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**Sampling of Frigate tuna (FRI: *Auxis thazard*)
as byproducts of purse seiners at the port of
Antsiranana-Madagascar (2011-2017)**

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ABSTRACT

Almost the six neritic tuna (and mackerel) species under the IOTC mandate are caught in Madagascar waters by small scale and artisanal fisheries using gillnets, handline and trolling. However, no catch monitoring has so far been specifically carried out for neritic tunas concerning these fisheries.

Regarding the industrial fishing, foreign purse seiners often caught Frigate tuna in the Madagascar waters while operating in the Mozambique Channel, particularly from February to June. Since catches of Frigate tuna are considered as byproducts and are seldom recorded in the logbooks, Madagascar has recently started from 2011 to evaluate and sample the catches of frigate tuna at the port of landing.

The results of the sampling are presented in this paper, mainly the annual variation of the Frigate tuna landed and its length frequency data.

Keywords: Neritic tuna, Frigate tuna, purse seiners, byproducts, landing

1. INTRODUCTION

In Madagascar, industrial tuna fishing is conducted by foreign vessels that have obtained fishing licenses in Malagasy waters. Longline and purse seine are the main fishing gear used. Purse seiners are operating in the Mozambique channel from February to June and some of them mainly under European flag landed their catches at the port of Antsiranana since the opening of the tuna cannery (1990).

Apart from the targeted tunas, byproducts which are composed by all non-targeted species plus small or damaged targeted tuna species that are not accepted by the cannery are also landed. They are often neglected and are not recorded in the fishing charts but sold on the local market and constitute an important source of food for the local population. Even if Madagascar through USTA has implemented sampling of tuna catches at the purse seiners landing since 1991, our interest on byproducts has been started recently. Among them is the Frigate tuna that constitutes 1 to 25% of the byproducts landed.

This paper is precisely giving an update of the study in 2011 which concerned the preliminary demographic structure parameters of Frigate Tuna through landing in Antsiranana. The objective of the 7 years sampling is to know the importance of Frigate Tuna in terms of catch and to present the variation of their population characteristics.

2. METHODS OF SAMPLING

2.1. Overview of the purse seiners landing

At each arrival of the purse seiners at the port, the investigators intervened to collect the logbooks and the tank plans in order to know the tonnage to be landed or transshipped, and to develop the sampling plan. In the latter case, it is necessary to refer to the tank plans in order to determine which one can be sampled. A purse seiner usually contains 12 to 18 tanks. A tank is good for sampling (according to the sampling system adopted by Miguel A. H.Armas in 1988) when it contains:

- Fish from a single fishing operation of which the quantity of fish above 10 kg is also known;
- Fish from two or more fishing operations but caught in the same fishing area, same quarter and the same associated system.

Furthermore, in order for the sampled fish to be representative of the tank, the sampling of a tank must consist of two turns, one at the beginning-middle of the tank and the other at the middle-bottom of the tank.

During landing, the tunas pass on the sorting mat leading to a large net that transports them outside the boat. It is during this passage that samplings of tuna and also byproducts are taking place.



Photo 1: Description of the different activities during landing

Generally, two to three investigators are required during tuna sampling, but it depends also on the working conditions on board a purse seiner. While one directly measures the fish, the other ensures the recording of information in a pre-established form. The data thus collected are transcribed and managed in a database called AVDTH (Acquisition and Validation of Tropical Tuna Fishing Data).



Photo 2: Measurements of tuna during sampling

2.2. Sampling of byproducts

As shown in photo 1, the byproducts are sorted and set aside by the dockers as soon as they leave the tank. We are also deploying two investigators to ensure the data collection of the byproducts. The method of data collection remains the same as described by RAHOMBANJANAHARY D. in 2012. It consists initially, to carry out sampling at landings and transshipments. In fact, 200 fishes among the byproducts are first identified and then measured in fork length (FL) by the investigators per day and per boat. The collected information is immediately recorded in pre-established form.

The objective of the sampling is to have an idea of the species composition of the byproducts and their size distribution.

