



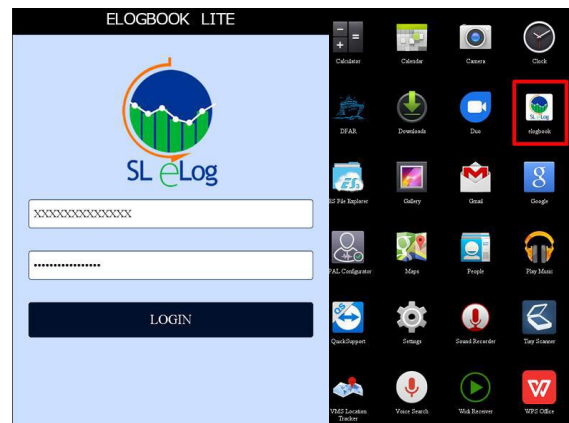
The introduction & evaluation of a 'Crew-based' (Local) Observer Programme on 30 Sri Lankan longline vessels

A sub project of the Sri Lankan longline fishery improvement project

FINAL REPORT

NEW VENTURE FUND SUB GRANT (SEA-pelagikos-NVF-06012018)

updated on 19th September 2019



implemented through

Department of Fisheries & Aquatic Resources Development

Information Technology Unit – Colombo / District Fisheries Offices in Chilaw and Negombo

in collaboration with

Mahawewa Longline Boat Owners' Association

Negombo Longline Boat Owners

co-financed by

SEAPACT

researched & developed by

pelagikos pvt ltd

on behalf of

Sri Lankan Longline Fishery Improvement Project



Multi-day Boat
Owners' Associations



Abbreviations

ALB	Albacore	kg	Kilogram
App	Android Application	LEC	Black escolar
BET	Bigeye tuna	NBO	Negombo
BIOT	British Indian Ocean Territories	OTH	Other
BLM	Black marlin	PLS	Pelagic stingray
BSH	Blue shark	POA	Atlantic pomfret
BUM	Blue marlin	PSK	Crocodile shark
CCTV	Closed-circuit television	RMJ	Spinetail mobula
CHW	Chilaw	RMM	Devil fish
DBO	Common bottlenose dolphin	RMT	Chilean devil ray
DFAR)	Department of Fisheries & Aquatic Resources	SEAS	Seafood Exporters' Association of Sri Lanka
DFO	District Fisheries Office	SFA	Sailfish
DKK	Leatherback turtle	SKJ	Skipjack tuna
DOL	Dolphinfish	SMA	Shortfin mako shark
EC	European Commission	SWO	Swordfish
EDU	Electronic Data Unit	TIG	Tiger shark
EEZ	Exclusive Economic Zone	VMS	Vessel Monitoring System
<i>eObserver</i>	Electronic observer	WAH	Wahoo
ETP	Endangered, Threatened and Protected	YFT	Yellowfin tuna
FAL	Silky shark		
GBA	Great barracuda		
GoSL	Government of Sri Lanka		
GPS	Geographic Positioning System		
GUT	Indo-pacific king mackerel		
IOTC	Indian Ocean Tuna Commission		

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Executive Summary

Crew-based (Local) Observer Programme

The Indian Ocean Tuna Commission (IOTC) adopted a Resolution on a Regional Observer Scheme in 2011, known as Resolution 11/04. Resolution 11/04 sets out the minimum independent data recording requirements for fisheries for tuna and tuna-like species in the IOTC area. Uniquely in the Indian Ocean, Sri Lanka has more than 1,500 fishing boats measuring less than 24 m in length overall, registered with the IOTC to fish beyond Sri Lanka's exclusive economic zone (EEZ). Due to the small size of these vessels and the health and safety concerns associated with the deployment of independent observers on such small vessels, Sri Lanka to date has been unable to meet the IOTC's minimum independent data reporting requirements for its beyond EEZ fishing fleet under Resolution 11/04.

Two options – a Crew-based (Local) Observer Programme and an Electronic Observer Programme - have been proposed to collect minimum independent trip, gear, set, catch and scientific data from Sri Lanka's less than 24 m multi-day fishing fleet. A sub project under the Sri Lankan Longline Fishery Improvement Project (FIP) was launched to investigate the potential of a **Crew-based (Local) Observer Programme** in 2018. The sub project was implemented through the Department of Fisheries & Aquatic Resources (DFAR) Electronic Data Unit (EDU) in Colombo and the District Fisheries Offices (DFO) in Negombo and Chilaw. The sub project was implemented in collaboration with the multi-day boat owners' associations in Negombo and Chilaw.

The sub project was co-financed by **SEAPACT** a group of leading North American Seafood Companies, which aim to improve the sustainability of global seafood by using the collective power of like-minded North American seafood companies to improve fishing and fish farming systems globally. The sub project was designed and implemented by pelagikos pvt ltd on behalf of the members of the Sri Lankan longline FIP. The Sri Lankan longline FIP was initiated by the Seafood Exporters' Association of Sri Lanka (SEASL) in 2017.

Officers of the DFO in Negombo and in Chilaw proposed 33 boat owners / skippers from Negombo and Chilaw for the Pilot Phase of the Crew-based (Local) Observer Programme. Skippers and one or more members of the crew from 20 multi-day fishing vessels of less than 24 m were selected by the DFO and trained to collect trip, gear, set, catch and scientific data using tablets (18) or digital cameras (02). The Pilot Phase of the sub project started on September 2018 and was completed in March 2019. Trip, gear, set, catch and scientific data was collected at the harbor during a debriefing session conducted by the DFO officers in Negombo and Dikowita harbours between 5th November 2018 and 17th January 2019. Information and data was then transferred from the DFO to the DFAR's Information Technology Unit in Colombo for processing. The processed information and data were uploaded to a database for analysis by researchers at pelagikos pvt ltd in March 2019.

The results of the Pilot Phase demonstrated that **verified catch data and other scientific data related to the fisheries for tuna and tuna-like species in the IOTC area of competence** could be collected from Sri Lankan multi-day boats measuring less than 24 m length overall, in accordance with IOTC Resolution 11/04.

The success of the Pilot Phase led to a request from pelagikos pvt ltd to SEAPACT to extend the project period by three months, to enable the sub project to run a 2nd Phase, improving on the lessons learnt during the Pilot Phase. A no cost extension was approved and the 2nd Phase of the Crew-based (Local) Observer Programme commenced in April 2019

During the 2nd Phase of the Crew-based (Local) Observer programme, the improved protocol enabled the DFAR to collect 34 IOTC Observer data requirements for fisheries for tuna and tuna-like species related to the trip, the gear, individual sets and catch and scientific data pertaining individual fish and other captured species, including ETP species caught per set. In total the improved protocol enabled DFAR to achieve **98% compliance** with IOTC requirements for independently verifiable catch data and other scientific data related to fisheries for tuna and tuna-like species in the IOTC area of competence, for 34 IOTC Observer data requirements for three sets per trip.

The remaining minor data deficiencies (2%) associated with the protocol include

- (i) Estimating the length of billfish (where the Observer often failed to take an image of the whole fish);
- (ii) Estimating the length of other captures species that were discarded (dead or alive) without being brought onboard the vessel (there is no measuring in these images) and
- (iii) date and time data deficiencies due to the malfunctioning of the tablets issued by DFAR, which forced two of the Crew-based (Local) Observers to use smartphones to collect digital data during their trip.

The initial success of the Pilot Phase and improvements demonstrated during the 2nd Phase are a consequence of the DFAR officers and staff working in close collaboration with boat owners and skippers through the department's DFO in Negombo and Chilaw and harbour offices in Negombo and Dikowitta and the development of a new, simple, low cost, independent observer protocol. The Crew-based (Local) Observer protocol combines existing, mandatory logbook information and data, semi-structured post-harvest interviews and independently verifiable, electronic data collected using digital cameras, tablets and smartphones.

The results of the Crew-based (Local) Observer programme (Pilot and 2nd Phase) demonstrates that ***independently verifiable catch data and other scientific data related to fisheries for tuna and tuna-like species in the IOTC area of competence*** can be collected from Sri Lanka's multi-day boat longline fishery where vessels measure less than 24 m length overall, in accordance with IOTC Resolution 11/04.

The cost of data collection was LKR 30,000.00 (US\$ 166.00) per trip, plus the cost of briefing, debriefing, data analysis and reporting.

Six recommendations are proposed to further improve the accuracy / veracity of information and data collected using the Crew-based (Local) Observer protocol before the next deployment of Crew-based (Local) Observer. The six recommendations are as follows

Recommendation I Skippers and crew selected as Local Observers need to be given **written instructions with images** describing the number of sets from which they need to collect data; guidance on how to take an image of the full length of the fish (notably billfish) and a reminder of the need to take at least one image of every fish and other captured species retained / discarded for the entire set.

Recommendation II **A method to estimate the length of discarded (dead or alive) fish and other captured species** that are not brought onboard the boat is required to enable DFAR to collect length data for these species.

Recommendation III Skippers and crew selected as Local Observers need to be given **training about de-hookings and line cutters** to ensure more fish and other captured species that are caught can be discarded alive

Recommendation IV Skippers and crew selected as Local Observers must be issued with **digital cameras** as this is the most effective and reliable way to collect electronic information and data about the catch.

Recommendation V The payment of a **financial incentive per trip** is necessary to ensure the successful submission of the Crew-based (Local) Observer Programme Record Book and images for three sets per trip

Recommendation VI Ten to fifteen skippers should be selected and appointed as **‘Local Observers’** under each DFO within which there is a multi-day boat EEZ and or beyond EEZ fishery. The **‘Local Observers’** will be required to collect IOTC Observer data from not more than three to five trips per year.

Electronic Logbook (eLogbook Lite) Android Application

In April 2015, Sri Lankan fish export to countries in the European Union was banned by the European Commission (EC), due to the prevalence of illegal, unreported, and unregulated fishing in Sri Lanka's offshore (EEZ) and high seas (beyond EEZ) fisheries¹. A total of 56 violations of the IOTC's management, monitoring, control and surveillance requirements were produced by the EC to the Government of Sri Lanka (GoSL) in support of the ban. Key violations included no records of the location (GPS points) of the fishing grounds within and beyond Sri Lanka's EEZ; inadequate or no records of the catch per boat; the absence of mandatory trip and gear data; no details of the non-target species caught and discarded dead or alive.

To address these violations and regain access to key European markets for Sri Lanka seafood² the GoSL immediately initiated the introduction of a real time satellite based Vessel Monitoring System (VMS) for Sri Lanka's fisheries operating beyond the EEZ and a Logbook in which skippers could record the mandatory trip requirements for trip, gear, set and catch.

The initial Logbook system introduced in 2015 was a paper-based, manual system which is still in use today. A number of issues continue to reduce the effectiveness / accuracy / veracity of the paper-based Logbook system. In 2017 the DFAR introduced a Rugged Tablet T800RG with an electronic Logbook (eLogbook Lite) application (app) to address the issues continue to reduce the effectiveness / accuracy / veracity of the paper-based Logbook system. Three issues compromised the effectiveness of the eLogbook Lite system introduced by the DFAR in 2017. (1) The tablets were not accurate in receiving satellite signals at sea to give reliable and accurate GPS locations for the setting and hauling points during each fishing trip. (2) The tablets were too big to handle in the boat and charging the tablets at sea proved to be problematic. (3) Boat owners who had not received a free tablet under the 2017 programme were unwilling to buy their own tablet to participate in the eLogbook Lite programme.

In August 2019 the DFAR proposed and the Crew-based (Local) Observer sub project agreed to support the development of an eLogbook Lite android application for smartphones. The DFAR proposed that the application would enable the DFAR to collect electronic trip, gear, set and catch data requirements of the IOTC's; provide accurate GPS data for the fishing activities of both EEZ Only registered (without VMS) and beyond EEZ registered vessels (with VMS) and enable the DFAR to integrate digital trip, gear, set and catch data with the digital scientific data collected through the Crew-based (Local) Observer protocol.

¹ <https://www.scientificamerican.com/article/eu-to-ban-fish-from-sri-lanka/>

² <https://www.undercurrentnews.com/2015/06/29/sri-lanka-seafood-exports-drop-41-on-eu-ban/>

The Android app developed by Hynet Pvt Ltd between September 2018 and August 2019 is a mobile app designed to replace the tablet application (2017) and the traditional paper logbook introduced by the DFAR in 2015. The app was designed to maximize the skipper's productivity by providing tools to assist in automating the process of entering full trip, gear and catch data during the fishing trip, which would otherwise have to be performed manually (at the end of the voyage).

After the data has been uploaded to the server, it is verified online by the Harbour Office by logging into the DFAR's database. Following verification, the data is then certified online by the Assistant Director of High Seas Division of DFAR. The final data verification for exported fish items is done by the DFAR officers of the DFAR's Bandaranayke International Airport Unit, before the fish caught during the trip are exported.

The eLogbook Lite app is currently being rolled out by the DFAR the installation of the app on skippers' smartphone is being undertaken on an individual basis by the DFAR officers of the EDU and Harbour Offices. In the future the DFAR hopes to add the app to the Google Play Store, so that skippers and boat owners can download the app themselves. In August 2019 Harbour officers in 13 out of the 17 multiday boat fishing harbours began introducing the app to selected skippers in their respective harbours. The EDU is in the process of awarding marks for each Harbour, depending on the progress that they are making towards the introduction of the eLogbook Lite mobile app.

As of the 30th August 2019, 1,030 eLogsheets have been prepared by the IT Division of DFAR by using e-Log Book mobile application. The eLogsheets includes video of a skipper releasing a turtle recorded by one of skippers participating in the programme. According to skippers, using e-Logbook mobile application for data collection is easier than using tablets.

The e-Logbook mobile application also enables the DFAR's EDU to integrate the digital images (electronic catch data) collected by the Local Observers using the Crew-based (Local) Observer protocol. By combining the electronic trip, gear and catch data collected through the eLogbook Lite app with the digital images collected by skippers using the Crew-based (Local) Observer protocol, the DFAR has evolved an independently verifiable, electronic Observer platform, which will enable Sri Lanka's EEZ and beyond EEZ fisheries further improve the fisheries' compliance with IOTC monitoring, surveillance and control and regional Observer Programme requirements.

Crew-based (Local) Observer Programme

Introduction

IOTC Resolution 11/04 - On a Regional Observer Scheme

The Indian Ocean Tuna Commission (IOTC) adopted a Resolution on a Regional Observer Scheme in 2011, known as Resolution 11/04. Resolution 11/04 sets out the minimum recording requirements for fisheries for tuna and tuna-like species in the IOTC area, as well as timelines for implementation and reporting by Contracting Parties and Cooperating Non-Contracting Parties to the IOTC, such as Sri Lanka. The implementation of the Regional Observer Scheme by IOTC CPCs officially commenced on 1st July 2010, and is based entirely on national implementation.

*IOTC Resolution 11/04 notes that **the objective of the IOTC observer scheme is to collect verified catch data and other scientific data related to the fisheries for tuna and tuna-like species in the IOTC area of competence. In order 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 CPC while fishing 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) shall be covered by this observer scheme. For vessels less than 24 meters if they fish outside their EEZ, the above mentioned coverage should be achieved progressively by January 2013.***

Sri Lanka has more than 1,500 fishing less than 24 m in length registered with the IOTC to fish outside Sri Lanka's EEZ. Due to the small size of these vessels and concerns about the health and safety of deploying an independent Observers on these vessels Sri Lanka has so far been unable to collect any verified catch data and other scientific data related to Sri Lanka's fisheries for tuna and tuna-like species in the IOTC area of competence.

Crew-based (Local) Observer Programme for Vessels < 24m

The Department of Fisheries and Aquatic Resources (DFAR) collects catch data from all for all offshore (EEZ) and high seas (beyond EEZ) multi-day fishing vessels through the Logbook / Catch Certificate system. This data is focused on the key commercial / export species (i.e. yellowfin and bigeye tuna, swordfish, sailfish and marlins). Some information on ETP species is also collected through the Logbook system. For vessels measuring more than 24 m length overall the DFAR collects verified catch data and other scientific data related to Sri Lanka's fisheries for tuna and tuna-like species in the IOTC area of competence through its National Observer Programme. However as noted above, health and safety concerns onboard vessels less than 24 m preclude the Phase of National Observers on Sri Lanka's multi-day fishing vessels registered with the IOTC to fish on the high seas.

Two options have been proposed to collect scientific and catch data from Sri Lanka's <24 m multi-day fishing fleet. The first is through a **Crew-based (Local) Observer Programme** involving trained skippers and crew. The other is through a **closed-circuit** television (CCTV) system, also known as video surveillance or more simply as an electronic observer (**eObserver**) program.

A sub project to investigate the potential of a Crew-based (Local) Observer Programme to collect trip / gear / set / catch and scientific data from Sri Lanka's <24 m multi-day fishing fleet was initiated by the Sri Lankan Longline Fishery Improvement Project (FIP) in 2018. The sub project was implemented through the DFAR's Electronic Data Unit in (EDU) in Colombo and the DFOs in Negombo and Chilaw, in collaboration with the multi-day boat owners' associations in Negombo and Chilaw. The sub project comprised two phases, a Pilot Phase (September 2018 – March 2019) during which 20 skippers were deployed as Local Observers and a 2nd Phase during which 13 skippers were deployed. The 2nd Phase of the Crew-based (Local) Observer Programme was implemented in 2019 to implement the recommendations and lesson learned arising out of the Pilot Phase.

An electronic logbook (eLogbook Lite) android application (App) was also developed during the course of the implementation of the Crew-based (Local) Observer Programme. The eLogbook Lite app was designed to enable the DFAR to integrate the digital images generated by the Crew-based (Local) Observer Programme with digital data describing the trip / gear / set / catch through one online platform hosted by the DFAR's EDU.

The Pilot Phase, 2nd Phase and eLogbook Lite android App were co-financed by **SEAPACT** a group of leading North American Seafood Companies dedicated to driving stewardship and continuous improvement of social, economic, and environmental responsibility throughout the global seafood supply chain. SEAPACT was created by the six founding members: Albion Farms & Fisheries, Fortune Fish & Gourmet, Ipswich Shellfish Group, Santa Monica Seafood, Seacore Seafood and Seattle Fish Co. **SEAPACT** now consist of [ten members](#). **SEAPACT** aims to improve the sustainability of global seafood by using the collective power of like-minded North American seafood companies to improve fishing and fish farming systems globally.

