014. This program continues under the supervision of the IOTC, and relevant reports are submitted to the IOTC as per Resolution 11/04 annually. However, more than 95% of the total fleet of Lanka consists of vessels less than 15 meters overall length. The size and the structure of these vessels constrain provision of minimum facilities for an on-board Observer, such as accommodation, working space and safety conditions. Therefore, the Sri Lanka was not able to implement the mentioned on-board observer program in the small vessels. Sri Lanka informed to the IOTC and other relevant parties the difficulties to comply with Resolution 11/04. As result, Sri Lanka proposed and presented a couple of alternatives to the IOTC to fulfil the requirements of this resolution for vessels less than 24m in length. In consequence, Sri Lanka is rated as fulfilling a partial compliance for the implementation of Resolution 11/04 in previous years' compliance reports .

Hence, DFAR and the IOTC signed (2018-10-23) the letter of agreement to develop EC-funded Pilot Project on EMS (Resolution 16/04 *On the implementation of a Pilot Project in view of promoting the Regional Observer Scheme of IOTC*:<http://www.iotc.org/cmm/resolution-1604-implementation-pilot-project-view-promoting-regional-observer-scheme-iotc>) and to support the implementation of the Regional Observer Scheme (Resolution 11/04 *On a Regional Observer Scheme*: <http://www.iotc.org/cmm/resolution-1104-regional-observer-scheme>) in Sri Lanka.

The objective of the project is to assist Sri Lanka to meet the obligations of IOTC in terms of monitoring fisheries activities at-sea through scientific data collection and reporting. The Project aims to support the current efforts by DFAR in establishing an at-sea scientific observer programme and supplement it through a number of activities, including:

- i. Facilitate the training of on-board observers through the development and delivery of a comprehensive and standardized training programme for observers, and observer programme managers (coordinators).

- ii. Develop electronic reporting tools to facilitate the data entry, processing, and validation of observer data.
- iii. Installation of an electronic monitoring system (EMS) on vessels where safety is a concern (i.e., vessels under 24 meters in high seas) to assess the feasibility of collecting observer's data via EMS and meet the mandatory coverage.

Initiation of EMS Pilot Project

As to guidance provided by the officials of IOTC Secretariat and Marine Instruments S.A.¹, DFAR communicated with local boat owners to implement this pilot project with their willingness and selected four longliners as a first step. DFAR facilitated the collection of specific technical information from boat owners. SG Holdings Lanka Pvt., Ltd² conducted the task briefed by Marine Instruments on the technical aspects of the EMS equipment. Marine Instruments had previously identified SG Holdings as their local partner, and they submitted information on the vessels selected to implement the project.

Officials of IOTC Secretariat, Technicians of Marine Instruments and AZTI visited Sri Lanka for a three day workshop from 24th to 26th September 2019. The IOTC-Sri Lanka EMS Pilot Project kick-off meeting included a harbour visit for the practical demonstration of installation and operation of the '*Electronic Eye V6*' EMS equipment onboard vessels. On land, a demonstration and overview of the EMS data processing and analysis software (Beluga and Medusa) was conducted. Finally, the team assessed the needs of Sri Lanka's pilot project and scheduled future steps on support and training.

DFAR received four sets of EMS Equipment and three desktop computers to implement the project. Boat owners, Observers and DFAR Officials participated on the first two days training at the DFAR conference hall and on 26th of September visited Negombo Fishing Harbour. On this day, Marine Instruments, SG Holdings and DFAR Officials judged the best way to proceed with the installation of EMS equipment on this type of fishing vessels. First two EMS sets were installed on two longliners by the first week of October. The other two were fully implemented by SG Holdings on another two longliners by the end of October at Dikkovita Fishing Harbour.

Eight external hard disks (two per vessel) were handed over to be installed and collect information from EMS systems on each individual vessel. Marine Instruments requested to send them back once the vessel

¹EMS manufacturer, supplier, and international technical services provider. <https://www.marineinstruments.es/>

²Sri Lanka technical services provider.

completed two fishing trips. The aim was to analyse the data before the next training session on mid-March 2020.

