Received: 9 October 2014

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IOTC–2014–WPB12–INF02

BILLFISHES CAUGHT IN THE MALAGASY EEZ FROM 2011 TO 2013 BY THE FOREIGN LONGLINERS

TWELFTH WORKING PARTY ON BILLFISHES

TOKYO, Japan 21 – 25 october 2014

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Abstract

The foreign fleets dominate the pelagic fishing in the EEZ of Madagascar. Tuna and Tuna like species are the targets of these fisheries in which the Billfishes appear in the catch. Analyses were made on logbooks recorded in the database of the Madagascar Fisheries Monitoring Center. The species composition and the spatiotemporal distribution of catches were obtained from the analysis. For all three years (2011 to 2013), 8.57% of longline catches are billfishes and at least four species are present such as Swordfish (44.36%), Sailfish (2.68%), Striped marlin (52.36%) and Black marlin (0.61%). The billfishes are caught around the EEZ during the seasons of the year but they are abundant in hot weather especially between October and February and in the East, South and West side. An evolution in space is noted on the catches of billfishes during the three years.

Key words*: Foreign longliner, logbooks, fishing zones, catch composition.*

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1. Introduction

Foreign fleets dominate the pelagic fishing in the Malagasy EEZ. Fisheries agreements have been signed between the Malagasy government and foreign companies to catch for tuna and tuna like species. In the fisheries agreements, each vessel is hired to send copies of their logbooks to the CSP. This logbook contains fishing activity, including their position, the surface temperature, the detail of the catch (quantity and quality) per day, etc. These information are stored in a database within the CSP as it is very useful in the monitoring and controls activity of the CSP.

Longline and purse seine, these are the type of fishery that foreign fleets do in the EEZ of Madagascar. The billfishes are present mainly in the longline catch. Thus, in this paper, the changes in catch composition and spatiotemporal distribution for the fishing were analyzed for the billfish species. Such analysis provide a trend in the evolution of billfish stocks and thus make it possible to provide tools in technical and political decision-making in the management of billfishes resources

2. Methodology

According to the Memorandum of Understanding between the Ministry in charge of Fishery and fishing vessel owners in the EEZ Malagasy, each fishing vessel has an obligation to send their logbook administration. The data analyzed for this document was obtained from logbooks received in the CSP.

2.1. Species composition

From the database, the weight of each species are grouped by year after triage, formatting and structuring. The table below summarizes the data used to monitor the catch composition of foreign longliners.

*Table 1 **:** summarizes the data used to monitor the catch composition of longliners*

Species	2011	2012	2013
SP_1	$W_{1, 2011}$	$W_{1, 2012}$	$W_{1, 2013}$
SP_2	$W_{2, 2011}$	$W_{2, 2012}$	$W_{2, 2013}$
SP_3	$W_{3, 2011}$	$W_{3, 2012}$	$W_{3, 2013}$
SP_4	$W_{4, 2011}$	$W_{4, 2012}$	$W_{4, 2013}$
SP_5	$W_{5, 2011}$	$W_{5, 2012}$	$W_{5, 2013}$
…			
SP_n	$W_{n, 2011}$	$W_{n, 2012}$	$W_{n, 2013}$

SP_i : Species num i

$W_{i, Y}$: Species num i weight for the year Y

The specific composition is expressed in percentage for each year from the following operation :

Catch rate of the Species i, for the year Y = (total weight of the Species i for the year Y/sum of the total weight of all Species for the year Y)x 100

$R_{i,Y} = (\mathbf{Wi, Y}/\sum_{i=1}^{n} \mathbf{Wi, Y}) \mathbf{x\ 100}$

$R_{i,Y}$: Catch rate of the Species i, for the year Y

$\mathbf{Wi, Y}$: total weight of the Species i for the year Y

$\sum_{i=1}^{n} \mathbf{Wi, Y}$: sum of the total weight of all Species for the year Y