The Pilot Phase and 2nd Phase of the Crew-based (Local) Observer Programme were designed, researched and developed by pelagikos pvt ltd on behalf of the members of the Sri Lankan longline FIP. The eLogbook Lite android App was designed, researched and developed by the DFAR's EDU and Hynet Pvt Ltd.

Methodology

Pilot Phase *(Seven months / September 2018 – March 2019)*

Officers of the DFOs in Negombo and in Chilaw selected 33 boat owners / skippers from Negombo and Chilaw for the Pilot Phase of the Crew-based (Local) Observer Programme. Among the 33 boat owners/skippers 20 were selected to participate in the Pilot Phase. The training programmes for selected skippers started in September 2018 with the support of boat owners and officers on District fishery office and the harbor offices in Negombo and Dikowitta. The whole crew participated for the training programmes as much as possible. Instructions were given to collect following data as Pilot Phase. The last skipper trained under the Pilot Phase completed his training in December 2018

- 1) **Trip Data** – *transferred from the vessel's Logbook (14 variables)*
- 2) **Gear Data** – *from the Crew-based (Local) Observer Record Book and vessel's Logbook (8 variables)*
- 3) **Set Data** – *from the Crew-based (Local) Observer Record Book and vessel's logbook (2 variables)*
- 4) **Catch / Scientific Data** – *Electronic images taken by the Crew-based (Local) Observer (11 variables)*

A detailed description of the 35 variables / data fields collected by the selected skippers under each of the four categories above is contained in the Pilot Phase Report submitted to SEAPACT in April 2019.

2nd Phase *(Five Months / April - August 2019)*

The same list of 33 skippers was used to select skippers for the 2nd Phase of the Crew-based (Local) observer program, which commenced in April 2019. Ten boats from Pilot Phase and ten new boats which didn't collect data in Pilot Phase were selected for the 2nd Phase of the programme. Skippers were provided with tablets by the DFAR or Nikon Coolpix camera by the project. The tablets and cameras were used collect images of each fish caught while fishing. Skippers were provided with an updated, simpler flip board through which to collect length and weight data (see image overleaf).

Out of the twenty boats selected for the 2nd Phase, 13 boats (nine boats from Chilaw and four boats from Negombo) were trained between April and June 2019 (see Table 1). Seven boats participated in the Pilot Phase and the 2nd Phase. Six boats / skippers were new to the programme.

Five changes to the data collection protocol used during the Pilot Phase (*see Pilot Phase Report for further details*) were made and conveyed to skippers during the 2nd Phase, to improve the accuracy of data collection during the trip. The five changes were as follows

- 1) To collect Set / Catch / Scientific Data for only three sets per trips. This change was made to reduce the work load of skippers / crew collecting data and thereby improve the quality / accuracy of data collected per set³.
- 2) To not collect sex data of the catch⁴
- 3) Use the new flip board to indicate the weight of the fish only⁵.
- 4) To take a picture of whole fish, which for billfish means the image must be taken before they are gutted and gilled.
- 5) All the boats which complete the data collection will be paid after arrival⁶.

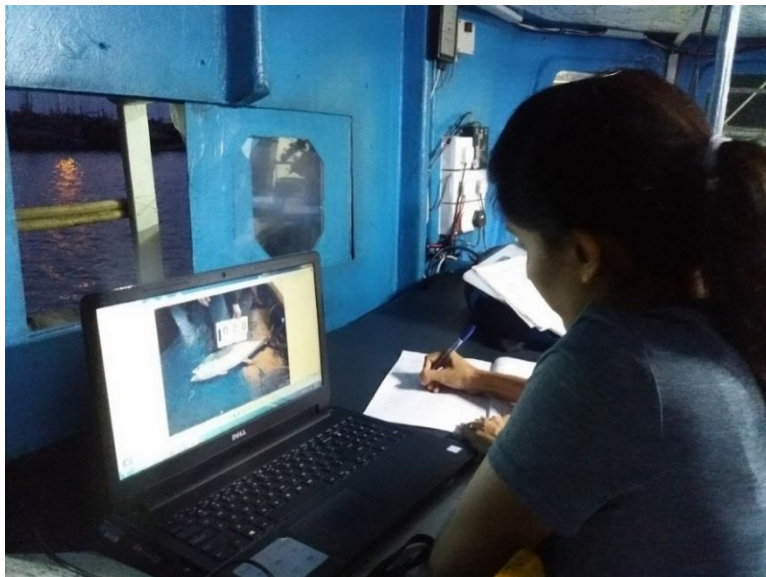
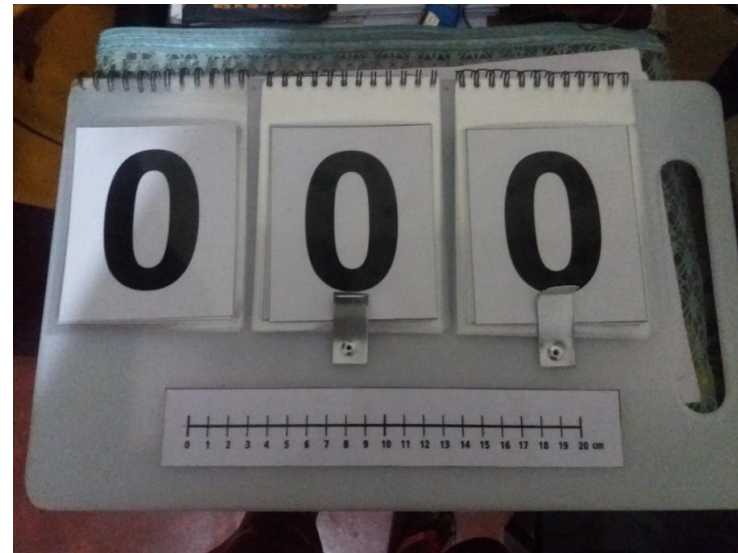
13 skippers were trained by using cameras (7 skippers) issued by the project and tablets (6 skippers) issued by DFAR. Two skippers who had been trained to collect data using tablets had to use their smartphones to collect data at sea, due to technical failures of the tablets.

³ See *Pilot Phase Report* - based on feedback from skippers and crew during the Pilot Phase, it was clear that the Crew-based (Local) Observer programme cannot achieve 100% coverage of the catch for an entire trip.

⁴ See *Pilot Phase Report* – sexing the catch at sea was not practical for most species, including the target species – yellowfin tuna – as most fish – with the exception of billfish - are stored whole, not gutted and gilled.

⁵ See *Pilot Phase Report* – data including in the first flip chart used in the Pilot Phase (i.e. set number, sex, date, retained / discarded) can be collected during the debriefing.

⁶ See *Pilot Phase Report* – the introduction of a payment was deemed appropriate to acknowledge the skipper and crews' effort and commitment in support of the crew-based (Local) observer programme, in the same way payments are made to the Observers working under the National Observer Programme.



Data Collection & Processing

Pilot Phase

Trip, gear, set, catch and scientific data was collected at the harbor during a debriefing session conducted by the DFO officers in Negombo and Dikowita harbours between 5th November 2018 and 17th January 2019 (*see Pilot Phase Report for further details*). The DFO staff extracted the information from the vessel's Logbook and a structured interview based on the Local Observer Record Book to collect trip, gear, set data. Digital images collected using a camera or tablets were downloaded to an external hard drive.

Information and data was then transferred to the DFAR's Information Technology Unit (EDU) in Colombo for processing. The processed information and data were uploaded to a database for analysis by researchers at pelagikos pvt ltd. The images were reviewed and edited to remove duplications. Spatial and temporal data were extracted from each image, together with the species, sex, weight and length of each fish and other non-target species recorded in the catch. The outcome of fish or other non-target species *i.e.* retained or discarded dead or alive was noted.

2nd Phase

Data was collected from 11 of the 13 skippers trained during the 2nd Phase. Two boats were unable to collect data due to bad weather condition of the sea in June. 34 fields (variables were collected from each vessel related to the Trip, Gear, Set, Catch and Scientific Data at the harbor during a debriefing session conducted by the DFO officers in Negombo and Dikowita harbours between from 22nd of May to 20th June 2019 (see Table 1). The one data field not collected during the 2nd Phase was sex. As in the Pilot Phase, the DFO staff extracted the information from the vessel's Logbook and used a structured interview based on the Crew-based (Local) Observer Record Book to collect trip, gear, set data. Digital images collected using a camera or tablets were downloaded to an external hard drive.

Information and data was again transferred to the DFAR's EDU in Colombo for processing. The processed information and data were uploaded to a database for analysis by researchers at pelagikos pvt ltd. The images were reviewed and edited to remove duplications. Spatial and temporal data were extracted from each image, together with the species, weight and length of each fish and other non-target species recorded in the catch. The outcome of fish or other non-target species *i.e.* retained or discarded dead or alive was noted.

Table 1 **Details of the 11 boats that returned with scientific and catch information and data during the 2nd Phase**

Boat No.	DFO	Boat Owner	Crew-based (Local) Observer	Departure	Arrival	Days	Sets	Data collection method
IMULA 0762 CHW	CHW	Mr.B.L.S Fernando	Mr.W.A.S.J Pushpakumara	11.04. 2019	22.05.2019	42	4	Nikon Coolpix camera Flip board
IMULA 0594 CHW	CHW	Mrs. P.Helena Fernando	Mr.P.Milan Chamara Fernando	04.05.2019	31.05.2019	27	3	Rugged Tablet T800RG, Flip board.
IMULA 0713 NBO	NBO	Mr.W.Shrinal Milinda Fernando	Mr. Niroshan Chaminda Fernando	09.05.2019	08.06.2019	32	4	Nikon Coolpix camera Flip board
IMULA 0526 CHW	CHW	Mr.P.S.N Fernando	Mr.W.M.S.Fernando	06.05.2019	09.06.2019	34	3	Nikon Coolpix camera Flip board
IMULA 0699 CHW	CHW	Mr. W.E.T Feranando	Mr.R.P. Prasanna Pushpakumara	13.05.2019	21.06.2019	38	3	Rugged Tablet T800RG, Flip board.
IMULA 0434 KLT	CHW	Mr.W.A.S.N Peris	Mr. W.L.D Thisera	21.05.2019	26.06.2019	36	5	Huwawi smart phone, Flip board
IMULA 0769 CHW	CHW	Mr.W.A.C. Feranando	Mr.W.Y.T. Feranando	23.05.2019	05.07.2019	46	3	Rugged Tablet T800RG, Flip board.
IMULA 0563 CHW	CHW	Mr.P.B Fernando	Mr. W.M.S.Priyankara Fernando	01.06.2019	06.07.2019	36	10	Nikon Coolpix camera Flip board
IMULA 0822 CHW	CHW	Mr. P.D. Fernando	Mr. W.A.S.T Fernando	22.05.2019	06.07.2019	47	7	Nikon Coolpix camera Flip board
IMULA 0818 CHW	CHW	Mr. M.C.N Fernando	Mr. W.P.S.C. Susantha Fernando	25.05.2019	10.07.2019	49	3	Samsung smart phone, Flip board
IMULA 0714 NBO	NBO	Mr.Geeth Fernando	Mr. W.S.A. Fernando	20.06.2019	29.07.2019	40	10	Nikon Coolpix camera Flip board

Sub totals **427** **55**
Average

Results & Analysis

Pilot Phase

The 17 vessels participating in the pilot phase of the Crew-based (Local) Observer Programme stayed at sea for a total of 637 days and shot longlines 148 times (*see Pilot Phase Report for further details*). The average number of days at sea was 37 and the average number of longlines shot per vessel was nine (09).

2nd Phase

The 11 vessels participating in the second phase of the Crew-based (Local) Observer Programme stayed at sea for total 427 days and shot longline 114 times (according to the Logsheet). As noted above, the Crew-based (Local) Observers were required to collect data in only three days during the 2nd Phase, as opposed to for every set during the Pilot Phase. Six boats collected data more than three days. For these vessels the sets with the most accurate data (i.e. the largest number of images and lowest difference between number of images and number of fish in Logsheets) were selected for data analysis that follows.

Trip Data

Pilot Phase

12 of the 14 TRIP DATA variables were collected from 9 vessels (86%) during the Pilot Phase. The balance nine vessels were able to provide 11 out of the 14 required variables (*see Pilot Phase Report for further details*). Overall 81% of the TRIP DATA collection requirement was collected during the pilot phase from 17 vessels.

2nd Phase

14 of the 14 TRIP DATA variables were collected from eight vessels (100%). Two vessel were able to provide 12 out of the 14 required data and only one vessel provide 13 out of the 14 (See Table 2). Overall 97% of the TRIP DATA collection requirement was collected from the 11 vessels that participated in the 2nd Phase of the programme. The IOTC registered number, gross tonnage and the radio call sign number of the boat had extracted from the IOTC website during the 2nd Phase.

Gear Data

Pilot Phase

All 17 vessels provided information / data for all eight variables (100%) for GEAR DATA collection (*see Pilot Phase Report for further details*). According to the *Local Observer Record Books*, longline vessels set their lines at between 30 and 50 bamba⁷ (180 ft to 300 ft), using 1,000 1,500 hooks per set. The bait used was either dead milkfish or frozen squid. Bait was always single hooked.

⁷ One bamba is the span of a fishermen's outstretched arms, roughly six feet or 1.8288 m

2nd Phase

All 11 vessels provided information / data for all eight variables (100%) for GEAR DATA collection (see Table 2). According to the Crew-based (Local) Observer Record Books, longline vessels set their lines at between 30 and 50 bamba⁸ (180ft to 300 ft), using 1,000 1,500 hooks per set. The bait used was either dead milkfish or frozen squid. Bait was always single hooked.

Table 2 Summary of the TRIP DATA and GEAR DATA collected from each vessel

Boat Number	Trip Data			Gear Data		
	Target	Achieved	%	Target	Achieved	%
IMULA 0762 CHW	14	14	100%	8	8	100%
IMULA 0594 CHW	14	14	100%	8	8	100%
IMULA 0713 NBO	14	14	100%	8	8	100%
IMULA 0526 CHW	14	14	100%	8	8	100%
IMULA 0699 CHW	14	14	100%	8	8	100%
IMULA 0434 KLT	14	12	86%	8	8	100%
IMULA 0769 CHW	14	14	100%	8	8	100%
IMULA 0563 CHW	14	14	100%	8	8	100%
IMULA 0822 CHW	14	14	100%	8	8	100%
IMULA 0818 CHW	14	12	86%	8	8	100%
IMULA 0714 NBO	14	13	93%	8	8	100%
Sub Totals	154	149	97%	88	88	100%

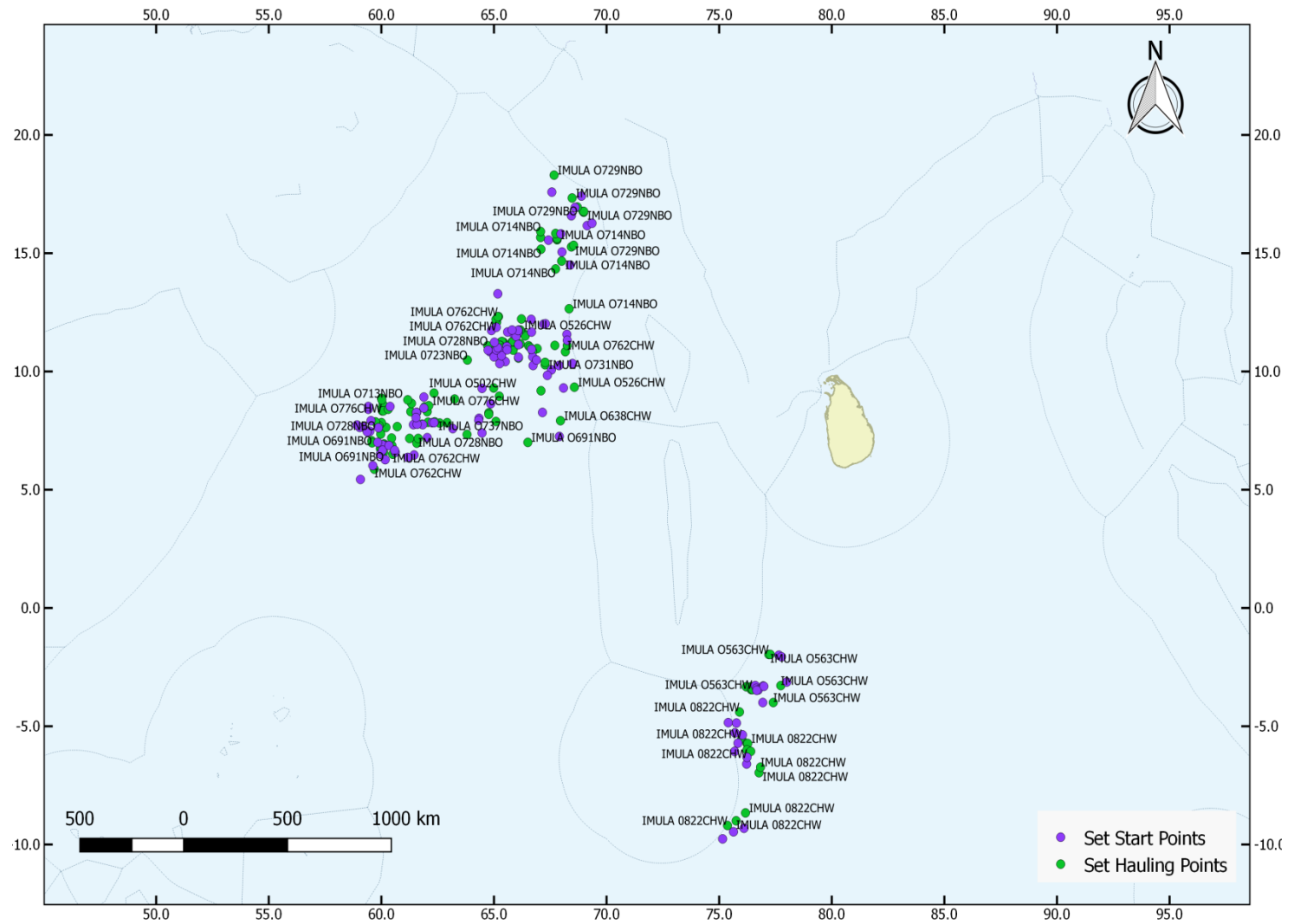
Set Data

Pilot Phase

A total of 148 lines were shot by the 17 vessels during the Pilot Phase. The most number of sets was 12, while the lowest number was three. The average number of sets per trip was 8.7. All vessels recorded the setting Geographic Positioning System (GPS) point as required in the Logbook. Nine vessels recorded the hauling GPS points for each set as required by the IOTC. 87% of the SET DATA collection requirement was collected during the Pilot Phase from 17 vessels (see *Pilot Phase Report for further details*). A map of the set locations for the 148 sets based on the GPS data recorded in the Logbook collected during the Pilot Phase is shown overleaf (Map I and *Pilot Phase Report for further details*). According to the GPS points recorded in the Logbook, vessels participating in the Pilot Phase of the Crew-based (Local) Observer programme set their longlines in the Arabian Sea off the western boundary of India's EEZ and to the west of the Maldives and British Indian Ocean Territories (BIOT) in the Laccadive Sea. No discrepancies were observed between the GPS data recorded in the Logbook and the GPS points recorded for individual fish caught during the Pilot Phase (see *Scientific Data / Location below*).

