

New information and data on the effectiveness of a crew-based observer protocol for IOTC data collection of on-board artisanal fishing boats targeting tuna and tuna-like species within Sri Lanka's exclusive economic zone, in compliance with Resolution 25/06 On A regional observer scheme

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Abstract

The Regional Observer Scheme (ROS) conducted by DFAR in 2013 revealed that, the small size and the less facilities of the artisanal and semi-industrial vessels of Sri Lanka are not suitable to deploy a human observer onboard. Department of fisheries and Aquatic Resources (DFAR) of Sri Lanka is currently working to develop a cost effective and technically efficient Electronic Monitoring System (EMS) to collect on-board data. The success of the crew-based observer program initiated in 2018, to collect independently verifiable information through the skipper in <24 m High seas (BEEZ) longline and gillnet vessels was continuously implemented with the support of DFAR. Data collection was initiated within Exclusive Economic Zone (EEZ), <24 m longline and gillnet vessels in 2025, to check the effectiveness of the crew-based observer program with the implementation of the Resolution 25/06 (*Resolution 24/04 updated in 2025*). The study revealed that the crew-based observer program conducted within EEZ is able to fill 86% of the requirements **once per trip** for the longline vessels, 84% of the reporting requirements **once per trip** for gillnet and 100% of the reporting requirement of data **once per set / shot** mentioned in the IOTC **Resolution 15/01** for both longline and gillnet. The crew-based observer program within EEZ was able to collect overall 99% of the sub categories of the **IOTC data reporting forms** under trip data, gear data, setting data and catch data of both longline and gillnet fishery. Six (06) vessels operating from Negombo Harbour, using both longlines and gillnets as fishing gear, were observed over 38 fishing sets across 14 trips during the period from March to August 2025. Yellowfin tuna was recorded as the main target species by weight (51.5%). Four (04) gillnet vessels were completed 122 days and observed 72 gillnet sets during the period of March – September 2025. Skipjack tuna was recorded as the target species in the gillnet fishery by weight (28%) then Kawakawa (16%) and common dolphinfish (16%) was recorded as the main other capture species in the catch. The crew – based observer program implemented beyond the EEZ (BEEZ) since 2018, and the program implemented within EEZ since 2025 able to collect trip, gear, set and catch data under the requirement of IOTC Resolution 24/04 and 25/06. Crew based observer program is another good method to interact with the fishing community, involve them in management decisions and to conduct research activities related to implement other Conservation Management Measures (CMM) of the IOTC. Thus, Crew-based observer programmes can serve as an alternative to conventional observers, providing IOTC-approved data formats, in line with the requirements stipulated in IOTC resolution 24/04 updated via 25/06.

Key words: Crew- based Observer Program, IOTC data reporting forms, Longline fishery, Gillnet fishery, CMM

Introduction

Department of Fisheries and Aquatic Resources of Sri Lanka implemented a Regional Observer Scheme (ROS) for artisanal and semi – industrial vessels of Sri Lanka in 2013 under the requirement of Resolution (11/04) on a Regional Observer Scheme (ROS) adapted by The Indian Ocean Tuna Commission (IOTC) (Gunawardena et al, 2018). The program was funded by Seafood Exporters' Association of Sri Lanka (SEASL²) through Sri Lanka Longline Fisheries Improvement Project (SLL FIP). The outcome of the program showed that the small size and the less facilities of the artisanal and semi-industrial vessels of Sri Lanka are not suitable to deploy an observer onboard. (Gunawardena et al, 2024)

The Electronic Monitoring System (EMS) is another data collection method implemented by the DFAR under the Resolution 23/08, with financial support from the European Union (EU) in 2018. (Gunawardena et al, 2024). Following several earlier implementations, DFAR is currently collaborating with a local supplier to resolve technical issues and develop a more cost-effective EMS system.

In 2018, crew-based observer protocol was initiated with < 24m, high seas longline vessels (BEEZ) to collect independently verifiable information and scientific information through skipper and crew on board under the requirement of Resolution 15/01 *On the recording of catch and effort data by fishing vessels in the IOTC area of competence* and 16/04 On a regional observer scheme. The success of the program led to continue the program since 2018 to 2025 under the co – funding bodies of SEAPACT¹, SEASL², New England Seafood International (NESI)³ and Oceans5 under the Blue Resources Trust / Oceans5 project.

