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Tuna Longline Fishery in the East Indian Ocean

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Abstract

Study on tuna from longline fishery in the East Indian Ocean was carried out during January to December, 2011. The data were collected from landing vessels in Phuket Province of Thailand by interview and port sampling. The landing vessels were from Taiwan, Belize, Malaysia, India and Indonesia and their lengths were 19-40 m lengths. They employed 1,300-1,500 hooks per vessel. The used baits were round scads and/or lived milkfish. Their fishing ground was in the latitude of 2°S to 12°N and longtitude of 77° to 95° 40′E. The high fishing period was during November to March and the low fishing period was during June to October . The total catch were 5,543,244 kg with the value of 766.8 million baht. The catch included tunas, billfishes and other miscellaneous bycatch for 4,318,743 kg (77.92 %), 92,351 kg (1.67%) and 1,132,150 kg (22.08%), respectively. Tunas mainly comprised yellowfin (*Thunnus albacares*) (68.77%) and bigeye (*T. obesus*) (9.14%), and a small quantity of albacore (*T. alalunga*) (<0.01%). The average total catch rate was 14,781.98 kg per trip or 847 kg per 1,000 hooks. Average catch rate of tunas, billfishes and other other miscellaneous bycatch were 660 14 and 173 kg per 1,000 hooks, respectively. The individual dressed weights of tunas were collected and analyzed. The individual weights of yellowfin tuna were 6-100 kg; the average weight was 38.47±14.01 kg; and the modal weight was 30 kg. The individual weights of bigeye tuna were 9-118 kg; the average weight was 38.46±17.78 kg; and the modal weights were 25 and 27 kg. The individual weights of albacore were 8-39 kg; the average weight was 14.25± 3.09 kg; and the modal weights were 12 and 13 kg. The distributions of fishing efforts, catch rates and fish sizes were shown in geographical map of fishing ground.

Key words: bigeye tuna, yellowfin tuna, albacore tuna, fishing effort

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1. Introduction

The geographical factor, the available infrastructure and directed flight to the Narita airport of Japan are the preference factors of the foreign vessels and their owner agencies to landing longline catch in Phuket since 1990s (Chantawongsa, 1995). However, the declaring catch onboard is usually in form of total weight of catch of each fish group. So, without the port sampling, the amount of species or the sizes composition of the caught tuna cannot be examined. Nevertheless, the catch sampling required human and other supported resources. So, it has not been carried out every year. In 1999, Andaman Sea Fisheries Research and Development Center has started to report its working on the data collection and statistics in the Andaman Sea and the tuna landings in Phuket since 1993 to IOTC (Chantawong and Panjarat, 1999; Chantawong *et. al*, 1999a). In addition, the Preliminary Results on Fisheries and Biology of Bigeye Tuna (*Thunnus obesus*) in the Eastern Indian Ocean (Chantawong *et. al*, 1999b) of the same period was presented as well. However, after those studies, the port sampling has not been continuously conducted until in 2011. Therefore, the study in 2011 will accomplish and update the picture of tuna long liners fishing in the East Indian Ocean and the sizes composition of caught tuna of this period. The results of those reports and of this study will be discussed.

2. Objectives

To study on tuna longline fishery in the key terms of fishing ground, fishing season, catch and value, species composition, fishing effort and catch rate and tuna sizes composition.

3. Methodology

3.1 Study Period: January-December, 2011

3.2 Data Collection

The data were gathered from 2 ways, the first was from the record of the customs on the import tuna from longliners and another way was the port sampling.

3.2.1 Customs: from the record of custom, the information on vessels and round catch of each group of fish carried by the vessel were acquired. All trips were acquired from customs.

3.2.2 Port sampling: Port sampling was carried out at Muang Distict of Phuket Province of Thailand. The samplings were five days per month. The ports include the small private ports and the Port of Fisheries Market Organization, semi-government organization. The steps of sampling are as following:

3.2.2.1 **Prior to landing:** Contact companies to request the schedule of the landing. It usually could be known 1-2 days prior to landing. The information acquired from this step including name of vessels, its nationality and total catch. The plan of sampling and preparing resources based on this information.

3.2.2.2 **On the landing day**: interviewed captain and requested them to locate fishing ground on map as well as other information of fishing activity, baits, number of fishing days, and the day of travelling, catch, fish composition, quantity of fish which carried by other vessels for landing and quantity of fish

from other vessel which carried by the sampled vessel. The markings were always with the fish that not belong to landing vessel itself so that to be weighted separately. The landing catch were identify based on Collette and Nauen (1983) and Nakamura (1985). Minimum fifty fish per vessel were sampled to record individual dressed weights (kg) (Appendix Figure 1).

4. Data analysis

4.1 The study mostly used descriptive statistic to describe fisheries characteristics e.g. nationality of vessel, fishing ground, bait, number of hooks, number of trip, value of fish (Thai Baht), catch (kg), species composition (%), individual weight (kg), catch per unit of effort: CPUE (kg/trip, kg/1,000 hooks) and tuna weight (average, mode, minimum and maximum weights).

4.2 The geographic information was used to explain the spatial context including fishing position and their distribution, species composition and the distribution of tuna sizes.

5. Result

5.1 Tuna longline fishery

5.1.1 Vessel characteristics

The bodies of landed vessel were two types including wood-fiberglass and wood. The wood-fiberglass was more common vessels. The vessel lengths were 19-23 m and there were 6-7 fish holes. The one on the front was usually used for storing bycatch in form of frozen. The nationalities of these vessels were Taiwan, Belize, Malaysia and India. The material of Indonesian vessels was wood with the length of 30-40 m. They host 7-8 fish holes that can store 20-50 tons (Table 1).

Table 1 Characteristic of tuna longliners landing at Phuket Province of Thailand, 2011

nationality (accronym)	boat material	capacity of fish storage rooms (ton)	length over all (m)
Taiwan (TW)	wood-fiberglass	20-60	19-23
Belize (BZ)	wood-fiberglass	50	23
Malaysia (MY)	wood-fiberglass	50	23
India (IN)	wood-fiberglass	50	23
Indonesia (ID)	wood	20-50	30-40

5.1.2 Fishing and fishing ground

The employed hooks were in the range of 1,300-1,500 per vessel, hydraulic winch, bouy and bouy line and radio bouy were the regular equipment. One vessel possessed 10-12 radio bouys. In the past, Indian mackerel and imported Argentina squid (*Illex argentinus*) were the common bait for tuna longliners that landed in Phuket (Chantawong, 1995; Panjarat et al, 2003; Chow and Weicheng, 2002). However, there prices have been more expensive. So, round scads and lived milkfish have been used. The fishing ground were in latitudes of 2°S to 12° N and longitude of 77° to 95° 40′ E where took 1-2 days to sail to and sail from and took 12 days of fishing. The high season of tuna fishing in this area was during November to March. The low fishing season was during May to October which was during Southwest monsoon season (Figure 1-2).

