

## ON THE FAUX POISSON TUNA LANDINGS IN ABIDJAN: ANALYSIS OF RECENT DATA AND PROPOSAL TO CREATE A TASK2 FILE<sup>1</sup> OF FAUX POISSONS TUNA CATCHES FOR MAJOR AND MINOR TUNAS

A. Fonteneau<sup>2</sup>, P. Dewals<sup>3</sup> and P.J. Pascual Alayón<sup>4</sup>

### SUMMARY

*This paper is making an analysis of Abidjan tuna landing data sold as “Faux Poissons”<sup>5</sup> by purse seiners (1990-2014). The comparison of multispecies and basic sampling indicates that the species composition of faux poissons catches should be corrected. A method allowing to estimate files of monthly catches by 1° square for major and minor tunas is proposed. Comparative analysis of catch at size (CAS) estimated in the basic fishery data and in the faux poissons market allows to conclude that the faux poissons CAS should not be added to the basic CAS, as large parts of the faux poissons catches are already included in the CAS. This analysis shows various deficiencies in the minor tunas statistics of the EU&al fleet. Sampling data allow to estimate that an average 6000 tons of minor tunas were sold yearly as faux Poissons by EU purse seiners between 1990 and 2005, while only 540 tons of minor tunas were declared yearly to ICCAT. TASKI catches of major tunas in the period have been widely overestimated. These questions would need further in depth statistical studies.*

### RÉSUMÉ

*Le présent article analyse les données des débarquements de thonidés à Abidjan vendus comme « faux poissons»<sup>6</sup> par les senneurs (1990-2014). La comparaison de l'échantillonnage multispécifique et de l'échantillonnage de base fait apparaître que la composition par espèce des prises de faux poissons devrait être corrigée. Une méthode permettant d'estimer les fichiers de prises mensuelles par carré de 1° pour les thonidés majeurs et mineurs est proposée. L'analyse comparative de la prise par taille (CAS) estimée dans les données de base de la pêcherie et du marché des faux poissons permet de conclure que la CAS des faux poissons ne devrait pas être ajoutée à la CAS de base, car une grande partie des prises de faux poissons sont déjà incluses dans la CAS. Cette analyse fait apparaître plusieurs déficiences dans les statistiques sur les thonidés mineurs de la flottille de l'Union européenne et associée. Les données d'échantillonnage permettent d'estimer qu'en moyenne 6.000 tonnes de thonidés mineurs ont été vendues chaque année comme « faux poissons » par les senneurs de l'UE entre 1990 et 2005, tandis que seules 540 tonnes de thonidés mineurs ont été déclarées chaque année à l'ICCAT. Les prises de thonidés majeurs de la tâche I au cours de cette période ont été largement surestimées. Il conviendrait de réaliser des études statistiques approfondies à ce sujet.*

### RESUMEN

*Este documento realiza un análisis de los datos de desembarque de Abiyán de túnidos realizados por los cerqueros y vendidos como faux poisson (1990-2014)<sup>7</sup>. La comparación del muestreo básico y de varias especies indica que debería corregirse la composición por especies de las capturas de faux poisson. Se propone un método que permite estimar archivos de capturas mensuales por cuadrículas de 1 grado para los grandes y pequeños túnidos. Los análisis comparativos de captura por talla (CAS) realizados en los datos pesqueros básicos y en el mercado de faux poisson permiten concluir que la CAS de faux poisson no debería*

<sup>1</sup> TASK2 file : an ICCAT file containing yearly tuna catches split by month and by 1° squares

<sup>2</sup> Fonteneau Alain, retired IRD scientist

<sup>3</sup> Dewals Patrice, IRD scientist, Seychelles

<sup>4</sup> Alayon Pedro, IEO scientist, Tenerife, Spain

<sup>5</sup> “Faux Poissons”, a term describing the local market of tunas, billfishes and other by catch species that are sold in the local market of Cote d'Ivoire.

<sup>6</sup> Le terme « faux poissons » décrit le marché local des thonidés, des istiophoridés et d'autres espèces de prises accessoires vendus sur le marché local en Côte d'Ivoire.

<sup>7</sup> “Faux Poisson”, término que describe el comercio local de túnidos, marlines y otras especies de captura fortuita que se venden en el mercado local de Côte d'Ivoire.