Resolution 25/06 on Regional Observer Scheme of the Indian Ocean Tuna Commission clearly shows Contracting and Cooperating Non-Contracting Parties can use alternative data collection methods⁴ for their less than 24 m vessel length overall fishing for tuna and tuna-like species exclusively in their EEZ. Therefore, the crew-based observer program was initiated with the vessels targeting tuna and tuna like species, in the EEZ of Sri Lanka using both longline and gillnet. currently Marine artisanal and semi-industrial fishing fleet of Sri Lanka comprised of 4,802 IMULA vessels (high seas and other) and 880 IDAY vessels⁵. The length of the vessels is between 34.9 ft – 60 ft.

Crew- based observer protocol (CBO)

Sri Lanka's protocol comprise with two stages of data collection; pre-departure briefing, and post arrival de- briefing.

Pre-departure briefing

During the pre- departure briefing mainly trip data including vessel information, vessel attributes, observer information are collected through harbour Office, vessel log-book, IOTC web site and an interview conducted with the boat owner and the skipper. Then the crew-based observers are provided waterproof digital camera with an in-built geographic positioning system (GPS) and scale on which to record the weight of each fish or other capture species caught. Skipper with the crew are

¹ www.seapact.org

² Seafood Exporters Association of the Sri Lanka who is funding to the Sri Lanka tuna and swordfish – longline Fishery Improvement Project (<https://fisheryprogress.org/fip-profile/8096/overview>)

³ www.neseafood.com

⁴ According to the Resolution 25/06, alternate data collection means alternate on-board data collection methods other than the ROS observers or EMS (e.g. crew sampling)

⁵ Fisheries Statistic, 2024, Ministry of Fisheries and Aquatic Resources

given proper training to how to handle and live release protected species with a tool kit including long handled line cutter and long handled de- hooker.

Post arrival de- briefing

All the data will be collected according to the IOTC data reporting forms. Remain trip information, gear data, set data and the catch data will be collected by using catch certificate, logbook, interview sheet and digital camera at the harbor during arrival.

Compliance with Resolution 15/01

The crew-based observer protocol created by DFAR is able to collect 100% of the data requirement mentioned in the IOTC Resolution 15/01, *On the recording of catch and effort data by fishing vessels in the IOTC area of competence* for < 24 m longline and gillnet vessels operate Beyond Exclusive Economic Zone (BEEZ) of Sri Lanka (Gunawardena et al, 2024). The current study revealed that the crew-based observer program conducted within EEZ is able to fill 12 requirements out of 14 reporting requirements **once per trip** for the longline vessels (86%) and 11 out of 13 reporting requirements **once per trip** for gillnet (84%); *the IOTC number and the IMO⁶ number is not applicable for the vessels operate within EEZ.* within EEZ is able to collect 100% of the reporting requirement of data **once per set / shot** for both longline and gillnet. (Table 01)

Table 01: Reporting requirements and variables under Resolution 15/01

Reporting Requirements <i>once per trip</i>	Variables	Protocol	Reporting Requirements <i>once per set/shot</i>	Variables	Protocol
1.1 Report Information	2	2	2.1 Operation		
1.2 Vessel Information	5	3	For longline	08	08 100%
1.3 Cruise Information	2	2	For gillnet	05	05 100%
1.4 Other required information			2.2 Catch	01	01 100%
Longline (Gear configuration)	5	5	2.3 Species		
Gillnet (Gear configuration)	4	4	For Longline		
Longline Total	14	12			
Gillnet Total	13	11			
			<i>Primary Species</i>	10	10 100%
			<i>Other Species</i>	13	13 100%
			<i>Optional</i>	06	06 100%
			For Gillnet		
			<i>Primary Species</i>	14	14 100%
			<i>Other Species</i>	13	13 100%
			<i>Optional</i>	05	05 100%
			2.4 Remarks	03	03 100%

Compliance with the IOTC data reporting forms.

IOTC data reporting for longline are consisting of 144 sub categories, including 67 sub categories of trip information, 21 sub categories of gear information, 43 setting information and 13 sub categories of catch data information. Among those sub categories 24 subcategories are not applicable to within

⁶ International Maritime Organization

EEZ fishery. Also, the sex data under catch data cannot be collect onboard by the crew-based observers.

Table 02: Compliance of program with the IOTC data reporting forms for longline fishery

Data type	Target	Applicable	Achieved	%	Remarks
Trip data	67	56	56	100%	11 sub categories not applicable
Gear data	21	11	11	100%	10 sub categories not applicable
Setting data	43	40	40	100%	Line setter speed, Branch line clip-on-time, Buoys clip-on-time are not applicable
Catch data	13	13	12	92%	Sex cannot be identified onboard
		120	119	99%	

IOTC data reporting for gillnet are consisting of 117 sub categories, including 67 sub categories of trip information, 18 sub categories of gear information 19 setting information and 13 sub categories of catch data information. Among those sub categories 12 subcategories are not applicable to within EEZ fishery (Annex A). Also, the sex data under catch data cannot be collect onboard by the crew-based observers.