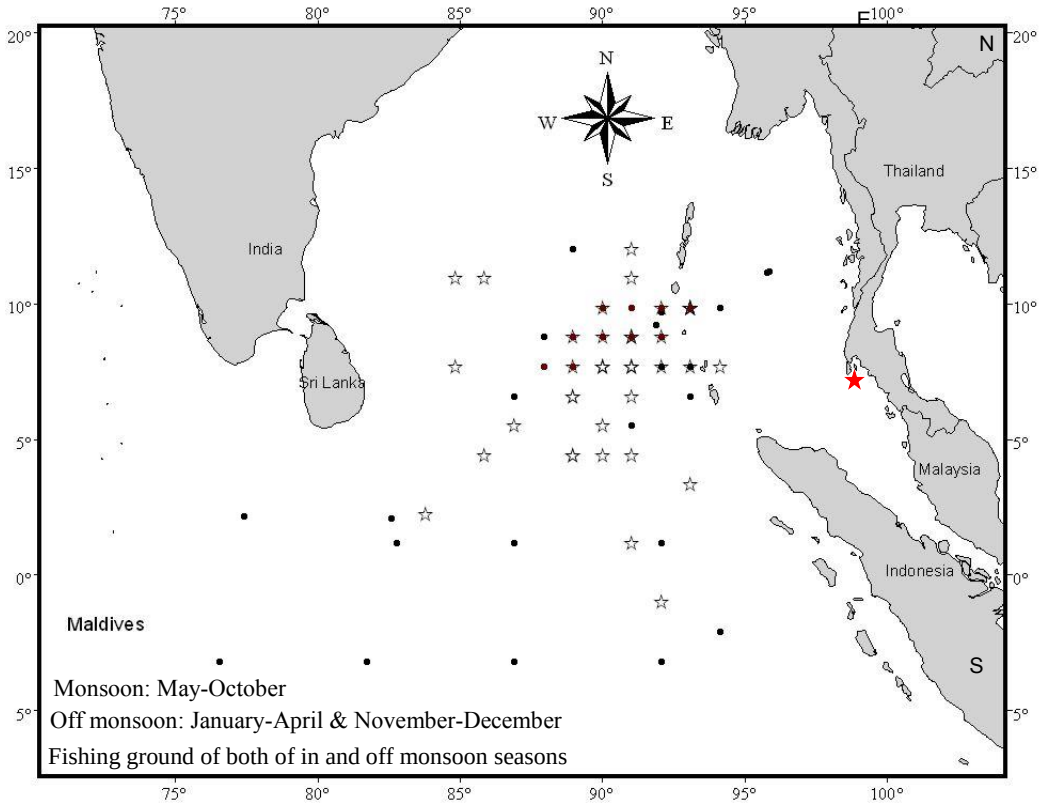

Figure 1 The seasonal effort distribution of tuna longliners in fishing ground, 2011

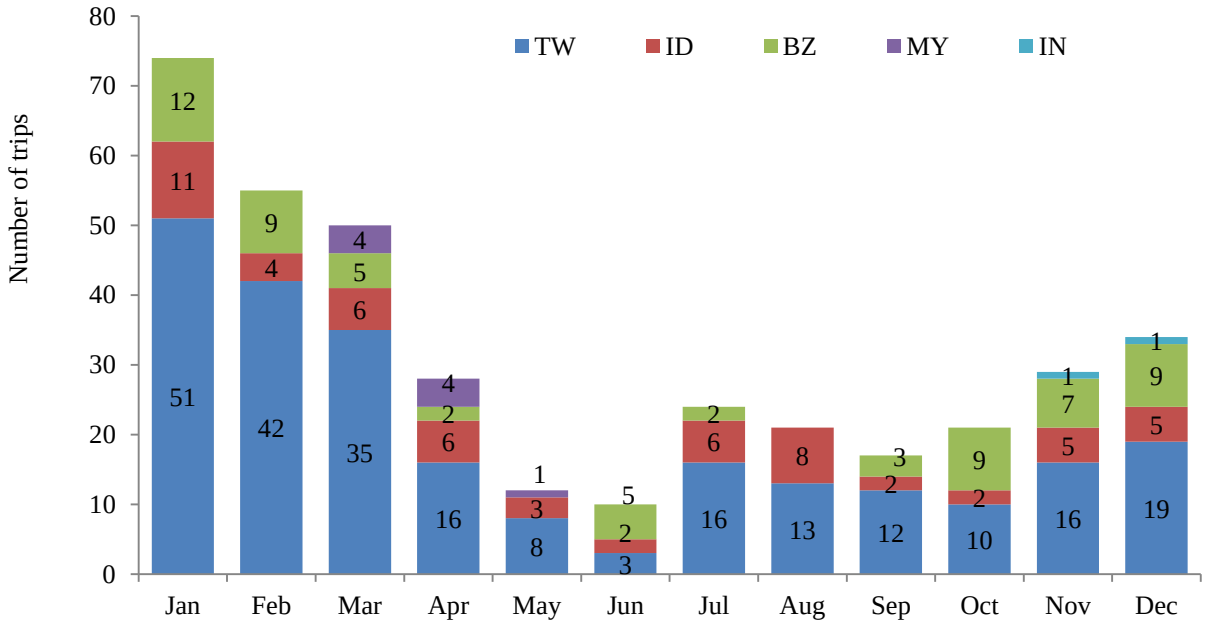

Figure 2 Number of trips of tuna longliners landing at Phuket Province, 2011

5.1.3. Catch and species composition

The total landing catch in 2011 was 5,543,244 kg including 4,318,743 kg of Tuna (77.92%), 92,351 kg of billfishes (1.67) and 1,132,150 kg of miscellaneous byctach (20.42%) . The tunas included Yellowfin (*Thunnus albacares*) and bigeye tunas (*T. obesus*) for 68.77% and 9.14% while albacore (*T. alalunga*) accounted less than 0.01%. Billfishes included blue marlin (*Makaira mazara*), black marlin (*M. indica*), swordfish (*Xiphias gladius*) and striped marlin (*Tetrapturus audax*) for 0.57%, 0.45%, 0.44% and 0.21%, respectively. Micellanaous fish accounted for 20.42% that include sharks, Spanish mackerel (*Scomberomerus commersoni*), oil fish (*Ruvettus pretiosus*) and sailfish (*Istiophorus platypterus*) (Table 2). However, the proportion of these fish could not be determined. In addition, it was remarked that the percentage of miscellaneous fish was higher during the low tuna fishing season. It was remarked in July and September when their percentages were up to 57.40 and 54.86 (Figure 3).

Species compositions were not different among fishing positions. However, it was noticed that the billfish were mainly caught in the latitude of 7°-10° N and longitude of 88°- 93° E (Figure 4).

