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Ministry of Fisheries and Aquatic Resources Development Sri Lanka

Analysis of Catch Assessment of Tuna Fisheries in Sri Lanka

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J.A.D.B. Jayasooriya, Fishery Statistician

Ministry of Fisheries and Aquatic Resource Development, Statistical Division, New Secretariat, Maligawatta, Colombo 10, Sri Lanka Tel/Fax.+94 112381367, Email: stat@fisheries.gov.lk

H.M.U.Bandara, Fishery Resource Management Assistant

Department of Fisheries and Aquatic Resources, New Secretariat, Maligawatta, Colombo 10, Sri Lanka Tel/Fax.0094112434075, Email:upamal77@gmail.com

Summary

Tuna fisheries in Sri Lanka are developing rapidly with the expansion of offshore and deep sea /high seas fishing. Over 4,000 boats are currently engaged in tuna fishing, out of which around 700 boats are categorized as single day and operated in the coastal areas where as about 3,300 are operated offshore and high seas adjacent to the EEZ. The estimated total large pelagic fishery production in 2012 was 105,240 Mt and the majority of large pelagic catch, consists of tunas 66,840 Mt (63%) followed by billfish 8,730 Mt (8.5%), sharks 3180 Mt (3.0%) and Seer 620 Mt (0.5%). Among the different fishing gears used for catching large pelagic fish, large-mesh gillnet (GN) or long line (GN/LL) as secondary gear, were the widely used fishing gears in tuna fisheries. Gillnet cum long line combination contributes to more than 75 % of the total tuna fishing effort in the country. Yellow fin tuna is a commercially important species and economic regain in the country is low due to the insufficient catch rates and high operational cost. Exported quantity of tuna in 2012 was 6,250mt and 2,210mt to European Union, 2150mt to Japan. 66 percent from total was exported to EU in 2008 and it has declined to 45 percent in 2012.

The tropical tuna fishery is encouraged to increase national fish production to meet the local demand in view of full fill the requirements of nutrition gaps. The statistical system in Sri Lanka is to be further improved to meet the requirements of regional fishery management information and IOTC resolutions. The catch position data will be depicting the fishery resources availability around the country. This study reveals that the methodology developed could be effectively used to estimate and standardized CPUE to cater the stock assessment of tuna resources in IOTC area. Tropical tuna catches from gill net fishery has decreasing pattern due to the encouraging lone line fishery. The local lone line fishery catches from beyond EEZ shows increasing trend. The CPUE is calculated for boat trip and therefore, many limitations could be seen in standardization. The system also monitors the tuna catch and effort monthly at 5 grid level. Therefore, it is needed to strengthen the tuna catch data collection system to make efficient reporting for tropical tuna fishery resource management information. The proposed system will comply with response the IOTC compliance matters and data requirements. (Res 10/02, Mandatory statistical requirements, Res 05/05, concerning the conservation of Sharks) Further assistance is proposed to improve the scientific researches on by catches of sea birds, turtles etc. Several improvements were added to the existing data collection system with the assistance of IOTC/OFCF and BOBLME. It addressed collecting position data, species, catch composition, gear types, trip duration, weight, lengths and other important variables. Skilled of officers were enhanced. Improvement of reporting and analysis will be considered in 2014 and capacity of officers to be enhanced.

1. Background

Sri Lanka is one of the oldest and most important tuna producing islands in the Indian Ocean. Exploration and exploitation of tuna fishery resources around this island have shown that the tuna resources of Sri Lanka are mainly, Yellow fin tuna (*Thunnusalbacares),* Big eye tuna (*Thunnusobsesus*), Skipjack tuna (*Katsuwonuspelamis*), Kawakawa (*Enthynnusaffinis*), Frigate tuna (*Auxisthazard*) and Bullet tuna (*Auxisrochei*).Tuna fisheries in Sri Lanka are developing rapidly with the expansion of offshore and deep sea /high seas fishing. Over 4000 boats are currently engaged in tuna fishing, out of which around 700 boats are categorized as single day and operated in the coastal areas where as about 3300 are operated offshore and high seas adjacent to the EEZ. The Multiday boats with modern navigational and communication facilities are being venturing now for high seas fishing. All the multiday fishing fleets in Sri Lanka are mainly targeted tuna and tuna like species and this is a multi-gear and multi-species fishery. The estimated total large pelagic fishery production in 2012 was 105,240 Mt and the majority of large pelagic catch, consists of tunas 66,840 Mt (63%) followed by billfish 8,730 Mt (8.5%), sharks 3180 Mt (3.0%) and Seer 620 Mt (0.5%). Among tunas, skipjack tuna are dominated in the commercial catches which accounted for 41,310 Mt followed by yellow fin tuna 16,310 Mt. The total large pelagic fish production was 105, 240 Mt and skipjack tuna has dominated in the catches by contributing 24 %. Among the different fishing gears used for catching large pelagic fish, large-mesh gillnet (GN) or long line (GN/LL) as secondary gear, were the widely used fishing gears in tuna fisheries. Gillnet cum long line combination contributes to more than 75 % of the total tuna fishing effort in the country. Long lines are promoted by the government of Sri Lanka to ensure quality fish production to cater the rapidly developing export market.Exports of Chilled- yellow fin tuna has increased in recent times with much attention being paid to the production and maintenance of the quality of the tuna catch in terms of handling, storage and transport.

Exported quantity of tuna in 2012 was 6,250mt and 2,210mt to European Union, 2150mt to Japan. 66 percent from total was exported to EU in 2008 and it has declined to 45 percent in 2012. Sri Lanka has important marine resources in the Indian Ocean and catches of IOTC species have increased considerably in recent years. The fisheries policies of the Ministry of Fisheries

and Aquatic Resources (MFARD) were formulated to increase the offshore large pelagic fishery production. The coastal resources are limited and therefore, the Government encourages offshore fisheries to fulfill the consumption requirements. The Government has planned to increase the per capita fish consumption from 28.0 g/day (2009) to 75 g/day (2016) in order to reduce malnutrition of the nation. The offshore production will be more than double in 2016 compared to the production in 2009.

Therefore to monitor these changes require sound catch monitoring system to ensure sustainability of resources so as current and future catch estimates are statistically robust. The new information system implemented in consultation with IOTC is focus to fulfill the fisheries management information such as short-term information for decision-making and long-term biological information needed to access the natural and human induced changes in fish stocks and ecosystems (Wolf *et al*. 1987). Long-term monitoring of fish stocks is necessary for proper fisheries management (Paul *et al*. 2002). Most of the nation's fisheries data/information collecting through monitoring of catch and effort

Skipjack tuna is 45%, Yellow fin is 27% and big eye is 2% from total catch during the past information in 2012.

2. Objective

The objective of this analytical study is to determine how to develop the data collection system, data processing and data reporting system in Sri Lankan fishery industry in order to cater the national and regional fishery management issues. Expected outputs estimates for the area and species, size frequency data for tropical tuna and alike species, estimate total landings, catch per unit effort (CPUE), Compliance with IOTC data collection and reporting standards for its fisheries, provide provisions for IOTC Resolutions 10/02 (Mandatory Statistical requirements), 11/04 (Regional Scientific Observer Program) and 05/05 (Conservation of Sharks), trained officers for data collection.