⁸ One bamba is the span of a fishermen's outstretched arms, roughly six feet or 1.8288 m

Map I - The set locations for the 148 sets collected during the Pilot Phase



2nd Phase

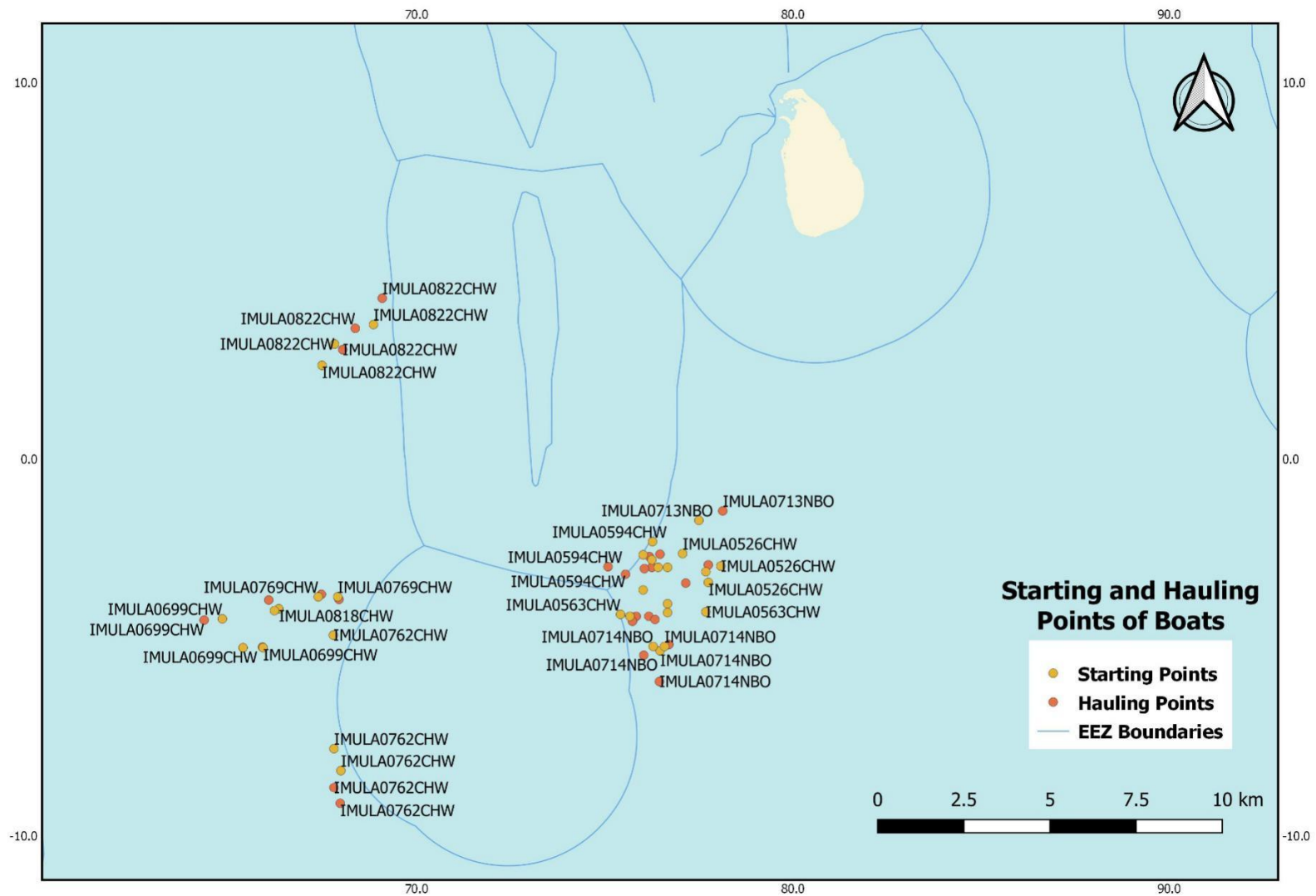
Data was collected from 55 sets made by the 11 vessels during 2nd Phase. As noted above the target during the 2nd Phase was to collect only three days fishing / three sets per trip, to increase the accuracy of the data (the number of images in relation to the number of fish recorded in the Logsheets) for a given number of sets (3) for each boat. Two vessels had some missing GPS hauling points, but all other Crew-based (Local) Observers completed the data collection. 89% of the set data collection requirement was collected during the second phase.

Table 3 Summary of the SET DATA variables collected from each vessel

Boat Number	Logsheets	Sets	Target	Achieved	%
IMULA 0762 CHW	9	3	6	6	100%
IMULA 0594 CHW	8	3	6	6	100%
IMULA 0713 NBO	10	3	6	6	100%
IMULA 0526 CHW	11	3	6	6	100%
IMULA 0699 CHW	9	3	6	5	83%
IMULA 0434 KLT	10	3	6	6	100%
IMULA 0769 CHW	11	3	6	6	100%
IMULA 0563 CHW	12	3	6	3	50%
IMULA 0822 CHW	12	3	6	6	100%
IMULA 0818 CHW	12	3	6	3	50%
IMULA 0714 NBO	10	3	6	6	100%
Sub Totals	114	33	66	59	89%

A map of the set locations for the 33 sets based on the GPS data recorded in the Logbook collected during the 2nd Phase is given overleaf (Map II). According to the GPS points recorded in the Logbook, vessels participating in the 2nd Phase of the Crew-based (Local) Observer programme set their longlines to the west and east of the Maldives and BIOT's EEZ (Indian Ocean / Laccadive Sea). Discrepancies were observed between the GPS data recorded in the Logbook and the GPS points recorded for the individual fish caught from two vessels during the 2nd Phase. Details of these discrepancies are described in Scientific Data – Location section below and Maps VI and VII.

Map II - The set locations for the 33 sets collected during the 2nd Phase



Key deficiencies in the TRIP / GEAR / SET DATA collection methodology highlighted in the Pilot and 2nd Phase are follows

DATA	Pilot Phase	2 nd Phase
TRIP	<ol style="list-style-type: none"> 1. None of the multi-day boats had an <i>IOTC Registration number</i> 2. The <i>Gross Tonnage</i> of all vessels was unknown / needs to be calculated by DFAR 3. Not all of the vessels had a <i>radio call sign number</i> 	<ol style="list-style-type: none"> 1. Only one boat does not have the <i>IOTC registration number</i>. All the other were extracted by IOTC website 2. No <i>data deficiencies</i> were observed for <i>Gross Tonnage</i> 3. Only three vessels were pending for the <i>radio call sign number</i> 4. One Crew-based (Local) observer does not have a Crew-based (Local) observer's ID number
GEAR	<ol style="list-style-type: none"> 1. No <i>data deficiencies</i> were observed for the GEAR DATA collection 	<ol style="list-style-type: none"> 1. No <i>data deficiencies</i> were observed for the GEAR DATA collection
SET	<ol style="list-style-type: none"> 1. Eight vessels did not complete all the <i>hauling GPS location</i> for all sets 	<ol style="list-style-type: none"> 1. Two vessels did not mention the hauling points 2. The GPS locations for hauling and setting of the two boats mentioned in the Logsheet are totally different from the locations extracted from the images of the catch (Map VI & VII)

Catch Data

Pilot Phase

According to the Logbook data submitted by skippers to the DFAR during the Pilot Phase debriefings 114,290 kgs of the target species yellowfin tuna (YFT) and commercially important species (*i.e.* bigeye tuna (BET), swordfish (SWO), blue marlin (BUM), black marlin (BLM) and sailfish (SFA)) were caught by the 17 vessels during the Pilot Phase (*see Pilot Phase Report for further details*). Almost three quarters of the catch reported in the Logbooks (73%) was accounted for by the target species (YFT - 83,774 kg). The average catch per vessel per trip was 7,619.23 (15 vessels). On average 892.89 kg of commercially important fish were landed per set. It should be noted here that the weight of non-target species (retained or discarded) is not generally recorded by the skippers in the Logbook data submitted by the skippers to the DFAR.

1,127 fish (*and other species*) were caught by the 17 vessels during the pilot phase (*see Pilot Phase Report for further details and images overleaf*), according to the Logbooks submitted by the skippers. The percentage of the catch which was 'observed' by the skippers during the Pilot Phase ranged from 9% to 91%. Skippers noted that when the catch rate was high, it was difficult to collect images of every fish caught. The Crew-based (Local) Observers collected images on 30% of the fish (and other capture / non target species caught) during the pilot phase.

2nd Phase

According to the Logbook data submitted by the skippers to the DFAR during the 2nd Phase debriefings 18,004 kg of the target species (YFT) and commercially important species were caught by the 11 vessels during the second phase in selected 33 sets (*see Table 4*). Almost a two thirds of the catch reported in the Logbooks was yellowfin tuna (11,433 kg / 63.5%). The average catch per vessel per trip was 1,800.4 kg (10 vessels). On average 545.5 kg of commercially fish were landed per set. As noted above, the weight of non-target species (retained or discarded) is not generally recorded by the skippers in the Logbook data submitted by the skippers to the DFAR.

539 fish (*and other species*) were caught by the 11 vessels during the 2nd Phase (*see Table 5 and images below*), according to the Logbooks submitted by the skippers. The percentage of the total catch which was 'observed' by the skippers during the 2nd Phase ranged from 36% to 194%. In cases where the 'observed catch' was higher than the reported catch during the 2nd Phase, this was the result of skippers accurately recording each and every retained and discarded fish from their catch. As noted above, in general most skippers do not enter non target retain fish and discarded fish in the Logsheet.

Out of the 11 boats that submitted data during the 2nd Phase, three were observed to have incorrectly entered data into in their Logsheets, when compared to the images (date and the location) submitted for the three sets. Deducting these fish from the total, the Crew-based (Local) Observers collected images on 105% of the target and commercially important fish species as well as other capture / non-target species caught during the 2nd Phase.

Images submitted by Crew-based (Local) Observers during the Pilot Phase



This result is a big improvement of percentage data collection when compared catch data of pilot phase (30%). This improvement in the accuracy of the Catch Data collected supports the programme's decision to limit data collection to three set per trip.

Table 4 CATCH DATA collected from each vessel during the 2nd Phase

Boat Number	Target & Commercially Important Species Catch (kg)						
	Total	YFT	BET	SWO	BUM	BLM	SFA
IMULA 0762 CHW	3,250	2640	340	145	0	60	65
IMULA 0594 CHW	1,868	1173	195	330	0	170	0
IMULA 0713 NBO	2,236	445	890	628	0	235	38
IMULA 0526 CHW	990	405	120	200	230	0	35
IMULA 0699 CHW	2,845	2090	190	245	320	0	0
IMULA 0434 KLT	1,065	680	100	190	95	0	0
IMULA 0769 CHW	1,095	725	0	300	70	0	0
IMULA 0563 CHW	935	625	230	0	0	40	40
IMULA 0822 CHW	2,560	1840	100	620	0	0	0
IMULA 0818 CHW	1,160	810	0	250	85	0	15
IMULA 0714 NBO							
Sub totals	18,004	11,433	2,165	2,908	800	505	193
		63.5%	12.0%	16.2%	4.4%	2.8%	1.1%

Table 5 CATCH DATA target and achieved collected from each vessel during the 2nd Phase

Boat Number	Target No Fish	Achieved No of Fish	%
IMULA 0762 CHW	88	91	103%
IMULA 0594 CHW	47	56	119%
IMULA 0713 NBO	54	71	131%
IMULA 0526 CHW	34	66	194%
IMULA 0699 CHW	68	49	72%
IMULA 0434 KLT	28	33	118%
IMULA 0769 CHW	29	29	100%
IMULA 0563 CHW	19	36	189%
IMULA 0822 CHW	64	23	36%
IMULA 0818 CHW	45	46	102%
Sub Totals	476	500	105%
IMULA 0714 NBO	?	39	?

Images submitted by Crew-based (Local) Observers during the 2nd Phase



Scientific Data

Pilot Phase

DFAR at the DFO and EDU extracted nine variables from each image taken by Crew-based (Local) Observers of 1,127 fish and other capture species caught by the 17 vessels during the pilot phase (*see Pilot Phase Report for further details*). The local name and English name were collected by the DFAR officers at the harbour during the debriefing meetings. The IOTC codes for each fish were added to the database by the EDU in Colombo. Data regarding the sex, outcome, weight, standard length, location caught and date / time caught were extracted from each image by staff of the EDU in Colombo.

2nd Phase

During the 2nd Phase DFAR at the DFO and EDU extracted eight variables from each image taken by Crew-based (Local) Observers of 539 fish and other capture species caught by the 11 vessels during the second phase (*see Table 6*). The local name and English name were collected by the DFAR officers at the harbour during the debriefing meetings. The IOTC codes for each fish were added to the database by the EDU in Colombo. Data regarding the outcome, weight, standard length, location caught and date / time caught were extracted from each image by officers of the EDU in Colombo.

Table 6 SCIENTIFIC DATA variables collected during the 2nd Phase

Variables		Target	Achieved	2 nd Phase	Pilot Phase
1	Local Name	539	539	100%	100%
2	English Name	539	539	100%	100%
3	IOTC Code	539	539	100%	100%
4	Outcome (Retained / Discarded)	539	539	100%	100%
5	Weight (kg)	539	539	100%	97%
6	Standard Length (cm)	539	431	80%	47%
7	Location Caught (Long / Lat)	539	474	88%	75%
8	Date / Time Caught	539	539	100%	75%

Local Name

Pilot Phase

The DFAR with the help of the Crew-based (Local) Observers were able to identify all of 1,127 fish and other species caught to the level of the Local Name (100% - *see Pilot Phase Report for further details* and Table 6).

2nd Phase

The DFAR with the help of the Crew-based (Local) Observers were able to identify all of 539 fish and other capture species to the level of the Local Name (100% - Table 6).

English Name

Pilot Phase

The DFAR officers in the EDU were able to identify all 1,127 fish and other species captured during the Pilot Phase to the level of the English / scientific name, with the aid of the IOTC Species Guides (100% - *see Pilot Phase Report for further details and Table 6*).

2nd Phase

The DFAR officers in the EDU were able to identify all 539 fish and other species captured during the 2nd Phase to the level of the English / scientific name, with the aid of the IOTC Species Guides (100% - *see Table 6*).

IOTC Code

Pilot Phase

DFAR officers in the EDU were able to assign individual IOTC codes to 1,116 fish images collected by the Local Observers. The commonest species identified in the observed catch was yellowfin tuna (YFT – 66%), followed by sailfish (SFA 10%), black marlin (BLM -8%) and swordfish (SWO – 7%). Twelve fish were caught without species specific ITOC Codes. These were recorded as OTHER. DFAR officers in the EDU were able to assign individual IOTC codes to 100% of the observed catch during the Pilot Phase (*see Pilot Phase Report for further details and Table 6*).

2nd Phase

DFAR officers in the EDU were able to assign individual IOTC codes to 507 fish images collected by the Crew-based (Local) Observers (*see Table 7*). The commonest species identified in the observed catch was yellowfin tuna (YFT – 51%), followed by swordfish (SWO – 10%), bigeye tuna (BET- 7%), escholar (LEC -6%) and Thirty two were caught without species specific ITOC Codes. These were recorded as OTHER. DFAR officers in the EDU were able to assign individual IOTC codes to 100% of the observed catch during the 2nd Phase (*see Table 6 and 7*).

Table 7 IOTC Codes collected during the 2nd Phase

IOTC	English Name	No.	IOTC	English Name	No.
	Bony Fish			Sharks	
YFT	<i>Yellowfin Tuna</i>	274	BSH	<i>Blue Shark</i>	10
SWO	<i>Swordfish</i>	56	PSK	<i>Crocodile Shark</i>	7
BET	<i>Bigeye Tuna</i>	37	FAL	<i>Silky Shark</i>	4
LEC	<i>Black Escolar</i>	34	SMA	<i>Shortfin Mako Shark</i>	2
OTH	<i>Other</i>	32	TIG	<i>Tiger Shark</i>	1
BLM	<i>Black Marlin</i>	14		Rays	
BUM	<i>Blue Marlin</i>	13	PLS	<i>Pelagic Stingray</i>	6
SFA	<i>Sailfish</i>	11	RMJ	<i>Spinetail Mobula</i>	2
GBA	<i>Great Barracuda</i>	6	RMM	<i>Devil Fish</i>	1
WAH	<i>Wahoo</i>	6	RMT	<i>Chilean Devil Ray</i>	1
ALB	<i>Albacore</i>	5		Reptiles	
DOL	<i>Dolphinfish</i>	5	DKK	<i>Leatherback Turtle</i>	3
SKJ	<i>Skipjack Tuna</i>	4		Mammals	
POA	<i>Atlantic Pomfret</i>	3	DBO	<i>Common Bottlenose Dolphin</i>	1
GUT	<i>Indo-Pacific King Mackerel</i>	1		Grand Total	539

Outcome

Pilot Phase

96% of the fish from which scientific data were recorded (1,077 out of 1,127) during the Pilot Phase were retained. 22 fish and other captured species representing 2% of the observer catch (by number), including turtles (4) and sharks (8) and rays (7) were returned / discarded alive to the sea. 28 fish and other captured species representing a further 2% of the observer catch including sharks (14) and rays (2) were to the sea / discarded dead. No sea birds or mammals were reported in the observed catch during the Pilot Phase (see Table 8 and *see Pilot Phase Report for further details*)

2nd Phase

89% of the fish from which scientific data were recorded (478 out of 539) were retained during the 2nd Phase were retained. 13 fish and other captured species representing 2% of the observer catch (by number) including sharks (5), rays (5), turtles (1) and mammals (1) were returned / discarded alive to the sea. 48 fish and other captured species (equal to 9% of the observed catch by number), including sharks (5), rays (3) and turtles (1) were returned to the sea / discarded dead (Table 9).