Table 03: Compliance of program with the IOTC data reporting forms for gillnet fishery

Data type	Target	Applicable	Achieved	%	Remarks
Trip Data	67	56	56	100%	11 sub categories not applicable
Gear Data	18	17	17	100%	Hanging ratio not applicable
Setting Data	19	19	19	100%	
Catch Data	13	13	12	92%	Sex cannot be identified onboard
	117	105	104	99%	

Result and reporting

15 skippers using longline, gillnet or combination gear within the EEZ, were deployed from Negombo fisheries harbor within the time period of March 2025 to September 2025. The skippers were selected by the Harbour officers of the High Seas Unit of Negombo fishery harbour. Although this is the initial stage of crew-based observer program within the EEZ, not all the skippers were succeeding in the data collection. Among them five (05) skippers are collecting good quality data, four (04) are still under training while three (06) were unable to collect data from more than one trip. Most of the skippers are using combination gears. Therefore, the vessels used longline in the time period of February to June converted to the gillnet due to the changes of monsoon pattern of the coastal zone of Sri Lanka.

Longline fishery within EEZ

longline vessels within EEZ set their lines at between 15 and 48 bamba⁷ (90ft to 288 ft), using 500 to 1,000 hooks per set. The bait used was either dead milkfish or dead flying fish. Main target species of the fishery is yellowfin tuna. Data of the longline fishery was collected from March – August 2025. Six (06) vessels were able to collect data on longline fishery by completing 14 trips, with 38 observed sets during 117 days. The crew-based observer protocol is able to map the fishing grounds, get an idea about the target and non – target species with the protected species in the catch, outcome of the fish species and to calculate the catch per unit effort (*e.g.* catch per 1,000 hooks).

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

Table 04: Catch and catch per unit effort (CPUE) (per 1000 hooks) of the longline fishery

Species	No	%	CPUE	Weight	%	CPUE
Target Species	52	41.6%	2.04	1,585	51.1%	62.33
Yellowfin Tuna	52	41.6%	2.04	1,585	51.1%	62.33
Other Capture species	71	56.8%		1,517	48.9%	
Swordfish	43	34.4%	1.69	946	30.5%	37.20
Escolar	6	4.8%	0.24	31	1.0%	1.22
Bigeye tuna	5	4.0%	0.20	326	10.5%	12.82
Indo-Pacific sailfish	2	1.6%	0.08	50	1.6%	1.97
Lancet Fish	2	1.6%	0.08	1	0.0%	0.04
Pelagic stingray	2	1.6%	0.08	92	3.0%	3.62
Pickhandle barracuda	2	1.6%	0.08	4	0.1%	0.16
Trevally	2	1.6%	0.08	5	0.2%	0.20
Wahoo	2	1.6%	0.08	10	0.3%	0.39
Bigeye Travelly	1	0.8%	0.04	2	0.1%	0.08
Black Marlin	1	0.8%	0.04	40	1.3%	1.57
Common Dolphinfish	1	0.8%	0.04	2	0.1%	0.08
Orange Snapper	1	0.8%	0.04	3	0.1%	0.12
Silky Shark	1	0.8%	0.04	5	0.2%	0.20
Protected Species	2	1.6%		0	0.00%	
Olive ridely	2	1.6%	0.08		0.0%	0.00
Grand Total	125			3,102		