DFAR and SG Holdings sent by mail six hard disks collected from the four longline vessels to Marine Instruments containing some data. Meanwhile, two gillnet vessels were identified in order to install the two remaining sets of equipment received by DFAR on 21st May 2020.

However, project activities were not able to complete as scheduled due to the COVID-19 pandemic situation.

Installations

Among all Sri Lankan artisanal longline fleet, four vessels were selected for the pilot. Their main characteristics and fishing operation parameters were analysed in order to adapt the installation to the specific needs of the fishery. The following table contains the main parameters analysed during installation planning phase.

			PARAMETER	VALUE	
VESSEL DESCRIPTIO N	GENERAL		Vessel name:	xxxxxxNBO-(registration no) -xxxxxx	
			Vessel material (fiberglass, aluminium, ...)	FIBERGLASS	
			Overall length:	48 FEET	
			Cruising speed:	6 OR 7 KNOTS	
			Can water ingress into wheelhouse (Y/N)	NO	
			Is there a dry space into wheelhouse for installing NAS (Y/N)	YES	
			Can Electronic Eye unit be installed on the roof (? (Y/N)	YES	
	POWER SUPPLY		AC	AC 110V/220V (Y/N)	NO
				Voltage Measure:	-
				AC power available at wheelhouse? (Y/N)	NO
			DC	DC 24V (Y/N)	YES
				Voltage Measure (charging):	DC 25V OR 26V
				Voltage Measure (discharging):	DC 24V OR 25V
	GENERAL		Is the vessel grounded? (Y/N)	NO	

			Power supply stable (no cuts or unstabilities) (Y/N)	NO		
			Is the vessel power supply uninterrupted during operation? (Y/N)	NO		
			How long can be the power supply be removed during operation:	-		
			Is the vessel powered at port?	AT PORT GENERATOR AND DC MAIN SWITCH OFF		
VESSEL OPERATION	FISHING GEAR		Manual / Hydraulic	HYDRAULIC		
			Machinery list:			
			Number of line drums:	ONE		
			Hydraulic winch (Y/N)	YES		
			Crane (Y/N)	NO		
	FISHING OPERATION		LOGLINER	Setting speed:	04 OR 05 HOURS	
				Hauling speed:	05 OR 06 HOURS	
				Setting operation duration AVERAGE (hours):	06 HOURS	
				Setting operation duration MAX (hours):	08 HOURS	
				Hauling operation duration AVERAGE (hours):	08 HOURS	
			Hauling operation duration MAX (hours):	15 HOURS		
			GILLNETTER		Setting speed:	-
					Hauling speed:	-
					Hauling operation duration AVERAGE (hours):	-
					Hauling operation duration MAX (hours):	-
	GENERAL				Fishing trip length (days):	30 - 40 DAYS
			Fishing trips per year:	08 TRIP		
			Number of areas to cover Indoor:			
			Number of areas to cover Outdoor:			
	PHOTO CHECKLIST:			Vessel general view:	DSCN 3720/DSCN 3721	
Operation areas (all):				DSCN 3719		
Setting position:				DSCN 3718		
Hauling position:				DSCN 3715		
Sorting position:				DSCN 3710		
Machinery [ALL] (line drum, crane, etc):				DSCN 3711		
Antennas position.				DSCN 3714		

Table 1. Vessel parameters

The following diagrams show the chosen installation of EMS equipment on Sri Lankan fishing vessels during the project.



Figure1 – Installation general view

Sri Lanka - REM installation for artisanal longliners (3 cameras + 1 sensor + NAS)