3. Materials and Methods

3.1 Collection of Catch and Effort Data

Catch, effort and biological data of the offshore and coastal large pelagic fishery are collecting at the major 22 fish landing sites around island wide from January 2013. The coastal region is divided into five statistical zones (figure 3). The catch data are collected from each boat types. On each day fish landing boats are listed and sampled two or three boats randomly. 26 samplers are sampled covering 22 fish landing centers/harbors on 12 days per month. Samplers are either stationed at the location where the fish are unloaded. Three form types were used for data collection and separate map was introduced to identify the fishing area. **Form A** (**Daily Effort)**– describe the fleet landing and sample size, it is intended that estimates of the 'operated boats' refers only to those boats operating in the large pelargic fishery and landing at that certain site on the sampling day**. Form B (Catch data)** – Catch data by species and effort information**,** By interviewing the crew member number of hooks, type of baits, duration of fishing and information on the fishing grounds were obtained. Days fished is the number of days that the boat was actively engaged in fishing. Eight types of boats MTRB, UN1, UN2A, UN2B, UN3A, UN3B, UN3C, and UN3D are operating in the large pelagic fishery and vessel type based on the size and construction of the vessel. A variety of fishing gears is used in the large pelagic fishery in Sri Lanka. Gillnet cum long line or gillnet are the mostly used fishing gear. Gillnet fishing effort is indicated by the number of pieces of the net that were carried on the boat and similarly long line fishing effort is indicated by the number of baskets of hooks . The total number of boats operated in each day is recorded to estimate the total daily catch. Each sampling day the samplers aim to measure landings from approximately 10% of the vessels in each of the vessel classes represented at the landing site. **Form C (Length Frequency Data) -** Length, weights and other useful information**.** One form to be completed for each sampling day. At the landing site average landing per day (Kg) by boat/gear types and species, catch by species and area, weights by length groups and major tuna species of each individual is measured to the nearest cm using a measuring tape.

Figure 01: Measurement of Length by tape

3.2 Fishing zone map:

Fishing zone map is used in the survey in order to identify the fishing area in five grid levels beyond the EEZ. The catch from EEZ was considered based on the harbour/landing in to five statistical zones. The data collectors were instructed to discuss with the crew or observe his fishing information diary and to identify the cOrrect fishing area.

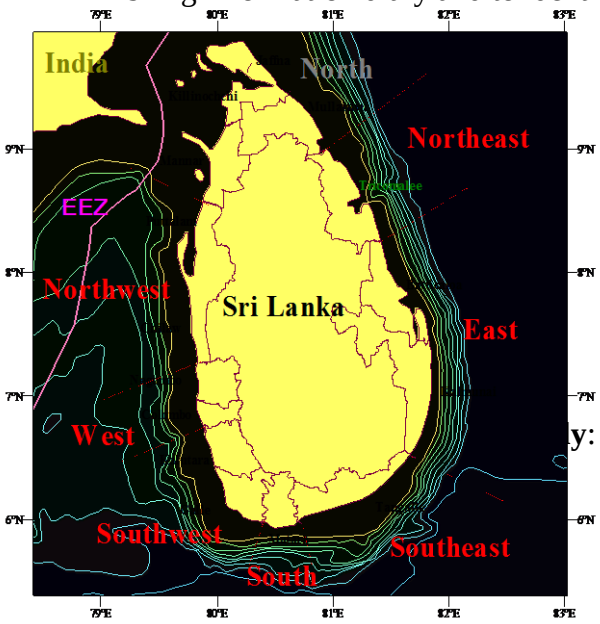
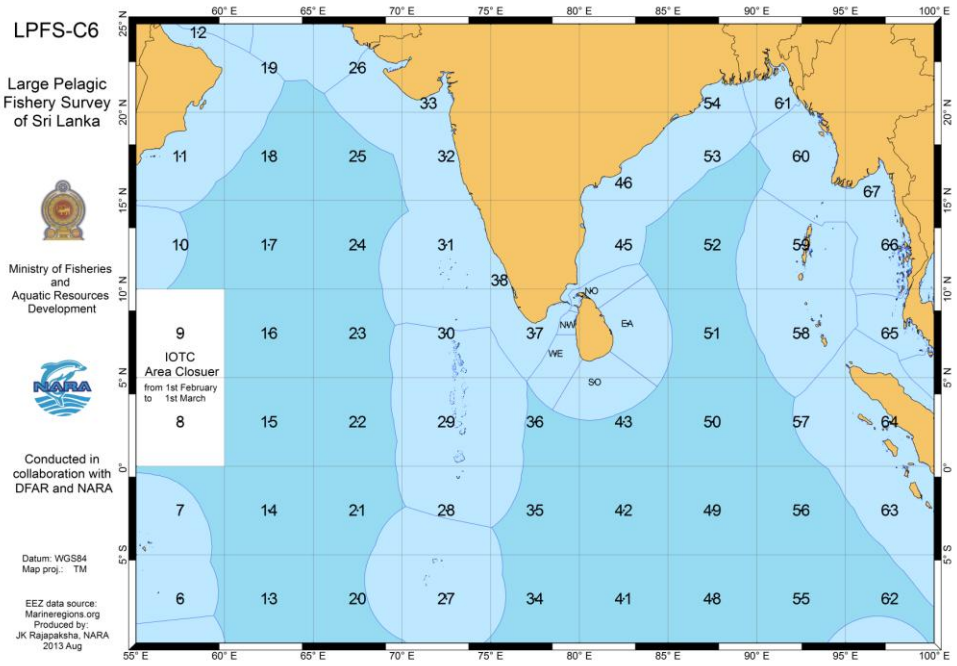


Figure 02 : Fishing zone map (EEZ)

Statistical Zones

1. North: Around Jaffna peninsula and gulf of Mannar
2. East : East and East considered as a zone (East coast)
3. South: South and South west considered as a zone
4. West: West and South west considered as a zone
5. North west

Figure 3: Fishing area map



Sample boats	OFRP (UN 1) 17 ft - 23 ft	IDAY (UN 2A) 28 ft - 34 ft	IMUL-1 (UN 2B) 28 ft - 34 ft	IMUL-2 (UN 3A) over 34 ft - 40 ft	IMUL-3 (UN 3B) over 40 ft to 50 ft	IMUL-4 (UN 4) over 50 ft to 60 ft
Landed	226	122	273	372	256	136
Sampled	37	23	28	36	26	20
Percentage	16%	19%	10%	10%	10%	15%

Table 1: Sample Coverage

The survey results for 1st half of the 2013 used to study. The coverage was 2% and accuracy was very low in previous survey. The current system increased the coverage up to 10% and the coverage in each boat type is given below.

UN 1= OFRP
- 5.5m - 7.2m
- Outboard engine(8 – 40HP)

UN2A = IDAY
- 8.8m-9.8m
- Single inboard engine(40HP)
- No insulated fish hold

UN2B = IMUL 1
- 8.8m-9.8m
- Single inboard engine(40HP)
- Insulated fish hold

UN3A = IMUL 2
- 9.8m-12.2m
- Single inboard engine(60HP)
- Insulated fish hold

UN3B = IMUL 3
- 12.2m-15.5m
- Single inboard engine(>60HP)
- Insulated fish hold

UN4 = IMUL 4
- 15.5m-18.3m
- Single /Double inboard engine(>60HP)
- Insulated fish hold

Figure 4: Tuna Fishing Boats by

Gear types used in previous data base was not clearly defined and is considered as main groups. The gear types were specified and clearly defined. The catch details of tropical tuna for the year 2012 and survey information is given below. The catch composition has shown some changes due to the employ of new officers and increase of sample size.

