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Shark catch characteristics by national longliner fleets in Madagascar (2010-2014)

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ABSTRACT

From 2010 to 2014, Malagasy national fleet deployed on average 7 longliners less than 24 meters operating in the eastern part of Madagascar's EEZ. They deploy 800 to 1300 hooks per set and do short cruises of 4 to 7 days to maintain their catch fresh. The main targeted species are tuna and swordfish but some billfish species and sharks are taken as bycatch. The evolution of shark catch by these longliners in recent years (from 2010 to 2014) is presented in this paper. The data have been collected from the catch declarations by the fishing companies. The total fish catch of the longliners is estimated at 1772 tons since 2010 with an average of 443 tons per year. The largest proportion of catches concerns the targeted species, primarily tunas (45%), then billfish (20%). Sharks represented 13% of catches. Note that the trend of total catch is decreasing since 2010, the same for sharks from 85 tons in 2010 to 45 tons in 2014. However, during the last for years, the cacth per unit effort (CPUE) has been globally increased. Principally, more than three shark species have been caught in the Malagasy waters but the shark catch is mainly dominated by the Shortfin mako (*Isurus oxyrinchus*) with 36% and the Blue shark (*Prionace glauca*) that represented 20% of the total shark catch over the four years.

Keywords: longliners, tuna, bycatch, sharks, shark catch, Madagascar

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BACKGROUND

Longline fishery has been developed after the decline of the shrimp stock in the western part of Madagascar in 2007. Currently, it has become the main fishing technique for tuna and tuna-like species in Madagascar. The following table shows the structure of the national longline fleets.

Table 1 : Number of longline vessels targeting tuna and tuna-like species (2007-2014)

YEAR	LONGLINE VESSELS		TOTAL
	<25m	>25m	
2007		01	**01**
2008	02	02	**04**
2009	02*	02	**04**
2010	05*	01	**06**
2011	06	01	**07**
2012	08		**08**
2013	08		**08**
2014	07		**07**

* 2 longline vessels used for prospection in 2009 and 4 in 2010

Most of the vessels have less than 25 meters length. They mainly used monofilament line. The length of main line is about 35 to 70 km and the float line is around 4 to 30 m. Night set is generally practiced (3 to 9 pm) with using circle hooks. They utilized circle hooks in order to reduce the catch rate of some bycatch species. 6 to 8 hooks per basket and 3 or 4 (yellow or red) chemical lightsticks every 3 or 4 branch lines were deployed (RAHOMBANJANAHARY, 2012).

In this paper, we are focusing on shark catch specificity because of, firstly, their classification within the IUCN. It is mentioned that the third of open ocean sharks face extinction (Merry D.

and Al, 2007). Secondly, many species of sharks are considered as near threatened species (i.e. *Isurus oxyrinchus*, *Carcharhinus falciformis*…) or vulnerable (i.e. *Prionace glauca*…).

I. MATERIAL AND METHOD

The fishing companies declare their catches regularly by sending the copy of their logbooks to the Ministry of fisheries and the related entities (CSP, USTA…). According to the model of logbooks provided by the Ministry of fisheries, the following informations are reported:

- the total catch (in kilo);
- the vessel (name, flag, registration number, tonnage, length, ...);
- the fishing gear (length of branch lines, length of float line, length between branch lines...);
- the fishing operation (date and geographic positions);
- the fishing effort (number of hooks between floats, number of hooks or baits used, number of fishing days, ...);
- And details on the species composition of their main catch and bycatch (number and weight).

Note that some information mainly fishing effort and geographical fishing position are sometimes missing because the logbooks are not properly filled by the captains. Furthermore, the logbooks data do not contain the individual weight neither the length. Then, we are simply in obligation to reasoning in terms of total weight of the catch along this paper.

