Bycatch from Tuna Purse Seine and Longline Fishing Gears in the Eastern Indian Ocean by MV SEAFDEC

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1) Introduction:

Tuna fisheries such as purse seine and longline on board Training/research vessel, MV SEAFDEC are one of the shipboard training programs given to the SEAFDEC member countries since 1993. Along with the training activity, fisheries resources researches for tuna and by-catch and oceanographic data collection in the eastern Indian Ocean were also conducted onboard MV SEAFDEC. In this paper, the authors concluded all the catch data from purse seine and longline operation by focusing on by-catch species. Based on these information, the appropriated responsible fishing technology will be applied and promoted to the SEAFDEC member countries in the later state. Terminology of by-catch in this paper means non-target species which were caught by tuna purse seine and tuna longline gears. The incidental catch from FADs was also discussed in this paper.

2) Materials and Methods:

2.1 Fishing Information

The training and research vessel, namely MV SEAFDEC is a Japanese designed purse seiner employing the extensive use of FADs or other drifting objects was used for this study. The purse seine net of MV SEAFDEC was made by Nichimo Co., Ltd. having a total net length of 1,155.9 meters and catching fishes from surface to 170m depth. For tuna longline gears, the Japanese longline system has been replaced by the longline-reel system using monofilament mainline since 2001. Number of hooks for each operation of longline was ranged from 350-700 hooks. The catching depth was from 55m to 200m from the surface. Fishing area is in the Eastern Indian Ocean from latitude 2°N - 10°S and longitude 80°-96°E, radiating around the Ninety East Ridge. The fishing periods were from October to March of following year.

2.2 Data Collection and Analysis

In purse seine operation from 1993-2005, total catch of tuna species and by-catch species were estimated from sub-samples. Species composition and size of tuna catch and by-catch were identified and measured both for fork length (cm) and weight (kg). The CPUE was calculated using a total catch in ton per operation. Percentage of by-catch species compared to tunas catch is summarized. The completed data set of by-catch species analyzed in this report was collected from October 2001- February 2005.

For longline operation, data collection were started from October 2001- February 2005, all species caught in each operation were recorded and measured for both length and weight. CPUEs are in term of number of fish and total weight of catch. Catching efficiency of tuna longline was also presented in term of Hook Rate Ratio (%). Catching depth was measured by Depth sensor.

3) Results and Discussion

3.1 Purse Seine Operation

3.1.1 CPUE and Its Distribution

A total operation for tuna purse seine by MV SEAFDEC from October, 1993 to February 2005 was 121, which can be separated into two periods as; 1st period from October 1993 to December 1999 conducted 67 operations and 2nd period from January 2001 to

February 2005 conducted 54 operations. **Figure 1** shows the size distribution of total catch of each operation in the Eastern Indian Ocean from 1993 to 2005.

3.1.2 Species Composition

Table 1 shows the check list of all species compositions by purse seine in the Eastern Indian Ocean surveyed by MV SEAFDEC from Jan. 2001 – Feb. 2005. 15 families with about 30 species of fishes and one family of Octopus were found by tuna purse seine. From 54 fishing operations indicated that the averaged 94% of total catch was tuna species namely Frigate tuna, Skipjack tuna, Yellowfin tuna and Bigeye tuna (see details in **Table 2**) and about 6 % of total catch was by-catch species. Within the 6% of by-catch, about 46% was represented by Rainbow runner and about 15% was triggerfish. Less than 10% of the total by-catch were Unicorn leatherjacket, Shark, Wahoo, Common Dolphinfish and others (see **Figure 2**).

3.1.3 Incidental Catch from FADs

Apart of purse seine operation using Drifting FADs or Payao, it was found that the net installed for aggregating the target species could also catch some marine animals such as dolphin and sea turtle. This is because the net performed as gillnet hanging beneath the FAD from the surface to about 10m depth. **Figure 3** shows some incidental catch from FADs. To reduce this incidental catch, SEAFDEC considers to modify the net materials for FADs and will further study to improve FAD in ecological friendly manner for those marine mammal.
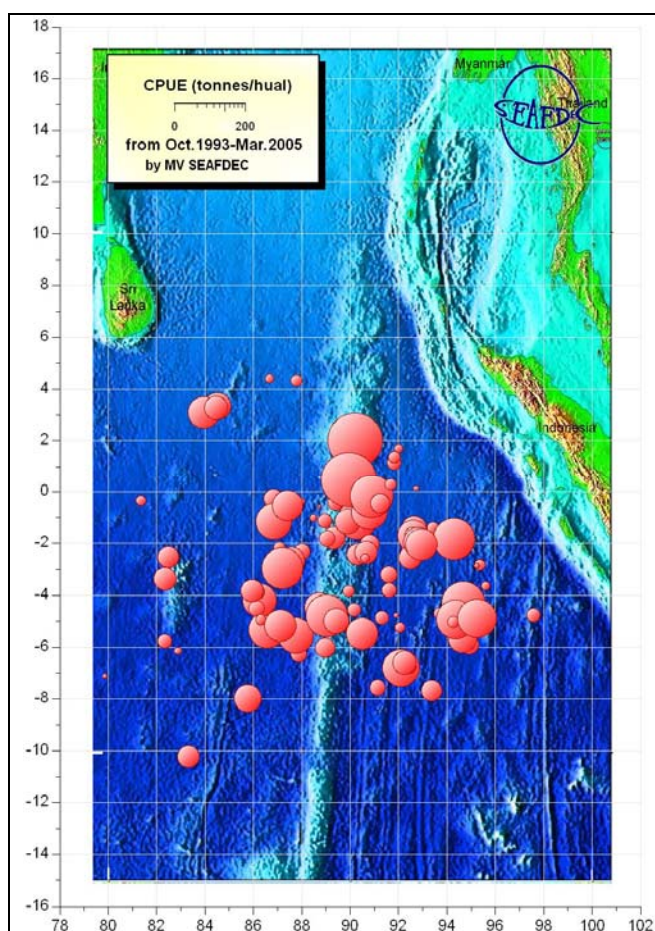