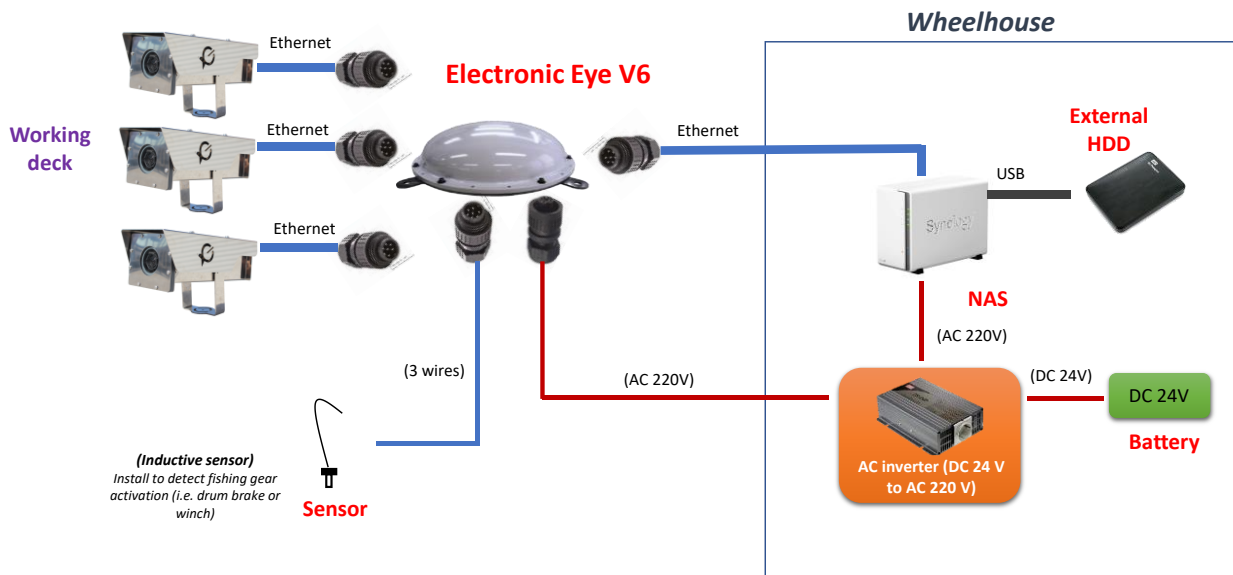


Figure 2 – Installation diagram

Three cameras were placed aiming to the working deck to record all fishing operations (setting, hauling and processing) from different angles and covering all the area of interest. Calibration marks were drawn during installation to allow measuring every specimen on images using Beluga data analysis software.



Figure 3 – Camera installation



Figure 4 – Calibration area

To ensure maximum GPS and Iridium satellite coverage, EM main unit was installed outdoor on top of the wheelhouse. Electronic Eye V6 main unit contains, apart from the GPS and the satellite transceiver, an internal 240 GB solid-state drive and backup batteries.



Figure 5 – Main unit installation

A network storage disk (NAS) with redundant 2TB storage capacity was placed in the wheelhouse. It was dimensioned to store several months of EM data and imagery on board. One external 2TB USB HDD was also connected to the NAS to allow DFAR inspectors EM data collection during any regular vessel inspection.

Additionally, a DC to AC power converter was installed on board to power NAS and Electronic Eye V6 system. This power inverter block was connected to the vessel 24 V battery, but grounding was not optimal due to vessel construction.



Figure 6 – NAS and AC/DC power inverter

After installations, the four vessels started to operate with the EM system powered on. Using Electronic Eye V6 satellite transceiver, vessel tracking and system health status could be monitored from the office. The following picture shows an example of the vessel tracking received.