Table 8 Discarded species data collected during the Pilot Phase

Discarded Alive	No.	Discarded Dead	No.
Bony Fish		Bony Fish	
Sun Fish	2	Ribbon Fish	7
Ribbon Fish	1	Yellowfin tuna	3
		Atlantic Pomfret	1
		Puffer fish	1
Sharks		Sharks	
Thresher Shark	4	Thresher Shark	7
Oceanic whitetip shark	3	Longfin Mako Shark	3
Silky shark	1	Oceanic whitetip shark	2
		Silky shark	1
		Tiger shark	1
Rays		Rays	
Pelagic Stingray	7	Pelagic Stingray	2
Reptiles		Reptiles	
Olive Ridley	4		
Sub Totals	22	Sub Totals	28

Table 9 Discarded species data collected during the 2nd Phase

Discarded Alive	No.	Discarded Dead	No.
Bony Fish		Bony Fish	
Ribbon Fish	1	Ribbon Fish	26
		Escolar	10
		Atlantic Pomfret	3
Sharks		Sharks	
Crocodile Shark	5	Blue Shark	2
		Crocodile Shark	2
		Tiger Shark	1
Rays		Rays	
Pelagic Stingray	4	Pelagic Stingray	3
Sickle-fin devil ray	1		
Reptiles		Reptiles	
Leatherback Turtle	1	Leatherback Turtle	1
Mammals			
<i>Common Bottlenose Dolphin</i>	1		
Sub Totals	13	Sub Totals	48

Weight

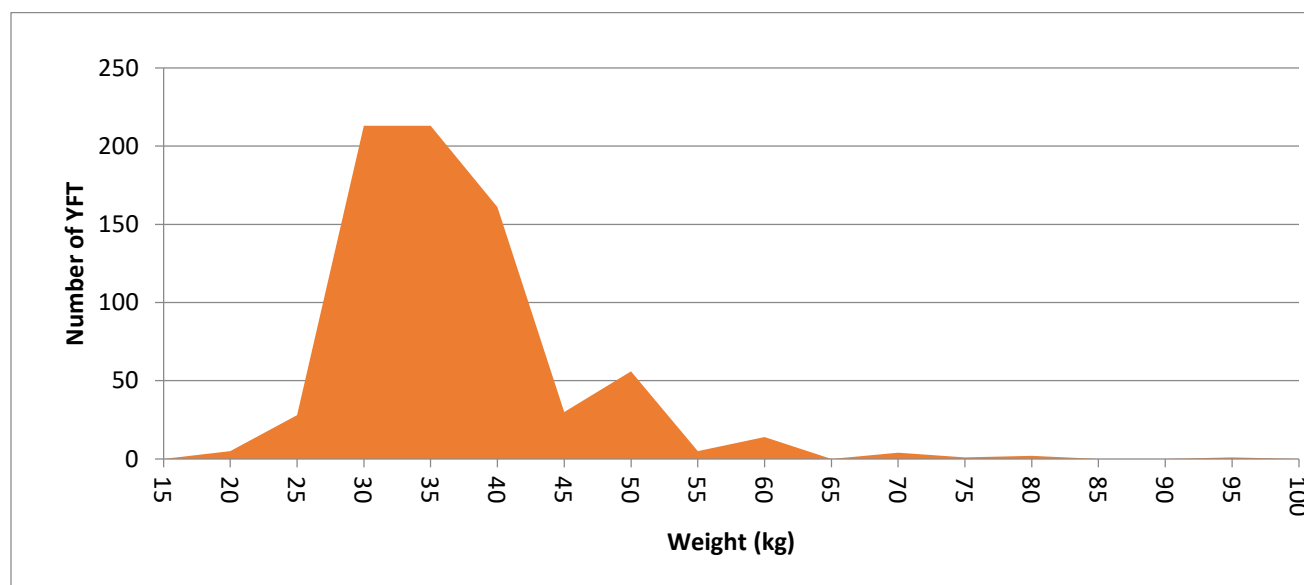
Pilot Phase

Weight data was recorded by Crew-based (Local) Observers for 1,094 fish and other captured species (see *Pilot Phase Report for further details*). The total weight of the observed catch from which data was collected was 39,354.5 kg, equivalent to 34% of the total catch (114,290 kg) recorded in the vessel Logbooks. Yellowfin tuna made up the largest percentage of the recorded catch by weight (68%), followed by black marlin (12%), swordfish (7%), sailfish (6%) and bigeye tuna (3%). All other species from which weight data were collected did not contribute more than 1% of the total recorded catch.

The weight frequency for yellowfin tuna - the target species for the Sri Lankan longline fishery – observed during the Pilot Phase is shown in Figure 1.

Figure 1 Weight frequencies for YFT based on data collected during the Pilot Phase

Thunnus albacares Maximum published weight: 200.0 kg ⁹



2nd Phase

Weight data was recorded by Crew-based (Local) Observers for 539 fish and other captured species (see Table 10). The total weight of the observed catch from which data was collected was 16,084 kg. Yellowfin tuna made up the largest percentage of the recorded catch by weight (62%), followed by bigeye tuna (9%), swordfish (7%) black marlin (5%) and blue marlin (4%).

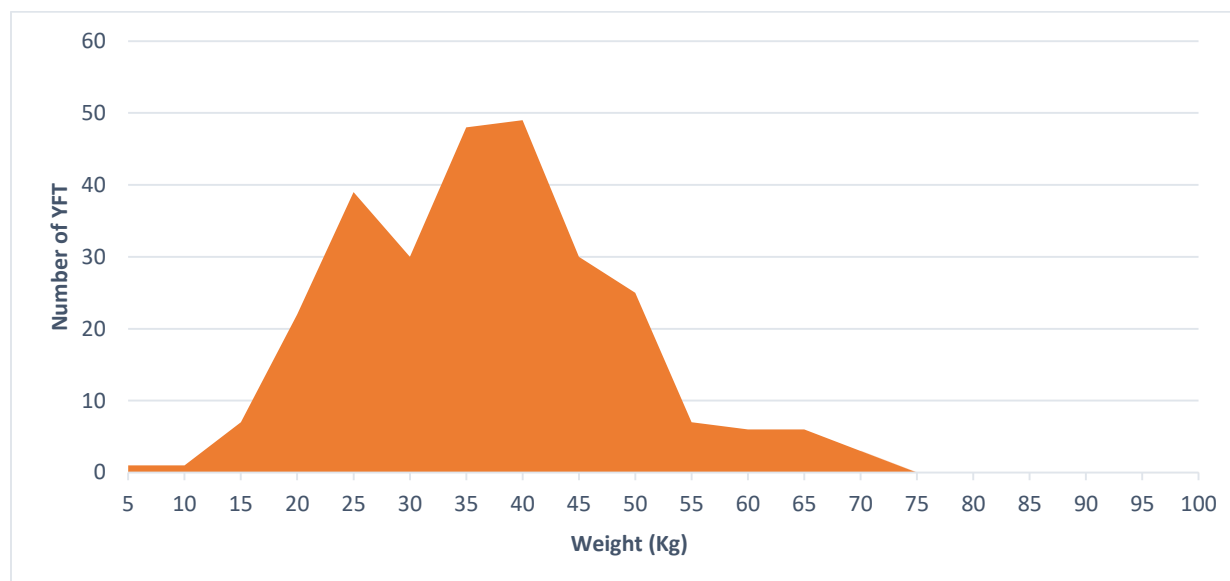
The weight frequency for yellowfin tuna during the 2nd Phase is shown in Figure 2.

⁹ <https://www.fishbase.de>

Table 10 **Weight (kg) data collected during the 2nd Phase**

Species	No.	Total	%	Min	Max	Average	SD
Yellowfin Tuna	274	9,890	61.5%	5	70	36.1	12.0
Bigeye Tuna	36	1,451	9.0%	12	65	40.3	12.4
Swordfish	56	1,182	7.3%	2	54	21.1	12.5
Black Marlin	14	751	4.7%	14	135	53.6	33.0
Blue Marlin	14	669	4.2%	30	120	47.8	25.7
Sickle-fin devil ray	1	400	2.5%	400	400	400.0	
Blue Shark	10	338	2.1%	15	80	33.8	22.2
Leatherback Turtle	3	230	1.4%	60	100	76.7	20.8
Sailfish	11	218	1.4%	5	35	19.8	8.8
Escolar	34	198	1.2%	3	15	5.8	2.5
Ribbon Fish	32	154	1.0%	1	10	4.8	2.2
Smoothtail mobula	2	110	0.7%	50	60	55.0	7.1
Albacore	5	81	0.5%	10	20	16.2	4.5
Silky Shark	4	78	0.5%	13	25	19.5	4.9
Shortfinmako Shark	2	70	0.4%	35	35	35.0	0.0
Dolphin	1	66	0.4%	66	66	66.0	
Wahoo	6	37	0.2%	4	10	6.2	2.4
Tiger Shark	1	30	0.2%	30	30	30.0	
Crocodile Shark	7	25	0.2%	3	4	3.6	0.5
Great Barracuda	6	24	0.1%	1	8	4.0	2.4
Pelagic Stingray	7	24	0.1%	2	4	3.4	0.8
Atlantic Pomfret	3	20	0.1%	5	10	6.7	2.9
Skipjack Tuna	4	14	0.1%	1	5	3.5	1.9
Dolphinfish	4	12	0.1%	2	5	3.0	1.4
Spanish Mackerel	1	7	0.0%	7	7	7.0	
Mobula Spp	1	5	0.0%	5	5	5.0	
Grand Total	539	16,084					

Figure 2 Weight frequencies for YFT based on data collected during the 2nd Phase
Thunnus albacares Maximum published weight: 200.0 kg ¹⁰



Length

Pilot Phase

Length (Fork Length) data was extracted from the images taken by the Local Observers by the DFAR's EDU for 529 fish and other captured species (*see Pilot Phase Report for further details*). The number of fish which length data was collected was 17% of the total catch (3,157 fish caught), according to the vessel Logbooks. Yellowfin tuna made up the largest percentage of the observed catch from which length data was collected (73%), followed by swordfish (8%), black marlin (6%), sailfish (6%) and bigeye tuna (3%). All other species from which length data were collected did not contribute more than 1% of the total observed catch. Length frequencies for yellowfin tuna observed during the Pilot Phase is shown in Figures 3.

2nd Phase

Fork length data was extracted from the images taken by the Crew-based (Local) Observers by the DFAR's EDU for 431 (80%) fish and other captured species (*see Table 11*). Yellowfin tuna made up the largest percentage of the observed catch from which length data was collected (62%), followed by swordfish (10%), bigeye tuna (8%) black marlin (3%), blue marlin (3%). Length frequencies for yellowfin tuna observed during the 2nd Phase is shown in Figures 4.

¹⁰ <https://www.fishbase.de>

Figure 3 Length frequencies for YFT based on data collected during the Pilot Phase

Thunnus albacares Maturity: L_m 103.3, range 78 - 158 cm. Max length : 239 cm FL male/unsexed;
common length : 150 cm FL male/unsexed¹¹

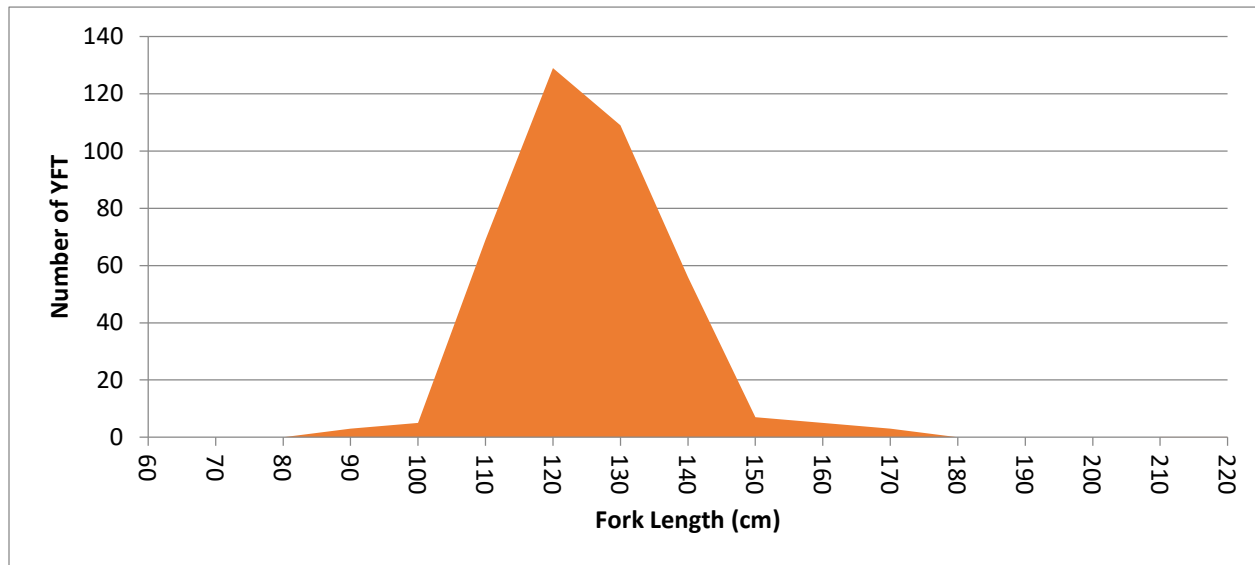
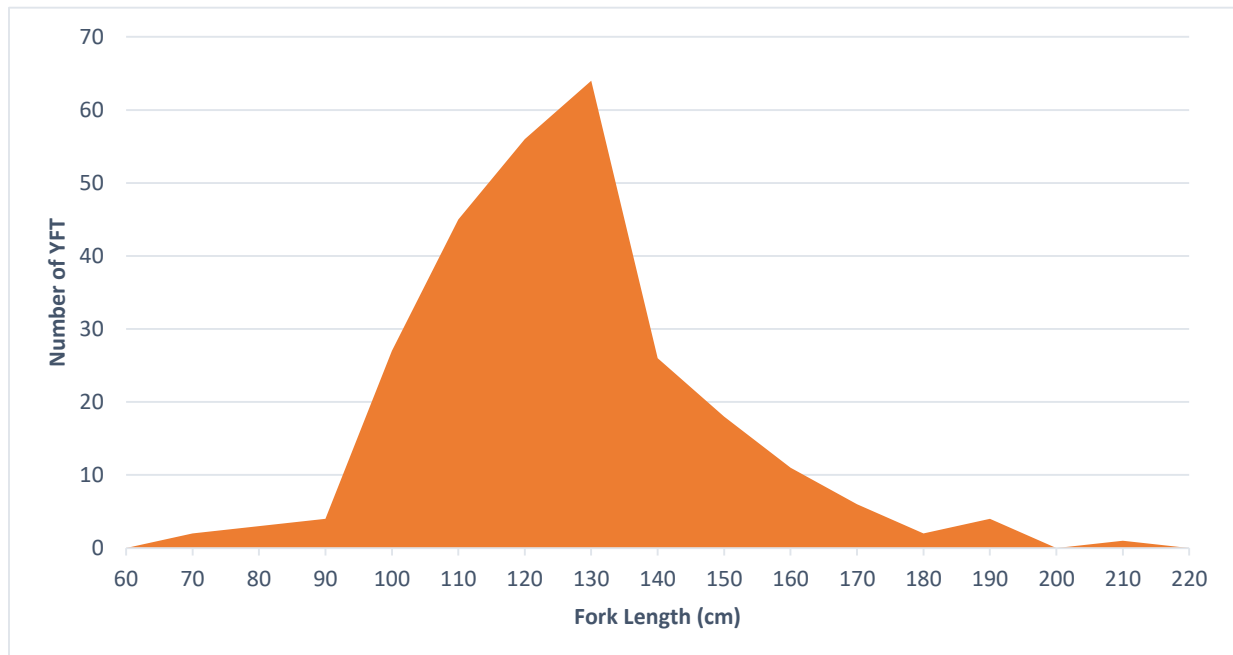


Figure 4 Length frequencies for YFT based on data collected during the 2nd Phase

Thunnus albacares Maturity: L_m 103.3, range 78 - 158 cm. Max length : 239 cm FL male/unsexed;
common length : 150 cm FL male/unsexed¹²