Species Group	2012(1)	2013(2)
Skipjack	42%	34%
Yellow fin	17%	12%
Big eye	2%	3%
Other tuna	6%	8%
Bill fishes	11%	8%
Sharks	4%	7%
Others	18%	27%
Total	100%	100%

(1) – Species proportion from large pelagic survey – NARA

(2) – Species proportion from large pelagic survey – Survey (IOTC-FAO-BOBLME)

Table 2: Species proportion (Tropical tuna) – 2012 and 2013

		GNLM	HLHL	HLTL	SNRN
		Large mesh gill net	Hand line	Tuna lone line	Ring Net
Yellow fin tuna	YFT	6%	11%	36%	15%
Skipjack tuna	SKJ	89%	82%	8%	16%
Big eye tuna	BET	1%	0%	36%	1%
Other tuna	TUX	4%	7%	20%	68%
Total		100%	100%	100%	100%

Table 3: Tropical tuna catch proportion by main gear types and species

		GNLM	HLHL	HLTL	SNRN	
		Large mesh gill net	Hand line	Tuna lone line	Ring Net	Total
Yellow fin tuna	YFT	9%	3%	64%	24%	100%
Skipjack tuna	SKJ	68%	11%	7%	14%	100%
Big eye tuna	BET	1%	0%	96%	3%	100%
Other tuna	TUX	3%	1%	24%	71%	100%

Table 4: Tropical tuna catch proportion by main gear types

Tropical tuna catches by boat types

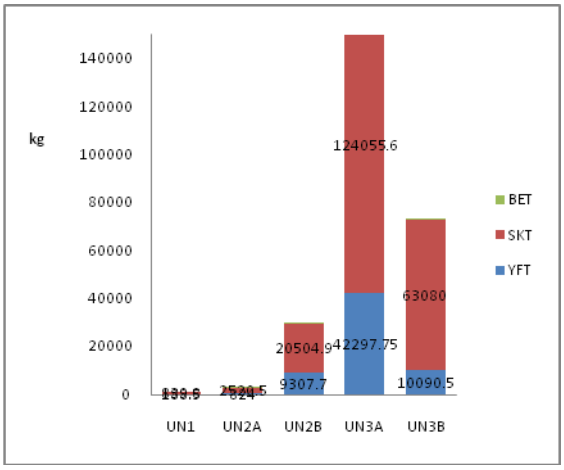


Figure 05: **Variation of Tropical Tuna Catch (kg) in the Different Boat Types, Used GNLM within Six Month Period**

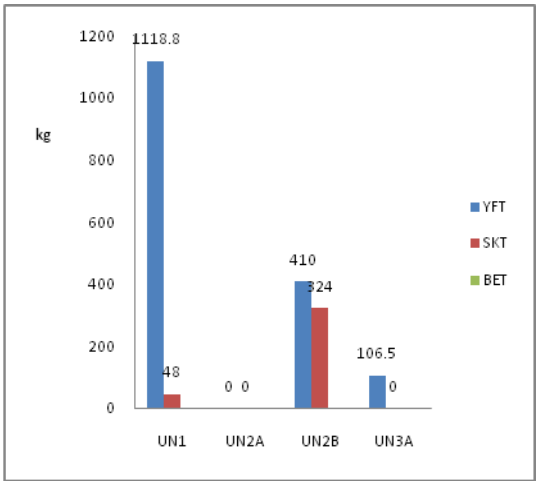


Figure 06: Variation of Tropical Tuna Catch (kg) in the Different Boat Types, Used HLHL within Six Month Period

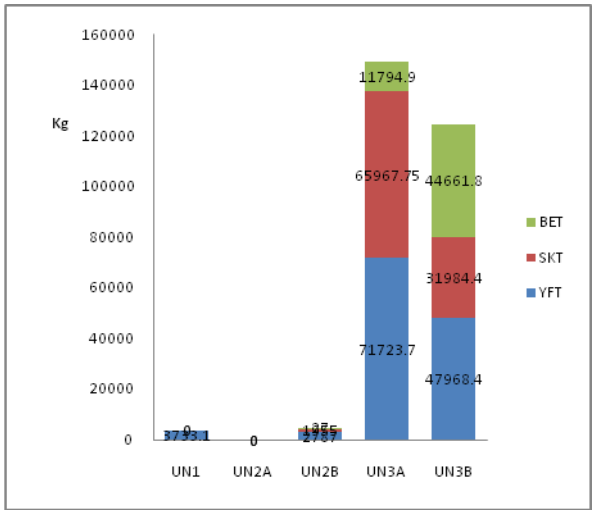


Figure 07: **Variation of Tropical Tuna Catch (kg) in Different Boat Types, Used HLTL within Six Month Period**

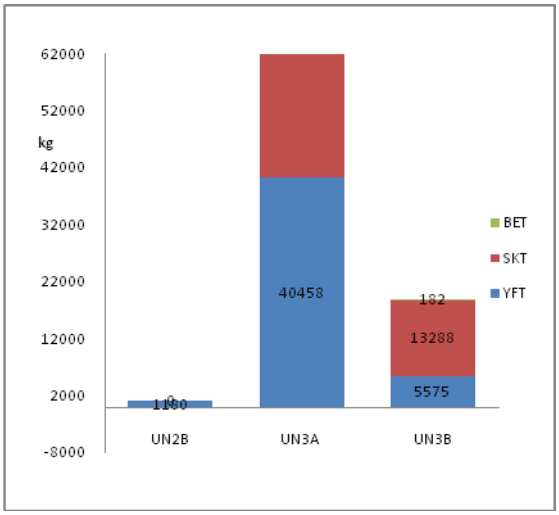


Figure 08: **Variation of Tropical Tuna Catch (kg) in the Different Boat Types, Used SNRN within Six Month Period**

The observed catch per trip in range of boat types fluctuates with the used gear type. UN3A boat catch was more dominant than all the types of boats. Maximum catch showed in GNLM gear type in UN3A boat. Skipjack tuna production was dominant in period of sampling.

