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Malagasy billfish fishery 2012

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ABSTRACT

Madagascar started exploring longline fishery in 2007 by shifting from trawl gear to small longliners. The number of vessel, targetting tuna and tuna like species, has been increasing. In 2012, the Madagascar deployed eight fishing vessels less than 24 m off the east coast. Note that some of them are multigear, wherebery fishing vessels may target demersal resources and at othertimes they may target tuna and tuna like species. The following results were obtained from the malagasy observer program database and from pelagic species companies' declarations. With 388 178 hooks, the total catch was 388 tons which are composed of 44.66% tuna, 25.38% billfish, 13.24% shark and 16.72% others species. Billfishes percentage landed comprised mainly of 73.54% swordfish. The contributions of two other species are 19.15% and 7.31% corresponding to striped marlin and other **other Istiophoridae ,** respectivly**.** Thus, CPUEs for swordfish and striped marlin were 186.8 Kg/1000 hooks and 48.6 Kg/1000 hooks, respectively. Their lenght-weight relationships were calculated as $W_{swordfish}= 10^{-5} LJFL^{2.9735}$ and $W_{striped\ marlin}=4x10^{-4} LJFL^{2.7064}$.

Keys: Madagascar, Longline fishery, billfish, CPUE, weight-lenght relationship.

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INTRODUCTION

Madagascar has a great potential in terms of fisheries due to its EEZ (Economic Exclusive Zone) estimated about 1.14 million km² and its total coastline extends for more than 5,600 km. From February to may, Mozambic channel attracts big purse seiners targeting tropical tuna.

Madagascar started exploring longline fishery in 2007 by shifting from trawl gear to small multigear. The number of vessels, targeting tuna and tuna-like species in the IOTC (Indian Ocean Tuna Commission) area of competence, has been increasing. In 2012, Malagasy flag deployed 8 longliners less than 24 m off the east coast (Annexe1). Note that some of them are multigear, wherebery fishing vessels may target demersal resources and at othertimes they may target tuna and tuna-like species. These small longliners carried out 5 to 10 days of trip. The length of main line was about 35 to 70 km and the float line was around 4 to 30 m. Night set was generally practiced (3 to 9 pm) with using circle hooks. They utilized this type of hook in order to reduce the catch rate of some bycatch species. 6 to 8 hooks per basket and 3 or 4 either yellow or red chemical lightsticks every 3 or 4 branch lines were deployed. Main of these companies utilized also bait squid (**Ommastrephidae**) (RAHOMBANJANAHARY, 2012). Note that until now, data collection has experienced many difficulties such as declared data exempted of set detail information as in logbook pattern and the investigations at the landing sites are not actives.

MATERIAL AND METHOD

The eight Malagasy multiday longline vessels provide in the end of the year an aggregating catch data wich was used in this study. They comprised of vessel information, monthly deployed hooks and composition species broken-down by species and by month. In addition, Malagasy observers report from november to december 2012 were used too. They included the daily catch per species in number and weight, effort in number of hooks, the mid operation fishing longitude and latitude position. The sampling biological information such as body weight in Kg, length in cm FL[1] and sex detail was also utilized to carry out this study. Thereafter, gonade development was determined wich was based on histological analysis and GSI index. Indeed, gonads were removed from external tissue and weighed to calculate the GSI for determining the maturity stage of the fish. Aggregated data on declared catch broken-down by species allowed us to carry out the composition species. Thereafter, catch rate such as catch per unit of effort (Kg/1,000 hooks) would be carried out. Besides,

[1] Lower jaw fork length for billfishes

aggregated data from observers including daily catch and geographical information let us to figure out the capture location on the map. In addition, body weight (minimum, mean and maximum weight in Kg) and length of fishes (minimum, mean and maximum fork length in cm) would be done after using aggregating morphological data. Size composition followed up by length-weight relationship of two species is, subsequently, processed and figured out on this paper. Comparison test of major species contribution were done by using catch declared landings in recent years.