Figure 1. Total catch distribution in the Eastern Indian Ocean from Oct. 1993 to Feb. 2005 by MV SEAFDEC
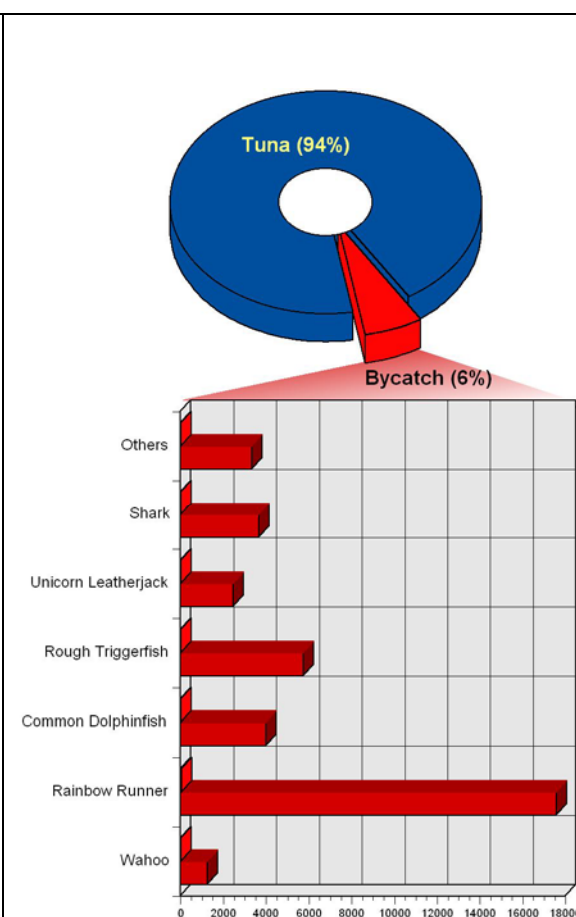
Figure 2. Percentage of tuna and by-catch and main composition of by-catch from purse seine gear in the Eastern Indian Ocean

Table 1 Check list of fishes caught by tuna purse seine in the Eastern Indian Ocean by MV SEAFDEC

Family	Scientific name	Common name
Fish		
Alopiidae	*Alopias* sp.	Pelagic tresher shark
Carcharhinidae	*Carcharhinus* sp.	Shark
Megachasmidae	*Megachasma pelagios*	Megamouth shark
Belonidae	*Tylosurus crocodilus crocodilus*	Needlefish
Carangidae	*Elagatis bipinnulata*	Rainbow Runner
	Seriola rivoliana	Longfin yellowtail
	Decapterus macarellus	Mackerel scad
	Decapterus muroadsi	Trevally
	Uraspis helvora	White-tongued trevalle
	Caranx lugubris	Trevally
	Carangoides orthogrammus	Trevally
	Caranx sp.	Trevally
	Brama dussumieri	Pomfret
Coryphaenidae	*Coryphaena hippurus*	Common dolphinfish
	Coryphaena equiselis	Dolphinfish
Lobotidae	*Lobotes surinamensis*	Tripletail
Kyphosidae	*Kyphorus vaigiensis*	Brassy chub
	Kyposus cinerascens	Blue seachub
Ephipididae	*Platex tiera*	Batfish
Sphyraenidae	*Sphyraena barracuda*	Great barracuda
Istiophoridae	*Makaira indica*	Black marlin
	Makaira mazara	Blue marlin
Scomberomoridae	*Acanthocybium solandri*	Wahoo
Scombridae	*Auxis thazard*	Frigate tuna
	Katsuwonus pelamis	Skipjack tuna
	Thunnus albacares	Yellowfin tuna
	Thunnus obesus	Bigeye tuna
Balistidae	*Canthidermis maculatus*	Rough triggerfish
Monocanthidae	*Alutera monoceros*	Unicorn leatherjack
	Aluterus scriptus	Unicorn leatherjack
Other		
Octopotidae	*Octopus* sp.	Octopus

Figure 3 Incidental catch from FADs for tuna purse seine; a) Dolphin and b) Seaturtle.

Table 2 Total Catch of Tuna and By-catch in the Eastern Indian Ocean by MV SEAFDEC
from Feb. 2001 to Jan 2005

Total Catch of Tuna and By-catch in the Eastern Indian Ocean by MV SEAFDEC from Feb. 2001 to Jan 2005