Table 2 : summarizes the data used to monitor billfishes composition

Billfishes	2011	2012	2013
Swordfish	$W_{SWO,2011}$	$W_{SWO,2012}$	$W_{SWO,2013}$
Sailfish	$W_{BIL,2011}$	$W_{BIL,2012}$	$W_{BIL,2013}$
Striped marlin	$W_{MLS,2011}$	$W_{MLS,2012}$	$W_{MLS,2013}$
Black marlin	$W_{BLM,2011}$	$W_{BLM,2012}$	$W_{BLM,2013}$

SWO : Swordfish BIL : Sailfish MLS : Striped marlin BLM : Black marlin

$W_{SWO, Y}$: Swordfish weight for the year Y,…

The species composition is expressed in percentage for each year from the following operation :

Catch rate of the species i, for the year Y = (total weight of the species i for the year Y/sum of the total weight of Billfishes for the year Y)x 100

$r_{i,Y} = (\mathbf{wi, Y}/\sum_{i=SWO}^{BLM} \boldsymbol{wi, Y})$x100

$r_{i,Y}$: Catch rate of the species i, for the year Y

$\mathbf{wi, Y}$: Total weight of the species i for the year Y

$\sum_{i=SWO}^{BLM} \boldsymbol{wi, Y}$) : Sum of the total weight of Billfishes for the year Y

2.2. Location of the foreign longline fishing :

The data used in the maps of the locations of the foreign longliners are extracted from the database. These data are geographic coordinates of the catch with the weight of billfishes and the date of fishing. This information is mapped per square of 1 ° x1 °. The following table summarizes the number of records used for these maps.

Table 3 : summarizes the number of records used for the maps

Year	**2011**	**2012**	**2013**
Number of longline vessels	40	66	83
Number of positions recorded	1553	4089	4441

3. Results

3.1. Catch composition of the foreign longliner

The following figure shows the evolution of the species composition of foreign longline catches