¹¹ <https://www.fishbase.de>

¹² <https://www.fishbase.de>

Table 11 Fork length (cm) data collected during the 2nd Phase

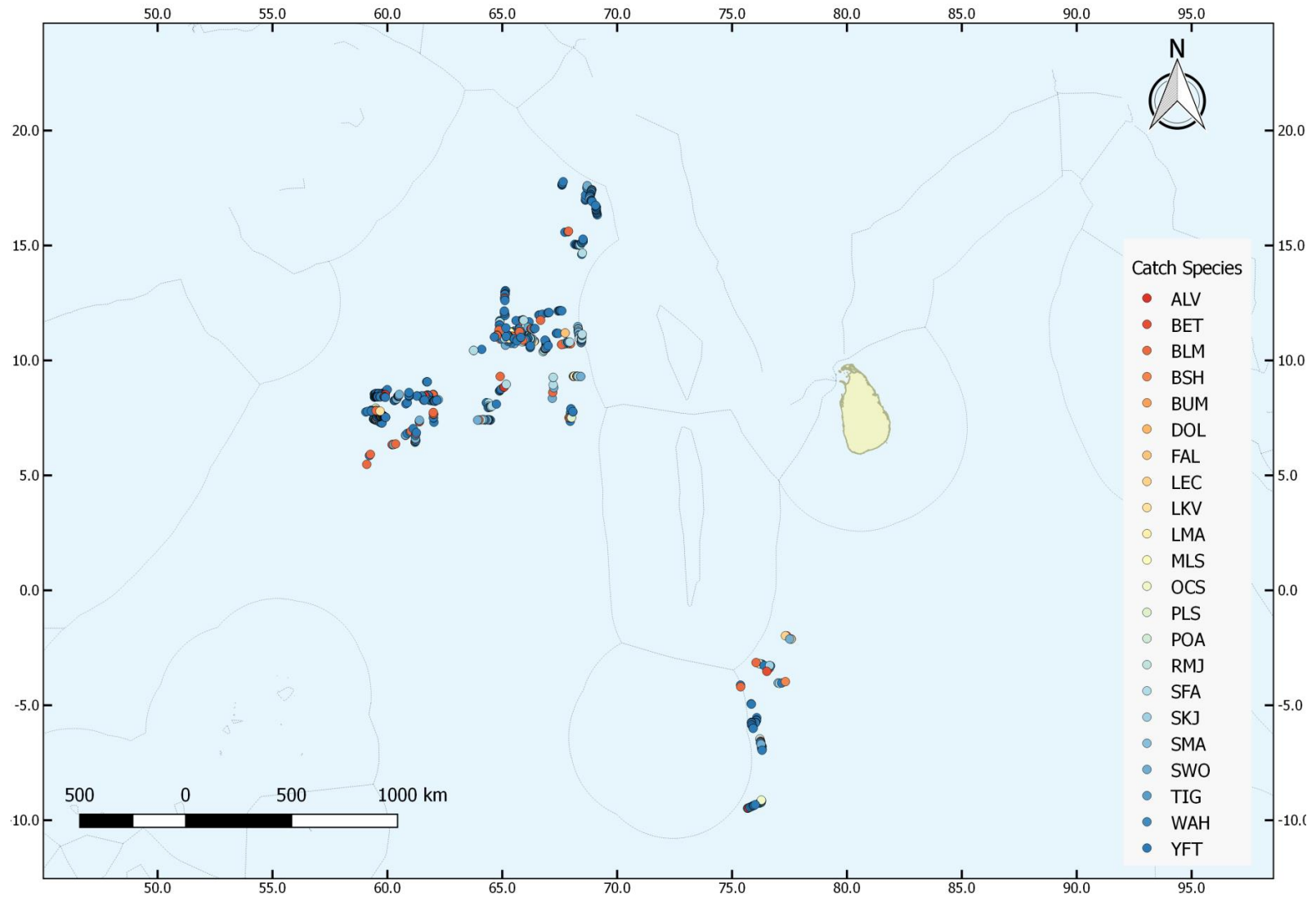
Species	No.	%	Min	Max	Average	SD
Yellowfin Tuna	269	62.4%	64	210	121.6	20.8
Sword Fish	43	10.0%	76.2	247.1	171.8	40.5
Big Eye Tuna	35	8.1%	56	194.2	114.9	21.2
Black Marlin	14	3.2%	145.6	263.3	201.1	32.5
Blue Marlin	14	3.2%	87.9	261.2	190.5	41.1
Escolar	13	3.0%	41.1	100	72.6	15.7
Sail Fish	11	2.6%	140	247	188.7	32.6
Blue Shark	6	1.4%	125.9	211.1	158.9	35.0
Albacore	5	1.2%	88.3	139.4	111.7	18.7
Wahoo	5	1.2%	97.3	128.5	108.9	11.8
Silky Shark	3	0.7%	100.5	173.3	134.1	36.7
Skipjack Tuna	3	0.7%	46.9	58.2	54.4	6.5
Dolphinfish	2	0.5%	77	121	99.0	31.1
Great Barracuda	2	0.5%	58.3	82.2	70.3	16.9
Ribbon Fish	2	0.5%	89.7	95.8	92.8	4.3
Shortfinmako Shark	2	0.5%	105	109.3	107.2	3.0
Atlantic Pomfret	1	0.2%	53.6	53.6	53.6	
Smoothtail mobula	1	0.2%	80	80	80.0	
Grand Total	431					

Location

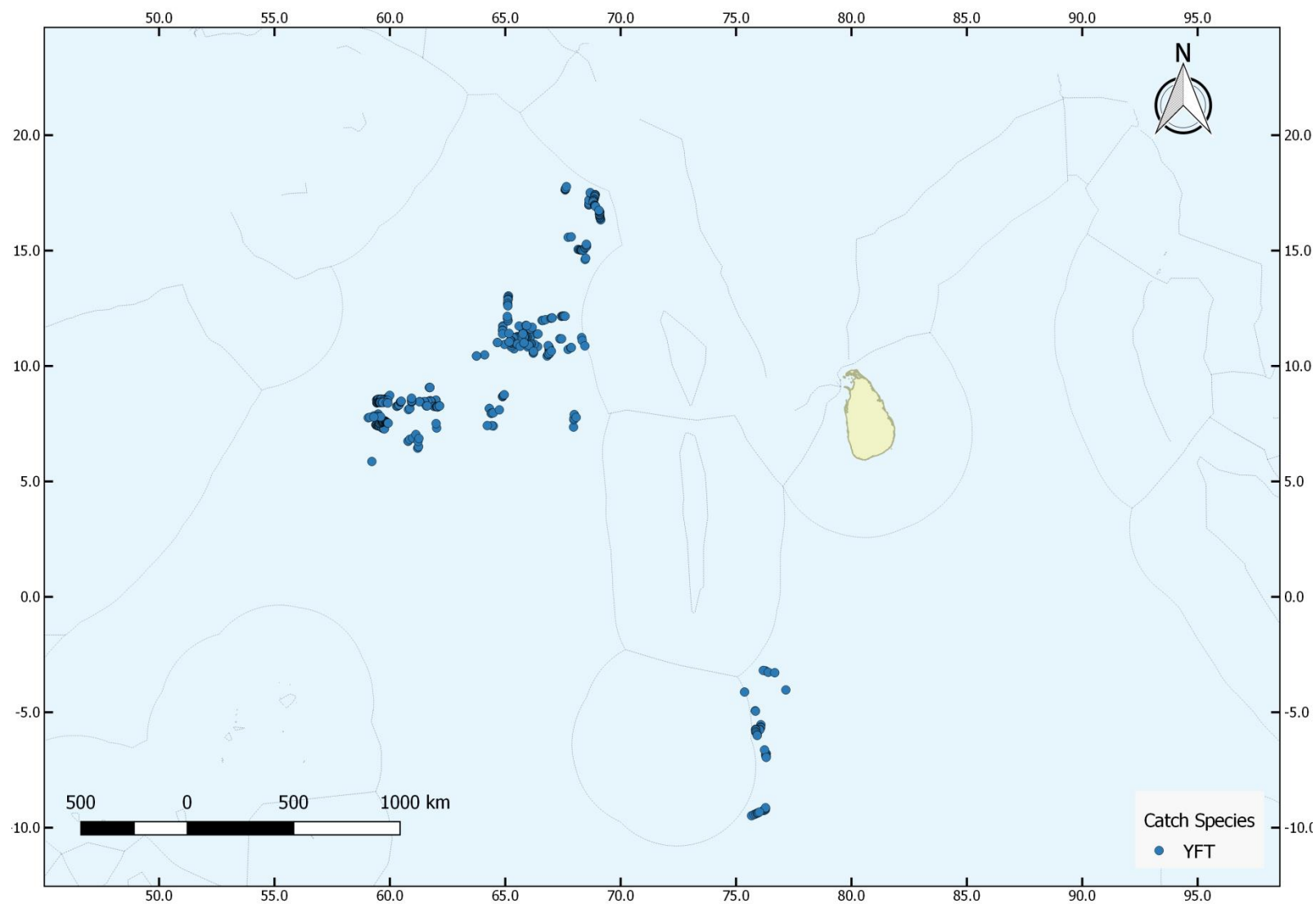
Pilot Phase

Location (Longitude / Latitude) data was extracted by the DFAR's EDU from 841 of the 1,127 images taken by the Local Observers under the pilot phase of the Local Observer Programme (75% - see *Pilot Phase Report for further details and Table 6 above*). No discrepancies were observed between the GPS data recorded in the Logbook and the GPS points recorded for individual fish caught during the Pilot Phase (see *Set Data above*). The location of the 851 fish and other capture species caught during the pilot phase are mapped in the Indian Ocean in Map III. The location of the yellowfin tuna and endangered, threatened and protected (ETP) species catch is shown in Maps IV and V.

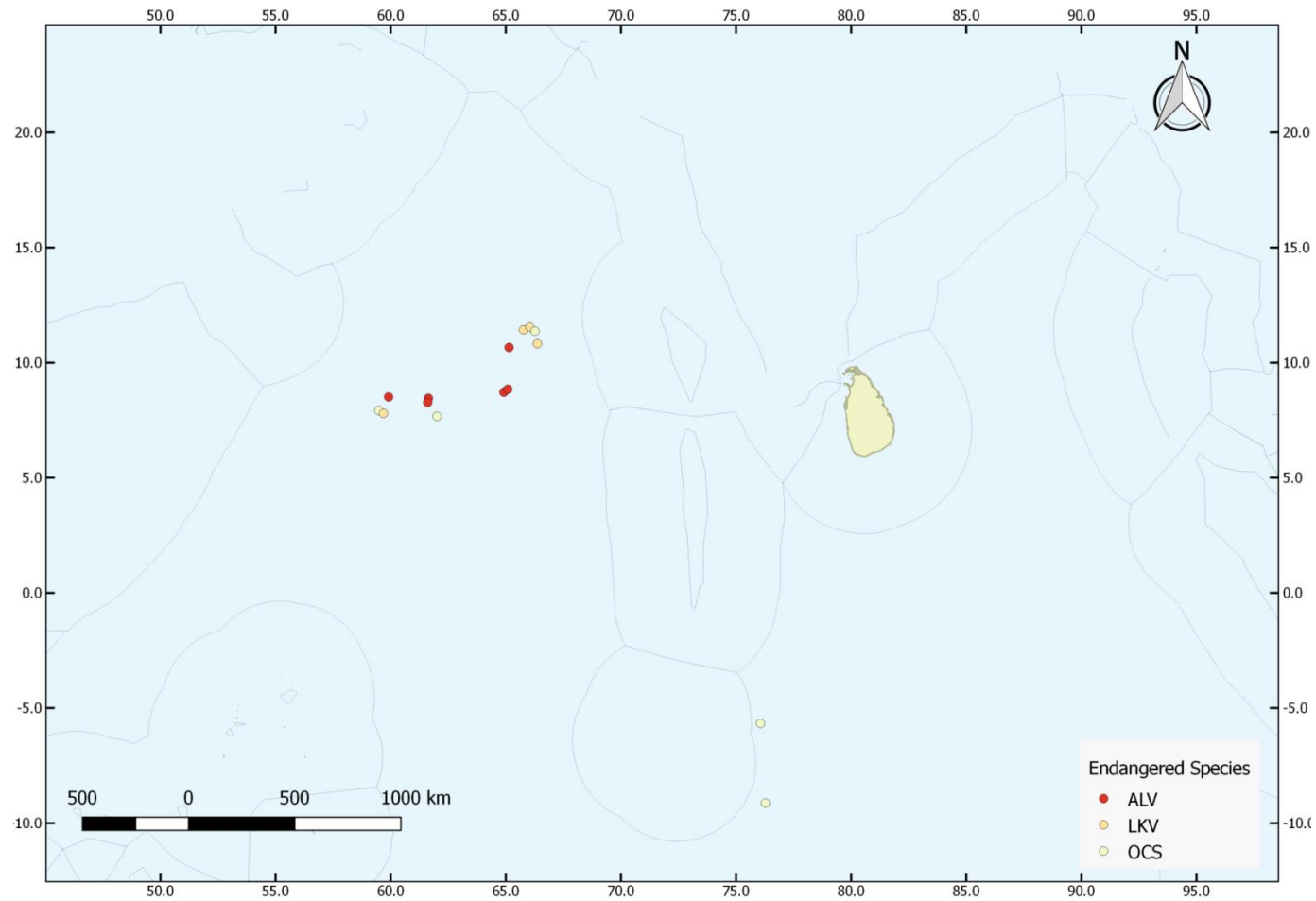
Map III - The location of the 841 species observed during the Pilot Phase



Map IV - The location of yellowfin tuna observed in the catch during the Pilot Phase



Map V - The location of ETP species observed in the catch during the Pilot Phase



2nd Phase

Location (Longitude / Latitude) data was extracted by the DFAR's EDU from 474 of the 539 images taken by the Observers during the 2nd Phase of the Crew-based (Local) Observer Programme (88% - *see Table 6 above*). Discrepancies were observed between the GPS data recorded in the Logbook (*see Set Data above*) and the GPS points recorded for the individual fish caught from two vessels during the 2nd Phase.

Two vessels recorded GPS data for longline setting and hauling points in their Logbooks indicating their location to be inside Sri Lanka's EEZ. However the GPS data extracted from the images of each fish caught for the same set and hauling data revealed that the actual location of the longlines was beyond Sri Lanka's EEZ. Maps VI and VII show the GPS points recorded in the Logbook and the GPS data extracted from the images section for the two vessels.

The location of the 474 fish and other capture species caught during the second phase are mapped in the Indian Ocean in Map VIII. The location of the yellowfin tuna and endangered, threatened and protected species catch is shown in Maps IXI and X.

Date / Time

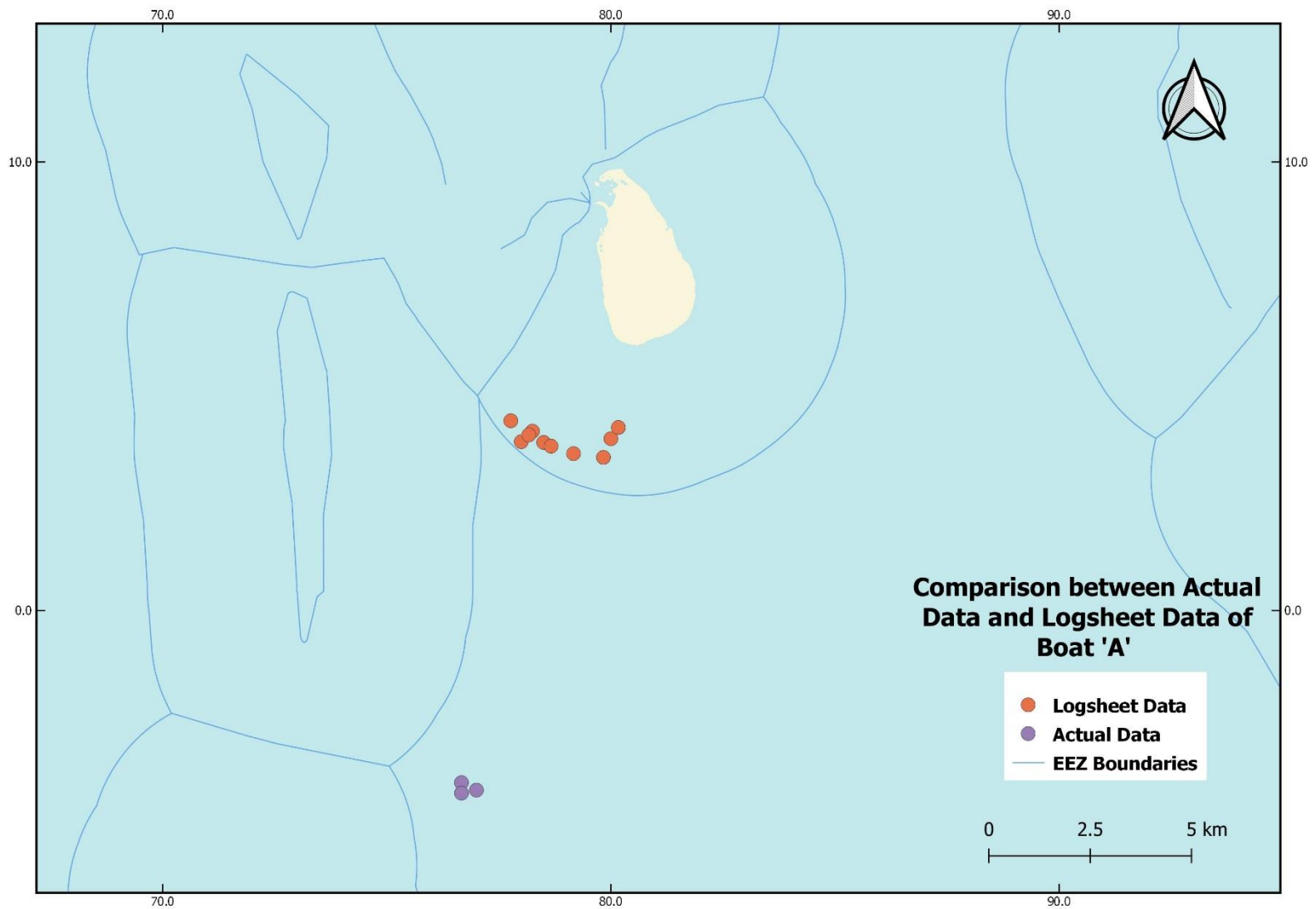
Pilot Phase

Date and time data was extracted by the DFAR's EDU from 1,127 1 of the 1,127 images taken by the Local Observers under the pilot phase of the Local Observer Programme (100% - *see Table 6 above and Pilot Phase Report for further details*).