Operation	Date	Latitude	Longitude	total catch (kg)	Tuna Catch (kg)	%	WAH	RAI	DOL	WST	ULJ	TPT	LTM	SCD	SCH	SHK	RAY	JCK	Others	Sub-total kg	%
1	6 Feb 01	00_01.1S	087_03.2E	648	424.6	65.52	2.3	159.7	-	-	5	-	-	5.6	0.8	50	-	-	-	223.4	34.48
2	10 Feb 01	00_16.6S	086_49.3E	15,000	10,503.1	70.02	-	1,300.4	2,089.4	78.0	62.4	-	-	-	109.1	857.6	-	-	-	4,496.9	29.98
3	11 Feb 01	00_22.8S	087_57.7E	2,500	-	-	-	787.6	86.0	-	280.4	-	-	947.0	251.3	139.6	-	8.1	-	2,500.0	100.00
4	27 Feb 01	00_40.2S	090_47.9E	22,000	20,212.7	91.88	-	1,209.2	23.7	-	82.8	41.4	47.3	303.1	79.8	-	-	-	-	1,787.3	8.12
5	1 Mar 01	02_25.4S	090_17.7E	18,000	17,574.1	97.63	-	120.3	-	-	291.2	-	-	-	9.6	-	-	4.8	-	425.9	2.37
6	3 Mar 01	03_37.8S	095_36.5E	3,000	2,301.5	76.72	72.7	95.6	339.7	-	135.9	42.7	-	-	-	-	-	11.9	-	698.5	23.28
7	5 Mar 01	01_26.3S	092_38.5E	25,000	19,480.2	77.92	106.2	4,205.6	-	-	722.2	-	74.3	212.4	23.9	-	-	175.2	-	5,519.8	22.08
8	6 Mar 01	01_33.0S	093_44.8E	10,000	9,243.1	92.43	-	258.2	30.9	-	256.0	39.7	-	163.3	0.4	-	-	8.8	-	756.9	7.57
9	20 Mar 01	02_52.0S	089_57.5E	500	373.0	74.60	2.2	111.5	2.4	-	2.6	-	2.8	4.3	-	-	-	0.8	-	127.0	25.40
10	18 Dec 01	02_37.6S	092_22.4E	1,000	970.7	97.07	-	2.8	3.2	19.7	-	1.5	-	-	1.5	-	-	0.6	-	29.3	2.93
11	19 Dec 01	02_12.1S	092_17.6E	3,000	2,330.0	77.67	-	328.3	91.1	36.0	6.4	-	-	13.7	18.1	176.4	-	-	-	670.0	22.33
12	20 Dec 01	03_47.9S	091_36.1E	9,000	7,937.5	88.19	-	-	461.4	536.0	40.7	-	-	-	-	-	-	-	24.4	1,062.5	11.81
13	21 Dec 01	03_49.4S	089_56.0E	5,000	4,634.4	92.69	74.6	128.3	26.9	103.0	14.9	-	-	6.0	-	-	-	-	11.9	365.6	7.31
14	23 Dec 01	05_46.0S	082_19.5E	8,000	7,655.1	95.69	-	-	-	168.0	-	-	-	-	-	176.9	-	-	-	344.9	4.31
15	24 Dec 01	06_08.0S	082_52.5E	2,000	1,695.3	84.77	103.5	-	151.2	-	-	-	-	-	-	39.8	10.2	-	-	304.7	15.24
16	1 Jan 02	02_16.3S	090_18.1E	1,500	1,060.2	70.68	39.9	56.4	-	340.9	-	-	-	-	2.6	-	-	-	-	439.8	29.32
17	2 Jan 02	01_46.9S	089_19.1E	20,000	17,010.7	85.05	224.3	2,390.4	40.8	147.8	22.9	-	-	45.9	94.3	-	-	22.9	-	2,989.3	14.95
18	3 Jan 02	01_48.8S	089_03.3E	10,000	4,549.7	45.50	-	2,731.9	73.4	2,016.2	438.9	-	-	-	55.0	-	-	134.9	-	5,450.3	54.50
19	4 Jan 02	01_07.2S	088_57.3E	8,000	4,607.2	57.59	-	1,973.9	-	487.5	79.4	-	-	108.8	7.6	722.5	-	13.1	-	3,392.8	42.41
20	18 Jan 02	02_17.9S	088_12.7E	2,000	1,876.4	93.82	-	92.4	-	-	-	26.1	-	-	-	-	-	5.1	-	123.6	6.18
21	8 Dec 01	04_36.7S	083_08.5E	20,000	19,963.7	99.82	-	-	-	36.3	-	-	-	-	-	-	-	-	-	36.3	0.18
22	9 Dec 01	05_01.5S	083_14.1E	12,000	12,000.0	100.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	10 Dec 01	04_58.4S	083_27.4E	10,000	9,910.6	99.11	-	-	-	81.5	-	-	-	7.9	-	-	-	-	-	89.4	0.89
24	11 Dec 01	04_31.3S	083_24.9E	10,000	9,743.4	97.43	-	-	124.1	111.0	-	-	-	-	-	-	-	21.5	-	256.6	2.57
25	14 Dec 01	03_71.9S	084_42.0E	27,000	26,157.7	96.88	282.9	-	-	237.9	-	-	-	-	-	321.5	-	-	-	842.3	3.12