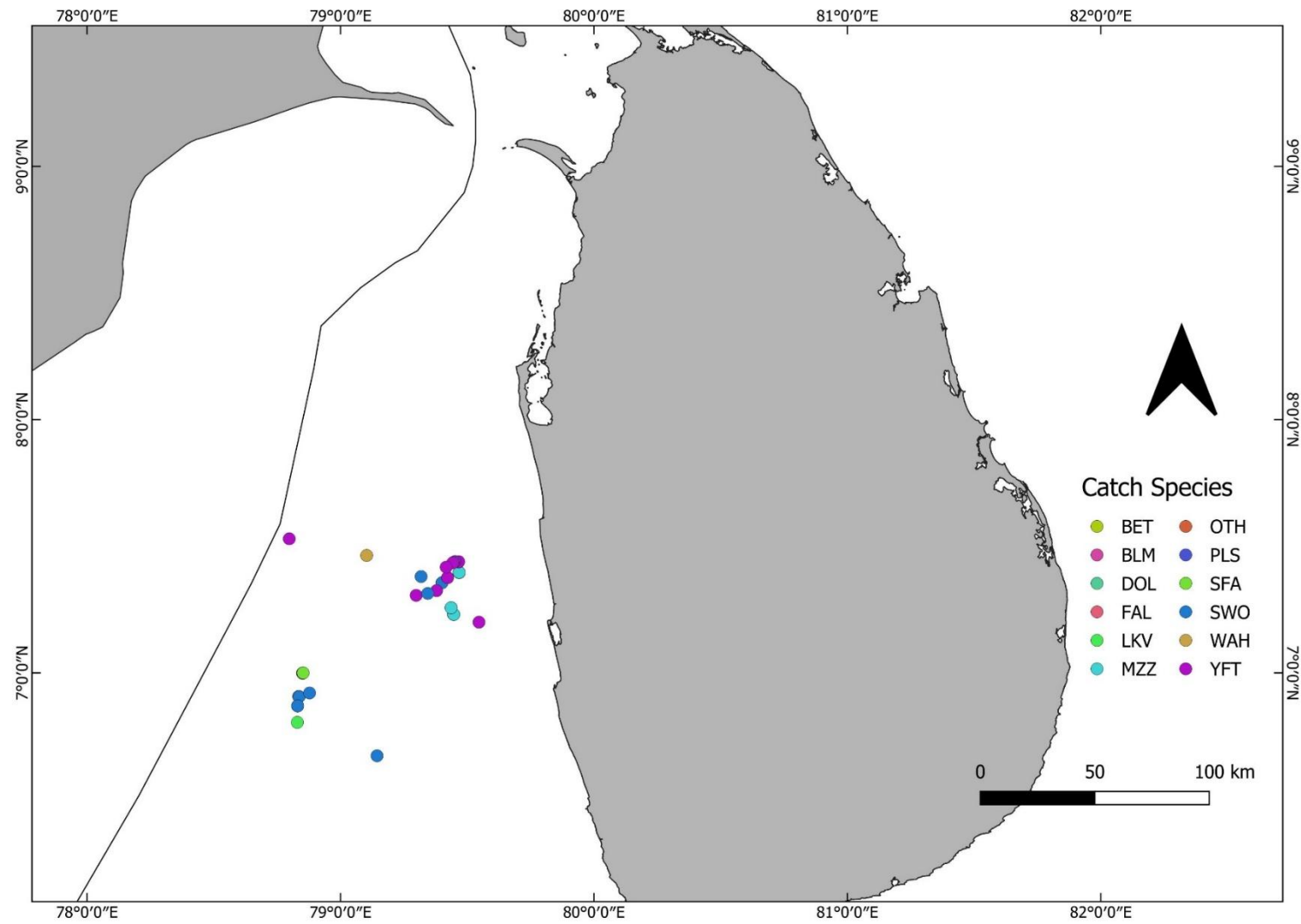


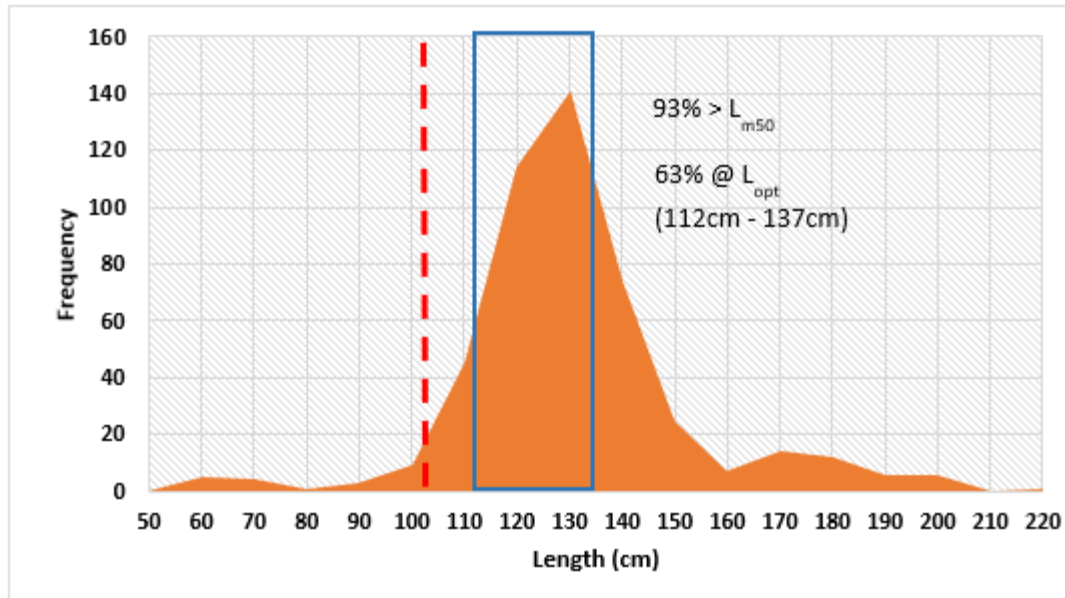
Figure 01: Fishing grounds of the longline vessels within EEZ

Also, crew-based observer program is giving an idea about the outcome of the species caught (retained/ discarded dead/ discarded alive). Two Olive Ridley turtles were caught on a longline and were released alive.