RESULTS AND DISCUSSION

1 Catch fluctuation

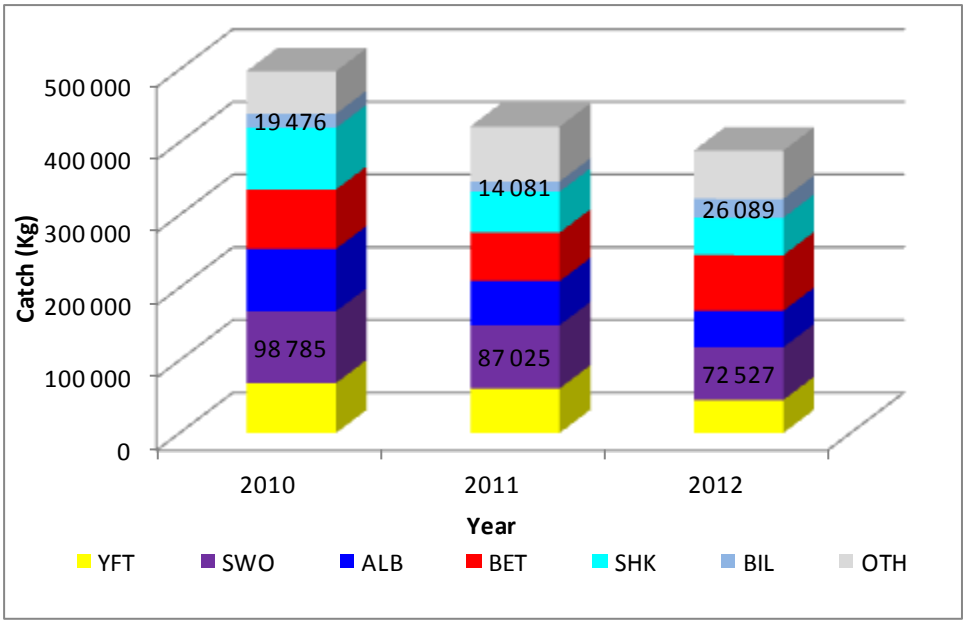


Figure 1 : Malagasy longliners annual catch (companies declared data)

Trend of total catches decreased throughout three last years. In other words, total catch landed was 497.8 tons in 2010 when it was estimated at 388.6 tons in 2012. The decreasing of total catches was due to the decreasing of total effort regarding to the number of big fishing vesssels (higher than 24m). Malagasy longliner flag accounted one vesssel more than 24 m in both 2010 and 2011 when in 2012, Madagascar used only small longliners, less than 24m. The trend of swordfish landed decreased also in terms of quantity from 98 tons to 72 tons in 2010 and 2012, respectivly. In the opposite, the trend of marlins and sailfishe landed increased in two recent years.

2 Spatial distribution of catch

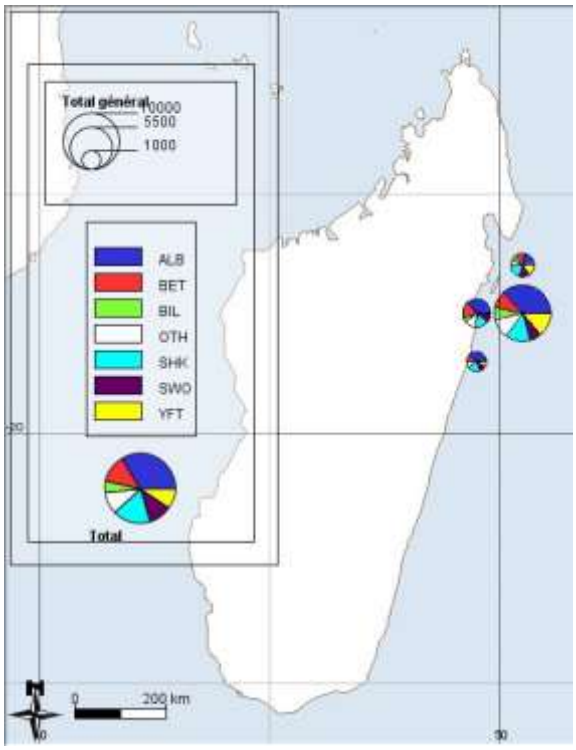


Figure 2 : Capture locations sampled by observers (November to December 2012)

Malagasy longliners targeted mainly fresh tuna and tuna like species. They have been operating only within the east of Madagascar waters. In addition, they limited the fishing day less than 10 days to keep fresh fish caught. Fishing areas were concentrated in two IOTC 5 degree squares which are: 6215045 and 6215050 because their landing sites are in Toamasina and Sainte-Marie. Sample size during this period was 951 fishes which were composed mainly of albacore tuna. Note that november to january is the best season of this species in southern Indian ocean. The IOTC one degree square 5216050 was the grid where we found the highest catch of swordfish (15.7%). Subsequently, the IOTC one degree square 5217050 was the highest catch proportion grid of mixed sailfish and marlin (6.5%).