26	10 Jan 03	03_26.9S	095_59.1E	1,000	987.5	98.75	-	-	-	6.9	-	5.6	-	-	-	-	-	-	-	12.5	1.25
27	12 Jan 03	02_41.9S	088_34.8E	3,000	2,976.9	99.23	-	-	-	23.1	-	-	-	-	-	-	-	-	-	23.1	0.77
28	17 Jan 03	03_01.1S	089_36.1E	500	491.5	98.30	-	-	-	5.8	-	2.7	-	-	-	-	-	-	-	8.5	1.70
29	18 Jan 03	05_00.9S	090_57.6E	9,000	8,852.7	98.36	-	-	91.1	56.20	-	-	-	-	-	-	-	-	-	147.3	1.64
30	19 Jan 03	04_46.8S	091_54.1E	850	804.3	94.62	-	-	41.3	4.4	-	-	-	-	-	-	-	-	-	45.7	5.38
31	20 Jan 03	05_12.8S	094_28.4E	6,000	5,973.7	99.56	-	-	-	26.3	-	-	-	-	-	-	-	-	-	26.3	0.44
32	21 Jan 03	05_13.5S	092_03.5E	4,000	3,955.5	98.89	41.8	-	-	2.7	-	-	-	-	-	-	-	-	-	44.5	1.11
33	23 Jan 03	06_15.4S	087_53.0E	10,000	9,986.8	99.87	-	-	-	-	-	13.2	-	-	-	-	-	-	-	13.2	0.13
34	24 Jan 03	07_57.8S	085_45.8E	30,700	30,533.2	99.46	-	-	-	166.8	-	-	-	-	-	-	-	-	-	166.8	0.54
35	25 Jan 03	10_12.7S	083_18.6E	19,000	18,879.8	99.37	120.2	-	-	-	-	-	-	-	-	-	-	-	-	120.2	0.63
36	29 Jan 03	03_11.4S	091_35.1E	11,000	10,927.1	99.34	-	-	-	23.2	-	49.7	-	-	-	-	-	-	-	72.9	0.66
37	18 Nov 03	07_07.2S	079_51.5E	1,000	948.9	94.89	-	16.4	-	19.8	14.2	-	-	-	-	-	-	0.7	-	51.1	5.11
38	23 Nov 03	05_45.0S	086_09.7E	266.9	30.2	11.32	49.2	36.0	94.7	47.6	3.9	5.3	-	-	-	-	-	-	-	236.7	88.68
39	24 Nov 03	05_18.8S	086_33.4E	55,000	54,724.9	99.50	-	-	168.6	106.5	-	-	-	-	-	-	-	-	-	275.1	0.50
40	25 Nov 03	04_27.5S	088_42.4E	34,000	34,000.0	100.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	17 Dec 03	05_33.1S	087_45.5E	50,000	49,762.4	99.52	-	-	-	90.7	-	-	-	-	-	146.9	-	-	-	237.6	0.48
42	19 Dec 03	05_07.2S	089_36.1E	10,000	9,952.8	99.53	-	-	-	-	-	-	-	-	-	47.2	-	-	-	47.2	0.47
43	21 Dec 03	05_53.4S	094_54.6E	15,000	14,971.9	99.81	-	-	-	-	-	-	-	-	-	28.1	-	-	-	28.1	0.19
44	22 Dec 03	04_20.3S	095_13.4E	15,000	15,000.0	100.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	11 Dec 04	01_43.0S	092_36.0E	40,000	37,776.0	94.44	-	1,168.9	-	320.7	-	-	-	-	-	734.4	-	-	-	2,224.0	5.56
46	12 Dec 04	01_23.6S	093_25.2E	5,000	4,647.2	92.94	67.9	146.4	25.8	100.7	2.9	-	-	-	3.8	-	-	-	5.3	352.8	7.06
47	13 Dec 04	01_51.8S	094_22.3E	5,000	4,882.2	97.64	-	26.1	-	64.8	2.9	13.5	-	-	-	-	5.9	-	4.6	117.8	2.36
48	14 Dec 04	02_13.5S	094_32.6E	4,000	3,914.6	97.87	17.7	-	-	44.2	0.5	-	-	1.8	-	21.2	-	-	-	85.4	2.14
49	11 Jan 05	04_33.5S	090_10.4E	7,000	6,785.3	96.93	50.3	43.1	-	24.3	-	-	-	-	-	97	-	-	-	214.7	3.07
50	14 Jan 05	02_45.6S	095_22.4E	3,000	2,916.1	97.20	-	33.6	-	15.1	-	7.5	-	5.1	-	22.6	-	-	-	83.9	2.80
51	15 Jan 05	02_49.6S	095_21.4E	5,000	4,945.4	98.91	-	-	14.0	37.9	-	-	-	-	-	-	2.7	-	-	54.6	1.09
52	21 Jan 05	02_32.6S	092_29.1E	20,000	19,899.4	99.50	-	-	-	100.6	-	-	-	-	-	-	-	-	-	100.6	0.50
53	22 Jan 05	02_19.5S	092_58.2E	3,000	2,991.0	99.70	-	-	-	9.0	-	-	-	-	-	-	-	-	-	9.0	0.30
54	23 Jan 05	02_08.6S	093_06.8E	12,000	11,724.9	97.71	-	138.7	26.0	36.5	-	-	-	-	3.6	63.8	-	6.5	-	275.1	2.29
Grand total				624,465	586,457	93.91														38,008	6.09