Table 2 Catch of fish from tuna longliners unloading in Phuket Province, 2011

fish		catch		Value (Thai baht)
		kg	%	
tuna	yellowfin tuna (YFT)	3,812,225	68.77	609,949,516
	bigeye tuna (BET)	506,465	9.14	81,032,407
	abacore tuna (ALB)	53	0.00*	8,476
	sub total	4,318,743	77.92	690,990,400
billfishes	swordfish (SWO)	24,410	0.44	1,513,420
	black marlin (BLM)	24,824	0.45	1,539,086
	blue marlin (BUM)	31,541	0.57	1,955,505
	stripe marlin (MLS)	11,576	0.21	717,720
	sub total	92,351	1.67	5,725,731
miscellaneous	sharks	18	0.00*	nd
	oilfish	4,006	0.07	nd
	others	1,128,126	20.32	nd
	sub total	1,132,150	20.41	70,072,555
total billfishes & miscellaneous		1,224,501	22.08	
Grand total		5,543,244	100.00	609,949,516

Remarks: * = less than 0.01 of value ; others = king fish, sun fish and sailfish

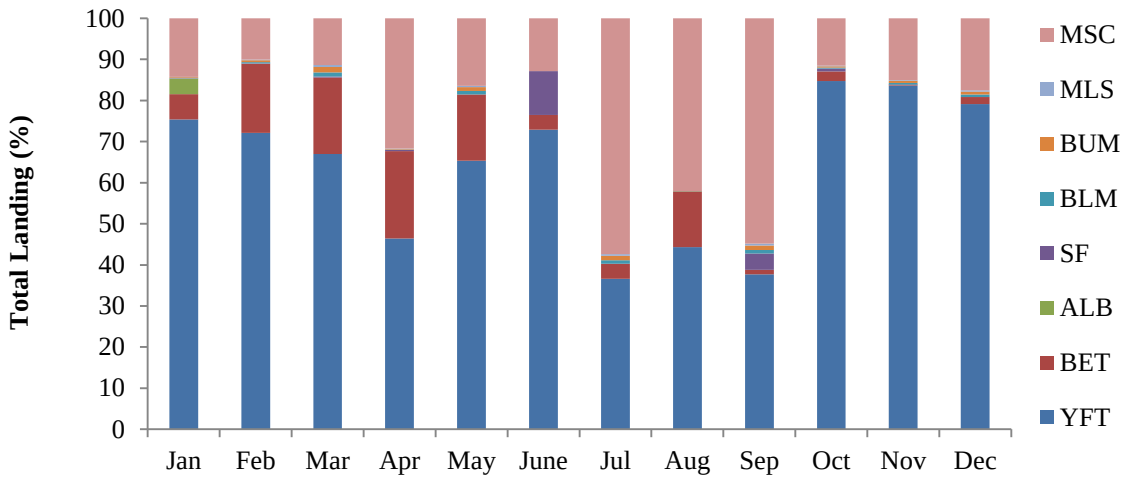

Figure 3 Monthly catch species from tuna longliners unloading in Phuket Province, 2011

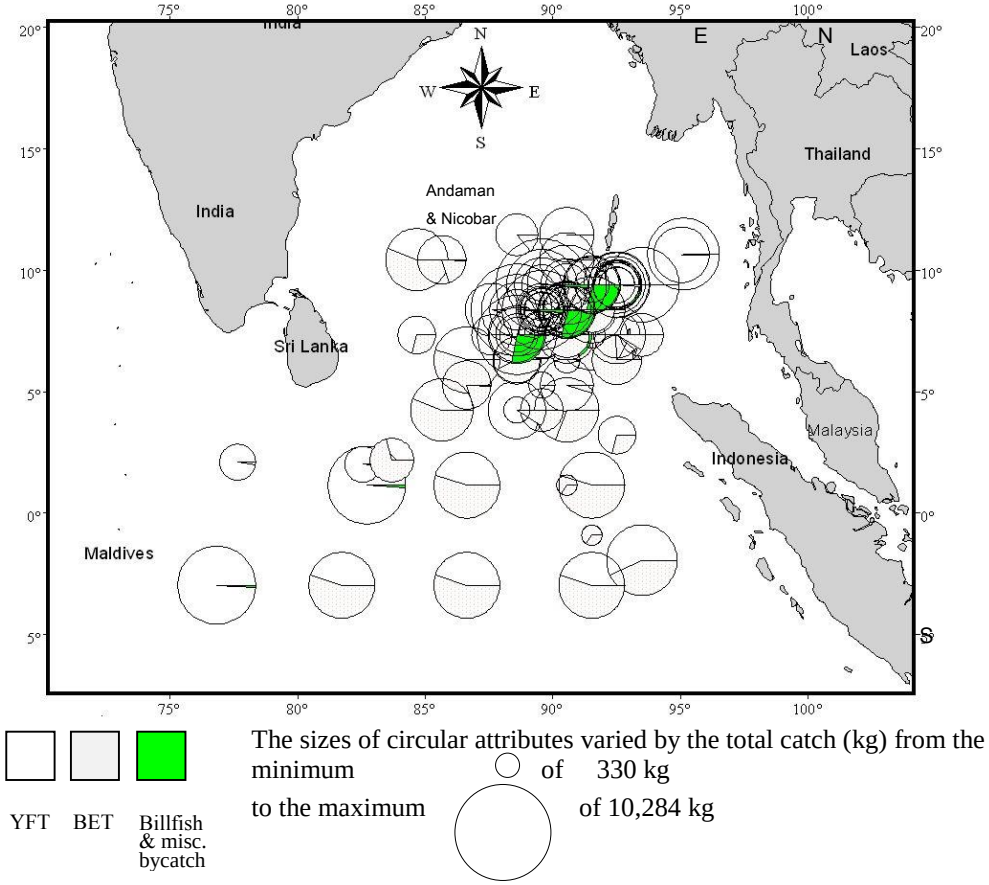

Figure 4 Composition of fish from tuna longliners

5.1.4 Fishing effort and catch rates

In 2011, there were totally 375 trips (Figure 2) and the average days/trip was 12.6. The average total catch was 14,781.98 kg/trip. The average catch rate of tunas and billfish were 11,762.91 kg/trip while the average catch rate of miscellaneous bycatch was 3,019.07 kg/trip. The lowest average total catch was found in June (9,357 kg/trip) and the highest average total catch was found in December (24,688.04 kg/trip). The total catch rates were in the range of 30-760 kg/ 1,000 hooks.

5.1.5 Tuna sizes composition

The study reports two kinds of information. Firstly, it reports the sizes of all landed tuna as to show the whole picture of the caught sizes. Secondly, it reports the sizes of tuna that their catching positions were known as to show the distribution of the sizes in the fishing ground. The study derived fishing ground of 46 trips out of the total 375 trips.

Sizes of the caught yellowfin tuna were in the range of 6-100 kg with the average of 38.47±14.01 kg and the size mode is 30 (Figure 5). The small tuna of 6-26 kg distributed in the area of Andaman and Nicobar Island while the larger size were likely to be found southwards and the largest size was 84 kg in the area below the equatorial. The average sizes of yellowfin tuna below the equatorial were in the range of 45-49 kg (Figure 6-9).

