Data collection and reporting system of Sri Lanka;
Where it was and where it now

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Abstract

The Large pelagic fisheries of Sri Lanka are quite dynamic and have undergone a rapid and progressive development over the time. The National data collection and reporting mechanism is being struggling hard in upgrading the system to take hold all the development initiatives. However, there is still need some advancements to response and fully comply with the ever advancing fisheries; introduction of new vessels and gears, increasing fishing effort, landing sites, fishing grounds etc. Fisheries management at the National level is quite interesting for generate production data such as estimation of economic indicators, policy planning and reforms etc. But what is interested in regional management is far more advanced.

Sri Lanka is being a member state and responsible party to the IOTC complying with the resolutions is greatly acknowledged. After being quiet sometimes with the establishment of the Meeting Participation Fund, Sri Lanka has revived her activities participation in management of large pelagic fisheries in the Indian Ocean. Lack of understanding and awareness of ever updating long list of resolutions is still making some hindrance in achieving fully compliance with resolution.

The Large pelagic fisheries in Sri Lanka are highly multifaceted. Fishing fleet is consisting large number of boats of varied technological status; traditional to high sea operation large vessels. Gear employed is too complex; undergo rapid technological development and also changers based on special and temporal abundance of resources.

The research institution of the Ministry of Fisheries and Aquatic Resources Development of Sri Lanka; the National Aquatic Resources Research and Development Agency (NARA) has long been collected large pelagic statistics including biological data through port sampling and used to provide data to IOTC over the past years to comply with the mandatory data requirement. Having difficulty in fine tuning the data with regard to the recent resolutions implemented by IOTC for upgrading the prevailing data collection – port sampling programme and the reporting system to improve the level of compliance. Resolution 10/02, 10/03, 13/02 etc. could not be fulfilled with port sampling along and thus a number of complementary data collecting systems; log book, port measures, onboard observer system are now initiated to obtained more precise data in upcoming with dedication of key responsible institutions; the NARA, the Department of Fisheries and Aquatic Resources (DFAR) and the Statistical Unit of the Ministry.

1. Fisheries in Sri Lanka

The marine fishery of Sri Lanka consists of two main sub-sectors; coastal and offshore fisheries. The offshore fisheries target exclusively on large pelagic mainly on tuna and tuna like species such billfish and seer fish while the coastal fisheries (fishing with the continental shelf and slop area) target on wider range; small pelagic, large pelagic and demersal finfish and non-finfish fisheries. In the offshore fisheries, the gears used are mainly the gillnets alone, longline alone, longline or gillnet one at a time in a single operation and ring net. The coastal fishery is conduct with multigears; mainly the small mesh gillnet, ringnet, troll lines, handline, longline, trammel net and beach seine depending on the target. Although offshore fisheries target mainly on tuna and tuna like species some amount of sharks are caught as an incidental catch. The shifting of the gear targeting towards deep sea large tuna employing tuna longline has influence reducing of both more surface inhabiting billfish and sharks. There are 2,463 multiday boats presently engaged in offshore and high- sea fishing for tuna and tuna-like species. Out of these 2,241 boats were actively operated in offshore and high seas in the year 2013. The fleet engaged in offshore and high-sea fisheries is the vessels of the length between 10- 15 meters LOA. Since latter part of 2013, 8 purse seiners of > 24 meters LOA have been entered to the offshore fishing fleet of Sri Lanka.

2. Data collection, management and reporting

Two institutions under the Ministry of Fisheries and Aquatic Resources Development (MFARD); the Department of Fisheries and Aquatic Resources (DFAR) and National Aquatic Resources Research and Development Agency (NARA) are mainly responsible in collecting Fisheries statistics. The DFAR utilizes its administrative arrangements and field network to collect fisheries data while NARA conducts through sampling programme undertaking with research staff and field samplers. The Statistics Unit of the Ministry of Fisheries is responsible for collecting, processing, analyzing and dissemination of the data related to the fisheries sector. As well it conducts random sampling in order to cross check the validity and accuracy of data collected by NARA and DFAR. The national fisheries data collection systems for estimation the fish production are given bellow.