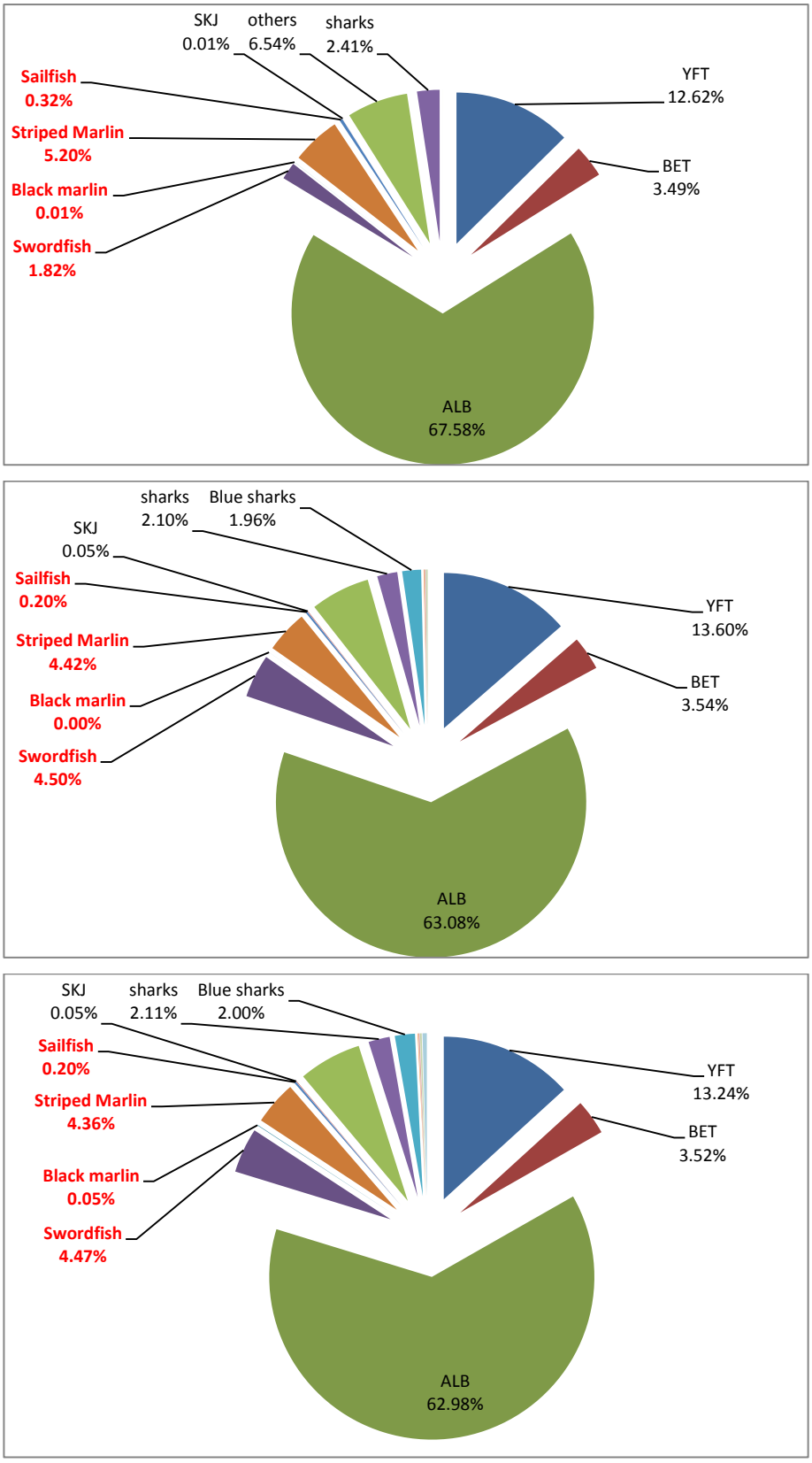


Figure 1: Catch rate of Billfish for the foreign longliners

The Albacore and the others species of tropical tunas represent the major proportion in weight of the longliner catches. Billfishes are represented at least by four species such as Swordfish, Sailfish, Striped Marlin and Black Marlin. Their catch rate is 8.57%. Looking only of Billfishes, the following chart shows the proportion of each of four species identified.