The analysis of 2010 to 2014 catch data has allowed us to obtain the evolution of the total catch and effort (number of hooks deployed) of longline vessels in recent years and their annual average catch. CPUE expressed in kg/100 hooks was obtained from catch and effort data. In addition, the declared catch data broken-down by species allowed us to carry out the species composition except for 2010 data during which there was no species identification of the catch.

Since this document is focused on the shark catch as bycatch by tuna longline fishing, analysis of shark catch was also deeply conducted to know its evolution and fishing effort in recent years, its percentage on the total catch landed the species composition and the dominant species of sharks.

II. RESULTS AND DISCUSSIONS

2.1. Annual variations of total fish catch, fishing effort and Catch Per Unit Effort (CPUE)

The Figure 1 presented the total fish catch in tons and the fishing effort in number of hooks used by the vessels, when the figure 2 shows the variation of CPUE. Note that 2013 data are not used in this paper since they are incomplete because most of the logbooks have been returned to the fishing companies waiting for correction.

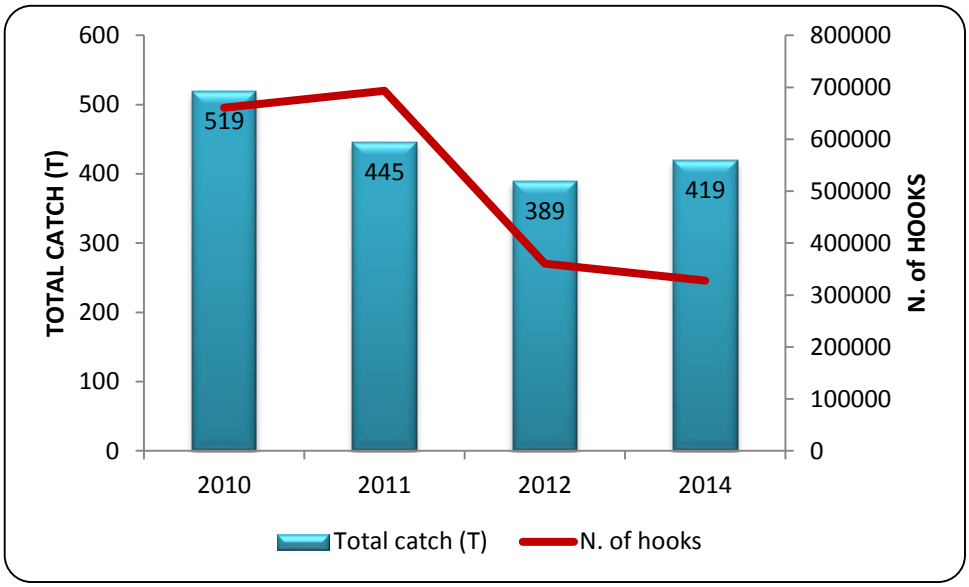


Figure 1 : Variations of catch and fishing effort by the national longliner fleets (2010-2014)