Table 05: The outcome of the species caught longline fishery within EEZ

Species	Total	Retained		Discarded Live (D)		Discarded dead (DD)	
		n	%	N	%	n	%
Target Species	52						
Yellowfin Tuna	52	52	100%		0%		0%
Other Capture Species	71						
Swordfish	43	43	100%		0%		0%
Escolar	6	6	100%		0%		0%
Bigeye tuna	5	5	100%		0%		0%
Indo-Pacific sailfish	2	2	100%		0%		0%
Lancet Fish	2		0%		0%	2	100%
Pelagic stingray	2	1	50%		0%	1	50%
Pickhandle barracuda	2	2	100%		0%		0%
Trevally	2	2	100%		0%		0%
Wahoo	2	2	100%		0%		0%
Bigeye travelly	1	1	100%		0%		0%
Black marlin	1	1	100%		0%		0%
Common dolphinfish	1	1	100%		0%		0%
Orange snapper	1	1	100%		0%		0%
Silky shark	1	1	100%		0%		0%
Protected Species	2						
Olive ridely	2		0%	2	100%		0%
	125	120	96%	2	2%	3	2%

Length data extracted from the images can be used to create length frequency of the target species combined with the biological data of the species which can be used to calculate the percentage of the fish caught at Optimum Length



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

Figure 02: Length frequency for yellowfin tuna (*T. albacares*), based on data

Gillnet Fishery within EEZ

The gillnet fishery within EEZ are using small mesh gillnet (mesh size 3 ¼") and large mesh gillnet (mesh size 5 ½", 6") targeting tuna and tuna like species. The height of the net is 40 -100 mesh, the total length is between 2km – 3.3 km and the number of net pieces is around 45.

Four (04) vessels from selected 15 vessels were collected data on gillnet fishery between March – September 2025. Some vessels which used longline for fishing was converted to gillnet from July 2025. Four (04) vessels completed 122 days and observed 72 gillnet sets. Due to the large number of target species such as skipjack tuna, yellowfin tuna, kawakawa and frigate tuna of the catch a sub sampling method was implemented to make the data collection procedure simple for the crew-based observer. The crew-based observer took images of the sub sample representing different weights of each species if the number of fishes caught was more than 10 individuals. The number of total fishes caught under each species also recorded during the de- briefing stage. The table shows target and non-target species in the catch of gillnet fishery.

Table 06: Catch and catch per unit effort (per 1000 hooks) of the gillnet fishery

Species	No	%	CPUE	Weight (Kg)	%	CPUE
Target Species	1,552	63%	0.4	4,310	53%	1.235
Skipjack tuna	667	27%	0.191	2,276	28%	0.652
Kawakawa	656	27%	0.188	1,277	16%	0.366
Yellowfin Tuna	151	6%	0.043	657	8%	0.188
Frigate tuna	78	3%	0.022	100	1%	0.029
Other Capture Species	875	33%	0.2	3,766	44%	1.077
Common Dolphin	371	15%	0.106	1,276	16%	0.365
Double spotted queenfish	209	9%	0.060	317	4%	0.091
Hound needlefish	103	4%	0.029	210	3%	0.060
Indo-Pacific sailfish	30	1%	0.009	576	7%	0.165
Trevallies	18	1%	0.005	36	0%	0.010
Great barracuda	16	1%	0.005	32	0%	0.009
Indo-Pacific King Mackerel	14	1%	0.004	41	1%	0.012
Spinetail devil ray	12	0%	0.003	785	1%	0.012
Mexican Needle fish	11	0%	0.003	18	0%	0.005
Milkfish	11	0%	0.003	74	1%	0.021
Cobia	10	0%	0.003	35	0%	0.010
Mangrove Red snapper	8	0%	0.002	15	0%	0.004
Gar Fisher	6	0%	0.002	10	0%	0.003
Swordfish	6	0%	0.002	120	1%	0.034
Atlantic tripletail	3	0%	0.001	7	0%	0.002
Batfish	3	0%	0.001	10	0%	0.003
Rainbow Runner	3	0%	0.001	4	0%	0.001
Wahoo	3	0%	0.001	31	0%	0.009
Black Marlin	2	0%	0.001	100	1%	0.029
Narrow-barred Spanish mackerel	2	0%	0.001	6	0%	0.002
Striped Bonito	2	0%	0.001	4	0%	0.001
Blue Sea Chub	1	0%	0.000	1	0%	0.000
Escolar	1	0%	0.000	3	0%	0.001
Flapnose Ray	1	0%	0.000	7	0%	0.002
Flathead grey mullet	1	0%	0.000	2	0%	0.001
Leatherjacket	1	0%	0.000	1	0%	0.000
Parrot fish	1	0%	0.000	2	0%	0.001
Rhomboid squid	1	0%	0.000	1	0%	0.000
Silky Shark	1	0%	0.000	4	0%	0.001
Siverbar fish	1	0%	0.000	1	0%	0.000