3 Biological data from observer program

Species	FL (cm)			Body Weight (Kg)			Sex		GSI maturity						Inds
	Min	Average	Max	Min	Average	Max	F	M	1	2	3	4	5	U	
Albacore	64	106	155	14	20	45	8	359	11	58	81	64	3	150	367
Silvertip shark	149	149	149	100	100	100		2			2				2
Thresher	182	182	182	70	70	70		1						1	1
Barracudas nei	56	90	131	3	6	13		8		2		2		4	8
Bigeye tuna	40	118	162	1	32	84	2	90	5	26	24	11	1	25	92
Blue shark	160	244	352	25	55	120	1	49	5		4			41	50
Bigeye thresher	210	213	216	82	83	83		2						2	2
Blue marlin	142	190	215	12	43	86		9		2	3	2	2		9
Common dolphinfish	89	106	154	5	8	15	1	237	6	48	100	39	2	43	238
Great barracuda	99	102	104	5	6	6		2				2			2
Striped marlin	186	190	194	7	8	8		2		1				1	2
Ocean sunfish	56	57	58	3	4	4		4	2					2	4
Oceanic whitetip shark	92	92	92	4	4	4		1	1						1
Oilfish	42	86	154	2	8	24		25		5	7	3		10	25
Skipjack tuna	54	64	69	3	5	7	1	17		1	14			3	18
Shortfin mako	212	235	258	34	58	82		2						2	2
Scleronema minutum	54	54	54	3	3	3		1			1				1
Shortbill spearfish	171	181	196	6	7	9		8		2	2			4	8
White seabream	104	104	104	25	25	25		2						2	2
Swordfish	97	143	221	7	29	87	1	59	9	16	4		2	29	60
Wahoo	190	194	196	9	10	10		6	3	2				1	6
Yellowfin tuna	112	127	163	25	38	79	3	48	1	15	12	7		16	51

**Billfishes species with body length measured in lower jaw fork length (LJFL)*

Table 1 : List of observed species in the national longliners observer trip during Nov-Dec 2012.

Two species of marlin and swordfish were the bulk of billfishes discovered by Malagasy observers throughout this period. The two species of marlin comprised of striped marlin (*Tetrapturus audax*) and Indo-Pacific Blue Marlin (*Makaira mazara*). Sixty specimens of swordfish (*Xiphias gladius*) were reported by observers over the period. It was determined that the ovaries presented five different development stages of oocytes. These stages were identified as follows; undeveloped stage, developing stage, maturing stage, ripening stage, hydrated stage and post-ovulatory follicle.

3.1 Striped marlin

Two specimen of striped marlin were discovered and processed by Malagasy observers on board. Both of them were male and weighed about 8 Kg. One individual of this species presented an undetermined GSI maturity stage. The other specimen was in developing stage in GSI maturity level.