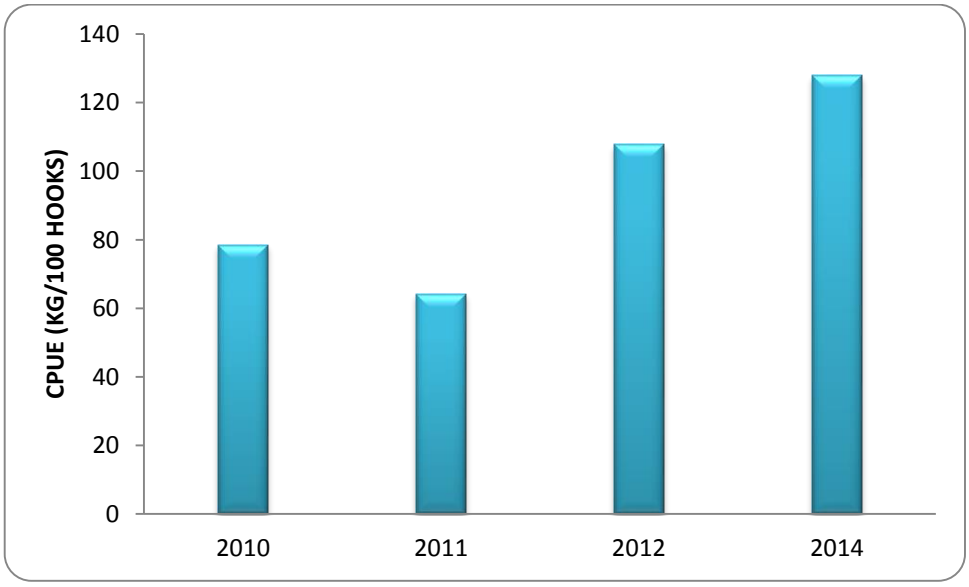


Figure 2 : Variation of Catch Per Unit Effort of Malagasy longliner fleets (2010-2014)

Over the four recent years, it is observed that the fishing effort is decreasing from 2010 to 2014. The total fish catch by the Malagasy longliners fleets is slightly affected by this effort variation. From 2010 to 2014, the annual fish catch varies from 519 tons to 419 tons passing by 389 tons in 2012.

However, the figure 2 shows that the catch per unit effort (CPUE) is increasing from 2010 to 2014. In other words, the CPUE rises when the fishing effort decreases considerably. In 2010, the fishing effort has been about 700,000 hooks that is the double if compared to the 2014 effort which is 300,000 hooks (fig.1). This last effort is matching to over 120kg of CPUE in 2010. In 2014, the 700,000 hooks are related to only about 80kg of CPUE.

2.2. Catch rates repartition per targeted fish group

The main targeted fishes such as tunas and billfishes are very important in terms of catch weight. They represent an average of 300 tons per year or the equivalent of 60% of total fish catch. The other bycatch is characterized by some species such as the great barracuda, jacks and crevalles nei, Pargo breams, Ground fishes, Wahoo… They globally occupied the next place with an average of 90 tons per year that represent the 20% of total catch weight.

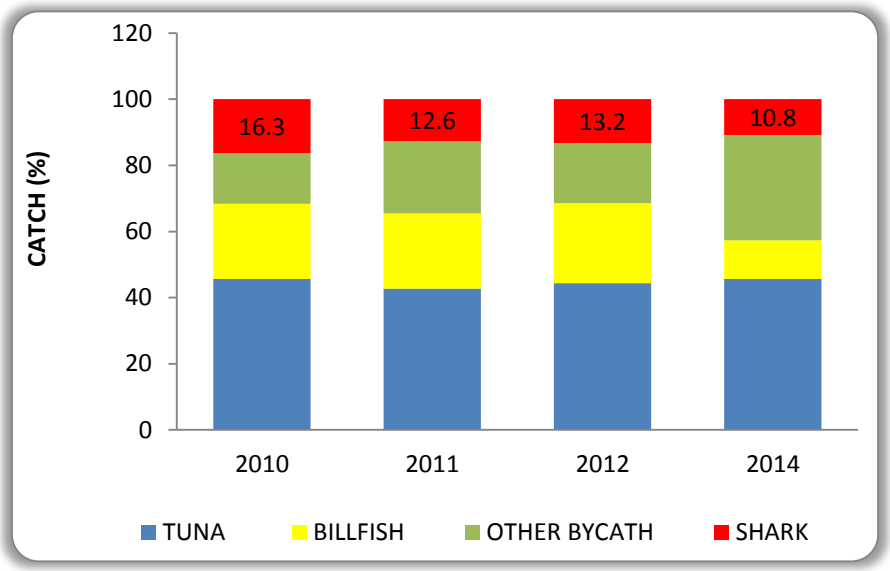


Figure 3 : Repartition rate of catch per fish group (2010-2014)