WAH = Wahoo (Acanthocybium solandri)
RAI = Rainbow runner (Elagatis bipinnulata)
DOL = Common Dolphinfish (Coryphaena bipinnulata)
WST = White-spotted triggerfish (Canthidermis maculates)

SHK = Shark (Carcharhinus sp.)
JCK = Jack (Urapis sp.)
ULJ = Unicorn leatherjacket (Aluterus monoceros)
TPT = Tripletail (Lobotes surinamensis)

LTM = Longtom (Tylosurus crocodilus)
SCD = Scad (Decapterus maruadsi)
SCH = Sea chub (Kyphosus bigibbus)
Others

3.2 Longline Operation

   3.2.1 CPUE and Hook Rate(%) of Longline

       With in a period from October 2001 to January 2005, MV SEAFDEC operated tuna longline in the Eastern Indian Ocean 27 operations. 8 operations of these were in the Andaman Sea within the EEZ of Indonesia, Thailand and Myanmar under the collaborative large pelagic survey by longline. Distribution of CPUEs in kilogram per haul and hook rate (%) from the longline operations can be shown in **Figure 4 and 5.** Hook rate from longline was ranged from 0.38-5.95% in the Eastern Indian Ocean and from 0.4–4.5% in the Andaman Sea.

   3.2.2 Species Composition from Longline

       Table 3 shows all catch results from tuna longline with included the bycatch compositions found in both areas in Eastern Indian Ocean and Andaman Sea. In this report, target species were tunas namely Yellowfin tuna, Bigeye tuna, Skipjack tuna and group of Swordfish, Marlins and Sailfish. Bycatch found by longline mainly were sharks namely Bigeye thresher shark, Blue Shark, White-tipped shark, Spottail shark, Crocodile shark, Silky Shark and string Ray. In addition, others bycatch were Lancetfish, Escolar, Snake mackerel, Great barracuda, Oilfish, Common Dolphinfish, Sickle pomfret and Wahoo. From our survey, two green turtles were also found as bycatch which were caught in the sea surface layer of about 55-70m.
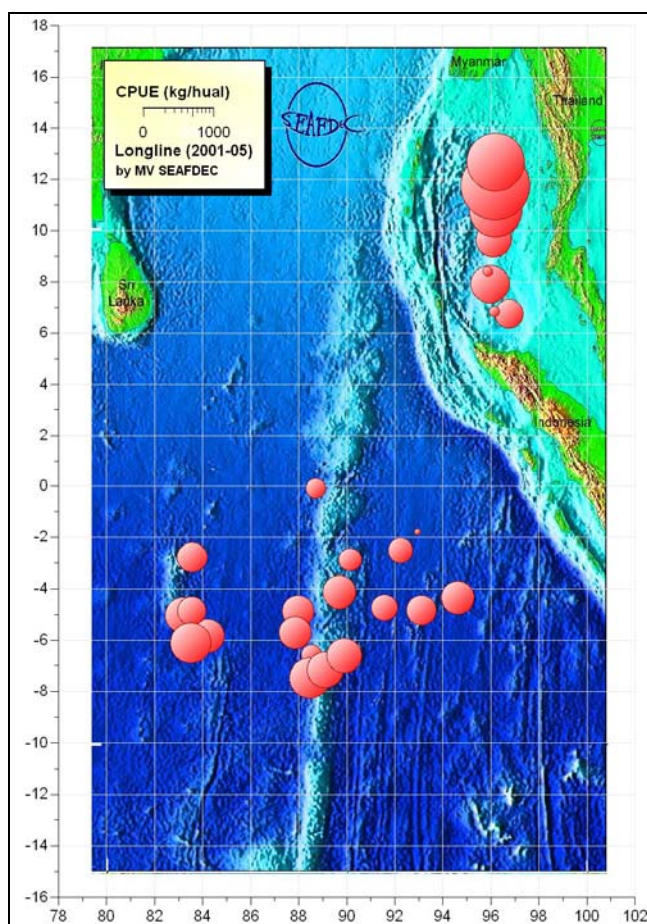

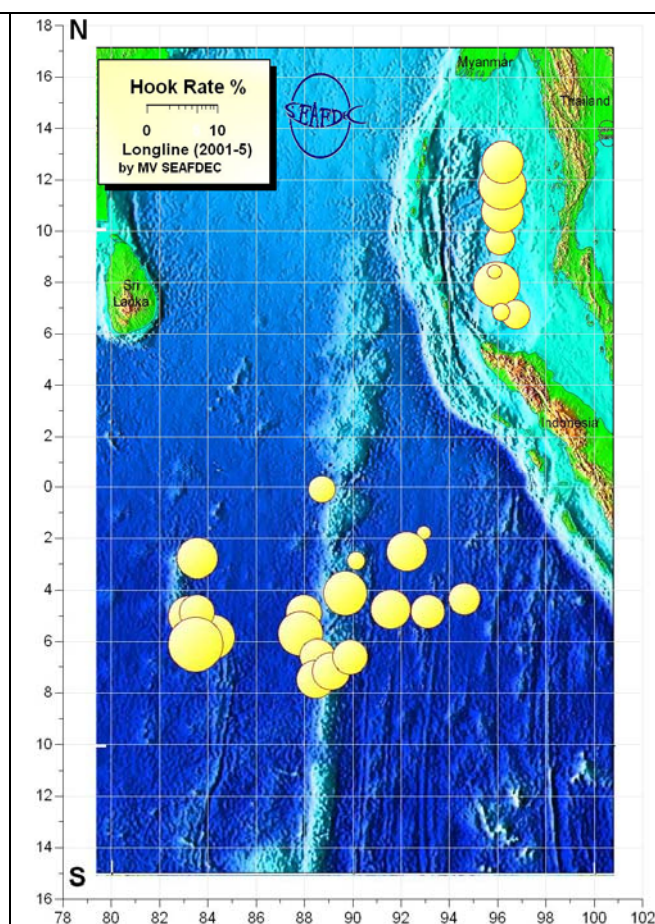Figure 4 Distribution of CPUEs (kg/haul) from tuna longline by MV SEAFDEC from October 2001-Jan 2005

Figure 5 Distribution of hook rate (%) from tuna longline by MV SEAFDEC from October 2001-Jan 2005

Table 3 Catch Results from Tuna Longline in the Eastern Indian Ocean and Andaman Sea by MV SEAFDEC from October 2001 to January 2005