3.2 Swordfish

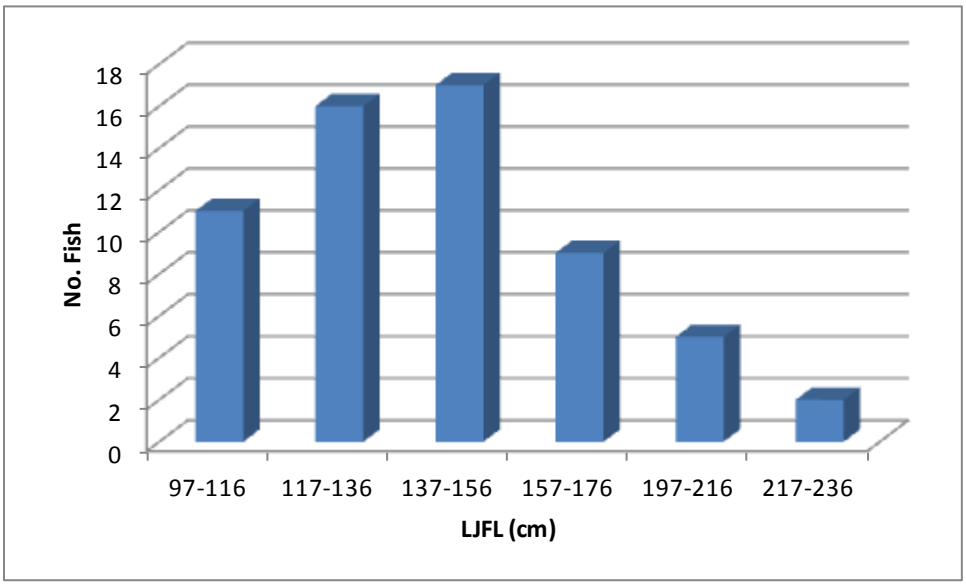


Figure 3 : Size frequency distribution of swordfish both sexes sampled within the eastern EEZ of Madagasar

The lower jaw fork lengths of sixty individuals were examined. The body weight ranged from 7 Kg to 87 Kg. LJFL varied from 97 cm to 221 cm. The figure above showed that the bulks (55%) of fish sizes were confined to 117 cm to 156 cm.

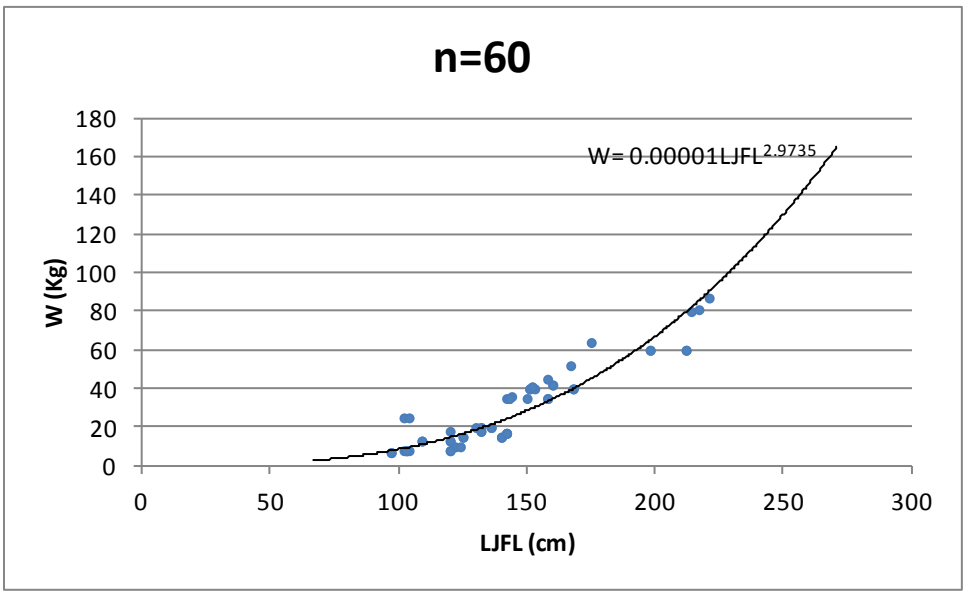


Figure 4 : Length-weight relationship of swordfish both sexes sampled in the eastern EEZ of Madagasar

The relationship between lower jaw fork length and body weight was calculated as W = 0.00001 $LJFL^{2.9735}$, (R^2 = 0.79). The "a" and "*b*" values (intercept and slope) was found as $1x10^{-5}$ and 2.9735 respectively. Thus, value of b showed negative allometric growth (b<3).

Males were significantly more numerous than females. The sex ratio (F/M) was calculated as 0.016. Processed swordfish comprised of 49% undetermined GSI, 15% undeveloped stage, 26% developing stage, 0.06% ripening stage and 0.03% post-ovulatory follicle.