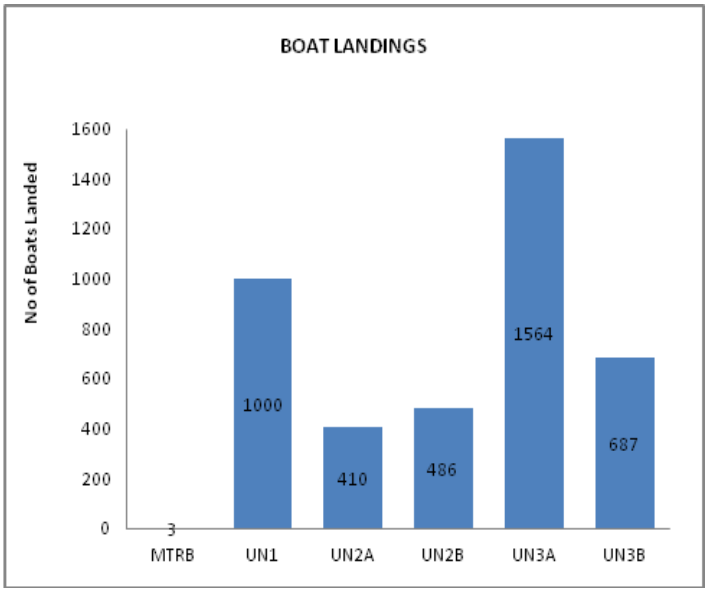


Figure 9: Number of Fleets Landing

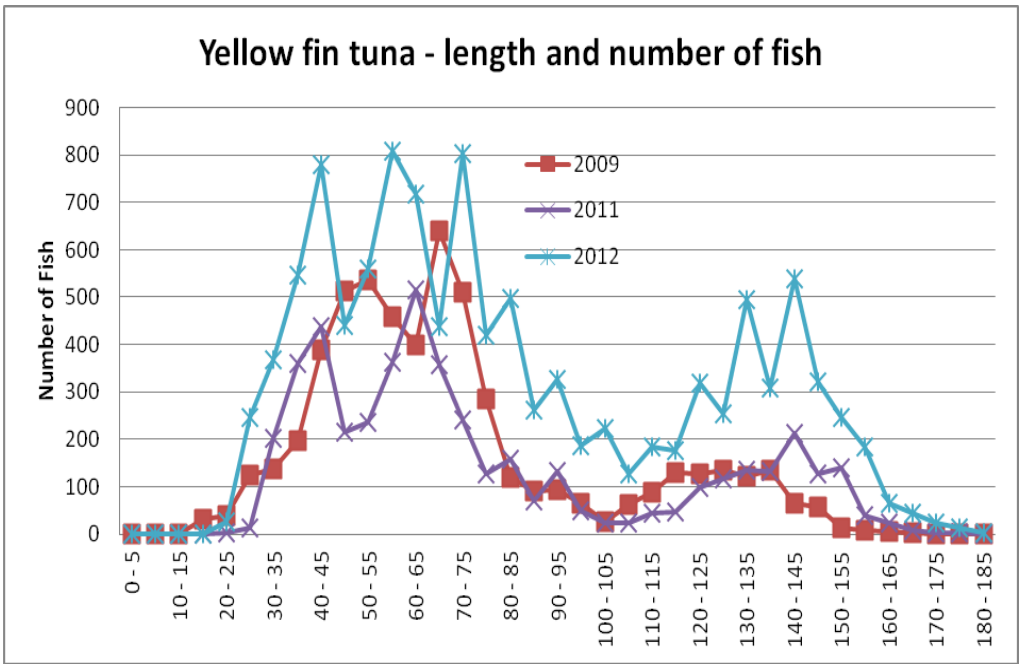


Figure 10: Yellow fin Tuna –Length and number of fish

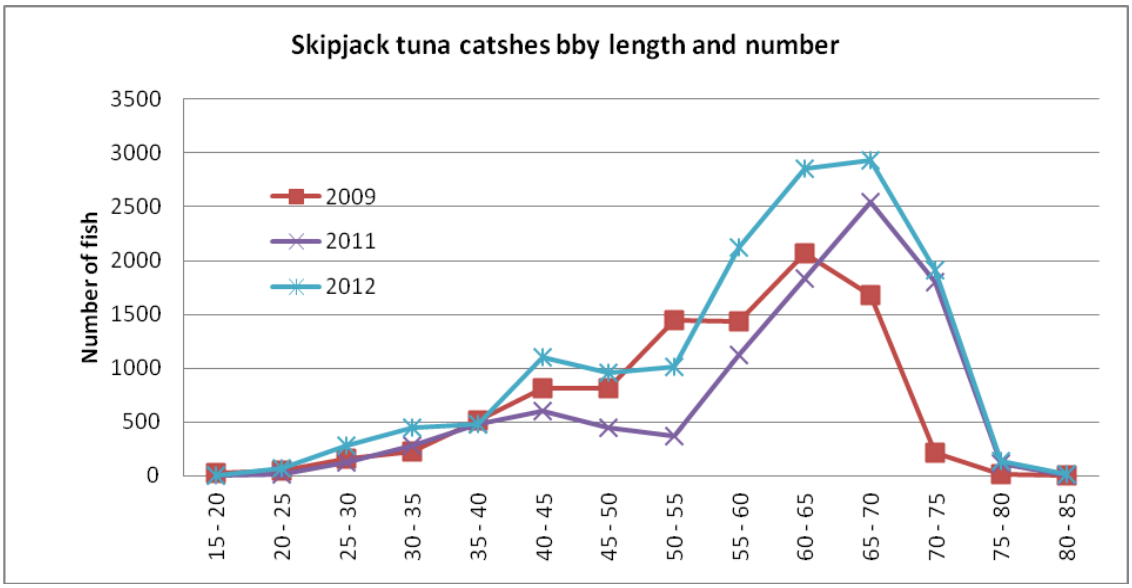


Figure 11: Skipjack Tuna cateches by length and number

Average weight by length of Skipjack tuna, big eye tuna and Yellow fin tuna

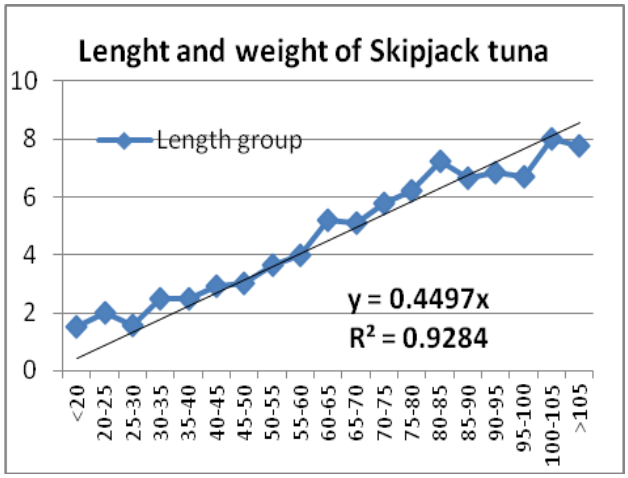


Figure 11: Length and Weight of Skipjack Tuna

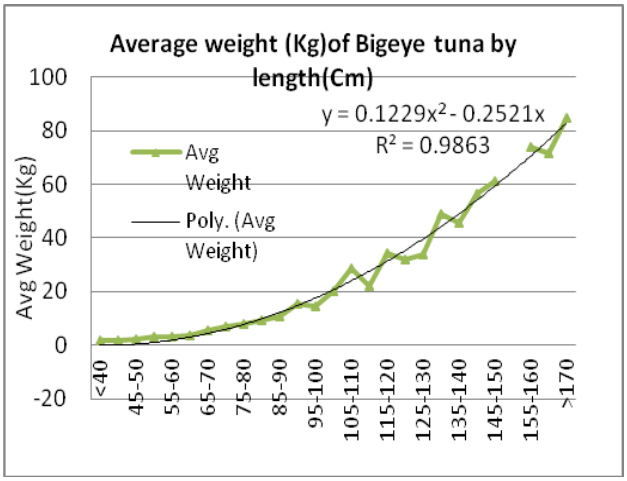


Figure 12: Average weight (kg) of Bigeye Tuna by Length (cm)