The second step is to explore the information associated with the quantitative evaluation of the byproducts landed by each boat. For this, a suitable form was designed to follow the dockers' speed movement. Indeed, different packaging is used by the dockers to bring the byproducts outside the boat such as the net (estimated to contain 1000 kg of fish), the cages (either 1200 or 1400 kg), the package (35 kg), etc. These packaging are then counted to evaluate the amount of byproducts landed and locally marketed.

All information collected will be entered in a database waiting for treatment and the filled forms are classified as archives.



Photo 3: Byproducts and some examples of packaging

3. RESULTS

3.1. Tuna catches at landing and transshipment of purse seiners in Antsiranana

The tuna vessels frequent the port of Antsiranana either to land or to transship tuna. As shown in figure 1, the amount of tuna landed and transshipped at the port of Antsiranana varies by the year and is positively correlated with the number of operation. The maximum landed and transshipped quantity of 46000 tons was observed in 1999 while the minimum in 2004 (3500 tons). Indeed, the average annual quantity of tuna handled at the landing port is 25000 tons the last 19 years, of which 46% is for the tuna cannery and 54% transshipped to cargo ships.

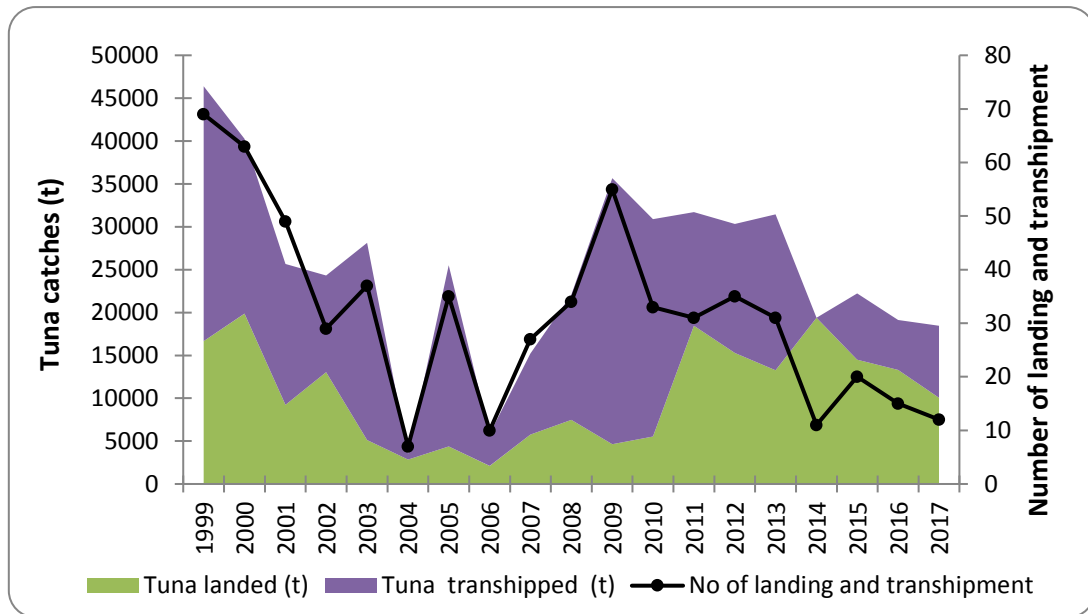


Figure 1: Annual variation of tuna catches recorded at the landing port (1999-2017)

This variation depends on the availability of tuna in the Mozambique Channel and also on the tuna cannery requirements. The hypothesis which is the preference of purse seiners to land in another neighboring port (e.g the port of Seychelles) should not be excluded.

3.2. Quantity and species composition of the byproducts landed

The monitoring of the byproducts landing since 2011 shows that they constitute on average 1.82% of the tuna landed and transshipped at Antsiranana. From 2011 to 2017, a total of 3295 tons are recovered by the dockers and resold either to the local market or transported to other regions. Thus, the annual average quantity of byproducts landed is 471 tons.

The byproducts here consist of all non-targeted species plus small or damaged targeted tuna species. And considering the sorting of catches on board of the purse seiners, byproducts are constituted in large part by the mixture of tuna (51%), followed by the skipjack tuna (21%).