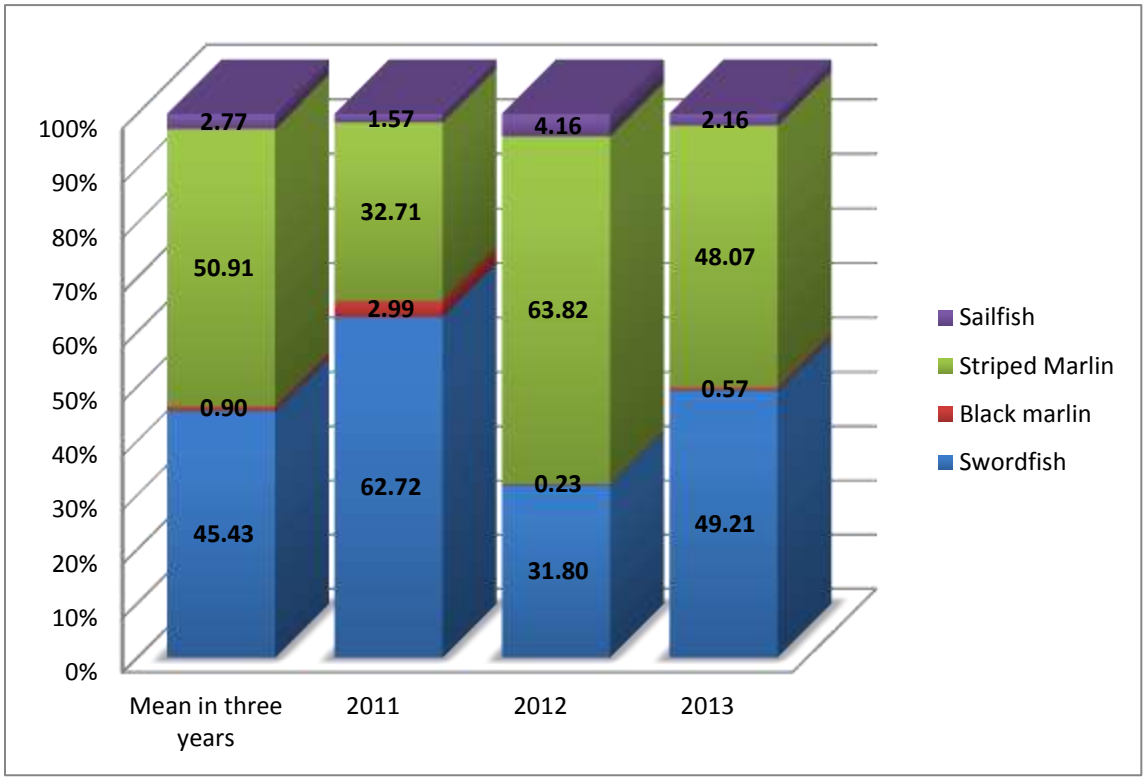


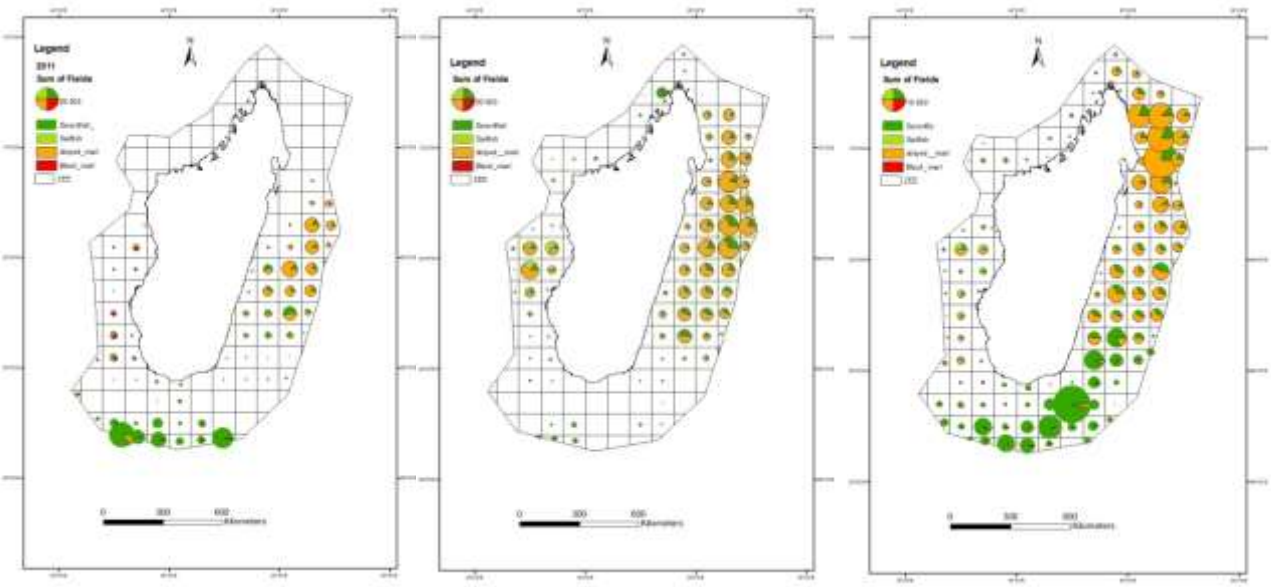
Figure 2 : Catch rates of all four species of billfishes

For the whole three years, Striped marlin and Sworfishes dominate the composition Billfishes with a rate of 50.91% and 45.43% respectively. A variation is observed along the period analyzed. In 2011 and 2013, the Swordfish dominates with a catch rate of 62.72% and 49.21% respectively before the Striped marlin (32.71% and 48.07%). But in 2012, the catch rates in Striped marlin was higher (63.82%) than that Swordfish (31.80%). Sailfish and Black marlin are minority with a catch rate of 2.77% and 0.90% respectively.

3.2. Spatiotemporal distribution of catches

3.2.1. Spatial distribution of catches in Billfishes

The figure below shows the distribution of catches in each year of the foreign longliners in the Malagasy EEZ.