*añadirse a la CAS básica, ya que una gran parte de las capturas de faux poisson ya están incluidas en la CAS. Este análisis muestra varias deficiencias en las estadísticas de pequeños túnidos de la flota UE y asociada. Los datos de muestreo permiten estimar que un promedio de 6.000 t de pequeños túnidos fueron vendidas anualmente como faux poisson por los cerqueros de la UE entre 1990 y 2005, mientras que solo 540 t de pequeños túnidos fueron declaradas anualmente a ICCAT. Los datos de captura de Tarea I de túnidos grandes en el periodo fueron ampliamente sobrestimados. Estas cuestiones deberían ser objeto de estudios estadísticos más detallados.*

#### KEYWORDS

*Catch, fish handling, multispecies fisheries, biological sampling, catch statistics, size distribution, Abidjan local market*

### 1. Introduction

Yearly catches of tunas and other by catch species landed by all the industrial fleets in the faux poissons market in Abidjan have been observed since the beginning of the early eighties (Bard et Amon Kothias 1985, Amon Kothias et al 1994, Hervé 1997, Romagny et al 2000, Chavance et al 2011). The level and trend of this component of the tuna fishery is for instance well shown by the yearly catches estimated by scientists and technicians since its beginning (**Figure 1**). Five species of tunas constitute the bulk of the tuna catches: 3 major tunas (yellowfin, skipjack and bigeye) and 2 minor tunas species (*Euthynnus* and frigate tuna) (wahoo being also landed, but in minor quantities and poorly sampled). These landings have been followed by scientists since the early eighties and a more comprehensive statistical follow up has been routinely conducted by CRO scientists since 2006 (Chavance et al 2011). This sampling allows now to estimate the species and size composition of most landings, in association with the date and name of each fishing vessel landing these tunas and then by flag.

However, these large catches of tunas have been seldom analysed by scientists in connexion with the basic fishery data (log books and multispecies sampling routinely done during the landings of most purse seiners). As the species composition of faux poissons landings appears to be somehow questionable, because of the major difficulties faced in this sampling, this work will examine if the species composition of the faux poissons landings is valid or not for major tunas (yellowfin and bigeye) and for the minor tunas (*Euthynnus* and frigate tuna catches). Furthermore, there was no attempt by scientists until today to create an estimated task 2 file of catch by 1° and month of these faux poissons tunas catches. As a consequence, these increasing tuna catches are now missing from the catch and effort data bases by 1° squares and month (task2) submitted yearly to the ICCAT secretariat. Subsequently, another goal of this paper is to propose a method allowing to estimate a task2 file by 1° and month of these faux poissons tuna catches (for major and minor tunas). This work will primarily target all the faux poissons landing by the EU and associated fleet of purse seiners (later called EU&al fleet), because this fleet has been permanently well followed and well sampled by scientists (Pedro Pascual Alayon 2016). Tuna landings by other fleets are also increasingly important, see **Figure 2**, especially during the last 10 years, for instance from Ghana, but these landings are more difficult to analyze in the absence of their multispecies sampling done during their landings in Abidjan and because their frequent landings from cargo freezers (These catches have not been covered by this study but they should also be carefully studied) . This paper will also target the analysis and comparison of the tuna sizes sampled in the basic sampling scheme and in the faux poissons market, this analysis being done in order to examine the validity of the working hypothesis adopted by SCRS in 2016, that the basic CAS and the CAS of Faux Poissons should be added in order to estimate the total CAS by the purse seine fisheries.

## 2. Data and method

This work is based on 3 main types of data:

1. the detailed file of the faux poissons monthly landings by flag in Abidjan during the 1982-2014 period that has been submitted to ICCAT and used to build the faux poissons component of the faux poissons entered in the ICCAT TASKI file<sup>8</sup> (these results being estimated by P. Chavance from IRD, based on the data provided by Cote d'Ivoire scientists). Our study solely used the Chavance detailed file. The 2015 and 2016 data were not available in this study because the faux poissons landing data in 2015 and 2016 have not yet been processed. This file also contains the size measurements done on these tunas sold as faux poissons. This analysis mainly covers the data collected since 2006, because the 1982-2005 landings were insufficiently sampled in term of their sizes and species composition.
2. the log book file of the EU&al purse seine fleet of all tuna landings in Abidjan, with the set by set information, and all tuna catches being estimated by fishing mode, by species and by size categories. These log book data have been corrected for their species composition by the TTT<sup>9</sup> software (creating the so called ECD file of the catch per set, by size categories and by corrected species)). The species composition of small yellowfin and bigeye in the multispecies samples and the species composition estimated in the faux poissons landings will also be compared in order to check the validity of the faux poissons species composition.
3. The multispecies sampling file covering all the landings of the EU&al purse seiners in Abidjan (the so called NN.T file), a file containing size data of all the major and the minor tunas available during the sampling by scientists targeting the species composition and sizes of major tunas.