#	Date	Latitude	Longitude	Survey Area	total catch pcs	total catch kg	YFT	BET	SWF	MAR	SAF	SKJ	Catch Sub-total (pcs/%)	Catch Sub-total (kg/%)	BTS	BSH	WTS	SPS	CDS	STR	DOL	SPF	ESC	LCF	SMK	GTT	Bycatch Sub-total (pcs/%)	Bycatch Sub-total (kg/%)
1	23 Oct 01	02_52.1S	090_08.0E	EIO	2	105.8	-	-	-	1(103.0)	-	-	1(50.0)	103.0(97.35)	-	-	-	-	-	-	-	-	1(2.8)	-	-	-	1(50.0)	2.8(2.65)
2	7 Dec 01	00_05.4S	088_42.8E	EIO	5	79.5	1(30.0)	-	-	-	-	-	1(20.00)	30.0(37.74)	-	1(40.0)	1(7.0)	-	-	-	-	-	-	2(2.5)	-	-	4(80.00)	49.5(62.26)
3	21 Dec 02	07_55.6N	095_57.6E	Andaman	17	297.0	-	-	2(26.8)	1(30.0)	7(121.0)	-	10(58.82)	177.8(59.87)	-	1(30.0)	2(70.0)	-	-	2(8.0)	-	-	2(11.2)	-	-	-	7(41.18)	119.2(40.13)
4	3 Nov 03	05_01.3S	083_11.2E	EIO	16	255.6	2(83.0)	3(125.0)	1(16.0)	-	-	-	6(37.50)	224.0(87.64)	-	-	2(15.0)	-	-	1(2.5)	-	-	3(8.5)	4(5.6)	-	-	10(66.67)	31.6(12.36)
5	6 Nov 03	02_46.4S	083_33.1E	EIO	12	180.1	-	3(150.0)	-	-	-	-	3(25.00)	150.0(83.29)	-	-	-	-	-	1(3.0)	-	-	4(23.5)	3(2.5)	1(1.1)	-	9(75.00)	30.1(16.71)
6	7 Nov 03	05_49.4S	084_12.1E	EIO	15	225.0	-	3(127.0)	3(13.0)	-	-	-	6(40.00)	140.0(62.22)	-	1(43.0)	-	-	-	1(2.0)	-	-	4(16.5)	2(5.5)	-	1(18.0)	9(60.00)	85.0(37.78)
7	9 Nov 03	04_52.2S	083_33.1E	EIO	8	160.5	1(35.0)	1(40.0)	2(53.1)	-	-	-	4(50.00)	128.1(79.81)	1(12.0)	-	-	-	-	-	-	-	2(3.4)	2(4.3)	-	1(17.0)	4(50.00)	32.4(20.19)
8	11 Nov 03	06_06.8S	083_29.6E	EIO	21	333.1	1(35.0)	3(146.0)	2(36.0)	1(53.0)	-	-	7(33.33)	270.0(81.06)	1(16.0)	-	-	-	-	4(13.0)	2(8.0)	-	5(21.8)	2(4.3)	1(0.7)	-	14(66.67)	63.1(18.94)
9	11 Dec 03	04_20.4S	094_36.7E	EIO	14	221.0	-	4(97.0)	2(22.5)	-	-	-	6(42.86)	119.5(54.07)	-	1(45.0)	1(5.0)	4(50.0)	-	1(2.0)	-	-	4(13.5)	1(0.8)	1(0.6)	-	8(57.14)	101.5(45.93)
10	12 Dec 03	04_50.5S	093_05.9E	EIO	16	178.4	1(36.0)	5(73.0)	1(8.0)	-	-	-	7(43.75)	117.0(65.58)	-	1(35.0)	1(10.0)	-	-	1(2.0)	-	-	4(13.5)	1(0.3)	1(0.6)	-	9(56.25)	61.4(34.42)
11	13 Dec 03	04_44.8S	091_33.9E	EIO	23	133.0	-	1(22.0)	2(26.0)	-	-	-	3(13.04)	48.0(36.09)	-	-	1(28.0)	-	2(14.9)	6(15.1)	-	1(8.0)	4(12.8)	2(2.6)	4(3.6)	-	20(86.96)	85.0(63.91)
12	14 Dec 03	04_07.7S	089_41.0E	EIO	28	221.4	-	3(89.5)	1(4.0)	-	-	1(5.0)	5(17.86)	98.5(44.49)	-	1(42.0)	-	-	1(6.0)	4(10.5)	-	-	13(60.9)	2(2.0)	2(1.5)	-	23(82.14)	122.9(55.51)
13	15 Dec 03	04_52.9S	087_58.4E	EIO	19	204.3	-	2(62.0)	7(70.7)	-	-	-	9(47.37)	132.7(64.95)	-	-	-	-	-	-	-	1(10.0)	7(58.4)	2(3.2)	-	-	10(52.63)	71.6(35.05)
14	16 Nov 04	06_45.1N	096_45.0E	Andaman	10	164.2	-	-	4(133.8)	-	-	-	4(40.00)	133.8(81.49)	-	-	-	-	-	2(5.0)	-	-	4(25.4)	-	-	-	6(60.00)	30.4(18.51)
15	17 Nov 04	06_51.5N	096_08.3E	Andaman	3	21.3	-	-	1(8.2)	-	-	-	1(33.33)	8.2(38.50)	-	-	1(10.0)	-	-	1(3.1)	-	-	-	-	-	-	2(66.67)	13.1(61.50)
16	18 Nov 04	08_25.5N	095_52.4E	Andaman	2	18.8	-	-	1(17.0)	-	-	-	1(50.00)	17.0(90.43)	-	-	-	-	-	-	-	-	-	-	1(1.8)	-	1(50.00)	1.8(9.57)
17	19 Nov 04	09_38.7N	096_06.5E	Andaman	9	249.8	-	-	2(75.0)	-	-	-	2(22.22)	75.0(30.02)	2(158.0)	-	-	-	-	3(6.9)	1(5.1)	-	-	-	1(4.8)	-	7(77.78)	174.8(69.98)
18	20 Nov 04	10_46.3N	096_11.4E	Andaman	22	567.3	2(109.0)	-	14(383.9)	-	-	-	16(72.73)	492.9(86.89)	1(51.0)	-	-	-	-	2(9.4)	1(6.1)	-	2(13.0)	1(9.4)	1(1.0)	-	6(27.27)	74.4(13.11)
19	21 Nov 04	11_45.7N	096_11.3E	Andaman	31	957.9	-	-	12(321.2)	-	3(64.0)	-	15(48.39)	385.2(40.21)	10(536.0)	-	-	-	-	4(21.2)	1(6.1)	-	1(9.4)	-	-	-	16(51.61)	572.7(59.79)
20	22 Nov 04	12_40.8N	096_12.0E	Andaman	16	673.5	-	-	7(237.1)	1(40.5)	-	-	8(50.00)	277.6(41.22)	4(288.0)	-	1(100.0)	-	-	1(4.1)	-	-	1(5.0)	-	2(2.9)	-	8(50.00)	395.9(58.78)
21	4 Dec 04	05_41.8S	087_50.4E	EIO	21	209.2	-	4(65.5)	4(32.9)	-	-	-	4(19.05)	65.5(31.31)	-	-	1(29.8)	-	-	1(4.1)	2(6.9)	-	10(60.4)	3(3.7)	1(0.5)	2(42.0)	17(80.95)	143.7(68.69)
22	5 Dec 04	06_33.8S	088_32.0E	EIO	13	86.2	-	-	4(32.9)	-	-	-	4(30.77)	32.9(38.17)	-	-	1(24.5)	-	2(7.2)	-	-	-	3(17.2)	3(3.7)	-	-	9(69.23)	53.3(61.83)
23	6 Dec 04	07_28.7S	088_27.4E	EIO	15	332.5	-	4(149.5)	3(20.7)	-	-	-	7(46.67)	170.2(51.19)	-	4(140.0)	-	-	1(3.0)	-	-	1(17.0)	-	2(2.3)	-	-	8(53.33)	162.3(48.81)
24	7 Dec 04	07_09.0S	089_05.7E	EIO	15	261.0	-	4(145.0)	3(19.6)	-	1(12.0)	-	9(60.00)	216.1(82.80)	-	1(12.0)	-	-	-	1(5.0)	-	1(10.0)	3(17.9)	-	-	-	8(61.54)	44.9(17.20)
25	8 Dec 04	06_36.3S	089_53.3E	EIO	13	245.8	2(81.0)	1(50.0)	2(6.4)	-	-	-	5(38.46)	137.4(55.90)	-	2(90.0)	-	1(8.2)	-	-	1(5.0)	-	-	4(5.2)	-	-	8(61.54)	108.4(44.10)
26	16 Jan 05	01_46.9S	092_56.4E	EIO	2	6.0	-	-	-	-	-	-	0(0.00)	0.0(0.00)	-	-	-	-	-	-	-	-	1(5.8)	1(0.2)	-	-	2(100.00)	6.0(100.00)
27	17 Jan 05	02_30.6S	092_13.7E	EIO	17	121.2	-	4(41.7)	1(8.0)	-	-	-	5(29.41)	49.7(41.01)	-	-	-	-	-	1(5.0)	-	-	7(59.7)	4(6.8)	-	-	12(70.59)	71.5(58.99)
grand total					385	6509.4																						