Species	No	%	CPUE	Weight (Kg)	%	CPUE
Squid	1	0%	0.000	1	0%	0.000
Titan triggerfish	1	0%	0.000	3	0%	0.001
Protected Species	5	0%	0.002	85	1%	0.024
Olive ridely	3	0%	0.001	25	0%	0.007
Common Bottlenose Dolphin	2	0%	0.001	60	1%	0.017
Grand Total	2432		0.696	8,161		2.337

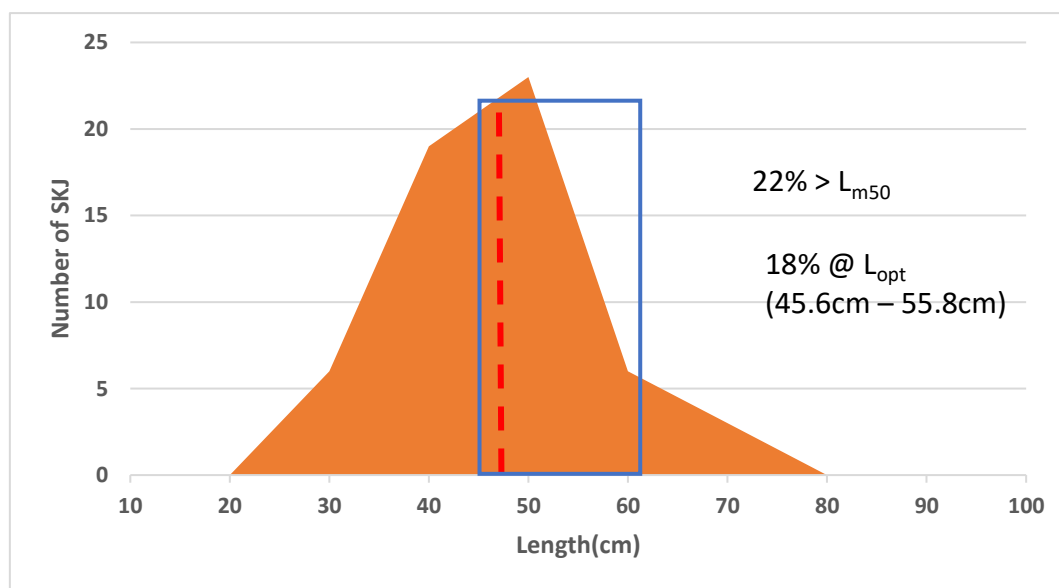
Among the different species caught 99% of the fish are retained mostly for the local market, some are for export market. Most of the fish caught were sold at Negombo fish market. Details are given on Table 05. Also, crew-based observer program is giving an idea about the outcome of the species caught (retained/ discarded dead/ discarded alive)

Table 05: The outcome of the species caught gillnet fishery within EEZ

Species	Total	R	%	DL	%	DD	%
Protected Species	1,495	1,495	100%				
Skipjack tuna	667	667	100.0%				
Kawakawa	656	656	100.0%				
Yellowfin tuna	151	151	100.0%				
Frigate tuna	21	21	100.0%				
Other Capture Species	932	932	100%				
Common dolphinfish	371	371	100.0%				
Double spotted queenfish	209	209	100.0%				
Hound needlefish	103	103	100.0%				
Frigate tuna	78	78	100.0%				
Indo-Pacific sailfish	30	30	100.0%				
Trevallies	18	18	100.0%				
Great barracuda	16	16	100.0%				
Indo-Pacific king mackerel	14	14	100.0%				
Spinetail devil ray	12	12	100.0%				
Mexican needle fish	11	11	100.0%				
Milkfish	11	11	100.0%				
Cobia	10	10	100.0%				
Mangrove red snapper	8	8	100.0%				
Gar fisher	6	6	100.0%				
Swordfish	6	6	100.0%				
Atlantic tripletail	3	3	100.0%				
Batfish	3	3	100.0%				
Rainbow runner	3	3	100.0%				
Wahoo	3	3	100.0%				
Black marlin	2	2	100.0%				