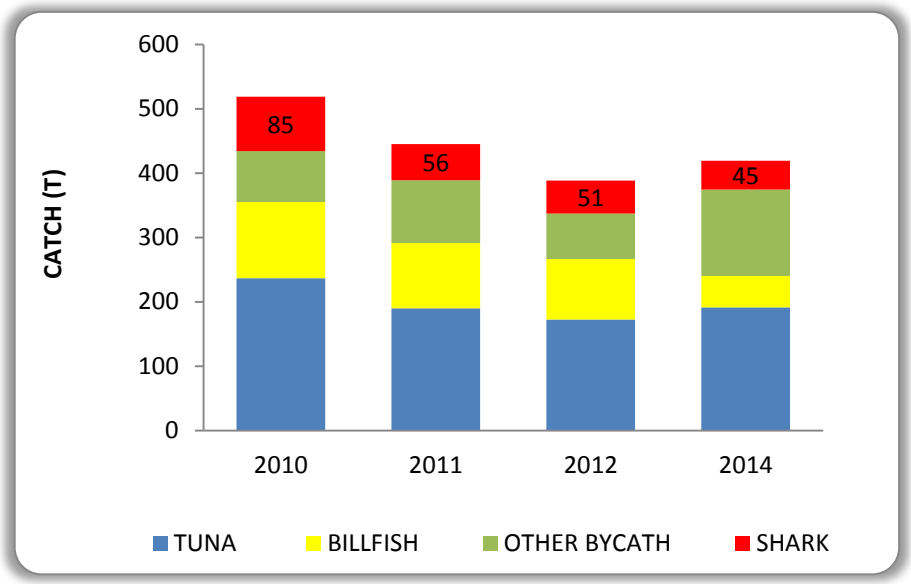


Figure 4 : Repartition of catch per fish group (2010-2014)

As shown in figure 3 and 4, the shark bycatch is evaluated at an average of 59 tons/year that represents the 13% of the catch by the Malagasy fleets. Thus, the weight of shark catch represents the lowest value comparing to the catch of other fish group. However, bio-ecologically, this proportion is important if we consider the status of the sharks according to the IUCN categorization.

Note that this average of 59 tons of sharks accidentally killed every year by these Malagasy vessels is equal to the shark catch by a single European Union longliner vessel in a year. If we focus on the whole number of the longliner vessels that act within the north of the Mozambique Channel where the Tunas are, the annual loss of these endangered cartilaginous species is disastrous.

2.3. Global shark species repartition rates

The figure 5 illustrates the repartition rates of the shark species during the three years (2011, 2012 and 2014. As it has told in the beginning, some data are incomplete; that is the case of 2010 when the captains did not distinguish the shark species. Moreover in 2013, there was a misreporting of data.