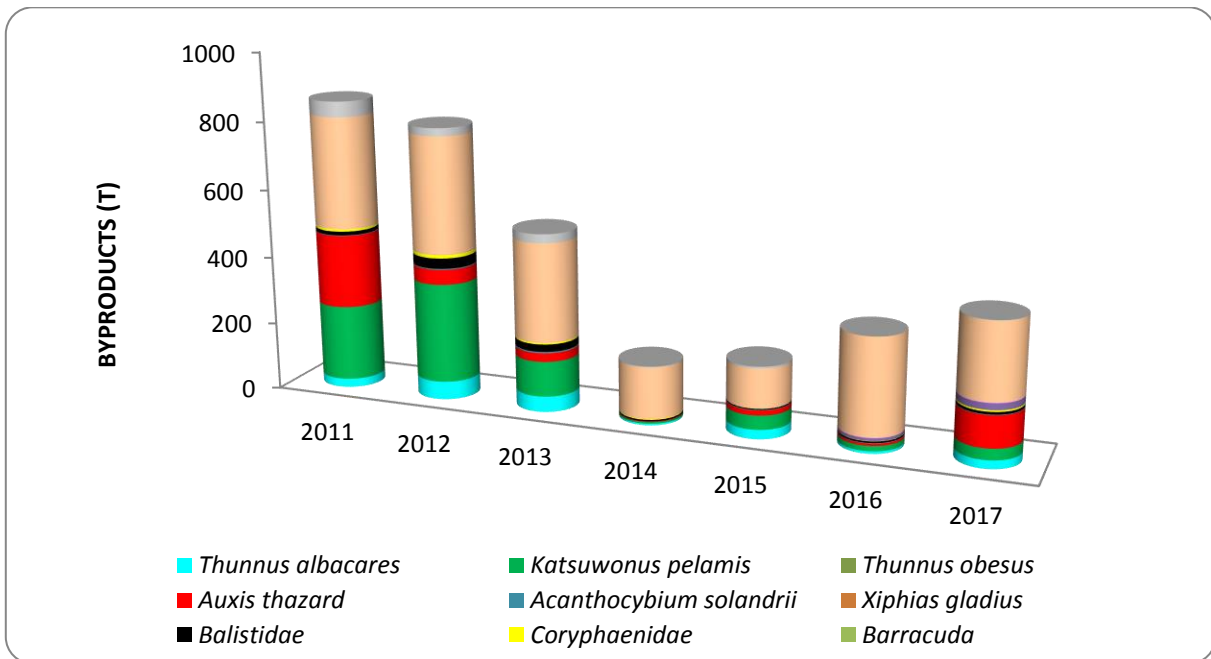


Figure 2: Annual variation and species composition of the byproducts landed (2011-2017)

The frigate tuna represents an average of 12% of the total catch or 57T per year. The highest catch of this species recorded at the port of Antsiranana during the last seven years reaches the 216T in 2011. This is in correlation with the total byproduct variation.

The figure 3 just shows that the amount of the frigate tuna landed can vary from a year to another, from 1% to 25% of the byproducts.