Species	Total	R	%	DL	%	DD	%
Narrow-barred spanish mackerel	2	2	100.0%				
Striped bonito	2	2	100.0%				
Blue sea chub	1	1	100.0%				
Escolar	1	1	100.0%				
Flapnose ray	1	1	100.0%				
Flathead grey mullet	1	1	100.0%				
Leatherjacket	1	1	100.0%				
Parrot fish	1	1	100.0%				
Rhomboid squid	1	1	100.0%				
Silky Shark	1	1	100.0%				
Silverbar fish	1	1	100.0%				
Squid	1	1	100.0%				
Titan triggerfish	1	1	100.0%				
Protected Species	5	0	0%	3	60.0%	2	40%
Olive ridely	3		0.0%	1	33.3%	2	67%
Common Bottlenose Dolphin	2		0.0%	2	100.0%		
Grand total	2,432	2,427	99.8%	3	0.1%	2	0.1%

Length data extracted by the images can be used to create length frequency of the target species combined with the biological data of the species which can be used to calculate the percentage of the fish caught at Optimum Length.



[Katsuwonus pelamis](#) Maturity: L_m 41.3, range 40 - 45 cm. Max length : 110 cm FL male/unsexed; common length : 80 cm FL male/unsexed

Figure 03: Length frequency for skipjack tuna (*T. albacares*), based on CBO data