The total catches of major and of minor tunas sold as faux poissons are considered to be valid ones, but the species composition of these catches will be compared and potentially corrected, based on the results of the multispecies sampling. A new species composition of small tunas will be obtained by the SMS model proposed by Fonteneau and al 2016, this new species composition being estimated by 1° square and month, based on the species composition of the sampled catches at small geographical and temporal scales. A tentative TASK2 file of the 1° squares monthly catches will be created by an ad hoc method (called T3faux poissons), simply assuming that all the faux poissons catches have been solely taken by the FAD fishery. This hypothesis was based on the sampling data that are showing that a great majority of the tunas caught at small sizes were taken by FAD sets: an average of 95 % of FAD catches vs only 5% from free schools catches for major tunas smaller than 46 cm. For the major tunas catches, this faux poissons TASK2 file was created assuming that the monthly faux poissons landings of each category of the EU&al fleet (France, Spain and associated flags) were caught in the same 1° squares as the FAD catches, and in proportion of the relative amount of faux poissons catches. As an example: if during 1 month a total catch of 1000 tons of FAD caught tropical tunas have been sold by a given flag to the canneries, and if during the same month this fleet has been selling 100 tons of major tunas on the faux poissons market, the task2 of the 1° fishing zones of these monthly catches will be identical to the FAD catches, but at level of 10% of these FAD catches sold to the canneries. For minor tunas (*Euthynnus* and frigate tuna) the 1° month catches of each species, *Euthynnus* and frigate tuna, was estimated by the SMS method (Fonteneau et al 2016), based on the species composition estimated in the multispecies samples in the small mobile strata (mobile 5°-3 months scale used by the SMS model). These estimated catches were later extrapolated to the total amount of minor tunas sold as faux poissons (keeping in mind that part of the small tuna catches are not visible in the multispecies samples, some of these faux poissons tunas being sorted before their sampling by scientists) (**Figure 3**). The major assumption of this method is that the minor tunas catches that are sampled in the multispecies sampling are representative of the geographical distribution of the catches and indirectly that the sorting rate between the wells and the multispecies sampling is not biased (for instance not selecting *Euthynnus* vs *Auxis*). These 2 factors will be examined and discussed. Total catch at size of tunas sold as faux poissons are estimated for each tuna species, simply extrapolating the sampled sizes to the amount of tunas sold as faux poissons obtained in our estimated catches. These faux poissons CAS will be compared to the today CAS of tunas submitted to the ICCAT by the EU scientists that are corresponding to the tunas sold to canneries.

---

<sup>8</sup> It should be noticed that there are significant discrepancies between the yearly catches by flag and by species in the ICCAT Faux Poissons TASK1 file and in our FP file provided by Chavance. The causes of these discrepancies should be understood.

<sup>9</sup> TTT: "Traitements des Thonidés Tropicaux", or data processing of tropical tunas.

### 3. Results

#### 3.1 Catch by species of major tunas

The TASK1 file corresponding to the faux poissons landings in Abidjan has been estimated for each fleet (Spanish, French and associated flags). Catches of major tunas (yellowfin, skipjack and bigeye) were estimated combining faux poissons data and the species composition of FAD sampled catches, while the species composition of minor tunas (*Euthynnus* and frigate tuna) catches was solely estimated by the SMS method (Fonteneau and al 2016). The species composition in the faux poissons data and in our results are showing some divergencies. Yearly bigeye catches have been most often estimated for all fleets at a lower level than the yellowfin catches in the faux poissons market (showing an average of 62% of yellowfin vs 38% of bigeye), while in the samples and in the corrected log books the yearly catches of the 2 species were nearly equivalent (showing an average of 51% of yellowfin vs 49% of bigeye). These differences between the faux poissons bigeye catches have been observed since 2009, see **Figure 4**. This uncertainty in the bigeye/yellowfin catches could be considered as being a quite minor problem because of the quite limited quantities of tunas involved, but it may also be an increasing problem and this statistical question should be clarified. It has been estimated that the our species composition based on sampling data was more realistic, being based on strong scientific bases, while the species composition of faux poissons remains very difficult to estimate and potentially biased, for instance because of the great difficulties to recognize the very small bigeye (because of their poor condition) and because of the complex and variable handling methods used in these faux poissons landings. These results (see table 1) are showing that catches of major tunas (yellowfin, skipjack and bigeye) have been sold each year in significant quantities on the faux poissons market by the EU&al purse seiners, the average yearly catches of major tunas during the 2006-2014 being estimated at 6590 tons (820 t. of yellowfin, 5000 t. of skipjack and 770 t. of bigeye). These catches are significant, and they correspond to an average 4.3% of the FAD catches by the EU&al purse seine fleet during the period.