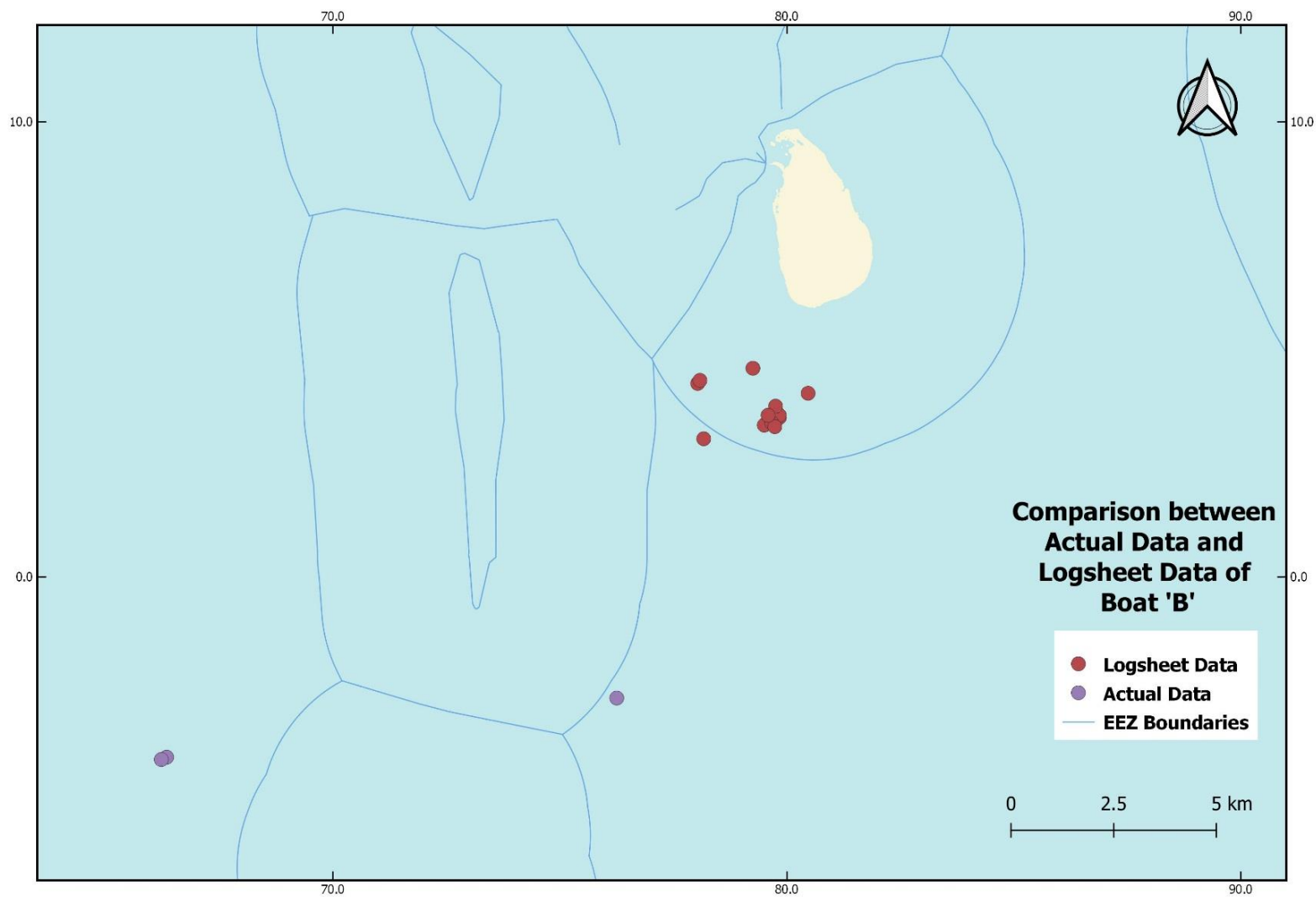
2nd Phase

Date and time data was extracted by the DFAR's EDU from all the images (539) taken by the Crew-based (Local) Observers under the pilot phase of the Crew-based (Local) Observer Programme (100% - *see Table 6 above*). Data discrepancies between the Logbook and electronic date / time data were observed for one vessel during the 2nd Phase. One vessel had incorrectly reported the date and time of fishing in their Logbook. The dates extracted from the images were different from the dates recorded in the Logbook.

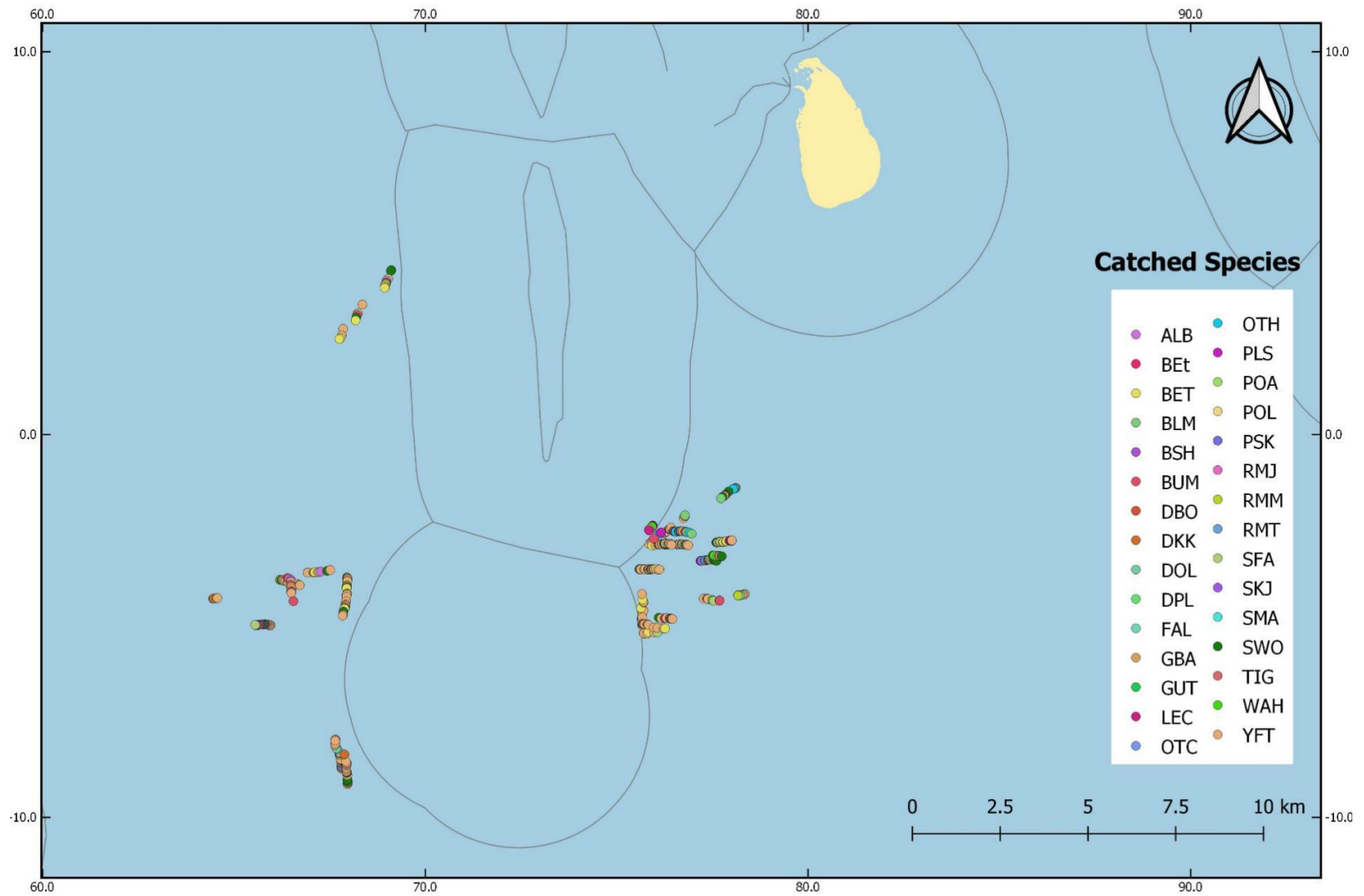
Map VI - Comparison between Logsheet GPS location catch GPS locations from boat A



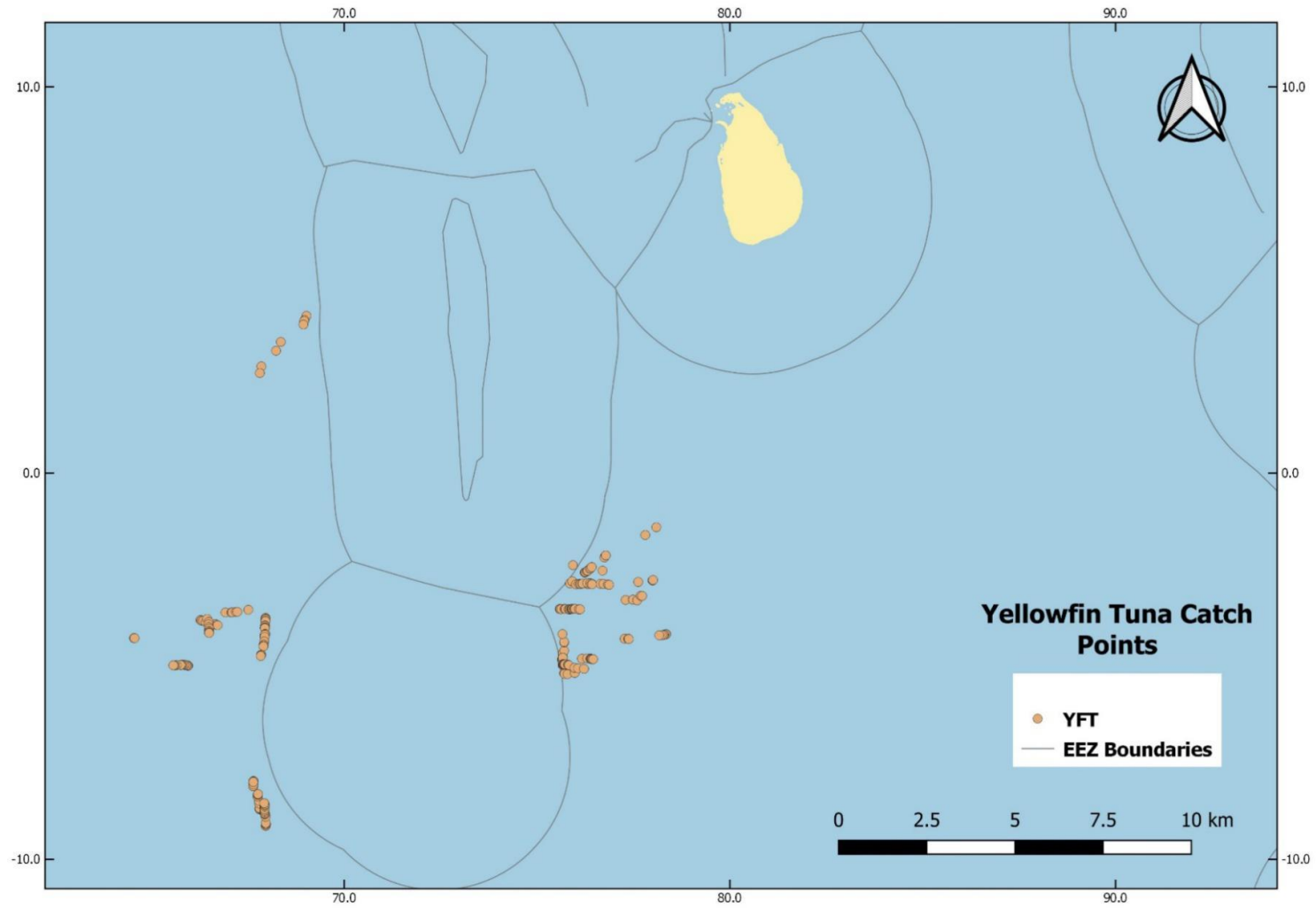
Map VII - Comparison between Logsheet GPS location catch GPS locations from boat B



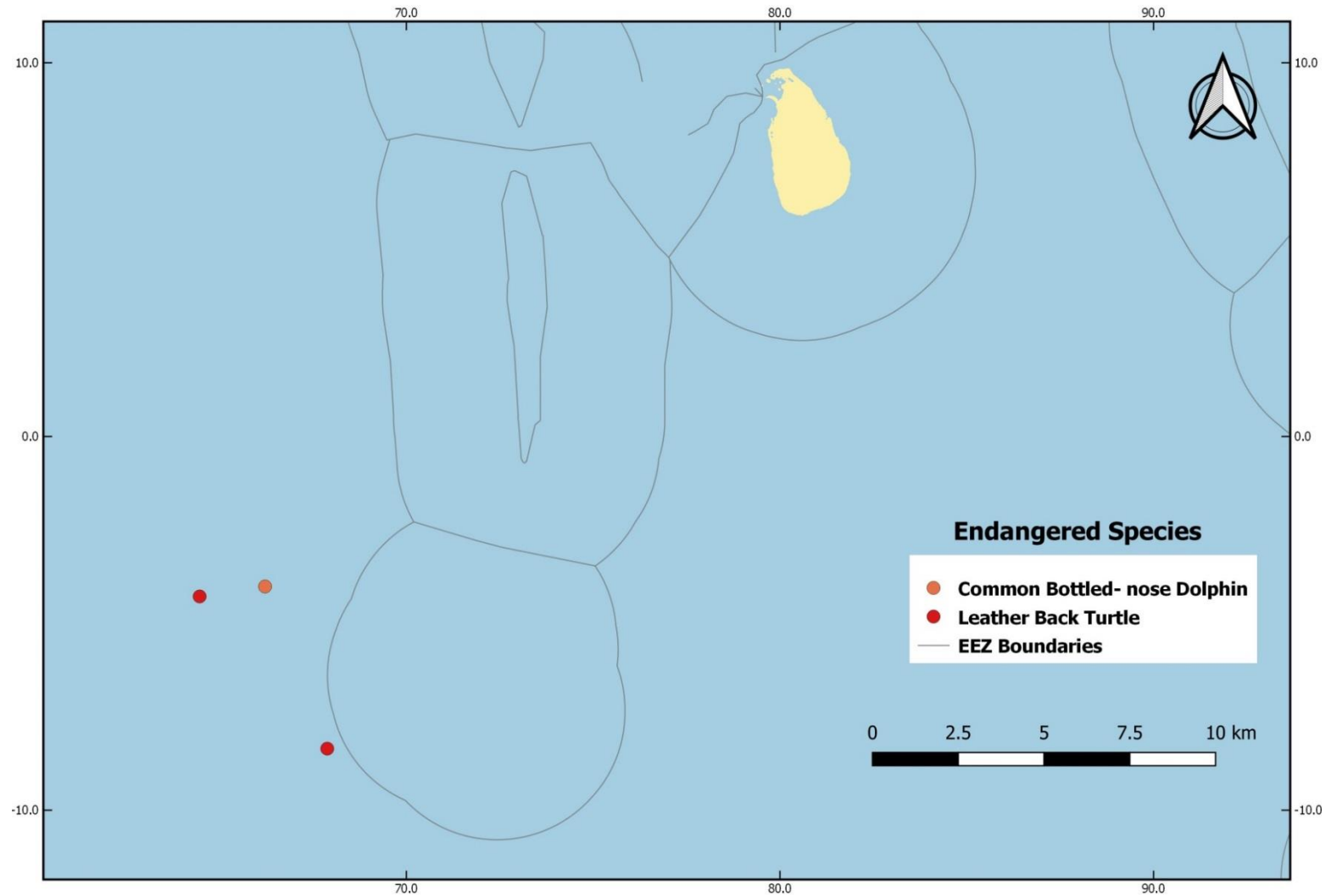
Map VIII - The location of the 474 species observed in the catch during the 2nd Phase



Map IX - The location of yellowfin tuna observed in the catch during the 2nd Phase



Map X - The location of ETP species observed in the catch during the 2nd phase



Key deficiencies in the CATCH / SCIENTIFIC DATA collection methodology highlighted in the Pilot and 2nd Phase are follows

DATA	Pilot Phase	2 nd Phase
CATCH		
CATCH	<p>Bad weather and small boats: Skippers pointed out that it was very difficult to collect images of the catch when the weather was rough</p> <p>Time constraints when the catch rate is high. Skippers pointed out that they are unable to collect data for each and every fish, from each and every set when the catch rate is high.</p> <p>Length measurements for discarded species: There needs to be have some method to identify the length of the discarded species such as turtles, pelagic stingrays and sharks, which are not brought on-board the vessels</p>	<p>Bad weather: Two boats arrived without images of the catch because of the bad weather condition</p> <p>Poor quality of the tablets: Because of the bad quality of the tablets two Crew-based (Local) observers were send with two smart phones</p> <p>Length measurements for discarded species: There need to be have some method to identify the length of the discarded species such as turtles, pelagic stingrays, Ribbon fish</p>
SCIENTIFIC		
ID	There were no data deficiencies related to identifying the observed catch at the local, English, scientific IOTC level.	There were no data deficiencies related to identifying the observed catch at the Crew-based (Local), English, scientific IOTC level.
SEX	Local Observers were able to identify the sex of 40% of the observed catch. Identifying the sex of fish (and other capture species) from external features is difficult. Many of the vessels stored the fish caught whole. Images of many of the observed catch for billfish were taken before fish were gutted and gilled so sex could not be determined.	Sex was not determined during the 2 nd Phase

DATA	Pilot Phase	2 nd Phase
OUTCOME	<i>There were no data deficiencies related to the outcome (i.e. retained / discarded alive / discarded dead) of the observed catch.</i>	<i>There were no data deficiencies related to the outcome (i.e. retained / discarded alive / discarded dead) of the observed catch.</i>
WEIGHT	There were no data deficiencies related to estimating the weight of the retained catch. However <i>Local Observers were unable to record weight data for the observed catch discarded alive, as these fish and other capture species were not brought on board the vessel.</i>	<i>There were no data deficiencies related to retained, discarded dead or alive</i> of the observed catch as a result of the improved training given during the 2 nd Phase and data collected during the debriefing
LENGTH	<i>DFAR was able to extract length data from only 47% of the images collected by the Local Observers.</i> More than half the images did not capture the whole fish. This was a problem particularly for billfish, where the full extent of the bill was not captured by the Local Observers in the image.	<i>DFAR was able to extract length data from 80% of the images in the pilot phase of Crew-based (Local) Observers</i> as a result of the improved training given during the 2 nd Phase
LOCATION	<i>DFAR was able to extract longitude and latitude data from 75% of the images collected by the Local Observers.</i> Software malfunctions in some of the tablets meant that not all images included geo-location data.	<i>DFAR was able to extract longitude and latitude data from 88% of the images collected by the Crew-based (Local) Observers.</i> The location data completely could not be able to be extracted from the two smartphones
TIME / DATE	<i>There were no data deficiencies related to the Time / Date.</i> DFAR was able to extract date and time data from 100% of the images collected by the Local Observers.	<i>There were no data deficiencies related to the Time / Date.</i> DFAR was able to extract date and time data from 100% of the images collected by the Crew-based (Local) Observers.

Conclusion

The results of the Crew-based (Local) Observer programme (Pilot and 2nd Phase) demonstrates that *independently verifiable catch data and other scientific data related to fisheries for tuna and tuna-like species in the IOTC area of competence* can be collected from Sri Lanka's multi-day boat longline fishery where vessels measure less than 24 m length overall, in accordance with IOTC Resolution 11/04 (see Annex A).

The initial success of the Pilot Phase and improvements demonstrated during the 2nd Phase are a consequence of the DFAR officers and staff working in close collaboration with boat owners and skippers through the department's DFO in Negombo and Chilaw and harbour offices in Negombo and Dikowitta and the development of a new, simple, low cost, catch data collection protocol. The Crew-based (Local) Observer catch data protocol combines existing, mandatory logbook information and data, semi-structured post-harvest interviews and independently verifiable, electronic data collection collected using digital cameras, tablets and smartphones.