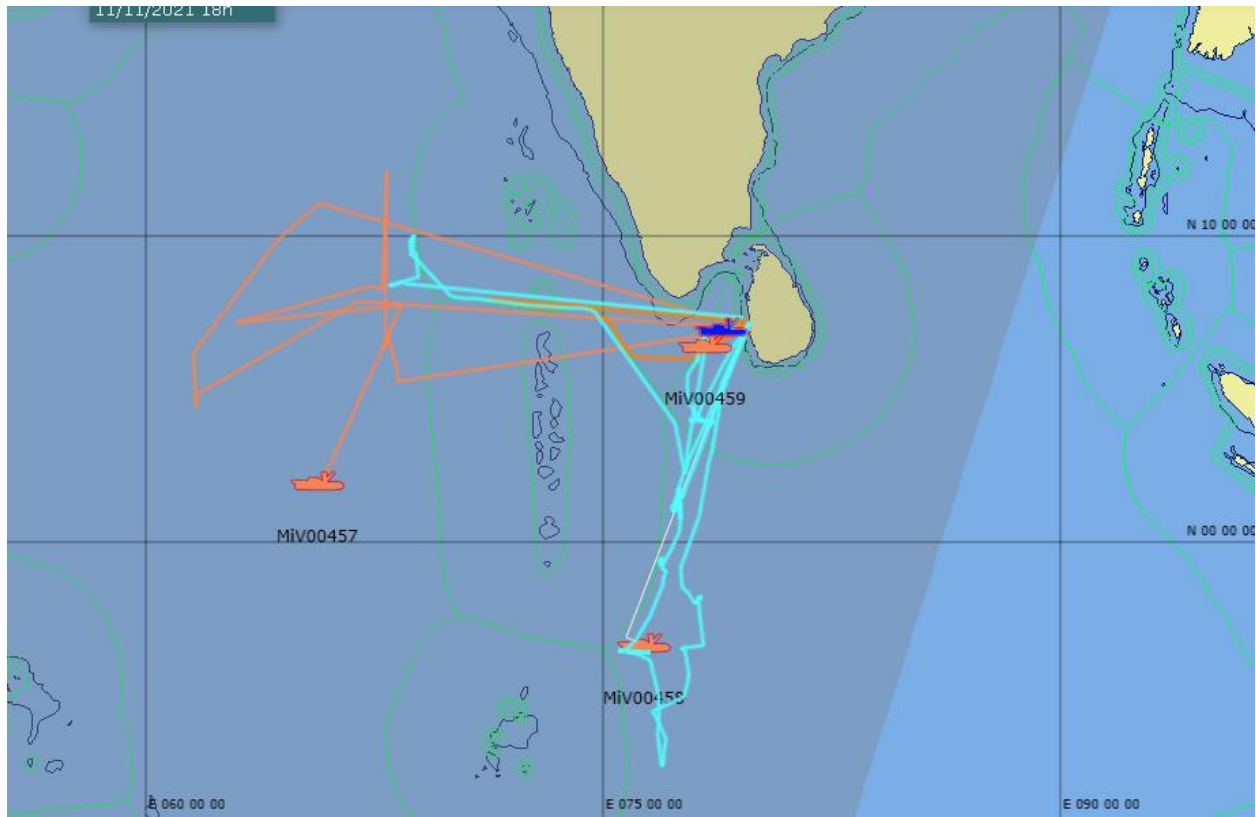


Figure 7 Satellite VMS tracking received

During operation, several power shortages were reported by the EM systems. After a power supply shortage, EM system continues its operation during up to 2 hours using its internal batteries and report an alarm using Iridium satellite constellation.

Fecha	Latitud	Longitud	Voltaje	Velocidad	Rumbo	Número foto	Modo foto
04/04/2021 00:37	06°54.98'N	78°54.46'E	16,6 V	3,7 kn	203 °	699	Rápido
03/04/2021 23:51	06°57.54'N	78°55.58'E	18,0 V	1,7 kn	209 °	386	Rápido
03/04/2021 21:37	07°00.78'N	78°57.40'E	24,8 V	0,6 kn	101 °	321	Lento
03/04/2021 21:12	07°00.83'N	78°57.17'E	24,6 V	2,1 kn	048 °	311	Lento
03/04/2021 00:42	06°32.33'N	78°25.28'E	17,9 V	4,0 kn	017 °	391	Rápido
02/04/2021 22:25	06°23.73'N	78°22.64'E	24,8 V	4,4 kn	015 °	324	Lento
02/04/2021 21:12	06°18.52'N	78°21.25'E	24,6 V	4,3 kn	016 °	289	Lento
02/04/2021 18:26	06°06.96'N	78°17.97'E	24,8 V	4,7 kn	009 °	206	Lento
01/04/2021 02:24	03°00.17'N	77°46.69'E	16,6 V	5,2 kn	005 °	795	Lento
01/04/2021 00:25	02°49.95'N	77°45.80'E	24,8 V	4,8 kn	004 °	447	Lento
01/03/2021 21:12	02°34.51'N	77°44.64'E	24,6 V	4,6 kn	006 °	353	Lento
01/03/2021 20:24	02°30.88'N	77°44.25'E	24,8 V	4,7 kn	006 °	330	Lento
01/03/2021 16:25	02°12.29'N	77°42.21'E	24,8 V	0,6 kn	169 °	210	Lento
04/03/2021 19:23	03°53.26'N	77°22.03'E	17,7 V	0,3 kn	144 °	276	Rápido

Figure 8 Health status example (power failures reported when less than 24V are detected).