#### 3.2 Catch by species of minor tunas

Catches of minor tunas (*Euthynnus* and frigate tuna) have been also sold each year in significant quantities on the faux poissons market, the average yearly catches during the 2006-2014 being estimated at 4810 tons (see **Table 1**). *Euthynnus* and frigate tuna catches have been estimated each year and for all fleets at similar levels in the today statistics of the faux poissons market (showing an average of 53% of *Euthynnus* vs 47 % of frigate tuna), while in the samples and in the SMS results the yearly catches of frigate tunas are most often widely dominant in weight at the yearly scale (showing an average of only 33% of *Euthynnus* vs 67 % of frigate tuna) (see **Figure 5**). It has been estimated that our species composition based on sampling data was more realistic, being based on strong scientific bases. Total average catches of minor tunas by the EU&al purse seine fleet were estimated at 1580 t. of *Euthynnus* and 3230 t. of frigate tuna. These catches are very significant, as they correspond to 10 % and 32% of the total catches in the Atlantic of these 2 species, as they have been declared to the ICCAT during the period.

#### 3.3 TASK2 file of faux poissons catches<sup>10</sup>

The TASK2 of faux poissons catches by 1°, month and flag corresponding to the faux poissons landings in Abidjan has been created using: (1) for the major tunas, the TASK2 data corresponding to the FAD fishery landings in Abidjan, and (2) for minor tunas, the results of the SMS method. These results allow to estimate for each fleet (Spanish, French and associated flags) and in each 1°-month strata, the catches of major tunas (yellowfin, skipjack and bigeye) and of minor tunas (*Euthynnus* and frigate tuna). The species composition kept for these monthly catches of major tunas and of minor tunas was the species composition estimated from the multispecies sampling and the SMS results, and not the species composition of these 2 groups as estimated in the today faux poissons statistics. This TASK2 file allows to estimate the geographical distribution by 1° squares of the faux poissons catches. This basic result is for instance summarized by average fishing maps showing the EU&al purse seiners faux poissons catches during the 2006-2014 period, for major tunas (**Figure 6**) and for minor tunas (**Figure 7**). The yearly catches of major and of minor tunas corresponding to these maps are shown by **Figures 8a** and **8b**. These TASK2 files could also be built for the period 1991-2005, but this work would need to estimate the amount of minor and of minor tunas sold in the Faux Poisson market during this period; this question is discussed in paragraph 3-7. This T3FP method has been built only as a feasibility test. In the long run, all the TASK2 files of the FP landings, catches and sizes, should routinely be created by the basic statistical software TTT used to create these files. This extension of the today software should be quite simple to develop, for instance following these rules:

---

<sup>10</sup> These TASK2 files of the FP minor and major tunas are of course available under request

- 1) use in the data processing small areas that are consistent with the amount of minor tunas species caught by time and area strata,
- 2) creating an independent statistical files (as in the TASK1 file) corresponding to these TTT landings,
- 3) doing the correction of species composition of minor tunas catches in the same way as in the TTT software for yellowfin, skipjack and bigeye (while today minor tunas are not involved in the correction of the species composition); an *ad hoc* method such our T3FP program could also be used.
- 4) adding in the TTT software the table of the Faux Poissons landings of all the trips and vessels. This table would allow to extrapolate the log books catches to the levels of these landings and to create the task2 file corresponding to each trip.