3.3 Blue marlin

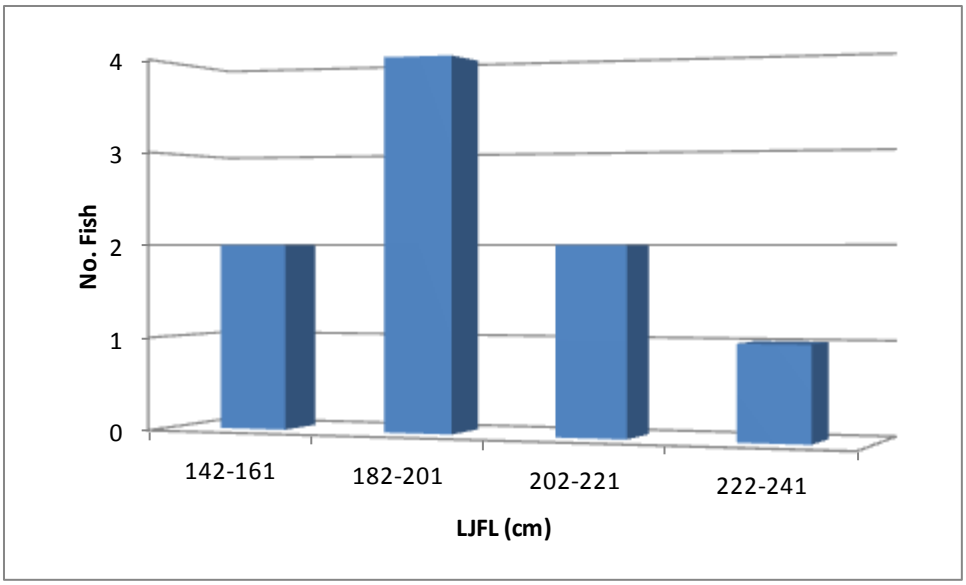


Figure 5 : **Size frequency distribution of blue marlin** both sexes sampled within the eastern EEZ of Madagasar

The lower jaw fork lengths of sixty individuals were also examined. The body weight varied from 12 Kg to 86 Kg. Subsequently, the average weight was 43 Kg. LJFL varied from 142 cm to 215 cm. The figure above showed that the bulks (44%) of fish sizes were confined to 182 cm to 201 cm.

Length-Weight relationship

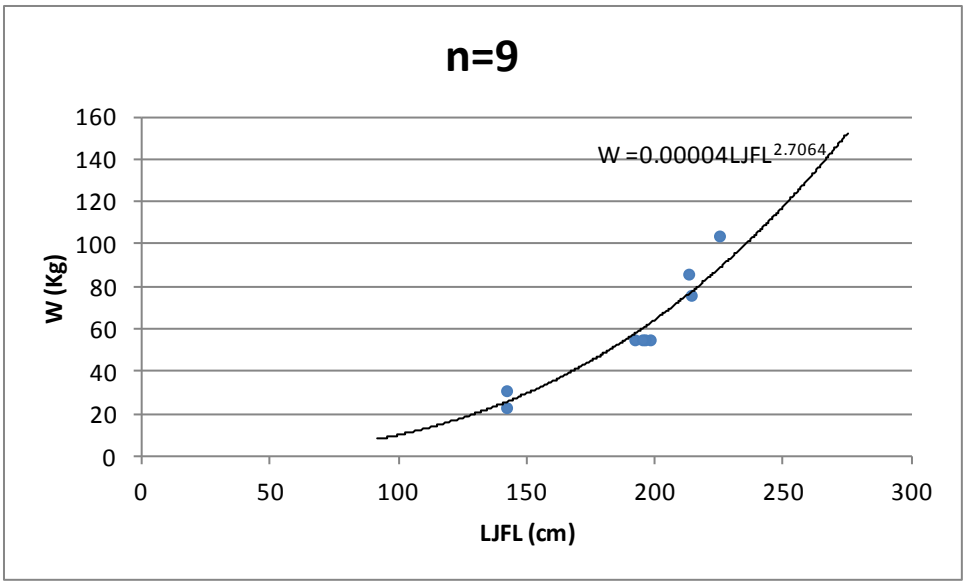


Figure 6 : Length-weight relationship of blue marlin sampled in the eastern EEZ of Madagasar

The relationship between lower jaw fork length and body weight was calculated as W = 0.00004 $LJFL^{2.7064}$, (R^2 = 0.92). The "a" and "*b*" values was found as $4x10^{-5}$ and 2.7064, respectively. Thus, value of b showed negative allometric growth (b<3).

All blue marlin processed were males. The GSI stages of nine specimens of this species were also examined. Processed blue marlin comprised of 22% developing stage, 33% maturing stage, 22% ripening stage and 22% hydrated stage.