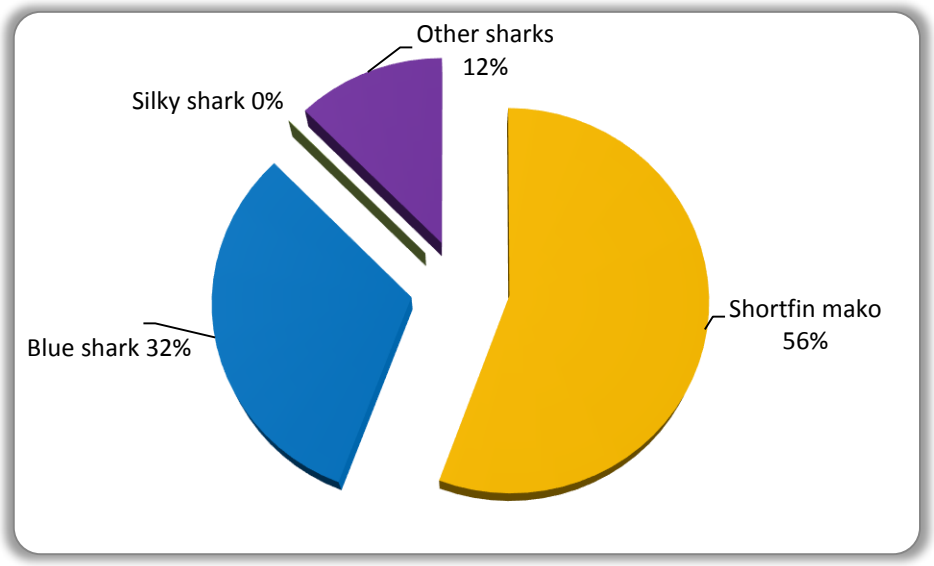


Figure 5 : Shark species repartition within the 2011, 2012 and 2014.

Shortfin mako (*Isurus oxyrinchus)* represents 56% of shark weight caught by the Malagasy longliners over the three studied years. The Blue shark *(Prionace glauca)* captured is about 32% of the total shark weight. The other sharks that the species names were not mentioned by the vessels data loggers represented the 12% of the sharks caught. The Silky shark (*Carcharhinus falciformis)* is known as accessories catch with the rate under 0.1%. We point out the details of each species quantity in the next subtitle which describes the repartition of shark species each year.

2.4. The variations of shark species catch, effort and CPUE (2010-2014)

Generally, the shark catch trends to decrease with the reduction of effort deployed by the vessels during the four last years. It means that the chance of the vessels to kill the sharks depends on the effort they mobilize.

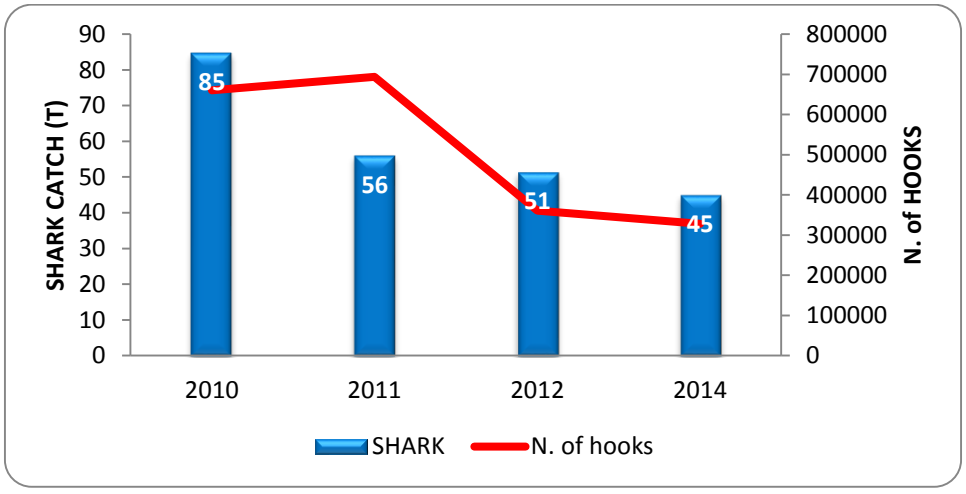


Figure 6 : Variations of shark catch and effort (2010-2014)