1). Total enumeration system for marine catch estimates
2). Large pelagic fishery sampling programme
3). Monthly administrative records of field officers of DFAR
4). Research based fisheries statistics

All the above data collection systems focused on the national data requirements; such as preparation of sound plans to develop the fishery industry while managing the fishery resources in Sri Lankan waters.

3. Data reporting and level of compliance with IOTC requirements

The fisheries statistics are being reported to IOTC by Sri Lanka annually; based on the estimation derived from PELAGOS database of the port sampling survey established in NARA since 1996. In parallel with the development of local fisheries and updating of the regional fisheries conservation and management measure, Sri Lanka has been made a severe effort in improving the existing statistics systems and initiate new systems to avoid the data gaps in complying with the resolutions of IOTC. As a result five main data collection systems have currently been functioned in Sri Lanka to cater the requirements of both local and regional fisheries management. The main data gathering systems presently operating are;

- Effort monitoring system conduct by DFAR (Vessel registry)
- Logbook system conduct by DFAR
- Vessels Monitoring System (VMS)
- Observer programme conduct by DFAR
- Port measures implement by DFAR
- Port sampling system conduct collaboratively by NARA and DFAR

With the development of the fisheries sector towards the high seas, the data collection system through port sampling have been improved in several occasions to cater the requirements in regional fisheries management. As well to improve the compliance status of Sri Lanka for resolution 10/02 and has been enabled to achieve a progressive status (Table 1).

Table 1: Compliance Status of Mandatory Statistical Requirement of IOTC (R- 10/02)

Information	Sub sector	Compliant Status of Sri Lanka			
		2011	2012	2013	2014
Nominal Catch	Coastal fisheries	PC	PC	C	PC
	Surface fisheries	NA	PC	PC	PC
	Longline fisheries	NA	PC	PC	PC
Catch and Effort	Coastal fisheries	PC	NC	C	C
	Surface fisheries	NC	NC	PC	PC
	Longline fisheries	NA	NC	PC	PC
Size Frequency	Coastal fisheries	PC	NC	NC	PC
	Surface fisheries	PC	PC	PC	PC
	Longline fisheries	NA	PC	PC	PC
By-catch data	Sharks	PC	PC	PC	PC
	Sea turtles	NC	NC	C	C
	Seabirds	NA	NA	NA	NA

C- Comply, PC- Partially Comply, NC- Non Comply, NA- Not Applicable
Source – IOTC

As the Sri Lankan fishing fleet is exclusively fishing on free summing schools and not depends on FAD, it has not yet deployed any FAD for facilitate the surface fisheries.

As the difficulty in separation of catch, effort and size data obtained from port sampling and thus reporting them in aggregated form in combine fisheries (longline and gillnet) fisheries and not being providing fishing position data in accordance with the requirement of IOTC, not available of size frequency data except yellowfin tuna and skipjack tuna, low coverage, etc. are the main issues in partially or non-compliance status. However, steps have been already taken to overcome many of those deficiencies in coming years.

4. Main data sources and data collection system (Brief description of the process, actions and measures)

4.1. Vessels Registry

The vessels registry of Sri Lanka contains information on all the fishing fleet. Information of the new vessels is added to the registry at the first registration in the Department of Fisheries and Aquatic Resources. The details of the vessels are stored in to the registry under the vessels identification number given at the registration.

The list of authorized vessels and the list of active vessels in order to comply with the Resolutions 07/02 and 10/08 of IOTC are submitted based on the output of vessels registry. Data in the vessels registry is importing to the PELAGOS database of the large pelagic fisheries, in order to verification of fishing effort in the port sampling programme.

4.2. Log book system

Log Book system was initiated in 2012 and introduced to the vessels greater than 34 feet in LOA to improve catch statistics collection to obtain precise information on catch and effort statistics with the spatial reference.