4 Composition species

				Comparison test of proportions (2010vs2012)
Years	**2010**	**2011**	**2012**	***p value***
%TUN	47,47%	44,79%	44,08%	0.9999
%SHK	17,02%	13,31%	13,18%	0.9999
%BIL	23,75%	23,97%	25,24%	0.99999

Table 2 : Inter-annual proportions of major species group in landing catch (companies declared data)

Tuna and shark proportions decreased significantly from 2010 to 2012 with $p \geq 0.9999$[2]. Contrary to these species announced before, billfish proportion increased significantly from 2010 to 2012 with $p \geq 0.99999$.

[2] Non parametric test, comparison of two proportions

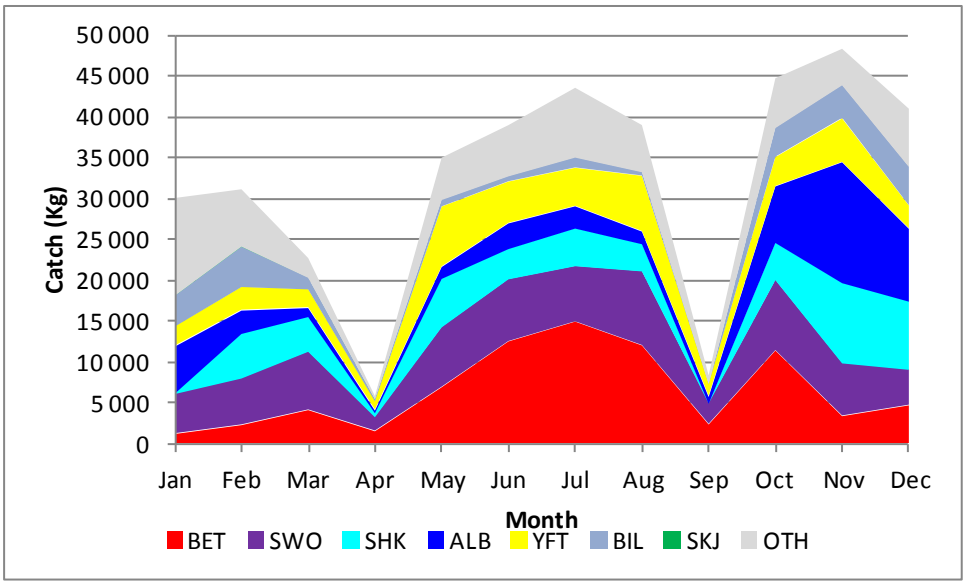
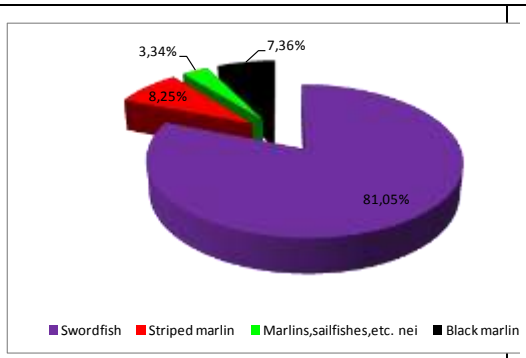


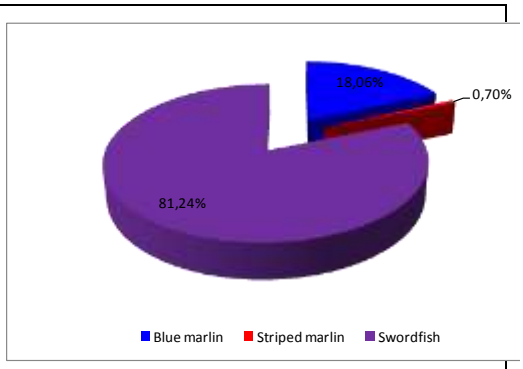
Figure 7: Catch fluctuation in 2012 (companies declared data)

This figure revealed that monthly catch rates ranged from 5.8 tons, in april, to 48.2 tons, in November. It's not recommended to fish far away from the coast during the cyclone period, January to the end of april. Thus, vessels were occupied by coastal and demersal fisheries. The low catch rate in september was due to maintenance of vessels. Total catch was 388.3 tons wich was composed of 44.66% tuna, 25.38% billfishes, 13.24% sharks and 16.72% other species.