The Crew-based (Local) Observer protocol enabled the DFAR to collect 34 IOTC Observer data requirements for fisheries for tuna and tuna-like species related to the trip, the gear, individual sets and catch and scientific data pertaining individual fish and other captured species, including ETP species caught per set. Overall the Crew-based (Local) Observer protocol enabled DFAR to achieve **98% compliance** overall with IOTC requirements for independently verifiable catch data and other scientific data related to fisheries for tuna and tuna-like species in the IOTC area of competence, for 33 IOTC Observer data requirements (see Table 12)

Table 12 Compliance with 33 IOTC Observer data requirements during the 2nd Phase

IOTC Observer Reporting Requirements			
Type of Data	Target	Achieved	%
<i>Trip Data</i>	154	149	97%
<i>Gear Data</i>	88	88	100%
<i>Set Data</i>	66	59	89%
<i>Catch Data</i>	476	539	113%
<i>Local Name</i>	539	539	100%
<i>English Name</i>	539	539	100%
<i>IOTC Code</i>	539	539	100%
<i>Outcome</i>	539	539	100%
<i>Weight</i>	539	539	100%
<i>Length</i>	539	431	80%
<i>Location</i>	539	474	88%
<i>Date / Time</i>	539	539	100%
Overall	5,096	4,974	98%

The Crew-based (Local) Observer catch data protocol used during the 2nd Phase enabled the DFAR to achieve 96% compliance with IOTC data requirements related to the trip (97%), the gear (100%) and each longline set (89%).

The Crew-based (Local) Observer catch data protocol used in the enabled the DFAR to collect more information and data concerning the catch (105%), than was recorded in the Logsheet, notably for retained and discarded species. The protocol was equally effective in terms of meeting IOTC's compliance requirements for species identification (100%), IOTC code (100%), Outcome (100%), Weight (100%) and Date / Time of the catch (100%). Some deficiencies remain to be address by the protocol with regard to the collection of IOTC data for length (80%) and Location Caught (88%).

Data deficiencies related to estimating the length of the fish or other species captured were due to the Crew-based (Local) Observer failing to capture the entire image of the fish notably for billfish and the inability to include the scale for discarded species not brought onboard the vessel. The data deficiencies related Date / Time were due to the malfunctioning of the tablets issued by DFAR, which forced two of the Crew-based (Local) Observers to use smartphones to collect digital data during their trip.

The cost of data collection was LKR 30,000.00 (US\$ 166.00) per trip, plus the cost of briefing, debriefing, data analysis and reporting.

Observations & Recommendations

Observations

The following observations were made during the 2nd Phase of the Crew-based (Local) Observer programme

1. ***Sub sampling the number of sets per trip vs sampling all sets:*** The decision to sub sample the number of sets per trip increased the accuracy / veracity of the catch and scientific data collected for each fish or other captured species caught, retained or discarded dead or alive compared to the same results achieved during the Pilot Phase.
2. ***Discrepancies between Logbook Data and Electronic Data:*** several discrepancies were noted between the catch / location / date & time data entered in the Logbook by skippers and the data extracted from the digital images by the DFAR
 - a) ***Catch Data:*** The increased accuracy / veracity of the catch data was notable for less commercially important species that are retained or discarded and ETP species that are discarded (dead or alive). Eight of the eleven vessels submitted more images of fish and other species caught, than were recorded in the Logsheets. The Logsheets are used mostly to record the commercially important species that are caught and intended for export.
 - b) ***Location Data:*** The new Crew-base (Local) Observer protocol enabled the DFAR to identify two vessels that had incorrectly reported their fishing locations in their Logbooks. In both instances these vessels were licensed to fish within Sri Lanka's EEZ, but the electronic catch data images revealed that both vessels were fishing illegally beyond the EEZ.
 - c) ***Date & Time Data:*** The new Crew-base (Local) Observer protocol enabled the DFAR to identify one vessel that had incorrectly reported date and time of fishing in their Logbooks. In this instance the dates extracted from the images were different from the dates recorded in the Logbook.
3. ***Cameras vs Tablets:*** Digital cameras are more suitable than tablets to collect electronic images with embedded GPS, date and time data because they are easier to operate, have a longer battery life, are easier to charge and easier to extract electronic information from.
4. ***Financial Incentive:*** paying selected skippers and their crew to collect IOTC Observer data greatly increased the commitment of skippers and the crew to collect accurate and reliable data.

Recommendations

The protocol used during the 2nd Phase enabled the DFAR achieved 97% compliance with 33 IOTC variables relating to the trip, gear, set, catch and other scientific data requirements for fisheries for tuna and tuna-like species in the IOTC area. Before the next deployment of Local Observers the following recommendations are proposed to further improve the accuracy / veracity of information and data collected using the Crew-based (Local) Observer protocol

Recommendation I Skippers and crew selected as Local Observers need to be given **written instructions** about number of sets from which they need to collect data; guidance on how to capture the full length of the fish – notably billfish and a reminder of the need to capture at least one image of every fish and other captured species for the entire set. .

Recommendation II **A method to estimate the length of discarded (dead or alive) fish and other captured species** without being brought aboard the boat is required to enable DFAR to collect length data for these species.

Recommendation III Skippers and crew selected as Local Observers need to be given **training about de-hookers and line cutters**, to ensure more fish and other captured species that are caught can be discarded alive

Recommendation IV Skippers and crew selected as Local Observers must be issued with **digital cameras** as this is the most effective and reliable way to collect electronic information and data about the catch.

Recommendation V The payment of a **financial incentive per trip** is necessary to ensure the successful submission of the Crew-based (Local) Observer Programme Record Book and Images for three sets per trip

Recommendation VI Ten to fifteen skippers are selected and appointed as **‘Local Observers’** under each DFO within which there is a multi-day boat EEZ and or beyond EEZ fishery. The selected **‘Local Observers’** will be required to collect IOTC Observer data from not more than five trips per year.

Electronic Logbook (eLogbook Lite) Android Application

Introduction

In April 2015, Sri Lankan fish export to countries in the European Union was banned by the European Commission (EC), due to the prevalence of illegal, unreported, and unregulated fishing in Sri Lanka's offshore (EEZ) and high seas (beyond EEZ) fisheries¹³. A total of 56 violations of the IOTC's management, monitoring, control and surveillance requirements were produced by the EC to the Government of Sri Lanka (GoSL) in support of the ban. Key violations included no records of the location (GPS points) of the fishing grounds within and beyond Sri Lanka's EEZ; inadequate or no records of the catch per boat; the absence of mandatory trip and gear data; no details of the non-target species caught and discarded dead or alive.

To address these violations and regain access to key European markets for Sri Lanka seafood¹⁴ the GoSL immediately initiated the introduction of a real time satellite based Vessel Monitoring System (VMS) for Sri Lanka's fisheries operating beyond the EEZ and a Logbook in which skippers could record the mandatory trip requirements for trip, gear, set and catch.

Manual Logbook - 2015

The initial Logbook system introduced in 2015 was a paper-based, manual system which is still in use today (see example overleaf). Trip, gear, set and catch data extracted from the paper-based Logbook was integrated manually into the Crew-based (Local Observer) Logbook described as above.

A number of issues continue to reduce the effectiveness / accuracy / veracity of the paper-based Logbook system. The DFAR has noted the following inconsistencies in the use of the paper-based, manual system Logbook system used by skippers and boat owners since 2015.

- Fishing locations that are recorded in the Logbook by skippers are not accurate, some locations recorded are land locations
- Boats which are registered to fish only in Sri Lanka's EEZ are engaged in illegal fishing beyond Sri Lanka's EEZ, but submit Logsheets with false GPS locations showing the vessels to be fishing within the Sri Lanka's EEZ (*see Scientific Data – Locations 2nd Phase above*)
- According to the fishermen handling the Logbook and writing up the trip, gear, set and catch data in the sea is difficult
- Logbooks alone are insufficient to enable DFAR to collect data on the total catch, including retained and discarded species with low or no commercial value.

¹³ <https://www.scientificamerican.com/article/eu-to-ban-fish-from-sri-lanka/>

¹⁴ <https://www.undercurrentnews.com/2015/06/29/sri-lanka-seafood-exports-drop-41-on-eu-ban/>

DFAR Logsheets - 2015

Daily Catch Data for a Fishing Trip - එක් මුහුදු ගමනක් සඳහා මිසින ඇල්ලීමේ දත්ත සටහන																																			
Name of Skipper/Reporter නැව්පුරායාගේ නම		Departure Date විදායා දිනය		Arrival Date පැමිණි දිනය		Boat Registration Number/නැව් පිටුවේ අංකය		National /ජාතික		IMUL-A-0822CHW		IMUL-A-0822CHW		IMUL-A-0822CHW		IMUL-A-0822CHW		IMUL-A-0822CHW																	
Skipper License Number නැව්පුරායාගේ අංකය		Departure Port විදායා වරාය		Arrival Port පැමිණි වරාය		Operation License Number/ මත්ලාශ්වර්ති අංකය		National /ජාතික		IMUL		IMUL		IMUL		IMUL		IMUL																	
Longline / Handline / Handline		Handline		Handline		Handline		Handline		Handline		Handline		Handline		Handline		Handline																	
Month	Date of start	Start time	Setting position	Latitude	Longitude	Float & Branch line length	No. of hooks between floats	Total no. of hooks	Type of bait	No. & Kg of fish	Yellow fin tuna	Big eye tuna	Striped tuna	Albacore	Long tail tuna	Kawakawa	Bullet tuna	Frigate tuna	Spanish mackerel	Wahoo	Sword fish	Bleu marlin	Buck marlin	Striped marlin	Salt fish	Blue shark	Mako shark	Hammer head shark	Silly shark	Manta spp	Manta spp	REMARKS	Other		
10	14	09:00	S 05.44	E 76.14	24	7	1400	00	No	15																									
11	6	11	S 06.00	E 76.14	11	11	11	11	No	1																									
11	11	11	S 05.32	E 76.00	11	11	11	11	No	3																									
11	14	11	S 08.40	E 76.10	11	11	11	11	No	2																									
11	16	11	S 04.00	E 75.45	11	11	11	11	No	3																									
11	19	11	S 04.12	E 75.22	11	11	11	11	No	1																									
11	21	11	S 06.44	E 76.50	11	11	11	11	No	8																									
11	23	11	S 06.58	E 76.46	11	11	11	11	No	40																									
11	25	11	S 06.04	E 76.24	11	11	11	11	No	2																									
11	27	11	S 05.44	E 76.16	11	11	11	11	No	8																									
11	29	11	S 04.24	E 75.54	11	11	11	11	No	5																									
Total number and Kg of fish										No	83	10																							
මුළු මාත් කුටි ගන්න සහ කිලෝ ග්‍රෑම් ගන්න										kg	358	382																							
Signature of the Skipper - නැව්පුරායාගේ අත්සන										Received / ලබා ගනිමි. Date 2018/11/29										Observation by the Officer - නිලධාරියාගේ නිරීක්ෂණ															
Date - දිනය 15.11.2018										Signature and Stamp of the Authorized Officer (FI / FRMA / FO / Harbour Manager)										LB-18 5															
																				0457															

Electronic Logbook / Tablet Application– 2017

In 2017 the DFAR introduced a Rugged Tablet T800RG with an electronic Logbook (eLogbook Lite) application (app) to address the issues continue to reduce the effectiveness / accuracy / veracity of the paper-based Logbook system. The tablet was purchased from Ewis Pvt Ltd, with the specifications such as a tab with good durability, which is resistant to the worse conditions in the sea given by DFAR. DFAR purchased 2,328 tablets from Ewis Pvt Ltd in August 2017 and distributed the tablets together with the app to multiday fishing boat owners that were registered to receive fuel subsidiaries and registered to fish only within Sri Lanka's EEZ. The tablets were given to EEZ Only registered vessels because these boats are not equipped with VMS. The eLogbook Lite system introduced by DFAR in 2017 sought to address both the trip, gear, set and catch data requirements of the IOTC and provide accurate GPS data for the fishing activities of EEZ Only registered vessels, which are suspected of fishing illegally beyond the EEZ.

Three issues compromised the effectiveness of the eLogbook Lite system introduced by the DFAR in 2017

- 1) The tablets were not accurate in receiving satellite signals at sea to give reliable and accurate GPS locations for the setting and hauling points during each fishing trip.
- 2) The tablets were too big to handle in the boat and charging the tablets at sea proved to be problematic
- 3) Boat owners who had not received a free tablet under the 2017 programme were unwilling to buy their own tablet to participate in the eLogbook Lite programme, but instead requested the DFAR to provide the same software application for smartphones, which they already owned.

Electronic Logbook / Smartphone (Android) Application – 2017

In August 2019 the DFAR proposed and the Crew-based (Local) Observer sub project agreed to support the development of an eLogbook Lite android application for smartphones. The DFAR proposed that the application would enable the DFAR to collect electronic trip, gear, set and catch data requirements of the IOTC's; provide accurate GPS data for the fishing activities of both EEZ Only registered (without VMS) and beyond EEZ registered vessels (with VMS) and enable the DFAR to integrate digital trip, gear, set and catch data with the digital scientific data collected through the Crew-based (Local) Observer protocol.

In September pelagikos Pvt Ltd signed a contract with Hynet Pvt Ltd to research and develop an eLogbook Lite android application for smartphones to collect electronic trip, gear, set and catch data requirements of the IOTC from Sri Lanka's EEZ and beyond EEZ fisheries, compatible with the Crew-based (Local) Observer protocol.

eLogbook Lite Android Application & Specifications

The Android app developed by Hynetz Pvt Ltd between September 2018 and August 2019 is a mobile app designed to replace the tablet application (2017) and the traditional paper logbook introduced by the DFAR in 2015. The app was designed to maximize the skipper's productivity by providing tools to assist in automating the process of entering full trip, gear and catch data during the fishing trip, which would otherwise have to be performed manually (at the end of the voyage).

The app contains two levels of access, each of which is described briefly below.

Level I - Harbor Officer (DFAR)

A DFAR officer is required to login to app using their individual Username and Password to initiate the app. This action is performed at the Harbor officer of the departing harbor. The vessel's registration details and the skipper's data are added by the DFAR Harbour Officer before the departure of the vessel. The key steps involved at Level I are as follows

- Step 1** The harbour officer tap login button
- Step 2** System will display login screen to harbor officer
- Step 3** Harbour officer enter username and password
- Step 4** Harbour officer tap submit button
- Step 5** System will display screen to add skipper and vessel details
- Step 6** Harbour officer enter vessel details and skipper details
- Step 7** Harbour officer tap submit button
- Step 8** System will display screen to add departure details

Level II - Skipper

Once the app has been activated by the Harbour Officer, the skipper can enter the departure data and add / edit the gear data through the app. The skipper also thereafter add/edit the catch data for each set during the fishing trip at the sea. Once the vessel returns to the harbour, the skipper can add the arrival data to trip data through the app and then submit all the data – trip / gear / set / catch – to the DFAR electronically. Once the skippers submits the information, the system will upload all data to the DFAR's server automatically and logout the skipper from system. The key steps involved at Level II are as follows

- Step 1** **Departure data**
 - ✓ Skipper add departure details
 - ✓ Skipper will tap submit button
 - ✓ System will display the screen with button to add gear data, catch data

Step 2 Gear data

- ✓ Skipper tap 'gear'
- ✓ System will display a screen to add gear or edit gear
- ✓ If Skipper select add system will display empty form to add gear data. Else system will display list of gear data which Skipper have added on current trip and Skipper have to select a gear to edit.
- ✓ Skipper will fill the details and submit
- ✓ System will validate and recode data and return to add gear data, catch data screen

Step 3 Catch data

- ✓ Skipper tap 'catch data'
- ✓ System will display a screen to add or edit catch data
- ✓ If Skipper select add system will display empty form to add catch data. Else system will display list of sets which Skipper have added on current trip and user have to select a set to edit.
- ✓ Skipper will fill the details and submit or submit and add new
- ✓ If Skipper click submit system will validate and recode data and return to add gear data, catch data screen. Else system will display new form to enter next catch data.
- ✓ System will validate and recode data and return to add gear data, catch data screen

Step 4 Arrival data

- ✓ Skipper tap 'Arrival'
- ✓ System will display a form to add arrival details
- ✓ If Skipper submit the form, system will validate and recode it.
- ✓ If internet connection available system will upload all data to server and logout skipper from system

After the data has been uploaded to the server, it is verified online by the Harbour Office by logging into the DFAR's database. Following verification, the data is then certified online by the Assistant Director of High Seas Division of DFAR. The final data verification for exported fish items is done by the DFAR officers of the DFAR's Bandaranayke International Airport Unit, before the fish caught during the trip are exported. A visual presentation of the eLogbook Lite Andriod app is presented in Annex II

Current Status, Implementation & Future Plans

The eLogbook Lite app is currently being rolled out by the DFAR the installation of the app on skippers' smartphone is being undertaken on an individual basis by the DFAR officers of the EDU and Harbour Offices. In the future the DFAR hopes to add the app to the Google Play Store, so that skippers and boat owners can download the app themselves.

As noted above the eLogbook Lite mobile app has four main actors. The DFAR at the district / harbour level initiates the app. The skipper accesses the system through the mobile app. The DFAR systems administrator accesses the system through the web portal and the Officers of the Bandaranayke International Airport DFAR Unit. Access to the app through the login password for the app is only available to the Assistant Director of the High Seas Division, the Harbour Officer and the Officers of the Bandaranayke International Airport DFAR Unit.

In August 2019 Harbour officers in 13 out of the 17 multiday boat fishing harbours began introducing the app to selected skippers in their respective harbours. Skippers selected were informed that they needed to make an '*eLogbook Lite team*' by adding skippers known to them. The minimum number of skippers in an '*eLogbook Lite team*' is six. The maximum number is 16. Each teams is called an *e-team*. The EDU is in the process of awarding marks for each Harbour, depending on the progress that they are making towards the introduction of the eLogbook Lite mobile app against the following requirements.

- Number of members in a team (Start score will be 0. for every additional member will add 1 point)
- All the members should complete the trip by collecting departure data, gear data, set data and arrival data using e-Log Book mobile application
- Score will be calculated using percentage of operational tab/smart phone with newest version of e-log application and percentage of inquiries to E-Wis pvt ltd for broken tabs.
- Evidence should be presented to prove that harbor officer had given practical training to the skipper about app before departure (*see images below*)
- Score will be calculated using number of inquiries to the EDU under the IT Division and the validity of those inquiries
- A score will be given for the implement of data collection from 1st of August according to the advices given by the IT Division

Training programs conducted by the harbor officers about e-Logbook mobile application



As of the 30th August 2019, 13 out of the 17 multiday boat fishing harbours in Sri Lanka (see *Table 13*) are implementing the data collection successfully. Among them Valachchenai, Cod Bay, Oluvil, Galle and Dondra fishery harbours have achieved the highest marks with better data collection.