Since inception of the programme data reporting in log books has been inspired and quality of information has also been progressively improved by conducting awareness and carrying out close monitoring programs focusing the skippers of multiday vessels.

The existing log book (initial issue) has been amended in complying with the Resolution 13/03 of the advisory of IOTC. The new version of log book will effective from 2015. The new book has been designed in such a way to minimize complains and constrains highlighted by the fishermen of the existing log book.

The use of log book on-board is made compulsory of any fishing voyage under the high seas fishing regulation.   Completed log sheets are collected by the Department of Fisheries and Aquatic

Resources (DFAR). After thorough scrutiny of the voluminous statistical datasets received capturing data pertaining to year 2014 to a database designed for log book has been commenced.

4.3. Vessels monitoring system

Basic arrangements are in place to implement the VMS during 2015. Regulations have been drafted to declare VMS as a mandatory requirement for high sea vessels under the provisions of Fisheries Act (Act No. 35 2013).

4.4. Onboard observer scheme

Onboard observer programme has been initiated in 2014 with 13 trained onboard observers, deploying in limited large vessels with the objective of collecting detailed data on fishing strategies, catches, by-catches, discards, biological data such as lengths, sex etc. The number of observers will be expanded of the vessels > 24m after completing of these trial operations.

4.5. Port measures

Foreign fishing vessels which are in the Authorized list of IOTC and holding a valid national registration and operation license are only permitted to land in Sri Lanka; and they make their landing only at the designated fishery harbor at Dikkowita. Port inspections are being carried out by the port inspectors appointed by the Department of Fisheries. Based on the landing data and the inspections reports, Sri Lanka submits landing data by species annually to the IOTC in accordance with the template recommended by the IOTC.

4.6. Port sampling programme

The output of the large pelagic fishery survey which resulted the updating of the PELAGOS database has been used to fulfill the requirements of data reporting to IOTC up to date (2013). Given the dynamic nature of fisheries and its accompanying issues, the data collection strategy should be considered as a living strategy to be updated when needed to reflect current situations. The port sampling program has been commenced since 1987 with the assistance of Indo Pacific Tuna Programme (IPTP) and has been upgraded and advancement in number of occasions as with the development of fisheries under the technical advisory of IOTC and finance assistance through several programmes during the past. The most recent advancement has been in 2012/2013.

4.6.1. Joint project work with IOTC, OFCF and BOBLME

In order to strengthen the data collection systems at least to achieve the minima levels of sampling coverage (5% of the vessels activities) recommended by the IOTC, the prevailing large pelagic data collection system was upgraded under the financial assistance of OFCF and BOBLME during 2012/2013 and thereby to overcome several issues and improve the level of compliance of Resolution 10/02; specially the poor coverage, aggregated level species wise information, poor species identification, lower accuracy in gear wise production information due to low coverage, under enumeration of fishing efforts, etc.

The overall objective of the project is to strengthen the data collection, processing and reporting systems on Sri Lankan large pelagic fisheries and thereby producing more accurate and timely effort and catch estimates per month, area and species and increase the amount of size frequency data collected for tuna and tuna like species in the large pelagic fisheries. This has allowed Sri Lanka to improve compliance with IOTC data collection and reporting standards, in particular provisions in the IOTC Resolutions 10/02 (Mandatory Statistical requirements), 11/04 (Regional Scientific Observer Programme) and 05/05 (Conservation of Sharks). The project was implemented by the MFARD in collaboration with DFAR and NARA in two phases.

4.6.2. Improvements

The improvements mainly focused on upgrading of the sampling program emphasizing better coverage and representativeness in order to increase the accuracy of catch and effort estimates and ensure the quality of size frequency data of the species. The enhancement of coverage enabled to better coverage of artisanal fisheries carried out seasonally targeting especially neritic tuna.