### **3.4 Major tunas: CAS in the faux poissons market and global CAS of each species**

The average sizes and average weight of major tunas sold in the faux poissons market have been well sampled since 2006, this sampling being done in the port of Abidjan, but well after the landing operation. Large numbers of size samples have been conducted on this category of faux poissons tunas: an average 25150 tunas have been sampled yearly in this faux poissons market (while much larger numbers, 336.000 tunas, were measured yearly during the basic multispecies sampling scheme during the landing process). These sampled sizes obtained during the period 2006-2014 can easily be extrapolated for each species to the average yearly catches of each species estimated on the faux poissons market (see **Figures 9 and 10**). These catches are most often showing small sizes and small average weight: during the 2006-2014 period, an average weight of 1.2 kg for yellowfin, 1.4 kg for skipjack and 1.3 kg for bigeye estimated during the 2006-2014 period. As a consequence, the average numbers of yellowfin and bigeye tunas landed by the EU&al purse seiners on the faux poissons market are quite important: average yearly numbers close to 1 million individuals of yellowfin and of bigeye during the 2006-2014 period. These faux poissons catches correspond to about 25% of the numbers of yellowfin and of bigeye declared in the today FAD CAS in the EU&al purse seiners landings. On the other side, the total catch at size of yellowfin, skipjack and bigeye caught by the UE&al purse seiners has been permanently estimated by scientists and submitted to the ICCAT secretariat. These CAS were based on the results of the multispecies sampling done on selected wells during the landings of most purse seiners. In theory, these CAS solely cover the sizes of tunas sold at the canneries, that have been declared in the TASK1 and TASK2 statistics, independently of the faux poissons statistics. However, it should be noticed that these CAS of the ‘canneries tunas’ submitted to ICCAT are showing for each of the 3 tropical tunas significant quantities of very small tunas, for instance at sizes under 1 or 1.2 kg that are in fact very seldom or never processed by the canneries because of their too small sizes. The faux poissons CAS can be compared to the CAS obtained from the multispecies sampling, see **Figures 11, 12 and 13**: this comparison is showing that the numbers of very small tunas are similar in the 2 files. These results are probably indicative that a large part of the faux poissons catches have been already sampled in the multispecies sampling, these catches being already included in the basic CAS file submitted to the ICCAT. In this hypothesis the faux poissons CAS should not be added to the regular CAS (as it was done in the 2016 yellowfin stock assessment), but the total catches and CAS of the FAD fishery should be extrapolated to the total catches of each fleet. This question would need further studies.

### **3.5 Sizes of minor tunas in the faux poissons market**

Small tunas sold in the faux poissons market have been well sampled at 2 distinct stages: first in the basic multispecies sampling (since 1991) and subsequently in the *ad hoc* size measurements done in the port of Abidjan in the faux poissons tunas. The average numbers at size of tunas measured in these 2 successive sampling are shown by **Figures 14 and 15**. Size distributions are very similar in the 2 sampling schemes, and the numbers of fishes measured are more important in the basic multispecies sampling (where the origin of the tunas, fishing dates and locations are also well identified based on the log books data and on the well maps). It should be considered that sizes of minor tunas obtained during the multispecies sampling should preferably be used in future scientific studies. Concerning the tuna sizes sold on the faux poissons market, it can be noticed that skipjack and *Auxis* are showing similar small sizes (average weight close to 1 kg, the sizes of *Euthynnus* tend to be a bit larger, showing an average weight 1.25kg) (**Figure 10**).

### **3.6 Faux poissons TASK2 and tunas catches in EEZ**

The proposed TASK2 estimated for the faux poissons catches of the EU&al purse seine fleet is showing that significant quantities of major and of minor tunas have been caught each year in the EEZ of various coastal countries, in addition to the tunas official catches sold to the canneries that are solely used to calculate the financial compensation for tunas caught in EEZ. These catches caught by the EU&al purse seine fleet, in the west African EEZ, that can be estimated at an average yearly level of about 6000 tons, have not been declared to the coastal countries because these faux poissons catches were not incorporated in the today TASK2 files.

### 3.7 Species composition of Faux Poissons catches during the period 1990-2005?

The landings of minor tunas in Abidjan can be estimated by species at least since 1990 based on the results of the multispecies sampling because large amounts of major and minor tunas have been randomly sampled daily in Abidjan since the early nineties. These size data of minor tunas were not used in the yearly data processing of the EU&al purse seiners because these catches were rarely identified in the log books, and never in the commercial landing data based on tunas bought by canneries. These estimated catches of minor tunas also allows to estimate the catches of major tunas in the 1990-2005 period, simply based on the difference between total tuna catches and catches of minor tunas. A first attempt to estimate the yearly landings of major tunas during this period was conducted under the following working hypothesis:

- 1) Total yearly catches of tunas landed as faux poissons by the French and Spanish purse seiners was kept
- 2) It was assumed that the multispecies sampling during the period was perfectly random, and that the sampled weight of minor tunas was corresponding entirely to the amount of minor tunas sold in the Faux Poissons market.
- 3) The yearly amounts of major tunas sold as Faux Poissons was estimated based on the weight of tunas smaller than 40 cm or 1.2 kg (the modal sizes observed today in the faux poissons market for the 3 species of major tunas), and this weight of very small tunas was later multiplied by a factor of 2 (based on the normal size distributions observed in recent years). This approximation is assuming that the size patterns observed in the faux poissons major tunas was stable and permanently observed during the 1990-2006 period.