The reason of the power cuts detected was addressed by DFAR and SG Holdings. There were two complaints after the first fishing trips from skippers and boat owners, namely: a) that their communication system was severely disturbed by the EMS equipment (jammed communications and unidentified noise were reported); b) unusual battery drainage. Therefore, the Sri Lanka Fisheries Department informed about the issues to Marine Instruments, and they suggested to undertake appropriate adjustments to address the issue on next installations.

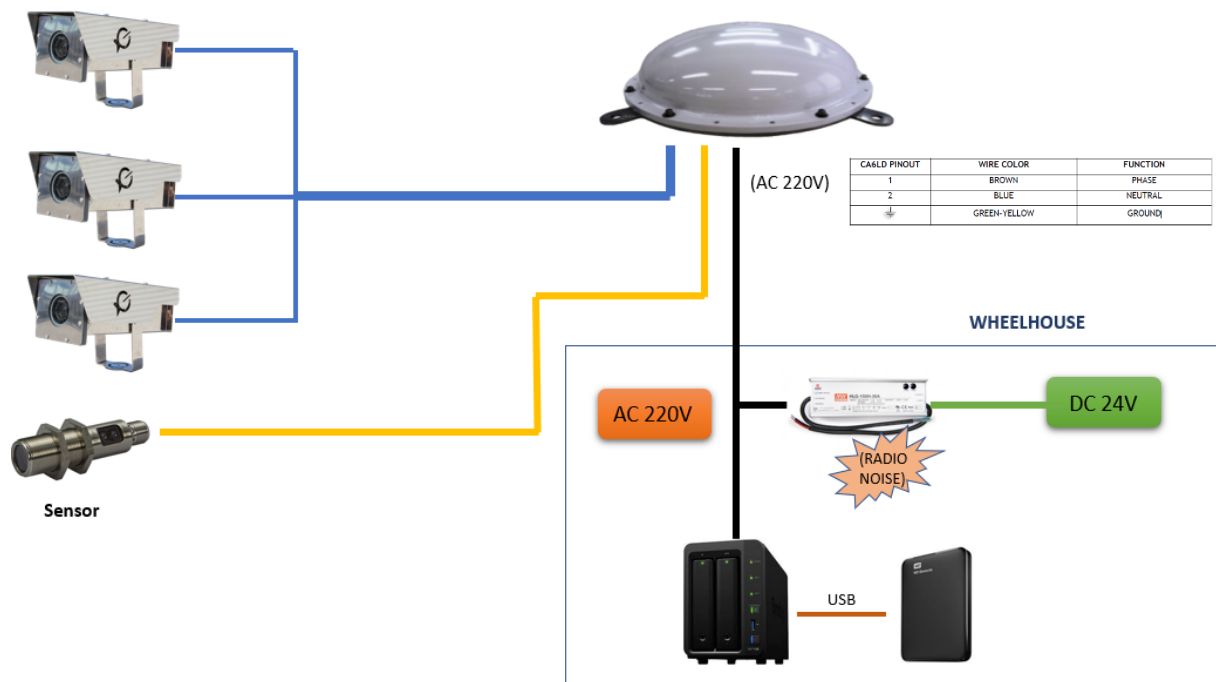


Figure9 Initial installation diagram (AC power)

Marine Instruments proposed solution is based on two action points:

- RF noise can be highly reduced or suppressed by eliminating the DC to AC power inverter and powering the EM system with 24V DC.
- Power consumption can be reduced up to 30 W by removing the NAS and connecting the external USB HDD directly to the Electronic Eye V6 unit. Without the NAS, EM main unit with 3 cameras power consumption will be below 30 W.

Retired NAS systems can also be installed in DFAR offices and used for data storage. This way, as an additional benefit, long term EM data storage will be centralized in DFAR premises instead being distributed among all vessels.