2011 **2012** **2013**

Figure 3: Spatial distribution of the catch in Billfishes for foreign longliner

On each map, the size of the circle represents the quantity caught in Billfish and each species corresponds to a portion of the circle whose color is dark green for the Swordfish, green light for the Sailfish, orange for Striped marlin and red for the Black Marlin . From a global view, the dark green and orange colors that correspond to Swordfish and Striped marlin dominate the catch in Billfishes. Most of the catch was on the east side and a few catches were made in the South and West sides. In evolutionary terms, in 2011 the catch is done only in the center of the side and the South East.

In evolutionary terms, in 2011 the catch is done only in the center of the side and the South East. Very few are catch in the southern part of the West façade. Swordfish are caught in the southern part and sailfishes in the East. In 2012, most catch are always made in the east side with a clear domination Sailfishes.

In 2013, the catch billfish are across the front (North to South) with a dominance of capture Swordfishes Sailfishes south and north. It is also noted that if the main catch in Billfishes were at the center of the east side for 2011 and 2012 in 2013 Billfishes were caught in the North and South Eastern part of the side.

3.2.2. Temporal distribution of catches in Billfishes

The following graph shows the change in the capture Billfishes during the seasons of the year

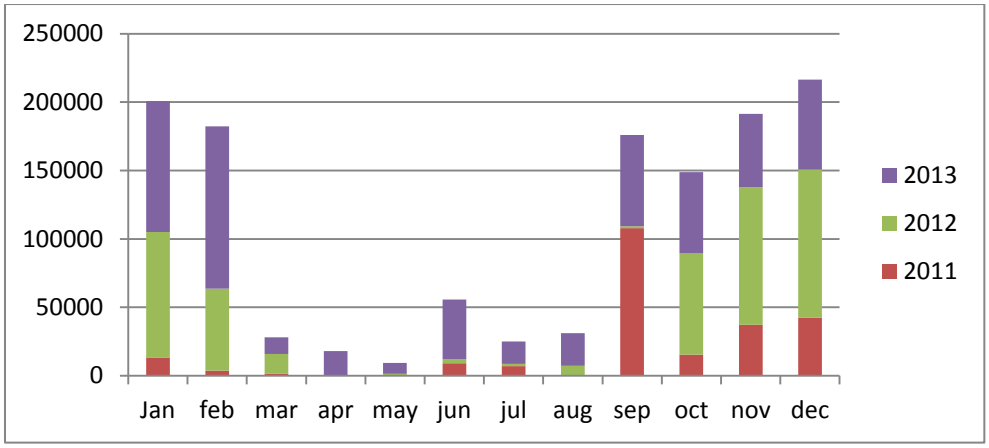


Figure 4 : Monthly distribution of the catch in Billfishes for the foreign longliners

For the whole three years, the cumulated catch billfishes are presented in the graph above. The catch is abundant since September to February of the following year. This period corresponds to the warm season. They are less abundant from March to August during the cold period.

4. Discussion and conclusion

Analyses of species composition in the catch of the foreign longliners show that at least four species of Billfish are present in the Malagasy water such as Swordfish, Sailfish, Striped marlin and Black marlin. The catch rate in Billfishes is relatively low compared to the Tunas.

The change in spatial distribution of the catch in Billfish could be related to the increased in the effort. It should be noted that the number of fishing vessel that send their logbooks increased (see Table 3).

As the stock of Billfish is regional scale, the trend of evolution is still unclear from this analysis. The fluctuation or stability of the studied parameters in this analysis does not conclude anything about the trend of the evolution of stocks. Different factors not yet analyzed on this study might be the cause of the situation. Migration, Environmental parameters, fishing effort, etc, may affect catch structure or the spatial and temporal distribution in the Malagasy waters. Thus, further analysis in large scale with a consideration of all factors is needed to better understand the trend of the evolution of Billfish stocks.

However, this partial analysis reveals that there is a fluctuation in the both catch structure and spatiotemporal distribution of the Billfish resources in Malagasy waters.