The yearly catches of major and of major tunas estimated by this method are shown by **Figure 16**. These estimated yearly catches can be compared to the yearly catches by species in the ICCAT TASKI that are shown by **Figure 17**. **Figure 18** is showing lower average catches of major tunas during the period: about 5000 tons vs 10000 t. in the ICCAT TASKI, and also showing a variable species composition of these yearly catches. The average weight of each species was estimated by this method at 20% of YFT, 69 % of SKJ and 13% of BET, then at levels that are similar to the ICCAT TASKI. This first attempt to estimate catches by species during the 1990-2005 period remains provisional and widely questionable. However, it should also be concluded that these estimated catches that are based on very strong random sampling data are probably already more realistic than the today working hypothesis used by ICCAT in its Faux Poissons TASK1 that there was no minor tunas in the 1982-2004 faux poissons landings and that the species composition of major tunas catches was constant each year during the 1982-2005 period (15% YFT, 76% SKJ and 10% BET)

An in depth analytical work and statistical studies of these data, based on the field knowledge of the faux poissons landings and of the multispecies sampling process, would be needed to solve these important historical problems in the ICCAT statistics of the FAD associated catches of tropical tunas and their CAS.

### 3.8 Sorting rates of minor tunas in the Abidjan faux poissons market

Tunas that are sold to the faux poissons Abidjan market, can be sorted at various stages, these potential selection of the faux poissons tunas have been tentatively summarized by **Figure 3**. The sorting rates at each stage of the landing process remain unknown, but our analysis allows to estimate the sorting rates of small tunas that have been occurring on board the purse seiners during the landing operations and before the multispecies sampling. This rate was estimated in 2 steps and as following:

- (1) The yearly average tonnages of minor tunas sampled in Abidjan (*Euthynnus* and frigate tuna) on the EU&al purse seiners catches that have been estimated during the multispecies sampling and by the SMS method (Fonteneau and al 2016) (period 2006-2014) have been estimated at 2960 t.
- (2) While the yearly average weight of these minor tunas estimated at the output of the Abidjan harbour sold as faux poissons by the sampling scheme targeting faux poissons has been estimated at a higher level of 4810 tons (same period).

Based on the ratio of these average 2 values, it can then be estimated that **36%** of the minor tunas have been sorted by stevedores before the multispecies sampling done by scientists on board the purse seiners, and then that 64% of these tunas have been routinely sampled in the basic sampling scheme. This estimated rate is only a first approximation that would need to be confirmed by additional calculations and by direct observations in the landing field. It should further be noted (**Figures 14** and **15**) that the sorting rates of minor tunas does not select

peculiar sizes, as the sizes sampled on the purse seiners and in the port of Abidjan were very similar. The amount of minor tunas that are transferred to freezer and exported to other countries remain unknown in the today statistics of Faux Poissons.

#### 4. Discussion on the FP landings and the today statistics

There is no doubt that the faux poissons catches have been quite poorly incorporated in the ICCAT statistics of TASK1 and TASK2. These problems are for instance highly visible for minor tunas, simply comparing various indicators of their catches by the EU purse seine fisheries since 1990:

- the yearly amounts of minor tunas sampled in the EU purse seiners catches since 1990 were permanently high: between 5 and 10% of the tunas measured, as shown by the yearly percentages of minor tunas in the multispecies samples of the FAD catches, (**Figure 18**), reaching average yearly catches of minor tunas of **4000 tons** (24% of LTA and 76% of FRI). It should also be kept in mind that these sampled catches are underestimating the real landings, because part of the minor tunas catches were sorted before their sampling (cf parag. 4-7). Based on the sorting estimated in the 2006-2014 period, an average catch of **6400 tons** of minor tunas was landed yearly by the EU purse seiner fleet during the 1991-2005 period.
- the yearly catches of tunas landed by the EU fleet on the Faux Poisson market during the same period was also high during this period (**Figure 19**), minor tunas being probably a major component of these total catches (as today: nearly 50% of tunas sold by the EU fleet as faux poissons). As a result, the yearly catches of faux poissons by species estimated by this work (**Figure 20**), is quite distinct from the original species composition of the Faux Poissons landings by Chavance (**Figure 21**)
- on the other side, the ICCAT TASK1 file is showing for this fleet before 2006 very low level of minor tunas catches; an average of only 540 t. There is then a clear anomaly in the EU statistics. The large catches of minor tunas sampled daily by scientists since 1990 should have been well estimated by species, based on the results of the multispecies sampling, and these catches should have been declared yearly to the ICCAT at least in the TASK1 and preferably also in the TASK2. This was not the case.
- Another anomaly should be noted comparing yearly catches of minor tunas in the TASK1 and TASK2 files of the EU purse seiners; while the TASK2 file is showing the same very low levels of catches between 1990 and 2006, the yearly catches of minor tunas since 2006 are much lower in the TASK2 file than in the TASK1 (while in theory, yearly catches in the TASK1 and TASK2 files should be identical in the results of the EU data processing).