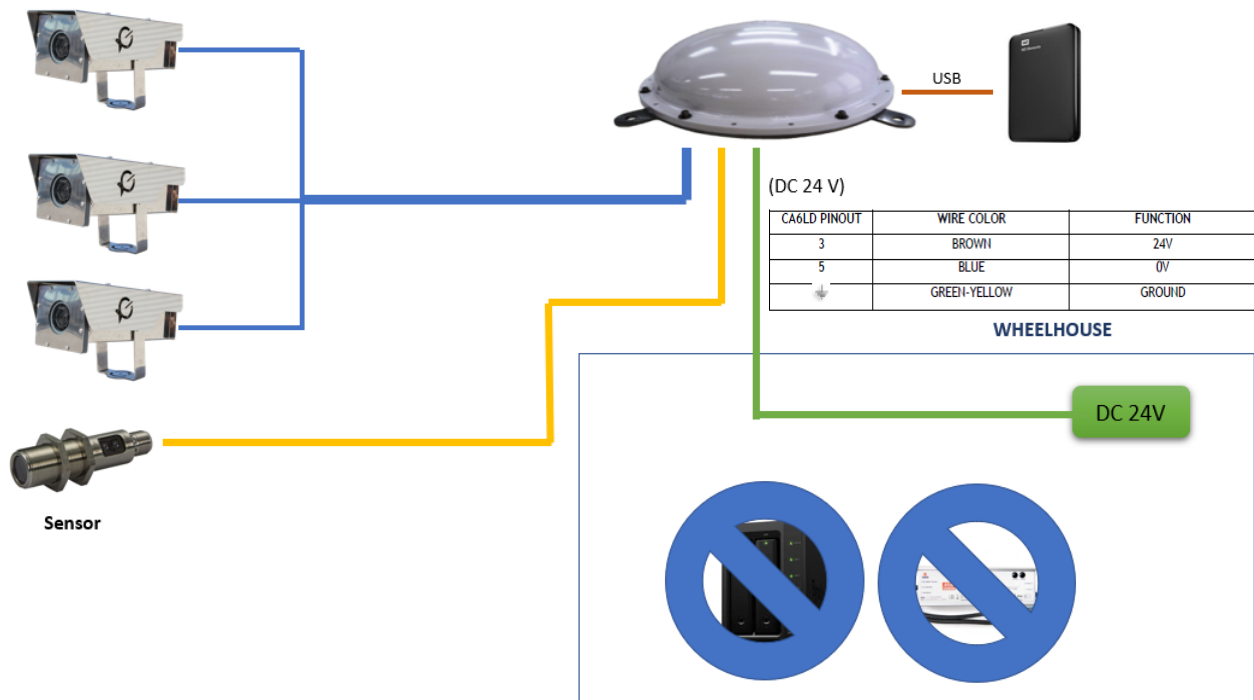


Figure10 New installation diagram proposed (DC power)

Data analysing and Training course

In December 2019 several hard drives belonging to the four longline vessels participating in the pilot study were analysed for the first time. Unfortunately, the volume of data (i.e., fishing days monitored) contained was not as expected. Table 2 below shows the EM records' summary by vessel.

Boat name	Harbour	Days	Data
Queen Mary 3	Negombo	41	54.7 GB
Shiyale Ameesha 1	Negombo	1	206 MB
Ishandi Duwa 6	Dikkovita	4	8.7 GB
Thilina Putha	Dikkovita	3	500 MB

Table 2. Summary of the EM records in the four longline vessels

The issues stated in the previous section led the equipment to be switched off systematically during fishing operations and/or permanently. None of the vessels recorded a full day, not even a full fishing operation (including complete setting/hauling). However, even if it was partial information, the EM records collected in one of the boats (Queen Mary 3) was sufficient to: i) carry out training in the use of the analysis software and database; ii) as well as to have a general idea of the capabilities of the system in this fleet in a hypothetical continuous use without interruptions.

The training took place in two phases: one before COVID19's outbreak, the other just before reaching the project's deadline. A first session was conducted at the beginning of the project focussing at demonstrating the use of the EM records' analysis software (i.e., Beluga). It was organized at DFAR facilities. In the absence of Sri Lanka's fleet raw data (EM records), examples of other EM programs including other fleets (purse seine and longline) were shown.