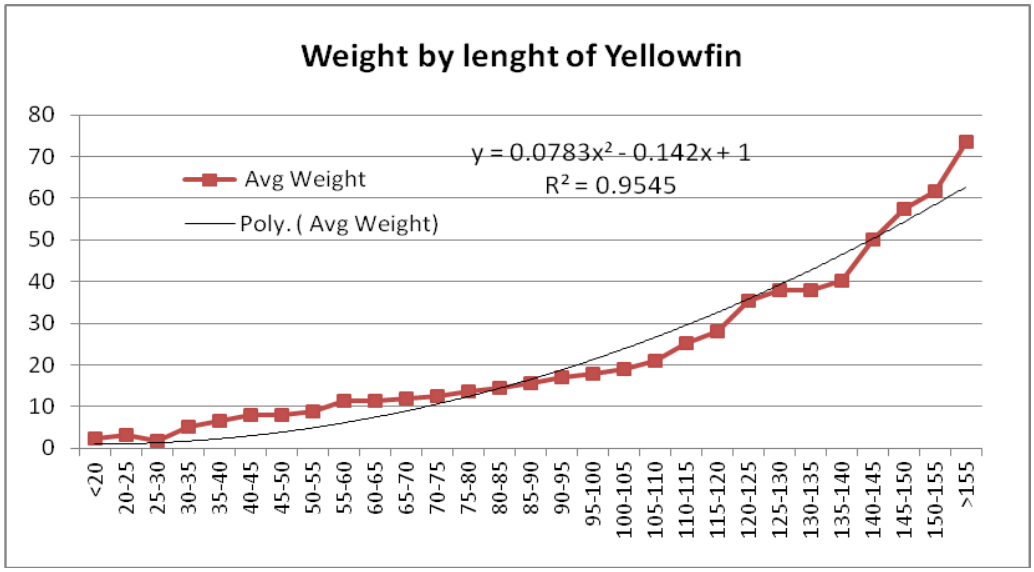


Figure 13:Weight by Length of Yellowfin

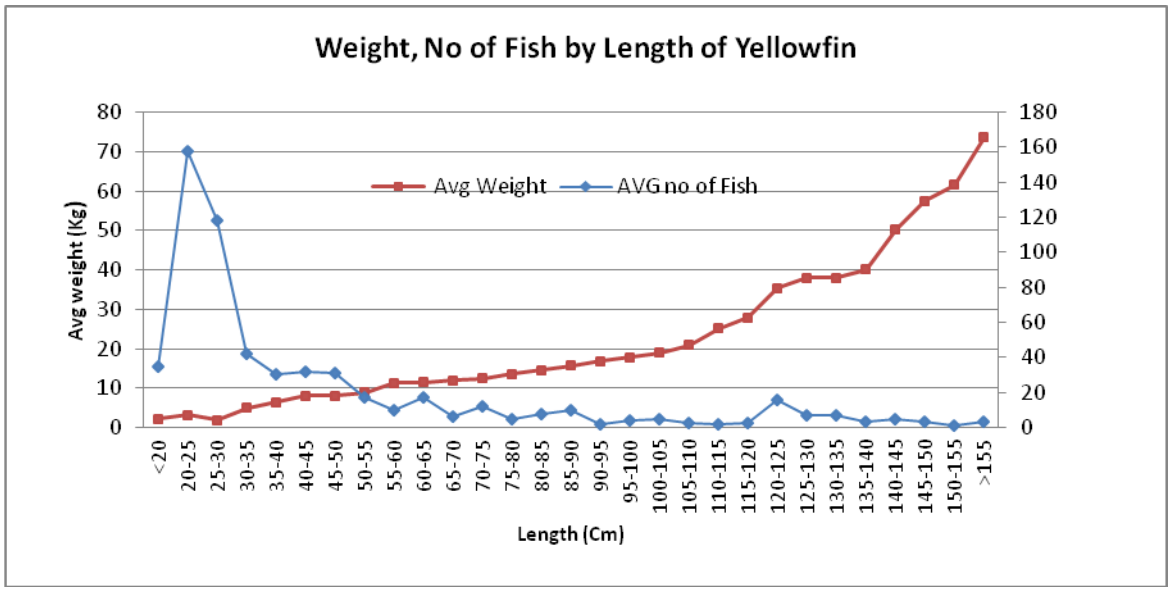
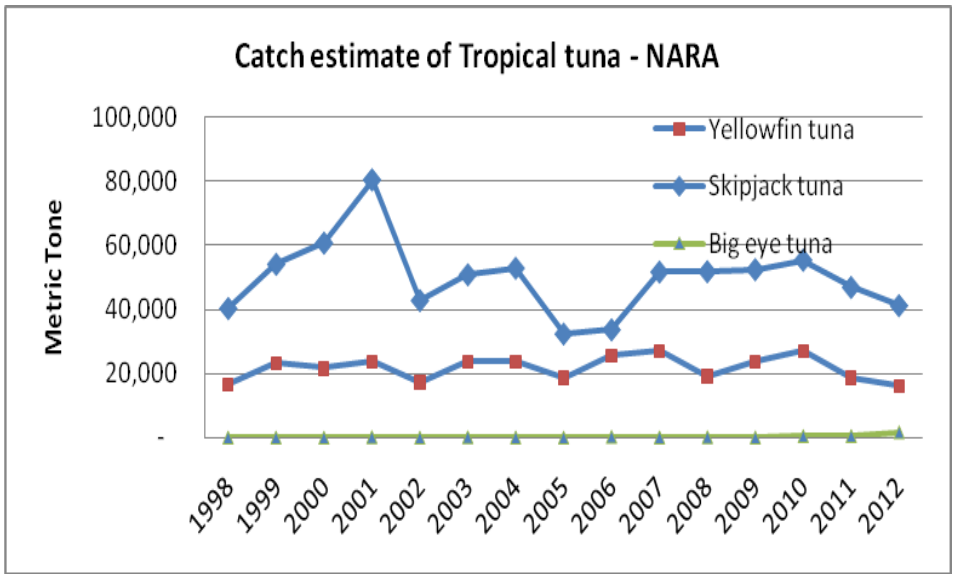


Figure 14: Weight, No of Fish by Length of Yellow fin

Fish Production – Tropical tuna (MFARD) (fig – 1a). Two systems are operating in Sri Lanka to estimate the tuna production. The Ministry analyzes the catch data and estimates are below. The big eye catch is around 2,000 metric tons per year. The yellowing tuna production has increased from 30,000mt in 1998 to around 70,000mt in 2011 and slight decline in 2012 to around 55,000mt.



Source: MBRD - NARA

The drastically drop was reported in 2005 due to the tsunami disaster.