Sizes of the caught bigeye tuna were in the range of 9-118 kg with the average of 38.46±17.78 kg and the size mode were 25 and 27 (Figure 5). It is similar to the yellowfin tuna that the small sizes of 9-14 kg distributed in the area of Andaman and Nicobar Island and the larger sizes were likely to be found southwards where the largest size was 84 kg in the area below the equatorial. The average sizes of yellowfin tuna below the equatorial were in the range of 50-67 kg (Figure 10-13)

The sizes of the caught albacore tuna were in the range of 8-39 kg with the average of 14.25±3.09 kg and the size mode are 12 kg and 13 kg (Figure 5). However, there were only the deriving fishing grounds of the four individual albacore tuna which were in the area of the latitude 5° N longitude of 87° E and latitude 9° N longitude 83° E (Figure 14).

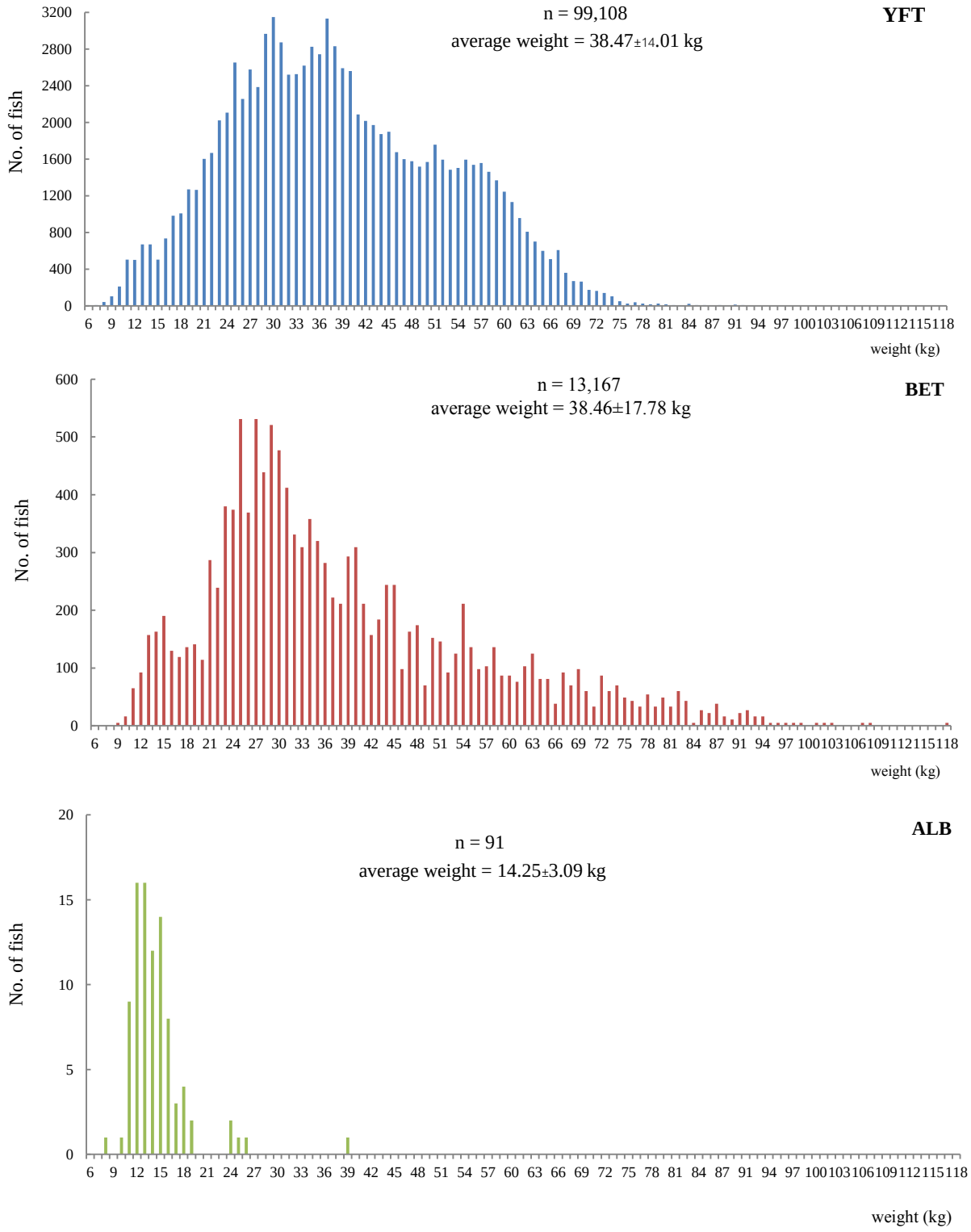

Figure 5 Frequency distribution of individual weight of tunas caught by longliners unloading in Phuket Province, 2011

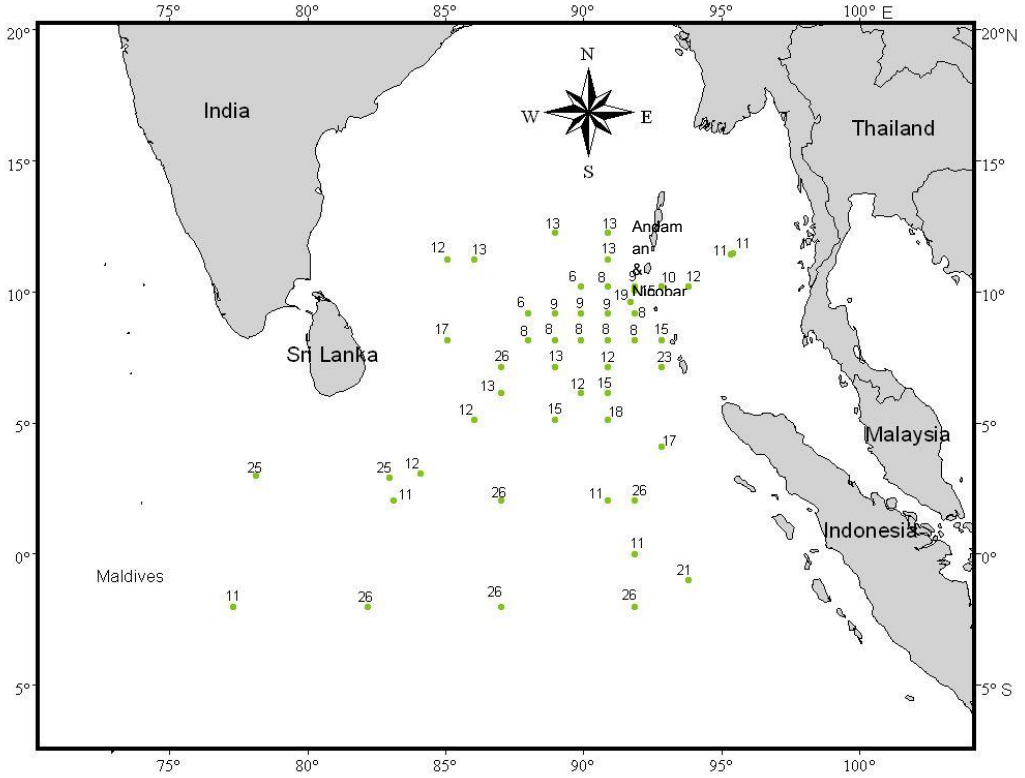

Figure 6 Minimum individual weight of yellowfin tuna caught from each fishing ground