Due to the inability of conducting physical training with the prevailing pandemic conditions the second stage of the training was planned to conduct virtually in end of September 2021 using *Jitsi Meet*³ and *AnyDesk*⁴ software. The first was used as a training virtual room, and the second was the tool that aided the trainers to interact with the workstations of the participants. A total of 8 observers, their coordinator and three DFAR officers participated in four training sessions, organized in groups of three as shown in Figure 11.

³ <https://jitsi.org/jitsi-meet/>

⁴ <https://anydesk.com/en>

EMS Data Analysis Training - DFAR 2021

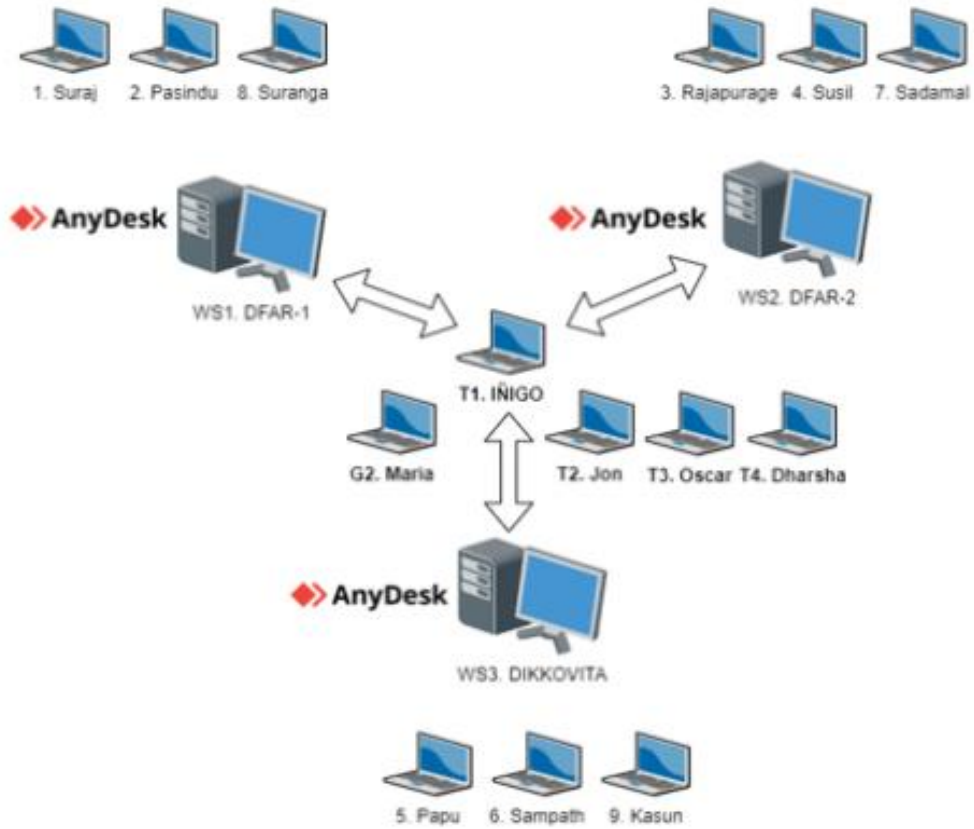


Figure 11. Organizational scheme of the online training sessions

During the training, participants were able to view and practice the software (BELUGA), data entry software (Medusa), as well as data exportation tools (figure 12).