YFT = Yellowfin tuna (*Thunnus albacares*)
BET = Bigeye tuna (*Thunnus obesus*)
SWF = Swordfish (*Xiphias gladius*)
MAR = Marlins (*Makaira sp.*)
SAF = Sailfish (*Istiophorus platypus*)
STM = Striped marlin (*Tetrapturus audax*)
SKJ = Skipjack tuna (*Katsuwonus pelamis*)

BTS = Bigeye thresher shark (*Alopias pelagicus*)
BSH = Blue Shark (*Prionace glauca*)
WTS = White-tipped shark (*Carcharhinus longimanus*)
SPS = Spottail shark (*Carcharhinus sorrah*)
CDS = Crocodile shark (*Pseudocarcharias kamoharai*)
STR = Sting ray (*Dasyatis sp.*)
SKS = Silky Shark (*Carcharhinus falsiformis*)

LCF = Lancetfish (*Alepisaurus ferox*)
ESC = Escolar (*Lepidocybium flavobrunneum*)
SMK = Snake mackerel (*Gympylus surpens*)
BCD = Great barracuda (*Sphyraena barracuda*)
OLF = Oilfish (*Ruvettus pretiosus*)
DOL = Common Dolphinfish (*Coryphaena bipinnulata*)
SPF = Sickle pomfret (*Taractichthys steindachneri*)
WHO = Wahoo (*Acanthocybium solandri*)

Consideration only the results from 2003 in the Eastern Indian Ocean found that about 67% from total catch in number of individual were bycatch and about 32% were target species as shown in **Figure 6**. For the Andaman sea, about 50% of total catch were bycatch and target species as shown in Figure 7.
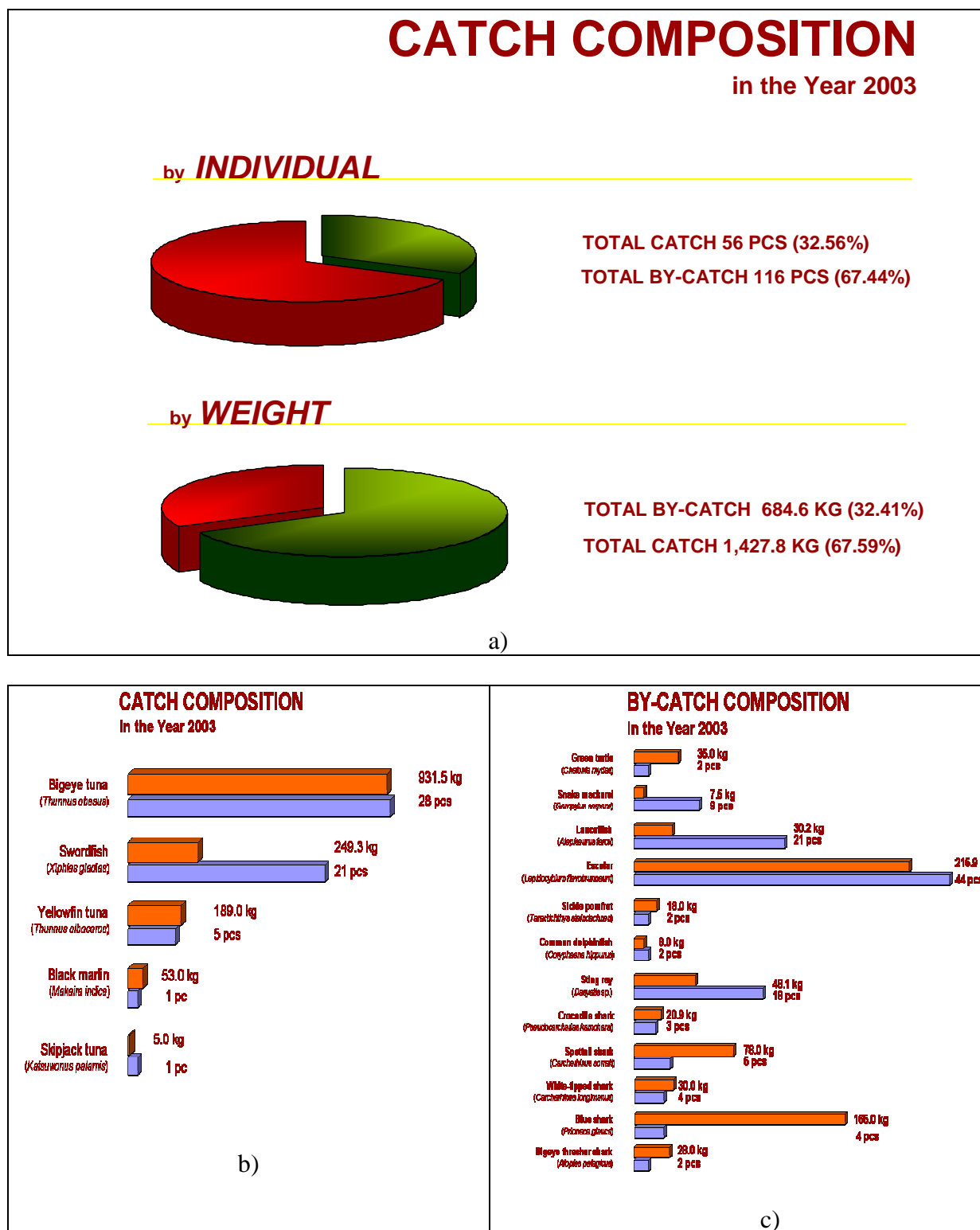