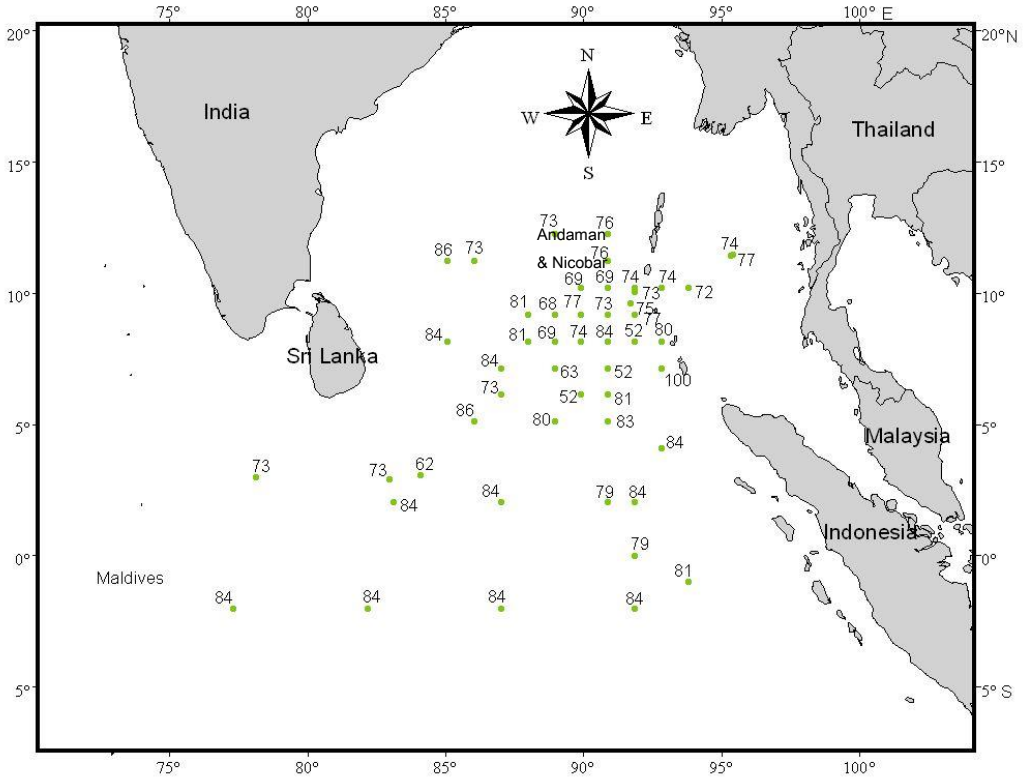

Figure 7 Maximum individual weight of yellowfin tuna caught from each fishing ground

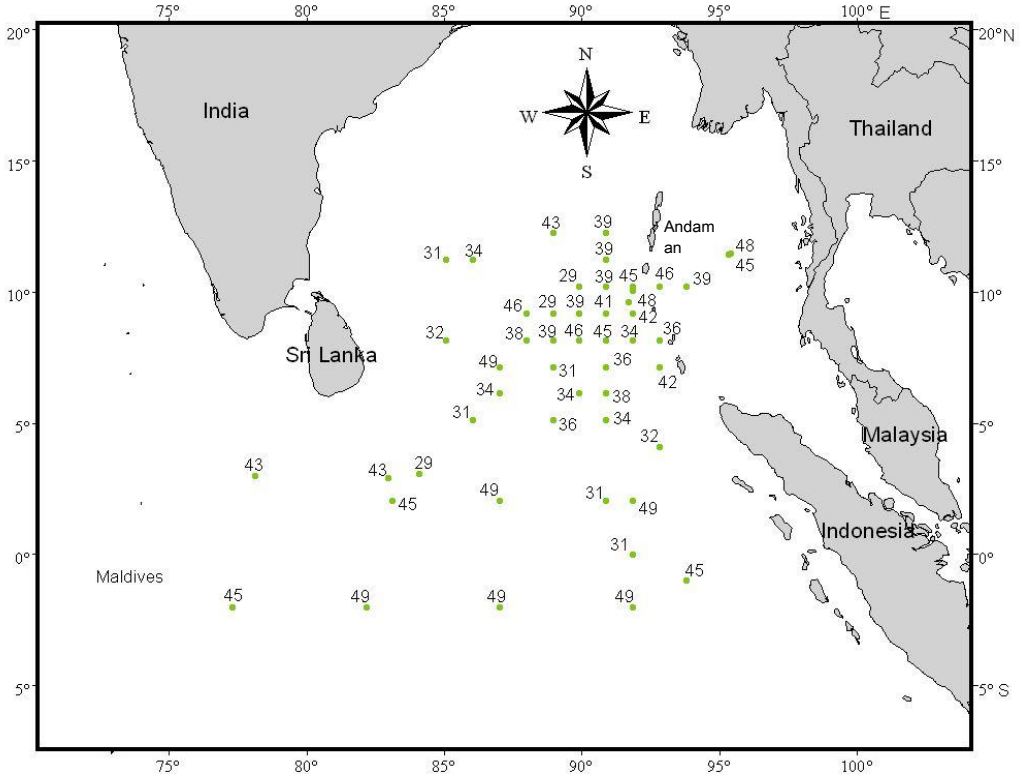

Figure 8 The average individual weight of yellowfin tuna caught from each fishing ground