Field staff has been increased. The number of enumerators has been increased by assigning 27 field officers of the Department of Fisheries and Aquatic Resources (DFAR) for data collection in addition to 12 samplers and research assistants of NARA. This enabled to increase the sampling coverage from 2% to 10%. The newly appointed data collectors of Department of Fisheries and Aquatic Resources were trained on sampling techniques, species identification, obtaining length and weight measurements of fish, completing data collection sheets, etc. and thereby improve their capacity to systematically collect and report reliable data.

The data collection sheets were improved under the advisory of the IOTC. Species identification sheets were designed mainly for tuna, billfishes and sharks, and distributed among the data collectors and supervisors.

Since strategy of port sampling system enabled to produce spacial data a map was introduced to the data collectors to identify the fishing area. Until the log book system is improved, the map assists to address the requirement of providing grid wise information as an alternative (Figure 1).

Figure 1: Map for identification of fishing area – Large Pelagic Fishery Survey
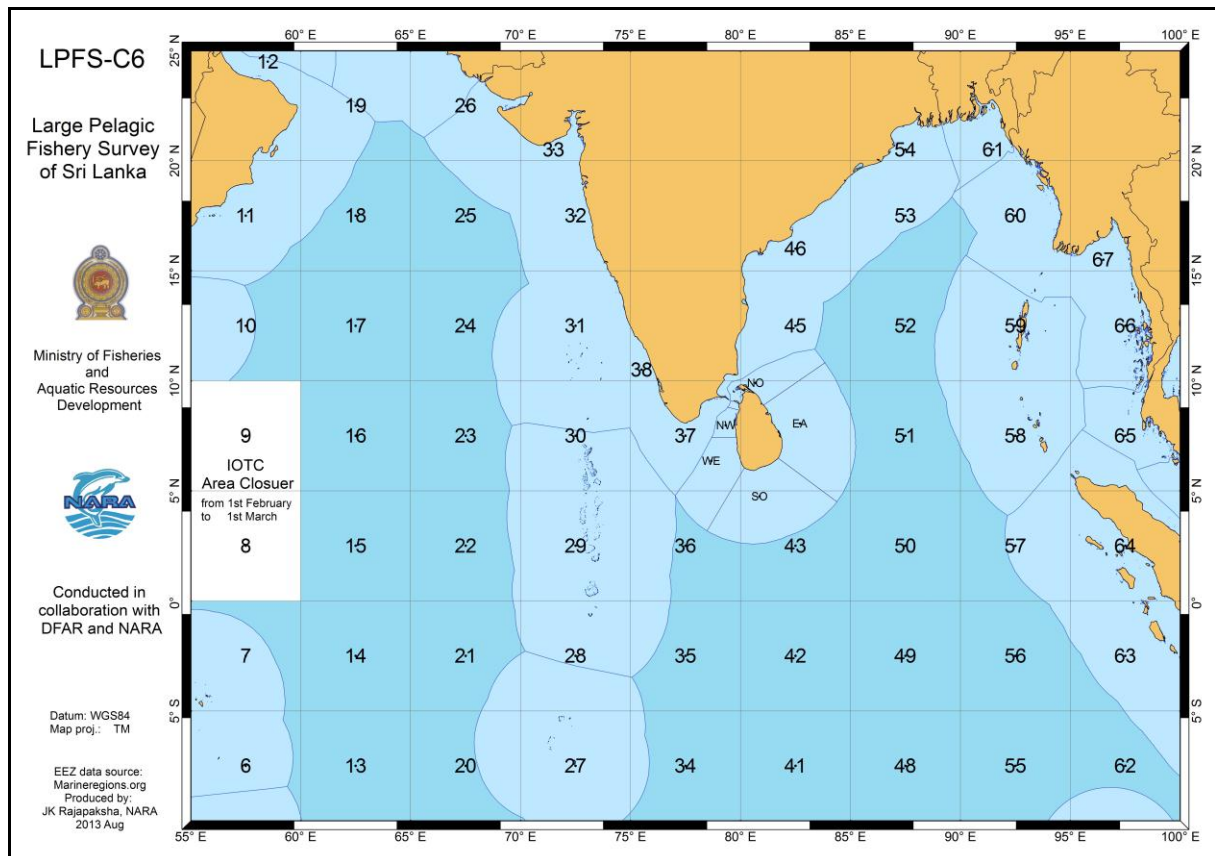
PELAGOS database is being upgraded by incorporating more parameters to bring more precise estimates of nominal catch, effort, size frequency, etc. The new upgraded system goes beyond the core set of data has been provided and it enabling to address the emerging data requirements. Further, it was found that coordination and co-operation among national institutions that produce fisheries statistics have been highly improved.