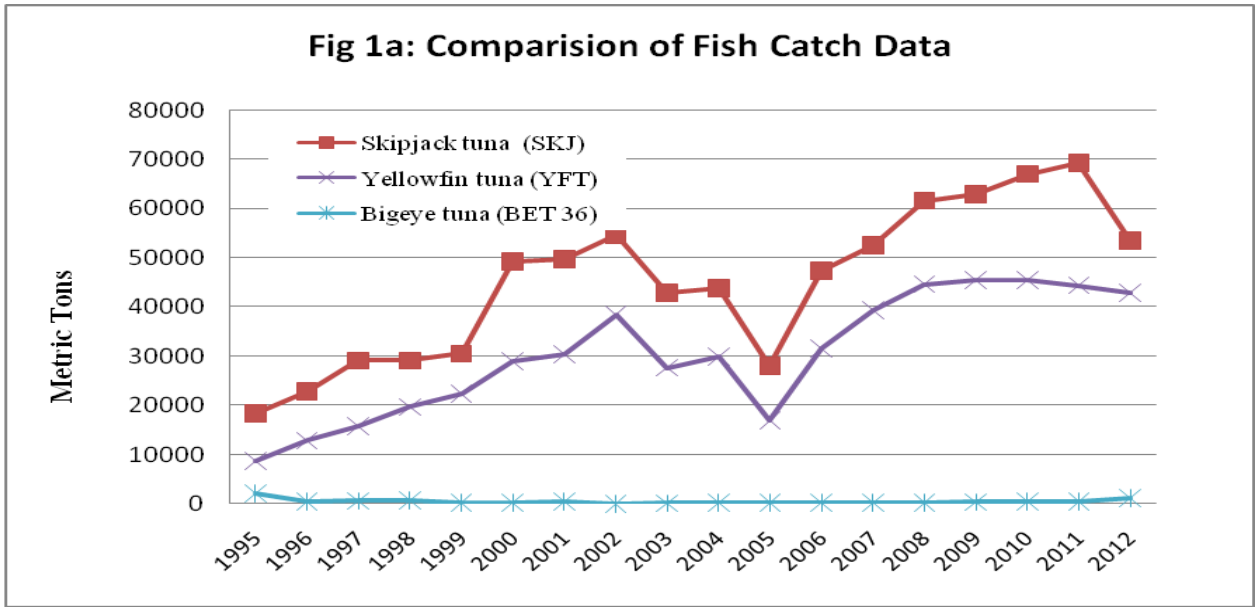


Figure 15: Comparison of fish catch data

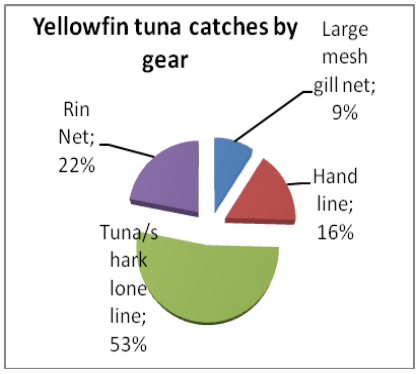
		GI	LL/GI	LL/TU	HL	PL	PSRN	TL	Total	%
YFT	Yellow fin	8,933	6,658	7,627	94	72	4,479	513	28,376	26.7
SKJ	Skipjack	26,264	12,052	1,157	100	638	7,135	102	47,449	44.6
BET	Big eye	19	26	1,590	55	-	1	-	1,691	1.6
Other	Other	14,446	8,236	2,508	211	23	2,979	386	28,789	27.1
Total		49,663	26,972	12,882	461	733	14,595	1,001	106,305	100.0

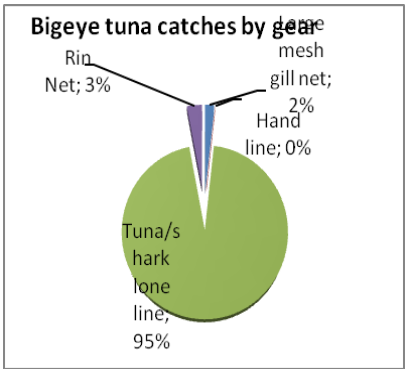
Table 5: Tropical tuna catch in 2012

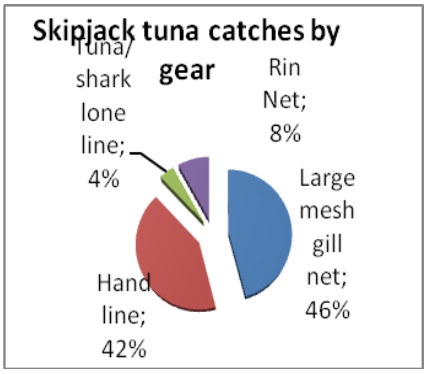
GI-Large mesh gillnet, LL/GI – Lone line and gillnet both, LL/TU Lone line and

Source: Large Pelagic data base, NARA

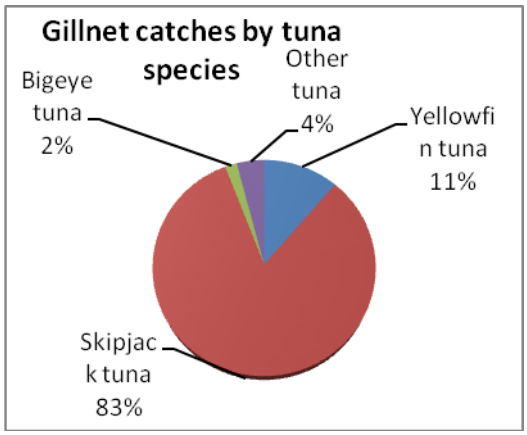
a. Percentage of Tropical tuna catches by gears