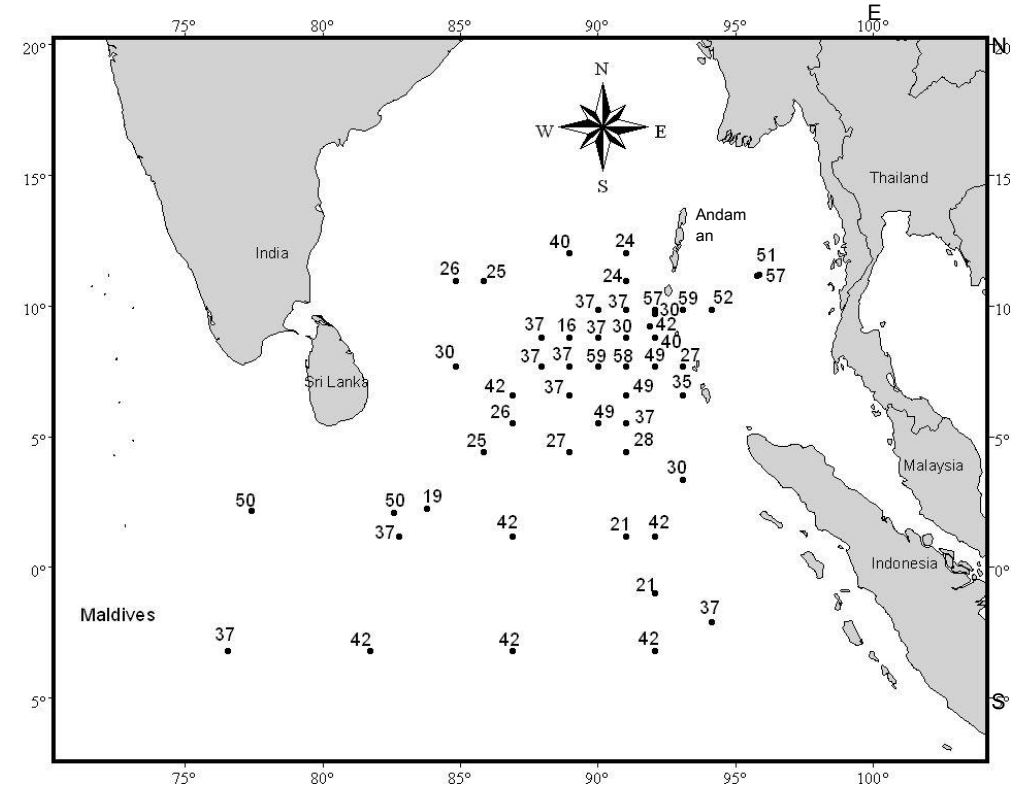

Figure 9 Modal individual weight of yellowfin tuna caught from each fishing ground

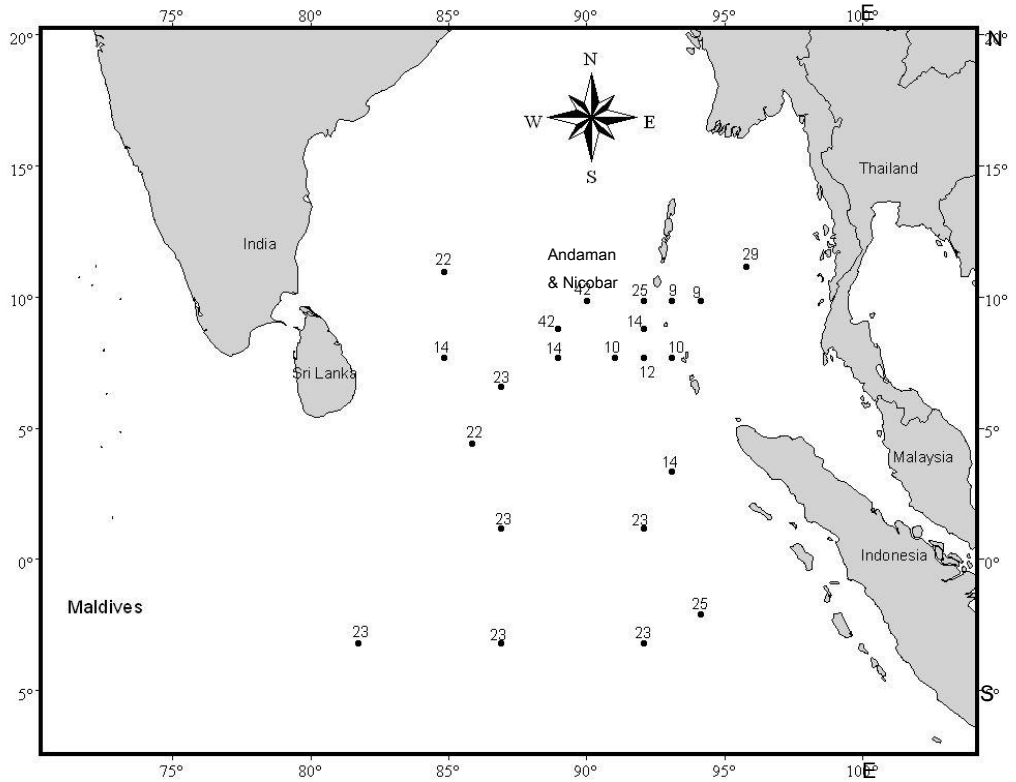

Figure 10 Minimum individual weight of bigeye tuna caught from each fishing ground

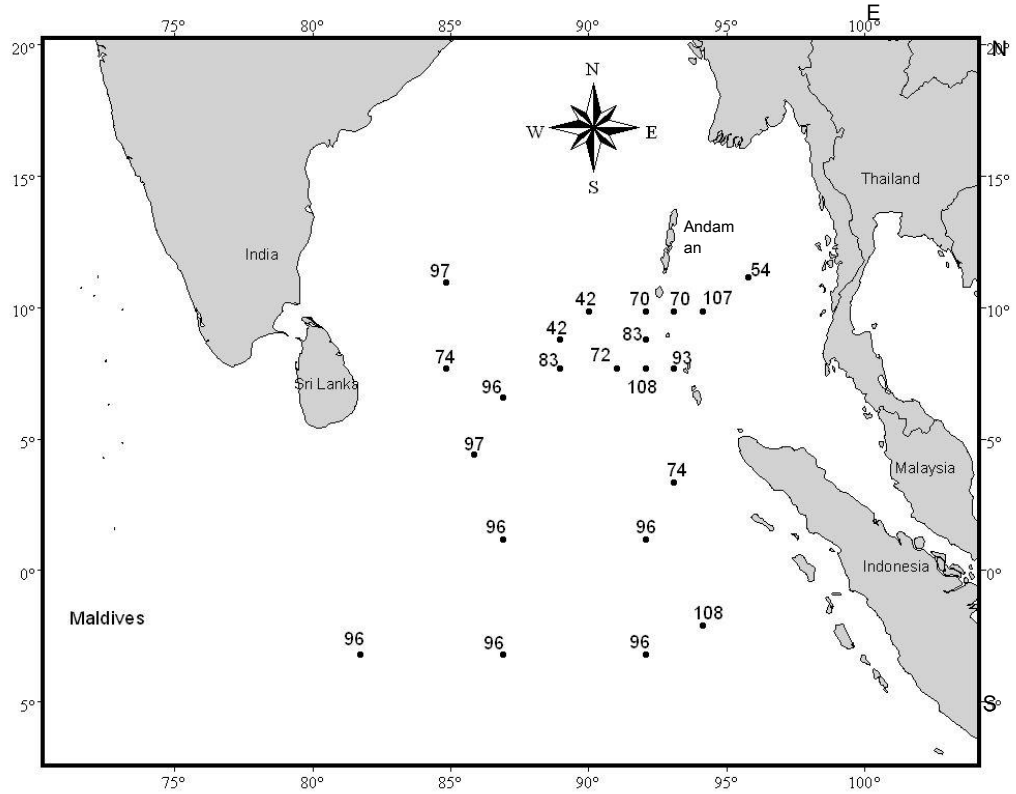

Figure 11 Maximum individual weight of bigeye tuna caught from each fishing ground