4.6.3. Data collection

The revised sampling system covers all large pelagic fisheries, including both multiday boats operating in offshore and high seas and also coastal day boats targeting tuna as well. Data collection activities are carried out by 39 data collectors of DFAR and NARA in all the major fishery harbours and anchorages where offshore multiday boats are landed and in few cases coastal landing sites where the large pelagic fish species landing seasonally by the coastal day boats. Accordingly 23 major fishing ports and 10 minor landing sites located in thirteen fisheries districts out of fifteen are covered; except Mannar and Kilinochchi where fishing for

large pelagic are not operating. Sampling activities are carried out $10 - 14$ days per month according to the pre scheduled time table allowing sampling of $300 - 450$ boats per month.

Under the new system the vessels operating in the large pelagic fishery are categorized in to six categories considering the LOA, structure of the vessel, fishing trip duration/ area of fishing activities undertaken. The fishing gears mainly used in large pelagic fishing activities in are considered separately. Including IOTC species and by-catch species, 33 species are monitored through the sample survey. The map introduced to identify the fishing area reflects the area of 10^0 S to 25^0 N and 55^0 E to 100^0 E. where EEZ covers has been divided in to five statistical zones to denote North, South, East, West and Northwest areas. The area beyond the EEZ has been divided in to five degree grids and coded.

4.6.4. Database management

The PELAGOS database built in MS Access 2007 and upgraded by the IOTC has been installed in NARA and MFARD. Testing of the database was done in Sri Lanka while training of the data entry staff and database administrators. The technical issues encountered during the data entering process were rectified with the guidance of IOTC Data Management Experts visited to Sri Lanka in several occasions. Data verification is done by the database administrators appointed in both institutions. A requirement of further training of the data entry operators and database administrators has been identified to carry out the task properly.

4.6.5. Catch estimation

Catch and effort estimation programmes are still being developed. Data collected by both institutions are supposed to rise to obtain final estimates of catch for Sri Lanka. The test data relating to four months (May – August 2013) were utilized by the IOTC Data Coordinator for analysis and testing the estimation procedures. The issues raised and the actions executed to address these issues are summarized the table 2 below.

Table 2: Issues raised and actions executed to address the issues

Issues	Action
1. Lack of representativeness in all boat types at sampling	Revise the training manual prepared for the data collectors with the instruction to overcome these issues in the manual Conduct a training session for data collectors and educated them to cover all boat types landed during each and every sampling day
2. Low catch estimates	

	Gaps in the number of vessels daily landed Make arrangements to obtain information independently on all vessels daily unloaded in each harbor to verify the details recorded by the enumerators. Samples do not account for all catches unloaded from the vessels sampled As many boats resort to partial landings that give a low CPUE (catch per boat), replace the catch per boat with catch per landing and verify the data with log sheets. Gaps in obtaining length weight measurements Special studies have been undertaken to improve and also derive length weight relationship especially for billfish which generally lands by processed. Improve the representativeness of the sample selected for obtaining length weight measurements, which also assist to verify the weight of the catch in the database.
3. Gaps in some sites, in which not all months have been monitored	Address this issue in the training manual and inform the data collectors; as well conduct close supervision to overcome the issue.
4. Processed fish of unknown species	Training manual revised and data collectors informed to address this issue /opportunity also available during data verification

4.6.6. Reporting

The data are currently being reported by Sri Lanka to IOTC at National level by using the following data reporting formats. As there are some gaps in data reporting which has been negatively affected to the compliance status of Sri Lanka, it is expected to improve the data reporting in PELAGOS database considering the guidelines for data reporting and requirements in resolutions 10/02.