The heterogeneity of these data sets during the studied period are clearly indicative of statistical problems in the faux poissons statistics that are due to a combination of various reasons, several of them being identified in this paper. There is now a need to fully recognize these problems and to correct all the historical Faux Poissons catch statistics (that are predominantly FAD catches), in order to optimize the past and future data processing of all the tuna species (minor and major tunas). These revised statistics should also ensure that the catches are well taking into account the faux poissons landing data (that have never been used in the past data processing of the EU TASK2). Minor tunas statistics should be widely based on the multispecies sampling done on the purse seiners, that have never been used in the data processing of the minor tunas catches.

#### 5. Conclusion and recommendation

This preliminary study of the faux poissons landings has been reaching the following conclusion and recommendation:

- (1) Total yearly catches of tunas sold in the local markets should be estimated and declared yearly with a high priority to the ICCAT by each CPC landing these catches, (as for the TASK1 obligation of tunas sold to canneries). Carry over of the yearly catches should never be done routinely in the TASK1 data for these important faux poissons tuna catches.

- (2) Independent TASK2 file estimating the corresponding catches by 1° and month should be usefully built by concerned scientists for their faux poissons catches, for instance following the simple rules proposed in this paper. This task2 file should cover both minor and major tuna catches. These results would of course remain quite uncertain and independent of the basic TASK2 files (as for TASK1). At least this TASK2 file would constitute a serious improvement compared to the today “*statistical black hole*” where these the faux poissons catches have been abandoned. These results could for instance be used to estimate more realistic financial compensation in the fishing agreements and they should also be fully declared to ICCAT and taken into account in the ICCAT budget. They would also provide valuable scientific information on the seasonal geographical distribution of small size tunas, for major and minor tuna species. These TASK2 files of the Faux Poissons landings should be built by a new version of the TTT software used by Spanish and French scientists and this new version should be developed as soon as possible
- (3) These task2 files should contain the 5 species of major and of minor tunas, the yearly total of these catches corresponding to the total amount of tunas sold in the faux poissons market; the species composition of this file should be corrected as well as possible based on sampling data, at least without landings of “unknown tuna species” and with a realistic scientific balance between quantities of yellowfin and bigeye and between Euthynnus and frigate tuna. Further studies should be developed in order to better estimate the relative amount of each species in the faux poissons landings and the uncertainties in this result.
- (4) The species composition of the faux poissons tuna catches during the period 1990-2005 should be carefully estimated for minor and for major tunas, based on sampling data, and the today ICCAT TASK1 data of this period should be subsequently corrected.
- (5) Our analysis provides first estimates of the sorting flow of tunas occurring before the multispecies sampling done on board the purse seiners, but the other types of sorting flow remain quantitatively unknown. These tuna flows between the fishing vessels and the various tuna markets should be better estimated by scientists, for instance based on *ad hoc* scientific observations. A special effort should target to estimate the amount of minor tunas that are exported by freezers and never sampled.
- (6) The total catch at size of yellowfin, skipjack and bigeye landed by the purse seine fisheries that have been estimated in 2016 by the ICCAT secretariat and later used in the yellowfin stock assessment analysis appears to be somehow questionable. It appears that the CAS of faux poissons should not simply be added to the basic CAS declared by the purse seine fishery (as it was done for yellowfin in 2016) because these today CAS already contain a majority of the tuna catches sold as faux poissons. This question would need further careful studies, taking note that it is an important problem because of the very large numbers of yellowfin and bigeye tunas sold as faux poissons in the local market of Abidjan.