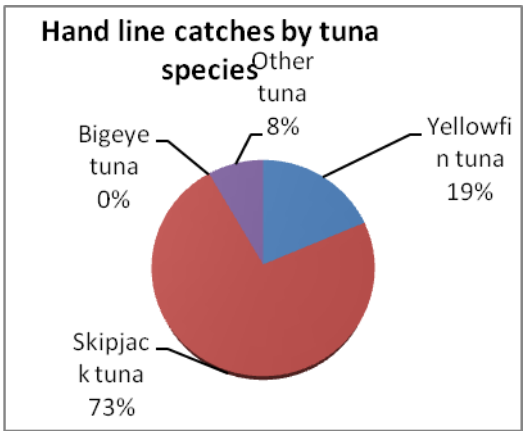


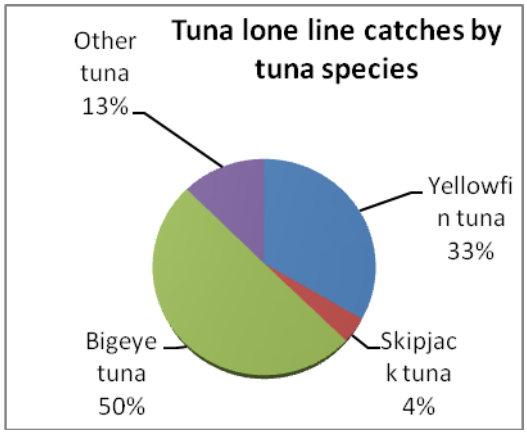


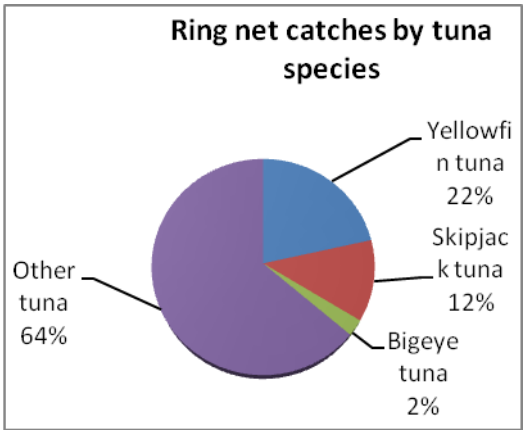


b. Percentage of Tropical tuna catches by type of gears









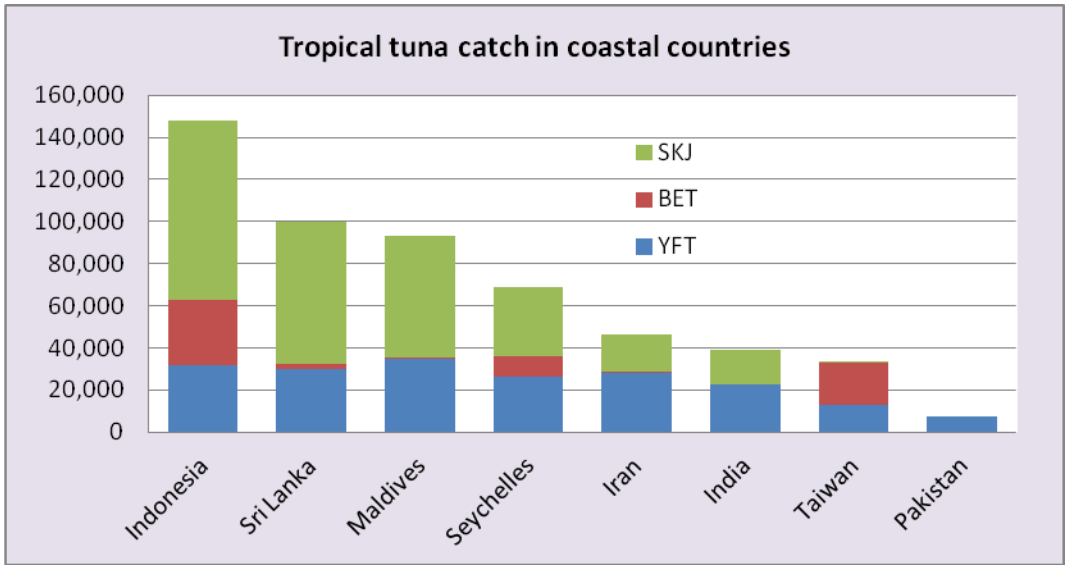


Figure 16: Tropical Tuna Catch in Coastal Countries

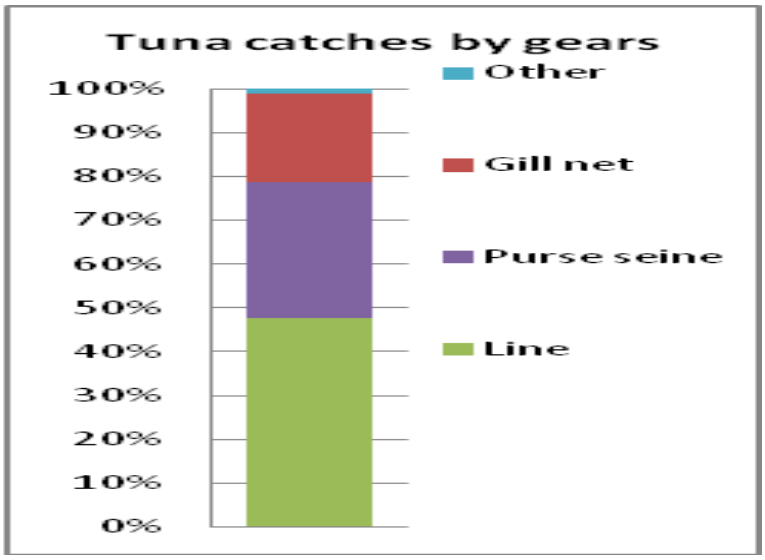
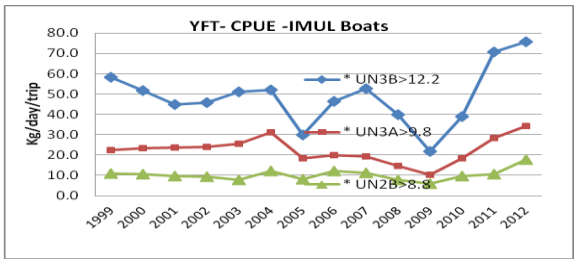


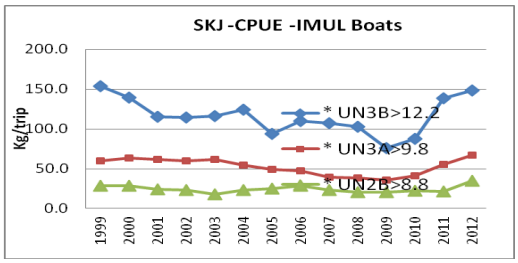
Figure 17: Tuna Catches by Gears in Sri Lanka (2013 –First Six Months)

5. Discussion

5.1 CPUE:

The CPUE calculate for the boat types and the information is not catering the management requirements. The proposed system will consider estimating CPUE at gear level and five grid level using the fishing map. The CPUE is not standardized and estimates are partially complying with the compliance matters of IOTC.





The fisheries are mainly artisanal, lively hoods dependent and multi gears. The CPUE is calculated for catch per trip for each boat types irrespective of gears. Trip length depends on fish harvest and the type of boats/gear combinations. Lack of past accurate scientific information for analysis/sharing and poor coverage due to the north and east conflict situation of the country during past years were affected continues data series. The newly initiated survey generates enough information to standardize the CPUE in tuna fisheries.

The Standardization of CPUE is sensitive issue in developing countries like Sri Lanka (coastal estates) due to non availability of reliable data and nature of fisheries statistics systems. Therefore, it is needed to strengthen the methodologies by considering the status of artisanal fishery that required information for tuna fishery resource management and is highlighted the need of expert assistance to identify the possibilities, make recommendations and standardize the CPUE with the systematic study based on available data.

5.2 Change of Species proportion

Species proportion during past eighteen year period, shark production is decreasing. Currently treasure shark species are prohibited for fishing. Over 3000 fishing families are depending on traditional shark fisheries around Sri Lanka. The catch of tropical tuna species has increasing trend. Larger boats and new technology for around 50 boats were found under the new lone scheam named DIYAWADIRIYA. Fuel subsidy scheme was given all the motorized vessels during past two year period. Therefore, catch composition was changed.