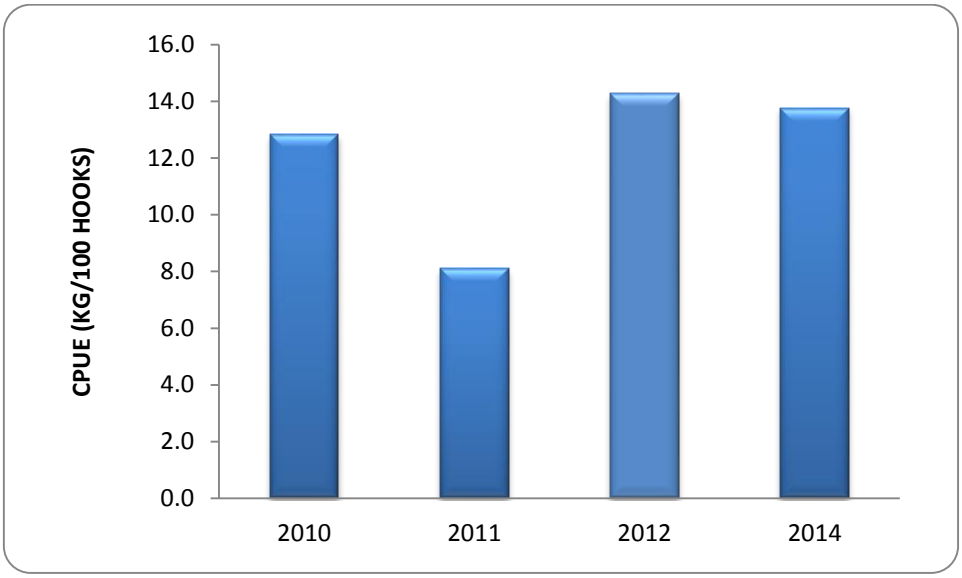


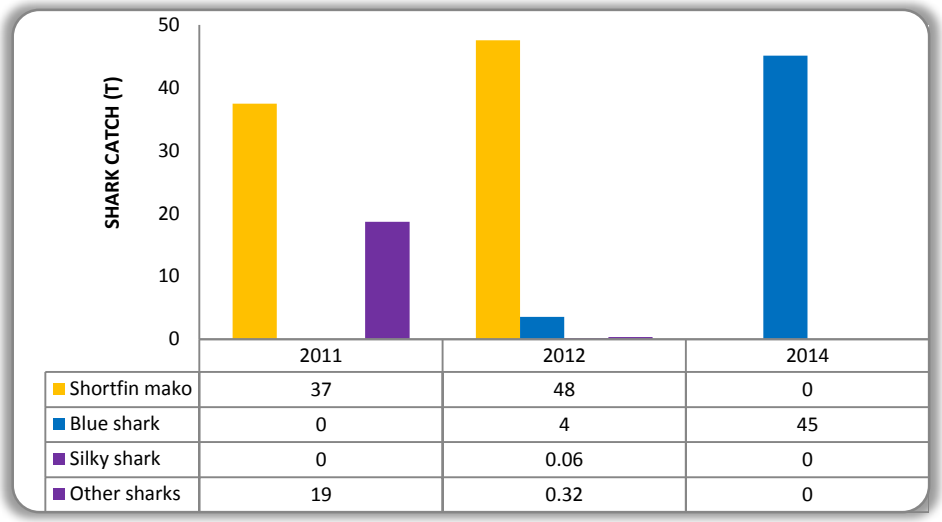
Figure 7 : Shark CPUE variation (2010-2014)

The shark catch weight of 85 tons in 2010 corresponds with about 660,618 hooks used. In 2014, only, 45 tons of sharks have been caught with about 327,884 hooks deployed (fig. 6).

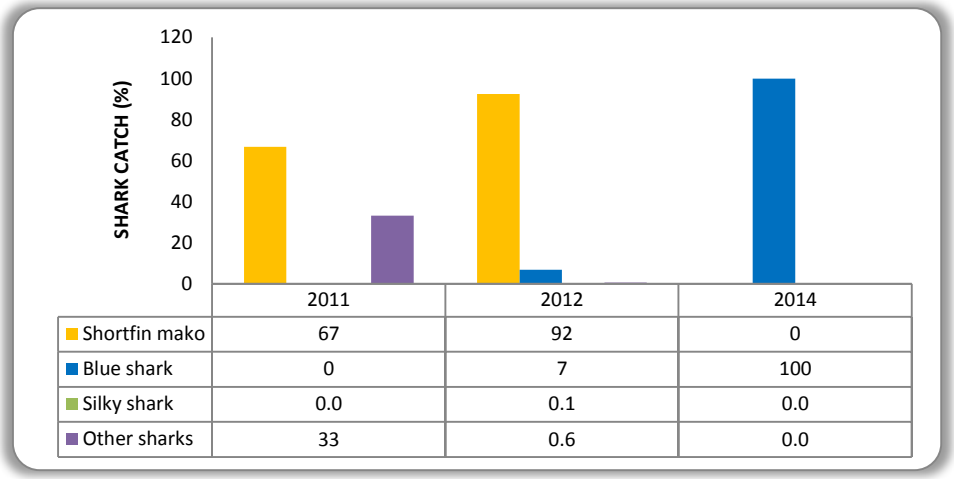
The variation of the CPUE does not really match with the effort variation (fig. 7). The highest CPUEs are observed in 2012 and 2014 (about 14kg of shark/100 hooks) while the effort recorded is the lowest during these periods.