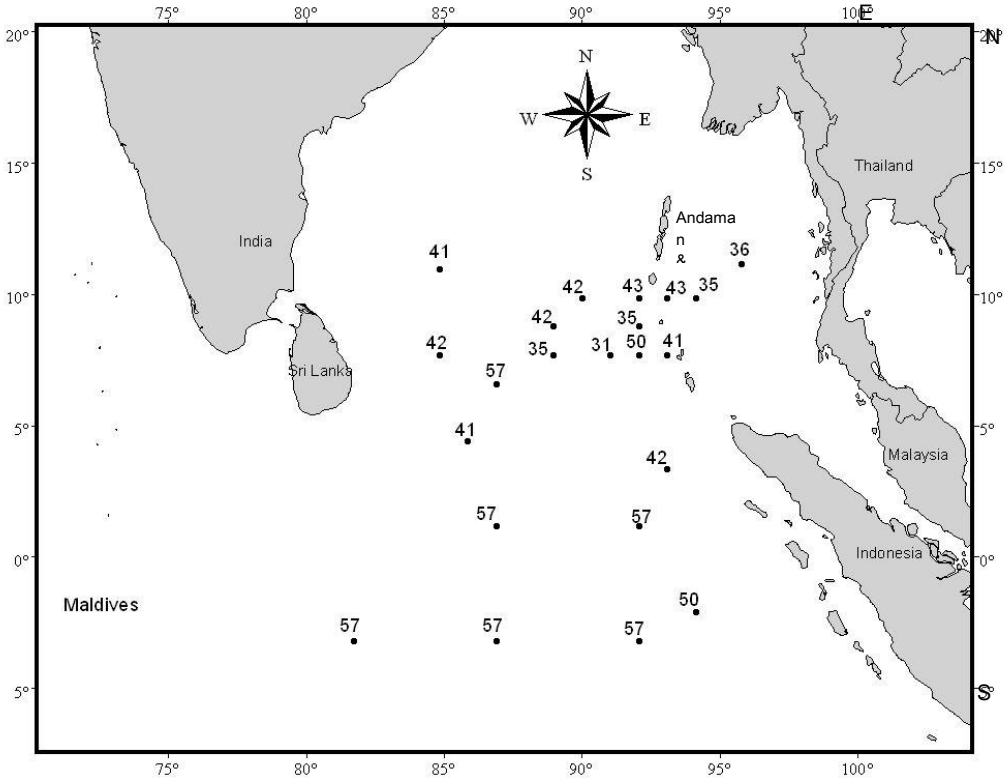

Figure 12 The average individual weight of bigeye tuna caught from each fishing ground

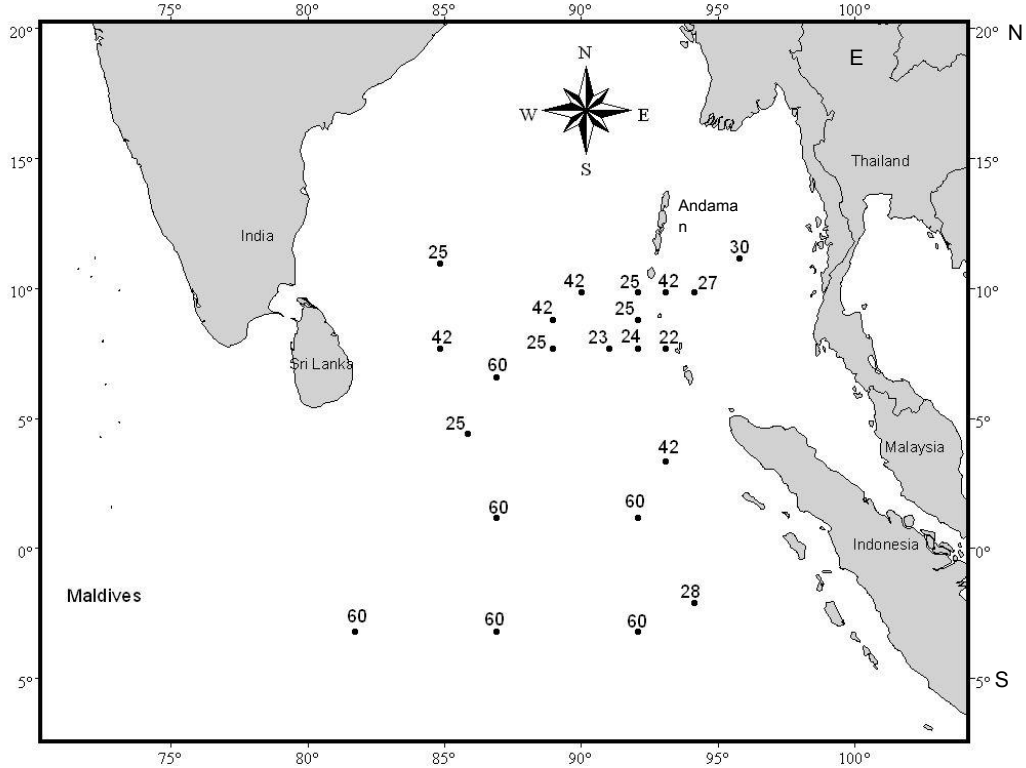

Figure 13 Modal individual weight of bigeye tuna caught from each fishing ground

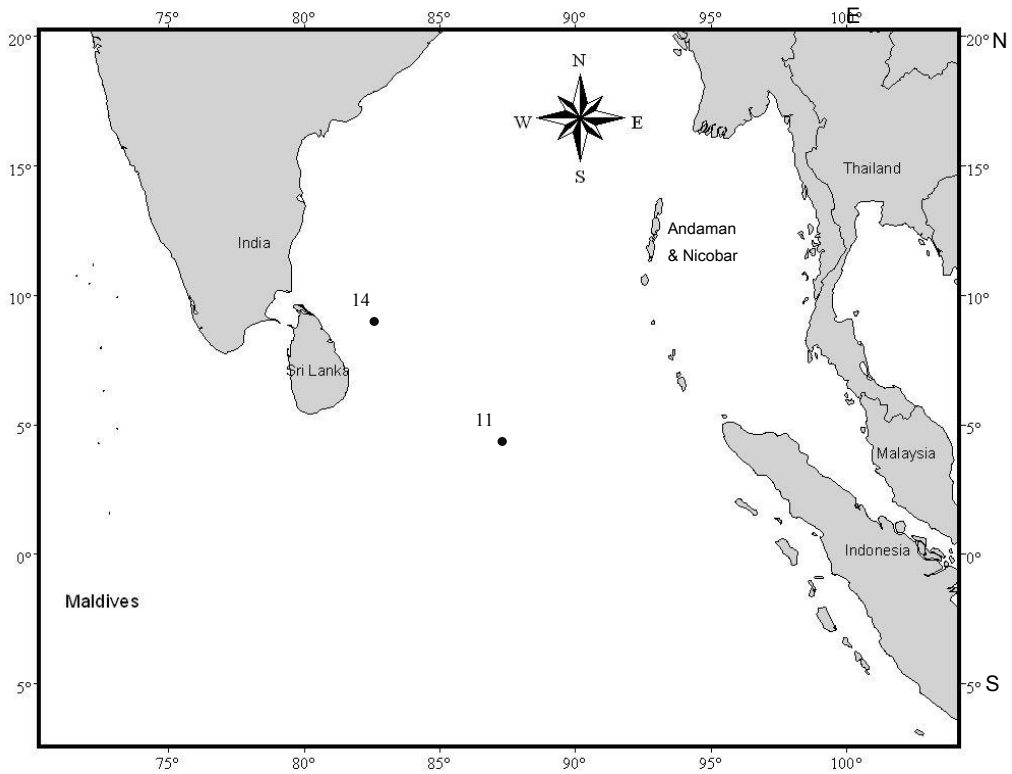

Figure 14 The average individaul weight of albacore tuna caught from each fishing ground