Table 3: Data reporting to IOTC

Data set	Type of data	Description	IOTC form	Species group
Annual catches	Nominal catch	Estimates of total annual retained catches in entire weight by species and type of fishery	1RC	IOTC species Important bycatch (Billfish & main species of sharks) Other fish species
	Discards	Estimates of discard in weight or number by species and type of fishery	1DI	Legally banned species (Thresher sharks, turtles, Cetaceans)
Active crafts	Number of crafts	Total number of fishing crafts operated by type of fishery, type of craft and craft size by year	2FC	Fisheries targeting IOTC species
Catch-and-effort	Coastal fisheries	Catch by species and fishing effort by type of fishery	3AR	IOTC species Important bycatch (Billfish & main species of sharks) Other fish species
Size data	Fish length	Length data by species	4SF	IOTC species

5. Way forward

Large pelagic fisheries in Sri Lanka are being fast developing. It leads in increasing demand from policy makers, resource users and investing community for information to deal with and also to address the emerging issues relating to the sustainability, environment, climate change, and socioeconomic objectives in managing the fisheries. IOTC management strategy broadens the scope of fisheries statists such fleets, area, fisheries, species and time periods to be covered and sets up minimal requirements for data collection both in land and onboard fishing vessels.

Government has expedited the development of an implementation plan for statistic collection, including taking the steps necessary to achieve 100% compliance through a well-targeted research agenda to support the implementation of the statistical methodology and also the development of methodological guidelines.

The limitation of the status of fisheries statistics has been engineered and reformed the statistics system by establishing log book system and on-board observer programme which facilitates comply with the resolutions; 10/02, 13/03, 05/03, 13/06, 13/05, 10/06, 12/09, 12/02, 13/04 and 11/04.

The current issues in partially or non-compliance with IOTC statistical requirement will rectify as specified in Table 4.

Table 4: How to rectify the current compliance issues

Issue	Appraises	Out come
Aggregated catch data by gear for coastal, surface and longline fisheries for some fleet components	Log book data	Catch and effort data separated by gear
Size frequency data separation	Log book data	Size frequency data separation by coastal and high seas
Spatial data: Size data Longline fisheries Surface fisheries	Observer reporting & log book data	Length data by species by type of fishery by 5° grid area by month Catch by species in number or live weight and effort in number of hooks set by 5° grid area and month strata Catch by species in live weight and fishing effort by type of fishery by 1° grid area and month strata
Surface and Longline fisheries	Observer reporting	Observed effort and catch, including incidental catch, by species by fishing trip, 1° grid area and month strata; and details about the type of biological data collected, type of vessel, type of gear, and mitigation measures used during the trip.

6. Recommendation and assistance required

Further to support already received, the following areas have also been identified in which Sri Lanka need additional support from the IOTC technical cooperation and or other external source for financial assistance.

1. Capacity building on database administration/ management to deal with emerging issues and requirements

This capacity building begins with support to:
- Develop national strategies for the development of statistics; where such strategies are in place, review them to determine where revisions are needed.
- Build a network of data mangers, supervises and supporting staff including data collectors.
- Educate staff on statistical methodology for sampling, survey design, data compilation, and data analysis.
- Provide computers, software, and other technical equipment.
- Disseminate the results and respond to requests.
- Training on PELAGOS database handing independently

2. Capacity building of onboard observers

This is new exercise to Sri Lanka which has to perform with thorough understanding and thus capacity building of onboard observers is much important to get the full advantage of deploying an onboard observer.

3. Advancement of log book and effort database (vessel registry) to facilitate obtaining timely data for policy reforms