2.5. The annual variation of the shark species catch (2011, 2012, 2014)

The figure 8, 9 shows the species composition of shark catch during 2010 to 2014. More than three species of shark are caught by the Malagasy longliner but only three have been identified such as shortfin mako (*Isurus oxyrinchus*), Blue shark (*Prionace glauca*) and silky shark (*Carcharhinus falciformis*). Moreover, the shark species within the 2010 data are not identified by the vessels data loggers.



	2011	2012	2014
Shortfin mako	37	48	0
Blue shark	0	4	45
Silky shark	0	0.06	0
Other sharks	19	0.32	0



	2011	2012	2014
Shortfin mako	67	92	0
Blue shark	0	7	100
Silky shark	0.0	0.1	0.0
Other sharks	33	0.6	0.0

Figure 8, 9 : Species composition of the shark catches (2010-2014)

In terms of weight (fig 8, 9), the first couple year (2011 and 2012) is dominated by the shortfin mako that represents 37 tons and 48 tons (67% and 92% of shark catch weight). However, the catch of this species of shark has not been recorded in 2014. During this last year, the whole shark catch is represented by the Blue shark with 45 tons of fresh weight.

The absence of the Shortfin mako in 2014 may be supported by the following hypothesis: (1) the important catch of this species in 2011 and 2012 caused the rarity of its population in the Malagasy EEZ where the National vessels operate. Then, other species such as the Blue shark appears from the 2012 and became abundant in 2014. (2) Because of the insufficiency of the data about geographical position, it's arbitrary to say that these Malagasy longliner vessels might change fishing zone in 2014. However, we can consider these couple of explanations true until we get the current year data (2015). If after the important catch of the blue shark in 2014 we will recorded the lowest or zero catch of this same species in 2015, the first hypothesis will be the best.

CONCLUSION AND RECOMMENDATIONS

To conclude, the total fish catch by Malagasy longliner vessels within the Madagascar EEZ does not totally depends on the fishing effort mobilized by the vessels. Nevertheless, the CPUE is negatively correlated with the fishing effort. The CPUE trends to decline with an important rise of effort. Consequently, to prevent overfishing of these pelagic open ocean species, the deliverance of fishing license should consider the number of vessels and effort.

Regarding the bycatch, the results showed that the shark catch is positively correlated with the fishing effort. The Malagasy fleets similar to the other vessels could not prevent the accidental catch of sharks. However, Malagasy longliner fleets have adopted fishing techniques to minimize shark catch such as the use of monofilament lines and the deployment of "circle hooks".

At the end, the Tuna Statistic Unit of Antsiranana (USTA) regrets about the lack of data we are facing. The USTA is based in the North of Madagascar and is working mainly in the Antsiranana harbor but the longliner fleets are in the Eastern region of the big Island. Hopefully next year, the unit in collaboration with the Madagascar Ministry of Fishery will set up two new regional offices that will reinforce our Tuna and other pelagic species fishery survey in the Eastern and the Western coasts of Madagascar.

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