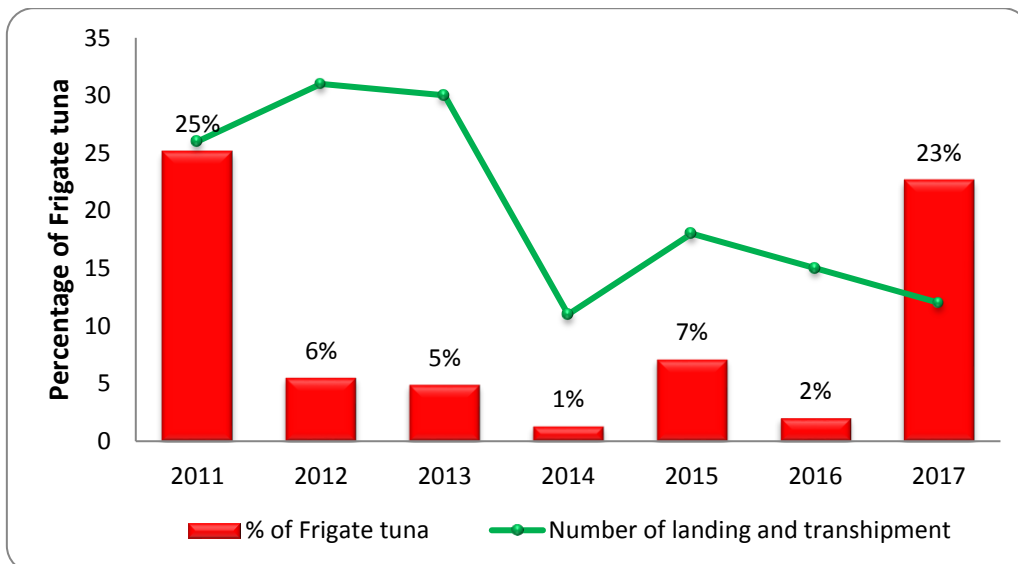


Figure 3: Variation of the percentage of frigate tuna in the byproducts (2011-2017)

As shown in the figure 3, there is an important variation of the rate of frigate tuna catch over the years. This variability of proportion is firstly due to the succession of purse seiners and the cargo ships that operate at the port over each year. Globally, the purse seiners, with their all coming fish catch from the fishing activities transport important quantity of byproduct comparing to the cargo ships. The products transported by the cargo ships are already pre-selected, so that the quantity of byproduct is very low.

This variability of proportion the frigate tuna is also may be due to the bycatch rejection on the high sea. This affirmation is just a supposition and to be confirmed.