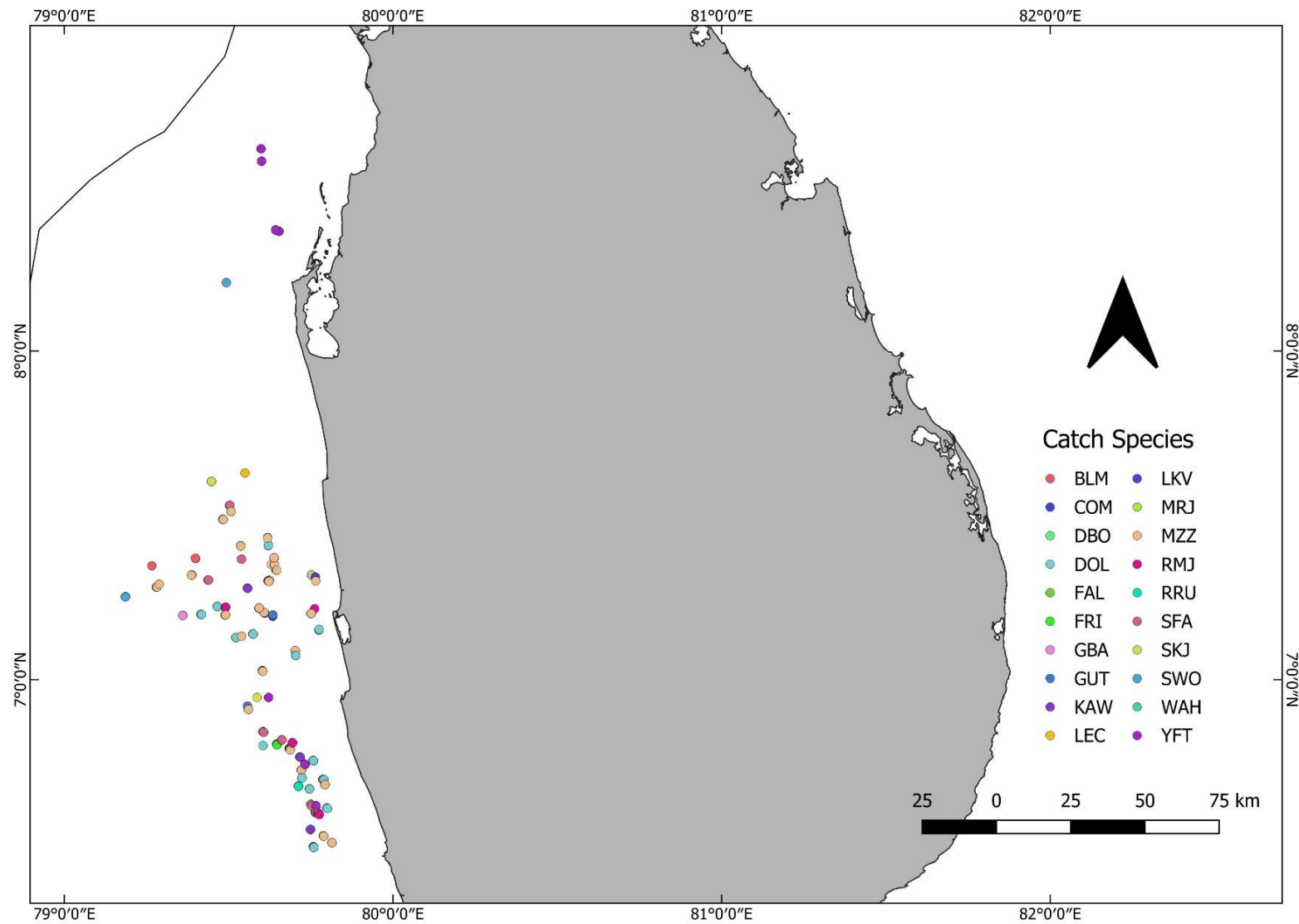


Figure 03: Fishing grounds of the gillnet vessels within EEZ

Conclusion

The nature of the Sri Lankan artisanal and semi -industrial fishing vessels make it impossible to deploy scientific observer or Electronic Monitoring System (EMS) above fishing vessel under Resolution 11/04 and 22/04 On Regional Observer Scheme. The crew- based observer program in Sri Lanka able to collect trip data, gear data, set data and catch data since 2018 for BEEZ vessels under the requirement of Resolution 24/04 and 25/06.

The crew-based observer program within EEZ was initiated in March 2025, to check the feasibility of the program within EEZ according to the Resolution 25/06 On Regional Observer Scheme of Indian Ocean Tuna Commission. The crew-based observer program with in EEZ, able to collect almost overall 99% of the sub- categories of the IOTC data reporting forms under trip data, gear data, setting data and catch data of both longline and gillnet fishery. Data collection within EEZ is somewhat complicated comparing to BEEZ due to the seasonal variation, gear transformation, high number of fish species of the gillnet fishery and few numbers of crew in the vessel. But those challenges were almost overcome with successfully trained 05 skippers within the short period of time during the 1st phase of the program within EEZ.

The crew-based observer program will be a method support to prevent Illegal, Unreported and Unregulated (IUU) fishing in the sea. Because the selected skipper and the crew have a close relationship with the DFAR officers, therefore it is easy to recognize if they engage with any IUU fishing. Mostly the crew-based observers are selected skippers from the fishing community, so they are recognized as skippers who do not engage with IUU fishing. Those group of skippers and the crew can be identified as representatives from the fishing community to get valuable management decisions, to conduct research to find solutions for other CMM of IOTC. (Ex: DFAR conducted research with the crew-based observers to find the most suitable gear marker for the Sri Lankan multi day fishery, research studies were done to find out the most suitable tool kit for safe handle and live release of protected species, the most suitable solution for depredation of the yellowfin tuna harvest of the longline fishery will be also found with the participation of crew – based observers).

The results of the study indicated that the crew-based observer programme can serve as an alternative reporting methodology to the conventional observer programme. Data collected through the crew-based programme can be used to complete observer data formats approved by the IOTC, and thus, the crew-based observer approach can be considered a valid alternative in accordance with the provisions of IOTC Resolution 24/04.

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Annex A: Sub categories not applicable for within EEZ fishery include in IOTC data reporting forms**Sub- categories not applicable for the longline fishery within EEZ include in IOTC data reporting forms**

Trip data	Gear data	Set data	Catch data
1. Observer IOTC registration number	1. Tori line length	1. Line setter speed	
2. Vessel IOTC number	2. Streamer type	2. Branch line clip-on-time	
3. Vessel IMO	3. Streamer line length(max)	3. Buoys clip on time	
4. International Radio Call	4. Streamer line length(min)		
5. Vessel Phone	5. No. Streamers per line		
6. Vessel Fax	6. Distance between streamers		
7. Vessel email	7. Tori line attached height		
8. Chart operator- Full name	8. Streamer reach surface		
9. Chart operator – Nationality	9. Towed objects number		
10. Chart operator – Contact details	10. Towed objects type		
11. Fishing Master			

Sub- categories not applicable for the gillnet fishery within EEZ include in IOTC data reporting forms

Trip data	Gear data	Set data	Catch data
1. Observer IOTC registration number	1. Hanging ratio		
2. Vessel IOTC number			
3. Vessel IMO			
4. International Radio Call			
5. Vessel Phone			
6. Vessel Fax			
7. Vessel email			
8. Chart operator- Full name			
9. Chart operator – Nationality			
10. Chart operator – Contact details			
11. Fishing Master			