6. Discussion

During 1993-1998, the fishing grounds were from latitude 14°N to 3°S and longitude 80° to 95°E and the fishing grounds of this study were in latitudes of 12° N to 2°S and longitude of 77° to 95° 40′ E. So, it can be seen that the fishing grounds of longliners landed in Phuket were similar to the fishing grounds of the passed 20 years that they went to the area where took 1-2 days to sail to and sail from (Apendix Figure 2). It was interesting that the catch of shark were rarely reported (Appendix Table 1).

7. Challenges and Recommendations

This study carried out in 2011 where the port state measure was not practiced. The information derived based on interview and sampling instead of requesting logbook and then the obstacles were the barrier of languages as most of crews of these longliners were Taiwanese. The development of the catch document scheme and traceability as well as with the port inspection based on the Port State Measure might facilitate and enhance the accuracy of the derived information in the near future.

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Appendix figure 1 Sampling form

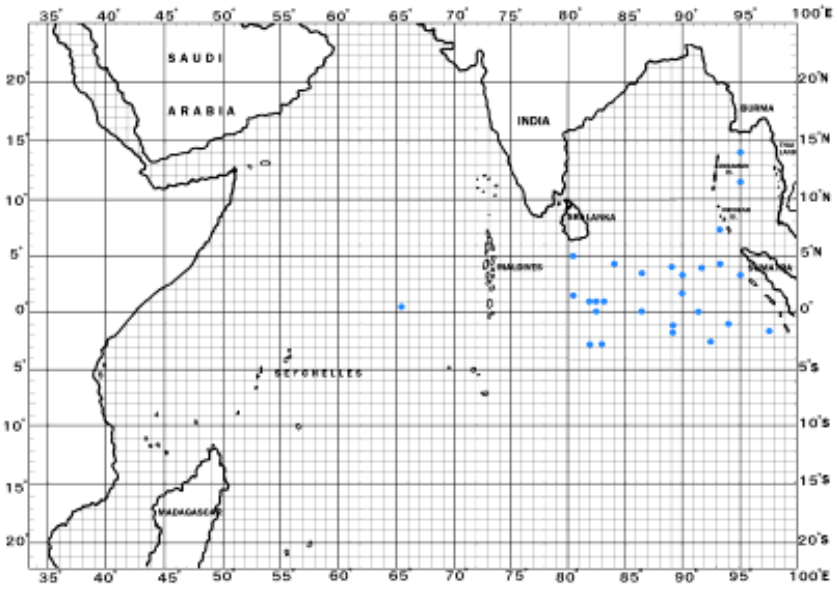
CT Number_____Processing Plant_____

Boat's name_____Date_____

No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1
1			21			41			61			1			21			41			61		
2			22			42			62			2			22			42			62		
3			23			43			63			3			23			43			63		
4			24			44			64			4			24			44			64		
5			25			45			65			5			25			45			65		
6			26			46			66			6			26			46			66		
7			27			47			67			7			27			47			67		
8			28			48			68			8			28			48			68		
9			29			49			69			9			29			49			69		
10			30			50			70			10			30			50			70		
11			31			51			71			11			31			51			71		
12			32			52			72			12			32			52			72		
13			33			53			73			13			33			53			73		
14			34			54			74			14			34			54			74		
15			35			55			75			15			35			55			75		
16			36			56			76			16			36			56			76		
17			37			57			77			17			37			57			77		
18			38			58			78			18			38			58			78		
19			39			59			79			19			39			59			79		
20			40			60			80			20			40			60			80		
total												**total**											

No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1	No.	kg	LD_1
1			6			11			16			1			6			11			16		
2			7			12			17			2			7			12			17		
3			8			13			18			3			8			13			18		
4			9			14			19			4			9			14			19		
5			10			15			20			5			10			15			20		
total												**total**											

1			6			11			16			1			6			11			16		
2			7			12			17			2			7			12			17		
3			8			13			18			3			8			13			18		
4			9			14			19			4			9			14			19		
5			10			15			20			5			10			15			20		
total												**total**											



Source: Chantawong et al., 1999

Year 1993-1998

Appendix Figure 2 Fishing ground of tuna longliner since 1994

Appendix Table 1 Total landings (t) tuna from foreign longline fleets landed in Phuket since 1993 to 2012

Year	Effort	Total	YFT	BET	ALB	BILL	SWO	SHA	Oil fish	Other misc.***	CPUE
1994	72	622	254	127	-	56	66	20	-	-	8.64
1995	187	1,415	958	200	-	133	113	13	-	-	7.57
1996	567	2,903	1,038	965	-	426	425	49	-	-	5.12
1997	558	2,632	1,138	676	-	425	383	10	-	-	4.72
1998	655	3,015	2,435	432	-	84	63	1	-	-	4.6
1999	883	4,373	2,124	1,909	-	200	140	1	-	-	4.95
2000*	665	3,118	1,310	1,244	-	247	209	108	-	-	5
2001*	876	4,372	1,895	1,378	-	531	500	-	-	68	4.99
2002*	816	4,971	1,960	2,475	-	281	145	-	-	110	6.09
2003*	563	4,995	3,360	1,194	-	240	175	-	-	27	8.87
2004*	582	5,317	3,708	1,197	-	235	153	-	-	24	9.14
2005*	517	5,953	4,354	1,077	-	171	113	-	-	238	11.51
2006*	442	4,830	3,584	615	-	133	87	-	-	411	10.93
2007*	494	6,315	4,410	748	-	346	105	-	-	706	12.78
2008*	533	7,710	4,587	1,772	-	387	268	-	-	696	14.47
2009*	521	6,821	4,926	1,025	-	27	129	-	-	714	13.09
2010*	575	9,230	7,425	371	-	76	4	-	-	1,354	16.05
2011*	375	5,543	3,812	506	**	68	25	*	4	1,128	14.78
2012*	315	7,024	3,976	943	-	88	47	-	-	1,970	22.3

Remark: *sampling **less than 0.1 ton; *** others = king fish, sun fish and sailfish