Table 13 Summary of total marks achieved by the fishery harbors in August

No	Harbour Name	Total Marks Officer level	No. of Officers	Total Marks Harbour Level
1	Valachchennai	122	4	30.50
2	Cod Bay	70	6	11.70
3	Oluvil	28	6	4.70
4	Galle	24	8	3.00
5	Dondra	16	8	2.00
6	Mirissa	7	7	1.00
7	Kalpitiya	6	3	2.00
8	Pitipana	6	5	1.20
9	Kottagoda	5	3	1.70
10	Nilwella	5	3	1.70
11	Hambanthota	5	3	1.70
12	Beruwala	3	8	0.40
13	Ambalangoda	1	5	0.20
14	Dikkowita	0	5	0.00
15	Hikkaduwa	0	2	0.00
16	Kudawella	0	8	0.00
17	Kirinda	0	4	0.00

As of the 30th August 2019, 1,030 eLogsheets have been prepared by the IT Division of DFAR by using eLogbook Lite mobile application (see overleaf). The eLogsheets includes video of a skipper releasing a turtle recorded by one of skippers participating in the programme. According to skippers, using e-Logbook mobile application for data collection is easier than using tablets.

The eLogbook Lite mobile application also enables the DFAR's EDU to integrate the digital images (electronic catch data) collected by the Local Observers using the Crew-based (Local) Observer protocol. By combining the electronic trip, gear and catch data collected through the eLogbook Lite app with the digital images collected by skippers using the Crew-based (Local) Observer protocol, the DFAR has evolved an independently verifiable, electronic Observer platform, which will enable Sri Lanka's EEZ and beyond EEZ fisheries further improve the fisheries' compliance with IOTC monitoring, surveillance and control and regional Observer Programme requirements.

DFAR eLogsheet - 2019

9/11/2019				Log Sheet view					
Daily Catch Data for a Fishing Trip				Verified by Harbor			Not Certified by AD		
DFAR	Name of Skipper/ Reporter	IMULA0639CHW	Departure Date	2018-12-30 13:56:00	Arrival Date	2019-02-12 13:56:00	Boat Rgeistration Number	National IOTC	IMULA0639CHW
	Skipper License No	SL006CHW	Departure Port	Dickowita	Arrival Port	Dickowita	Operation License No	National High Seas	
Gear Type									
Set No	Start Date & Time	Start Latitude	Start Longitude	End Date & Time	End Latitude	End Longitude	Fish Name	Quantity	Weight(kg)
561	2019-01-08 12:00:00	5.1000	79.0000	2019-01-08 13:56:00	0.0000	0.0000	Yellow fin tuna - RETAINED	3	120
561	2019-01-08 12:00:00	5.1000	79.0000	2019-01-08 13:56:00	0.0000	0.0000	Blue marlin - RETAINED	2	200
561	2019-01-08 12:00:00	5.1000	79.0000	2019-01-08 13:56:00	0.0000	0.0000	Sail fish - RETAINED	8	160
562	2019-01-10 06:00:00	520.0000	7,908.0000	2019-01-10 13:56:00	0.0000	0.0000	Yellow fin tuna - RETAINED	2	100
562	2019-01-10 06:00:00	520.0000	7,908.0000	2019-01-10 13:56:00	0.0000	0.0000	Sail fish - RETAINED	4	60
563	2019-01-12 06:30:00	540.0000	7,910.0000	2019-01-12 13:56:00	0.0000	0.0000	Yellow fin tuna - RETAINED	7	245
563	2019-01-12 06:30:00	540.0000	7,910.0000	2019-01-12 13:56:00	0.0000	0.0000	Blue marlin - RETAINED	1	115
564	2019-01-14 06:29:00	520.0000	7,850.0000	2019-01-14 13:56:00	0.0000	0.0000	Yellow fin tuna - RETAINED	10	400
564	2019-01-14 06:29:00	520.0000	7,850.0000	2019-01-14 13:56:00	0.0000	0.0000	Sail fish - RETAINED	4	50
565	2019-01-16 06:29:00	530.0000	7,900.0000	2019-01-16 13:56:00	0.0000	0.0000	Yellow fin tuna - RETAINED	3	90
565	2019-01-16 06:29:00	530.0000	7,900.0000	2019-01-16 13:56:00	0.0000	0.0000	Sword fish - RETAINED	1	40

1/2

9/11/2019

Log Sheet view

Daily Catch Data for a Fishing Trip

Verified by Harbor

Not Certified by AD

Summary of Catch Data for Voyage

Fish Name	Reported Quantity	Reported Weight	Verified Quantity	Verified Weight
Yellow fin tuna	25	955		
Sword fish	1	40		
Blue marlin	3	315		
Sail fish	16	270		

2/2

Colombo
19th September 2019

Annex I - The Indian Ocean Tuna Commission Resolution 11/04

TAKING INTO ACCOUNT the need to increase the scientific information, in particular to provide the IOTC Scientific Committee working material in order to improve the management of the tuna and tuna-like species fished in the Indian Ocean;

REITERATING the responsibilities of flag States to ensure that their vessels conduct their fishing activities in a responsible manner, fully respecting IOTC Conservation and Management Measures;

CONSIDERING the need for action to ensure the effectiveness of the IOTC objectives;

CONSIDERING the obligation of all IOTC Contracting Parties and Cooperating Non-Contracting Parties (hereinafter CPCs) to fully comply with the IOTC Conservation and Management Measures;

AWARE of the necessity for sustained efforts by CPCs to ensure the enforcement of IOTC's Conservation and Management Measures, and the need to encourage Non-Contracting Parties (NCPs) to abide by these measures;

UNDERLINING that the adoption of this measure is intended to help support the implementation of Conservation and Management Measures as well as scientific research for tuna and tuna-like species;

CONSIDERING the provisions set forth in Resolution 10/04 *On A Regional Observer Scheme* [superseded by [resolution 11/04](#)], adopted by the Commission;

CONSIDERING the deliberations of the 12th Session of the IOTC Scientific Committee held in Victoria, Seychelles from 30 November to 4 December 2009

ADOPTS, in accordance with the provisions of Article IX, paragraph 1 of the IOTC Agreement, the following:

Objective

1. The objective of the IOTC observer scheme shall be to collect verified catch data and other scientific data related to the fisheries for tuna and tuna-like species in the IOTC area of competence.

Observer Scheme

2. In order 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 CPC while fishing 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) shall be covered by this observer scheme. For vessels under 24 meters if they fish outside their EEZ, the above mentioned coverage should be achieved progressively by January 2013.

3. When purse seiners are carrying an observer¹ as stated in paragraph 1, this observer shall also monitor the catches at unloading to identify the composition of bigeye tuna catches. The requirement for the observer to monitor catches at unloading is not applicable to CPCs already having a sampling scheme, with at least the coverage set out in paragraph 2.

4. The number of the artisanal fishing vessels landings shall also be monitored at the landing place by field samplers². The indicative level of the coverage of the artisanal fishing vessels should progressively increase towards 5% of the total levels of vessel activity (i.e. total number of vessel trips or total number of vessels active).

5. CPCs shall:

- a. Have the primary responsibility to obtain qualified observers. Each CPC may choose to use either deployed national or non-national of the flag State of the vessel on which they are deployed;
- b. Endeavour that the minimum level of coverage is met and that the observed vessels are a representative sample of the gear types active in their fleet;
- c. Take all necessary measures to ensure that observers are able to carry out their duties in a competent and safe manner;
- d. Endeavour to ensure that the observers alternate vessels between their assignments. Observers are not to perform duties, other than those described in paragraphs 10 and 11 below;
- e. Ensure that the vessel on which an observer is placed shall provide suitable food and lodging during the observer's Phase at the same level as the officers, where possible. Vessel masters shall ensure that all necessary cooperation is extended to observers in order for them to carry out their duties safely including providing access, as required, to the retained catch, and catch which is intended to be discarded.

6. The cost of the observer scheme in paragraph 2 and 3 shall be met by each CPC.

7. The sampling scheme referred in paragraph 4 will be covered by the Commission's accumulated funds and voluntary contribution on a provisional basis. The Commission will consider an alternative for the financing of this scheme.

8. If the coverage referred in paragraphs 2 and 3 is not met by a CPC, any other CPC may, subject to the consent of the CPC who has not met its coverage, place an observer to fulfil the tasks defined in the paragraphs 1 and 2 until that CPC provides a replacement or the target coverage level is met.

9. CPCs shall provide to the IOTC Executive Secretary and the IOTC Scientific Committee annually a report of the number of vessels monitored and the coverage achieved by gear type in accordance with the provisions of this Resolution.

10. Observers shall:

- a. Record and report fishing activities, verify positions of the vessel;
- b. Observe and estimate catches as far as possible with a view to identifying catch composition and monitoring discards, by-catches and size frequency;
- c. Record the gear type, mesh size and attachments employed by the master;
- d. Collect information to enable the cross-checking of entries made to the logbooks (species composition and quantities, live and processed weight and location, where available); and
- e. Carry out such scientific work (for example, collecting samples), as requested by the IOTC Scientific Committee.

11. The observer shall, within 30 days of completion of each trip, provide a report to the CPCs of the vessel. The CPCs shall send within 150 days at the latest each report, as far as continuous flow of report from observer placed on the longline fleet is ensured, which is recommended to be provided with 1°x1° format to the IOTC Executive Secretary, who shall make the report available to the IOTC Scientific Committee upon request. In a case where the vessel is fishing in the EEZ of a coastal State, the report shall equally be submitted to that coastal State.

12. The confidentiality rules set out in the Resolution 98/02 **[superseded by [Resolution 12/02](#)]** *Data confidentiality policy and procedures for fine-scale data* shall apply.

13. Field samplers shall monitor catches at the landing place with a view to estimating catch-at-size by type of boat, gear and species, or carry out such scientific work as requested by the IOTC Scientific Committee.

14. The funds available from the IOTC balance of funds may be used to support the implementation of this programme in developing States, notably the training of observers and field samplers.

15. The elements of the Observer Scheme, notably those regarding its coverage, are subject to review and revision, as appropriate, for application in 2012 and subsequent years. Basing on the experience of other Tuna RFMOs, the IOTC Scientific Committee will elaborate an observer working manual, a template to be used for reporting (including minimum data fields) and a training program.

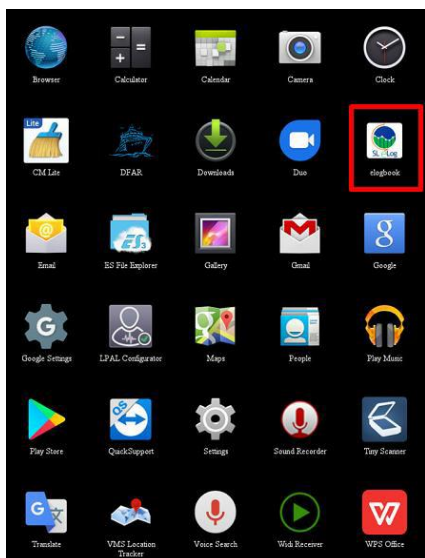
16. This Resolution supersedes Resolution 10/04 *On A Regional Observer Scheme*.

Footnotes:

1. **Observer:** a person who collects information on board fishing vessels. Observer programmes can be used for quantifying species composition of target species, bycatch, by-products and dead discards, collecting tag returns, etc.
2. **Field sampler:** a person who collects information on land during the unloading of fishing vessels. Field sampling programmes can be used for quantifying catch, retained bycatch, collecting tag returns, etc

Annex II – Visual Presentation of the “eLogbook Lite’ App

1. Tap on the icon to start the application and the login screen will be appeared. Use the login credentials to enter into the application.



2. Selecting the language is the first step to be completed and then you should fill the text fields such as Vessel ID, Skipper ID and Phone number and **Save** them to continue to START



TRIP

ELOGBOOK LITE

0000000000

Next

ELOGBOOK LITE

LANGUAGE

SET VESSEL ID

SET SKIPPER ID

SET PHONE ID

Save



Start Trip

Logout

3. After starting the trip, the departure date & time should be added → Next

Departure Date

Select Date & Time

Next

Departure Date

Set date

			July 2019							
	S	M	T	W	T	F	S			
Jun	22	2018	27	30	1	2	3	4	5	6
Jul	23	2019	28	7	8	9	10	11	12	13
Aug	24	2020	29	14	15	16	17	18	19	20
			30	21	22	23	24	25	26	27
			31	28	29	30	31	1	2	3
			32	4	5	6	7	8	9	10

Done

Departure Date

Set time

09	31
10	32
11	33

Done

Departure Date

July 23rd 2019, 10:32:00 am

Next

4. Departure harbor should be entered as the next step. By drag up the screen, more harbors are available. Chose the one which is mentioned in the log sheet. Once the NEXT is tapped, REMARKS should be added if available. If not, enter “00” in the text field and tap NEXT.

Departure Harbor

Pitipana

Dickowita

Kalpitiya

Galle

Hikkaduwa

Ambalangoda

Beruwala

Hambanthota

Next

Remarks

LB-18 1204

Next

5. Now it will redirect to the new window with a new set of menus GEAR DATA, SET DATA, CATCH DATA & END TRIP. Please note that END TRIP must be tapped once all the activities are entered in the log sheet which technically means that the particular trip of the vessel is ended.

Under **GEAR DATA** menu, there are the fields which capture the common information about the trip which are shown below.

Type of fishing	Sub category	Questions to be answered
Longline		Main Line, Branch Line, No of Hooks, Hooks type, Depth & Bait type
Gill net	Nylon braided	Mesh size, Ply of the net, Height of the net, Depth at which the Net Set & Number of net pieces
	Nylon Multifilament	-do-
	Other	-do-
Ring net		Length of the Ring Net & Height of the Ring net

These details are entered as they are indicated in the log sheet.

<div>Gear Data</div> <div>Set Data</div> <div>Catch Data</div> <div>End Trip</div>	<div>Gear Data</div> <div>Longline</div> <div>Gillnet</div> <div>Ring Net</div>	<div>Mainline</div> <div>00</div> <div>Next</div>
--	---	---

<div>Branch Line</div> <div>15</div> <div>Next</div>	<div>No. of Hooks</div> <div>7</div> <div>Next</div>	<div>Hooks Type</div> <div>J 36</div> <div>J 26</div> <div>O 83</div> <div>O 17</div> <div>Next</div>
--	--	---

<div>Depth</div> <div>00</div> <div>Next</div>	<div>Bait</div> <div>SQUID</div> <div>FLYING FISH</div> <div>MILK FISH</div> <div>OTHER</div> <div>Next</div>
--	---

- Under **SET DATA** menu, following fields such as **Set data**, **Start date**, **Set number**, **Start GPS**, **End GPS**, **End date** should be filled. Set data in the sense, each record/ row in the log sheet must be created as a set. For example, if the log sheet has 5 rows, then 5 sets should be created in the application.

Menu options:

- Gear Data
- Set Data**
- Catch Data
- End Trip

Set Data

LONGLINE

Next

Set Start Date

Select Date & Time

Next

Start GPS

02.16

69.40

Next

End GPS

02.16

69.40

Next

Set End Date

Select Date & Time

Next

Set date

March 2019

S	M	T	W	T	F	S
30	3	4	5	6	7	8
31	10	11	12	13	14	15
1	17	18	19	20	21	22
2	24	25	26	27	28	29
3	31	1	2	3	4	5
4	7	8	9	10	11	12

Done

Set time

09 31

10 32

11 33

Done

Set Start Date

Set date

			July 2019						
			S	M	T	W	T	F	S
Jul	22	2018	27	30	1	2	3	4	5
Jul	23	2019	28	7	8	9	10	11	12
Aug	24	2020	29	14	15	16	17	18	19
			30	21	22	23	24	25	26
			31	28	29	30	31	1	2
			32	4	5	6	7	8	9

Done

Set Start Date

Set time

09 : 31

10 : 32

11 : 33

Done

Set Number

1

Next

7. The last details those have to be entered is the **CATCH DATA** which contains of the fish details those are get caught by the vessel on that particular trip.

Gear Data

Set Data

Catch Data

End Trip

Catch Data

Enter Catch Data

View Catch Data

Edit Catch Data

(Under Development)

Save

Select Set

SET 1 / LONGLINE

SET 2 / LONGLINE

Next

Enter Retained Fish Data

Enter Discarded dead fish Data

Enter Discarded live Fish Data

Add Fish to another Set

Seve

Fish Type

TUNA

Neritic Tuna

BILL FISHES

Sharks /Rays

Other Fish

Other Animals

Turtles

Next

Fish List

Yellow fin tuna

FISH QTY WEIGHT

Big eye tuna

FISH QTY WEIGHT

Skip Jack Tuna

FISH QTY WEIGHT

Albacore

FISH QTY WEIGHT

Other tuna

FISH QTY WEIGHT

Enter Retained Fish Data

Enter Discarded dead fish Data

Enter Discarded live Fish Data

Add Fish to another Set

Save

Fish Type

TUNA

Neartic Tuna

BILL FISHES

Sharks /Rays

Other Fish

Other Animals

Turtles

Next

Fish List

Sword fish

4150

Blue marlin

FISH QTYWEIGHT

Black marlin

170

Stripped marlin

FISH QTYWEIGHT

Sail fish

FISH QTYWEIGHT

Enter Retained Fish Data

Enter Discarded dead fish Data

Enter Discarded live Fish Data

Add Fish to another Set

Save

Gear Data

Set Data

Catch Data

End Trip

As shown above, each fish details should be entered one by one along by its type.

8. When the **END TRIP** button is tapped, the particular trip by the vessel will come to an end. To complete this, it will further need some information such as **Arrival date & Arrival harbor**

The sequence of screens for completing a trip entry is as follows:

- Main Menu:** Contains buttons for 'Gear Data', 'Set Data', 'Catch Data', and 'End Trip' (highlighted with a pink border).
- Arrival_date_:** A screen with a 'Select Date & Time' button (highlighted with a red border) and a 'Next' button.
- Set date:** A calendar view for March 2019. The 'Done' button at the bottom is highlighted with a red border.
- Set time:** A time selection interface showing the time 10:32. The 'Done' button at the bottom is highlighted with a red border.
- Arrival_date_:** A confirmation screen showing 'March 17th 2019, 10:32:00 am' and a 'Next' button.
- Arrival Harbor_:** A screen with a list of harbor names: Pitipana, Dickowita (highlighted with a red border), Kalpitiya, Galle, Hikkaduwa, Ambalangoda, Beruwala, and Hambonthota. A 'Next' button is at the bottom.

9. Finally, when the harbor is selected and NEXT is tapped, it will ask to submit the filled data to the live server.