3.3. Frigate tuna size frequency distribution landed by purse seiners

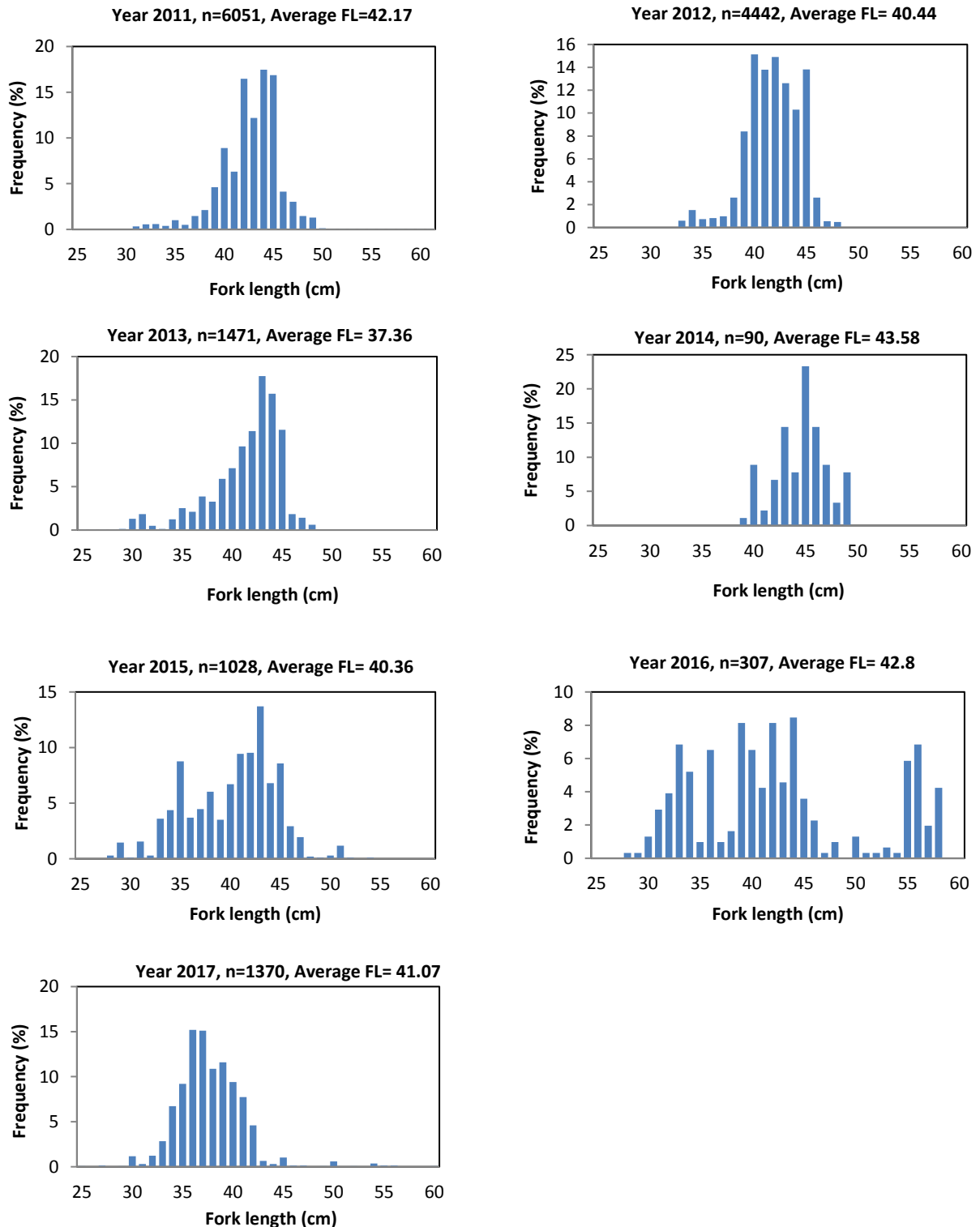


Figure 4: Size frequency distribution of Frigate tuna (2011-2017)

Globally, the size frequency of the frigate tuna recorded by the USTA at the Antsiranana harbor shows the homogeneous distribution of the population. However, some years, the 2015 and 2016 are characterized by the impressive heterogeneity of the frigate tuna population. The small

individuals and the bigger are spread along the distribution and the size frequency shows multimodal distribution. It is maybe because of the cohort of the year n and the year $n-1$ combination during the fishing period. For example, the bigger size individuals observed in the 2016 graph are supposed to be the part of the 2015 frigate tuna cohort.

The size (fork length) of the frigate tuna measured at the harbor of Antsiranana varies between 25cm and 58cm. And the average fork length recorded during the over the 7 last years oscillates between 37cm and 43.5cm. This lowest average value (37cm) of this parameter has been recorded in 2013. The year of 2014 is characterized by the highest average size of 43.5cm. This is firstly because of the effect of the sampling. In other word, during this year, the number of the purse seines that have operated at the harbor of Antsiranana has been only 4. It represents the lowest number comparing to the average of 10 purse seines per year. This low number of purse seine affects the sampling size and leads to the overestimated average of the frigate tuna size.

The average of size frequency estimated during the observation period is around 40 cm if the sexual maturity of this species is reached at about 29 cm fork length in Japanese waters and 35 cm around Hawaii (COLLETTE and NAUEN 1983, reported by RIJASOA F, 2015).

4. CONCLUSION

The analysis of data recorded over the landing and the transshipment of tuna at the port of Antsiranana permits to describe the variation of the quantity and percentage of frigate tuna catch. If the total byproduct represents 1.8% of the total catch of the purse seiners, our analysis shows that the frigate tuna represents the average of 12% of the byproduct or 57T per year.

The sampling of byproducts landed by the purse seiners was used to estimate the size frequency distribution of the Frigate tuna landed from the fishing operation carried out in the Mozambique Channel. The average size of the frigate tuna over the seven last years is between 37 to 44 cm. These average size values match with the sexual maturity stage of the *Auxis thazard*. And generally, from 2011 to 2017, the frigate tuna population is characterized by the homogeneous distribution of the fork length frequency except the results shown in 2015 and 2016. The smallest and the biggest individuals recorded during this period of study are 25cm and 58cm.

The landing of the byproduct at the harbor of Antsiranana contributes to the provision of the protein source for the local population in the north part of Madagascar. This product is directly sold at the local markets of Antsiranana and some proportion is transported to the other regions of Madagascar to fulfill the lack of seafood consumption.

To contribute the sustainability of these resources, the tuna statistic unit of Antsiranana (USTA) recommends the stock assessment study of these species.

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