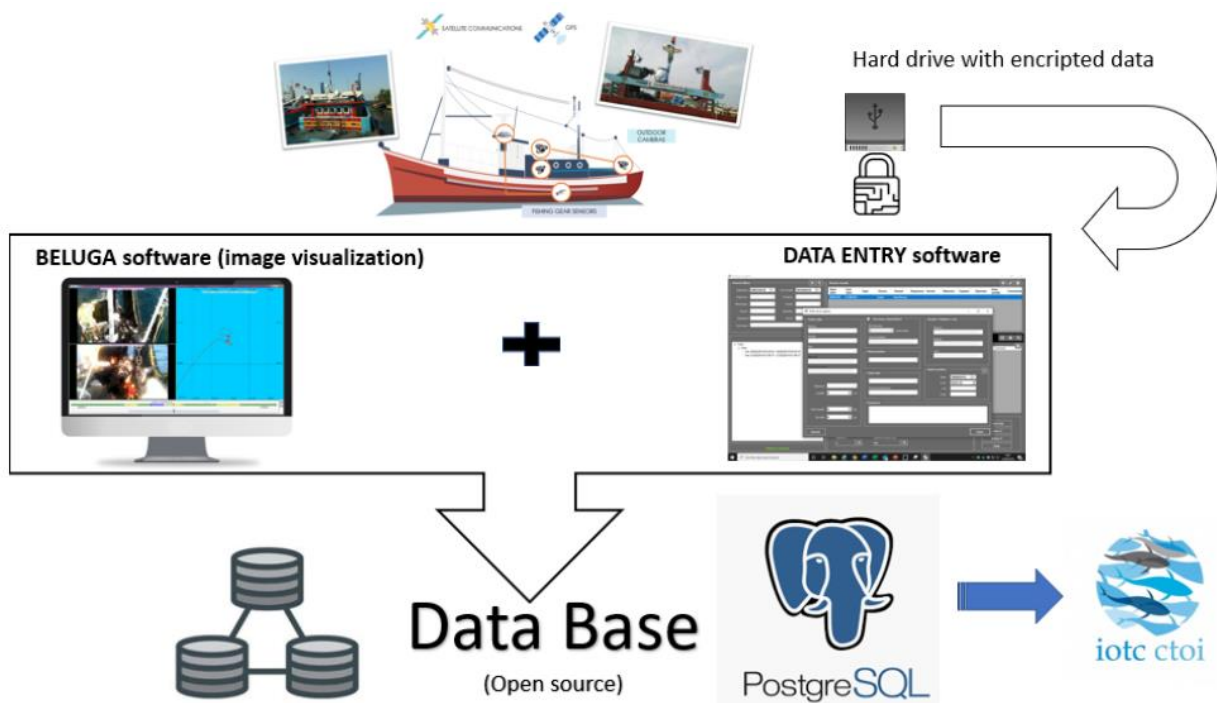


Figure12. Software use during the EM record and EM data flow from the vessel (source) to the IOTC (end user).

Issues Identified

- Expected outcomes from the project were not able to achieve as scheduled due to the unavoidable reasons.
- The installations used in this project (E-eye V6 with all its components) have presented issues when installed in the typical Sri Lankan wooden part of vessels. Vessels' batteries capacity was not as expected, and the equipment presented interferences with other devices installed on board. The solution to this problem has already been identified, but the inability to travel prevented equipment provider technicians to fix the installed units.
- Despite the difficulties, and the inability to carry out the training in person, 8 observers as well as their coordinator have been trained in the use of data analysis and input software. However, dry observer were not able to get proper training on data analysing due to inability of conducting physical training program. Software was installed only three desktop and three Observer could only trained by them self and rest of others was able to observe.

- The images and data obtained have been scarce and partial. In addition, only belonging to a single boat. However, they indicate that the EM could be a valid tool to complete several of the IOTC ROS data fields. As an example, presence/absence of special equipment or machinery; start setting date, time, and position (EMS battery allows to register data for about an hour after the equipment has been disconnected); presence/absence of shark lines; mitigation measures adopted (night and side setting); bait type; and species and fate of the reviewed catch. Further on, implementing a fully capable system, other variables, such as total number of hooks and % of used bait type could be monitored even if on the present pilot project cannot be identified.
- Boat owners and skippers complained on technical issues such as communication disturbance when switching on the EMS and excessive battery drainage.

Further Development

Sri Lanka was able to initiate and trial EMS in the small vessels under this pilot project. Sri Lanka looking forward to receive further assistance from IOTC to complete some of the tasks to see the feasibility of EMS for the small fishing vessels of Sri Lanka as an alternate to the on-board human observer.

There are two sets of EMS equipment remained at DFAR to be installed. DFAR need assistance to install them and apply suggested technical solutions (by Marine Instrument) to avoid communication issues raised by the skippers.

Training of understanding and the familiarization of the EMS by Sri Lankan Observers (Dry Observers) and boat owners need more training and awareness. At the same time, technical team of the EMS need to understand the Sri Lankan type vessel structure and its technical aspects for installation of EMS.