Figure 6a, b, c Catch composition in percentage by individual and by weight from tuna longline in the Eastern Indian Ocean by MV SEAFDEC in 2003
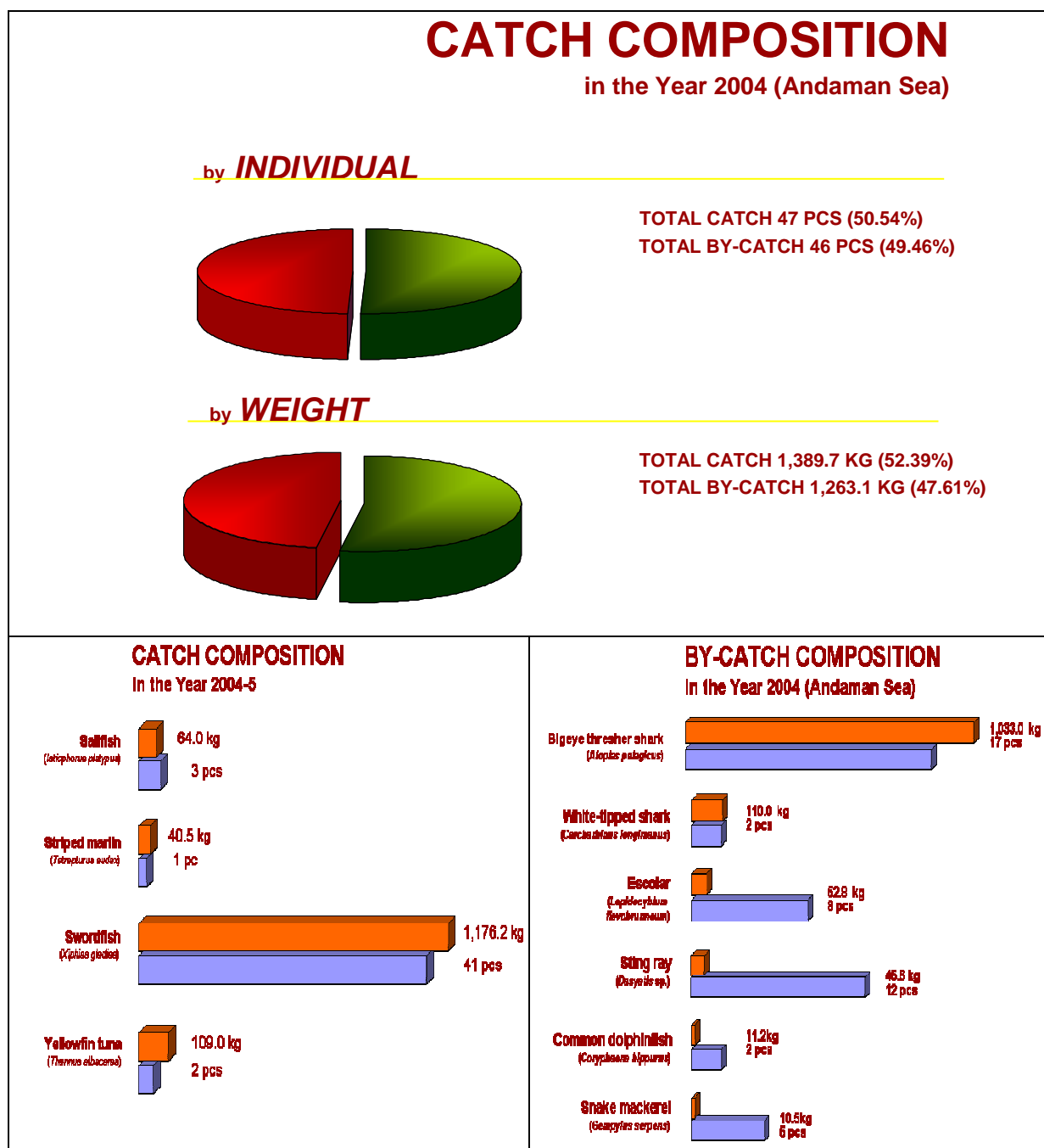
Figure 7a, b, c Catch composition in percentage by individual and by weight from tuna longline in the Andaman Sea by MV SEAFDEC in 2004

Acknowledgement