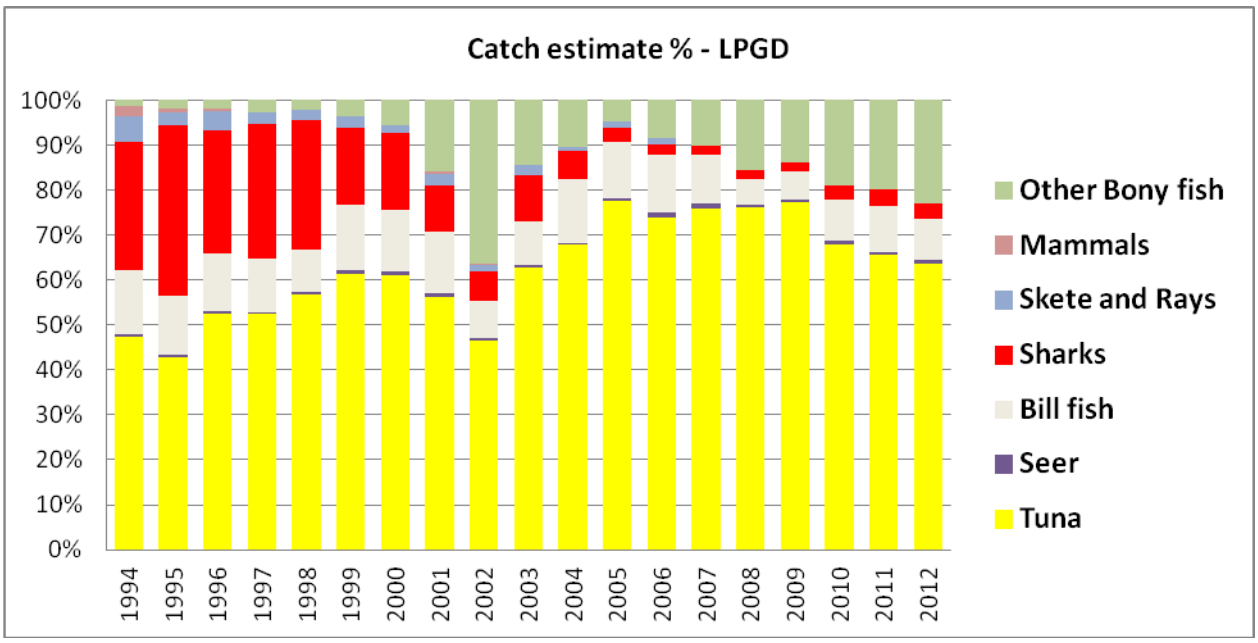


Fig: 18: Species proportion

5.3 Seasonality of tropical tuna catch

Two seasons are prevailing in Sri Lanka and tuna catches are fluctuated and peak period is reported in February-March (North east monsoon) and September-November South west monsoon). Small scale fishing boats changed their fishery from tuna to other (Carangids, rock fishes etc) focussing the income levels and resource availability. The fishing methods change depending on the season and region. The migration of fishers occurs depending on the seasonality from south and west to east.

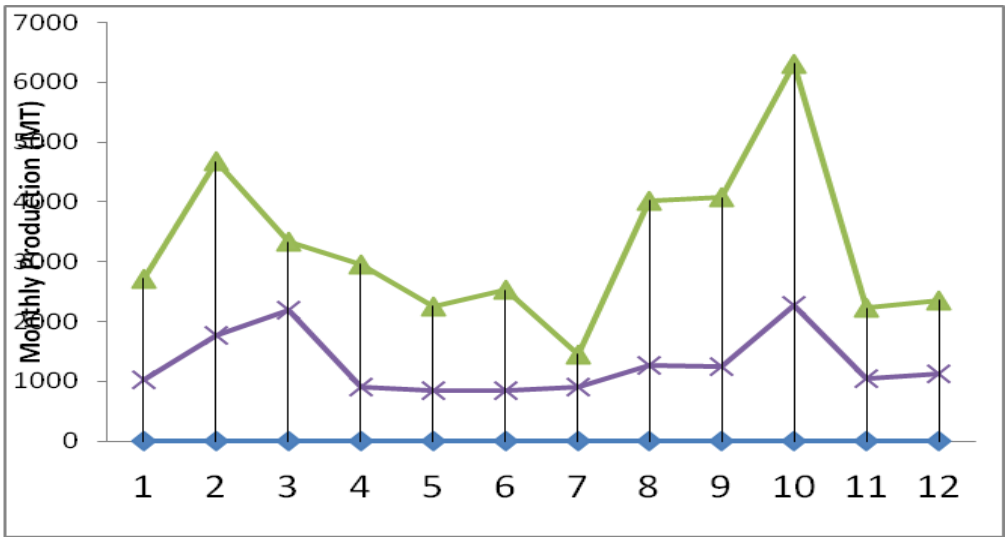


Fig 19: seasonal variation of tropical tuna catches

5.4 Length, weight relation ship SKJ and YFT

The relationship of length and weighjt is given in fig 20. Low weight catches of SKJ and YFT are reported duto the small puseners and the Government has adopted restriction to use light cause etc. The fishers are used the LL targeting the export market and high income from local market.

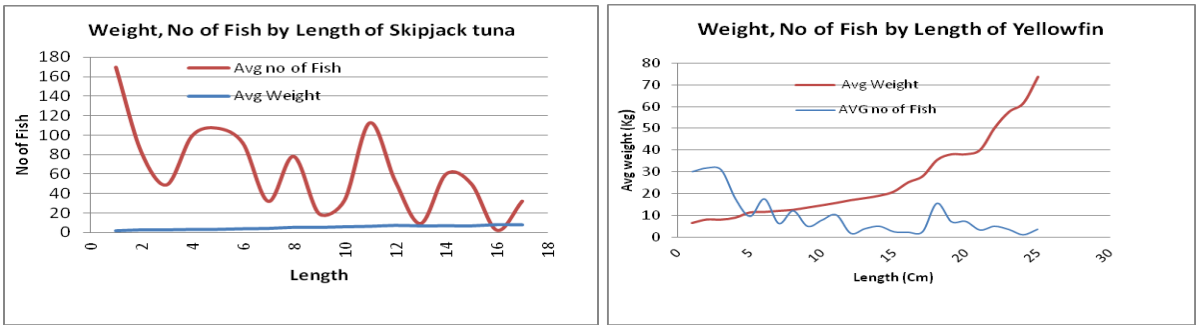


Fig 20: Length weight relationship SKJ,YFT

5.5 Average weight of SKJ and YFT

Average weight of SKJ and YFT are given in fig 21. Small purse seners are used to catch SKJ and catch weight is 2.5kg, the average weight of lone line and gill net fishery is 4.5kg, The gill net fishery is 5.5kg.

The smaller YFT is caught by the GI/LL fishery and the weight is around 6kg, The large mesh gill net cath is with average weight of 30kg and the average catch of tuna lone liners is 50kg.

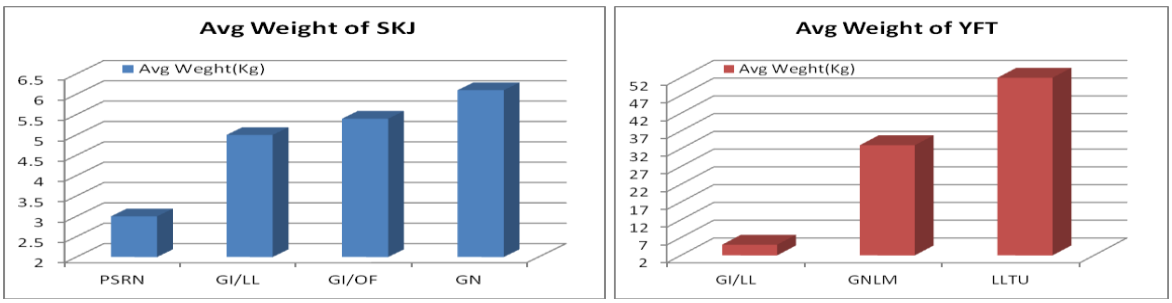


Fig 21: Average weight of SKJ and YFT

6. Conclusion and Recommendation

The tropical tuna fishery in Sri Lanka has expanded to generate export income and major export markets are EU and Japan. The demand EU is declined from 68 percent to 38 percent in 2010 and again shows increased to around 50 percent in 2012. The tropical tuna fishery is encouraged to increase national fish production to meet the local demand in view of fulfil the requirements of nutrition gaps. The statistical system in Sri Lanka is to be further improved to meet the requirements of regional fishery management information and IOTC resolutions. The catch position data will be depicting the fishery resources availability around the country. This study reveals that the methodology developed could be effectively used to estimate nominal catches to cater the national and international requirements such as IOTC. The system also monitors the tuna catch and effort monthly at 5 grid level. Therefore, it is needed to strengthen the tuna catch data collection system to make efficient reporting for tropical tuna fishery resource management information. The proposed system will comply with response the IOTC compliance matters and data requirements. Further assistance is needed to improve the scientific researches on by catches of sea birds, turtles etc.

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