5 Billfishes landing proportions



a) Average percentage of billfishes landed from declared data (2010-2012)



b) Billfishes landing from observer data (Nov-Dec 2012)

Figure 8 : Billfishes composition in total billfishes landed

The two charts above from two different databases, such as companies'declaration and from observer program databse, revealed two different percentages of billfishes contribution. Figure a) Billfishes landed comprised of 81% swordfish, 8% striped marlin, 7% black marlin and 3% **other**

Istiophoridae when figure b) revealed a predominance in percentage of swordfish (81%), followed up by blue marlin (18%) and small part of striped marlin.

6 Billfishes catch rates

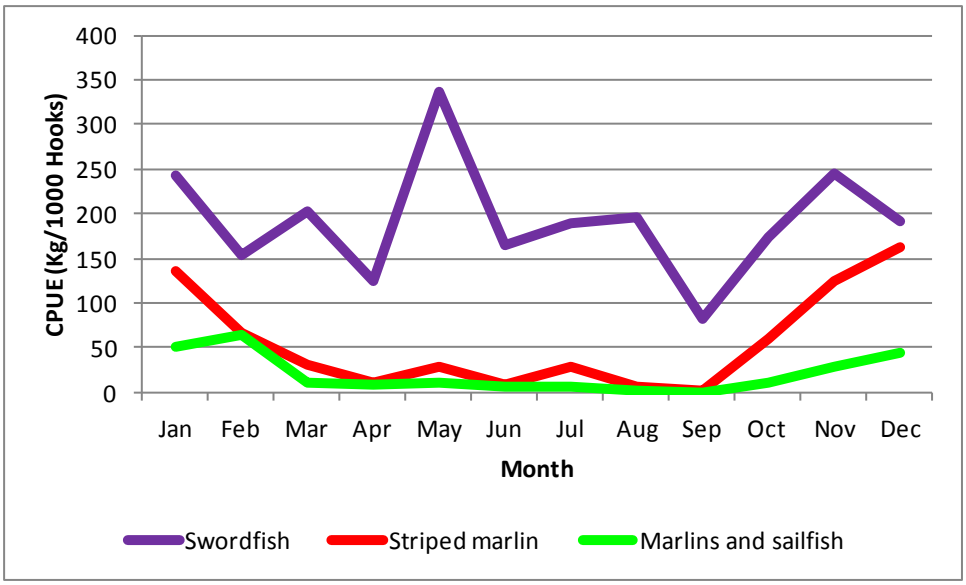


Figure 9: Monthly catch rate (companies declared data)

The CPUE of swordfish varied from 81.41 Kg/1,000 hooks to 337.07 Kg/1,000 hooks in september and may respectively.

For striped marlin and **other Istiophoridae** , we found out an evidence relationship between CPUEs and season. Indeed, CPUEs for summer season were at least the twice of the CPUEs for winter season. In other words, high values (more than 60 Kg/1,000 hooks) of striped marlin and **other Istiophoridae '** CPUEs were discovered from october to february, when they were less than 31 Kg/1,000 hooks from march to september.

CONCLUSION

Malagasy longliner flag were operated within the eastern part of its EEZ. Vessels have been targeting a fresh tuna and tuna like species during their short trip less than ten days. The trend of total declared catches decreased throughout recent years wich varied from 497 tons to 388 tons in 2010 and 2012, respectively. The decline of catches is due to the reduction of number of big vessels. Indeed, the trend of swordfish landed decreased also in terms of quantity from 98 tons to 72 tons in 2010 and 2012, respectivly. In the opposite, the trend of **other Istiophoridae** landed increased over this period. The data from Malagasy observer program were also used on this study. In spite of their limited sample size, they revealed that albacore tuna was the majority species during all observed sets (Nov-dec 2012). This study showed some biological information of all observed species such as

length, weight, sex, GSI maturity. The length-weight relationships were calculated as W = 0.00001 $LJFL^{2.9735}$ and W = 0.00004 $LJFL^{2.7064}$for swordfish and blue marlin, respectively.

REFERENCE

RAHOMBANJANAHARY M., 2012. Catch rates of sharks as bycatch caught by malagasy longliners, IOTC-WPEB-10, Cape Town, South Africa, 8p.

ANNEXE

Years	Prospection vessels		Active longliners		Total
	<25	>25m	<25	>25m	
2007				**1**	**1**
2008			**2**	**2**	**4**
2009	**2**			**2**	**4**
2010	**4**		**1**	**1**	**6**
2011			**6**	**1**	**7**
2012			**8**		**8**

Table 3: Number of malagasy active fishing vessels.