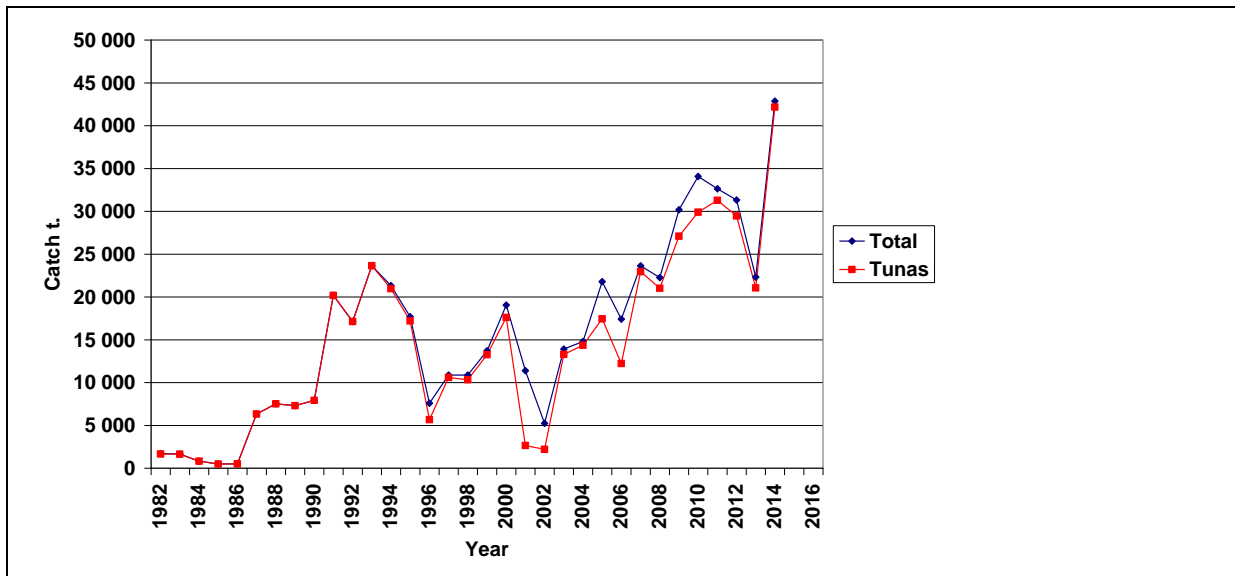


## References

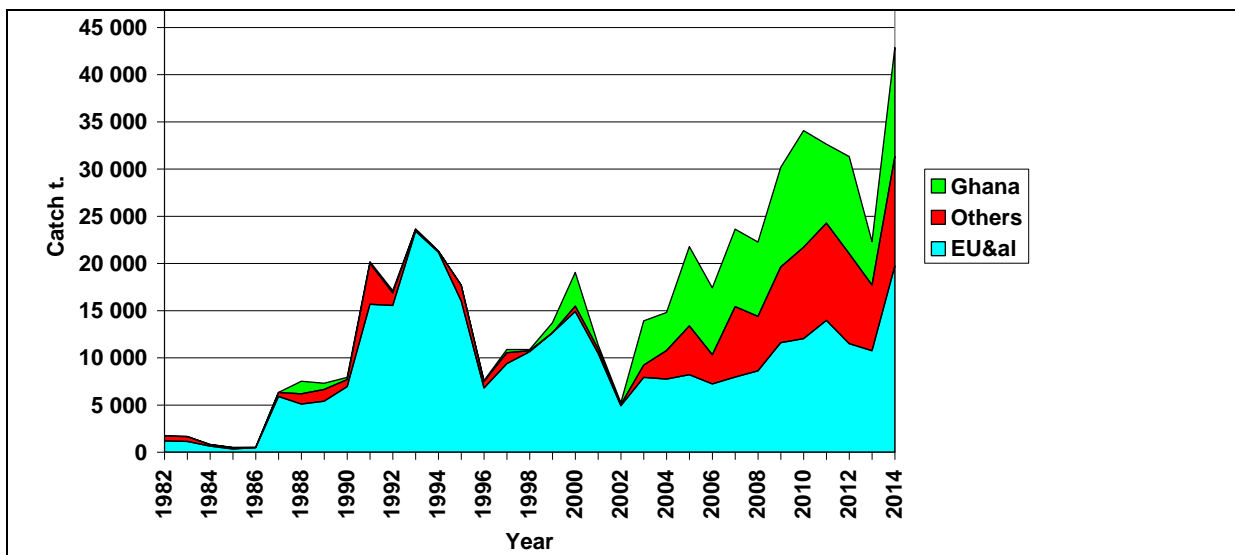
- Alayón P. Pascual, L. Floch, P. Dewals, D. Irié, A.H. Amatcha, M-J Amandè and E. Chassot. 2016. Statistics of the European and associated purse seiner fishing fleet in the Atlantic Ocean (1991-2015) Doc ICCAT SCRS/2016/177
- Amon Kothias, J.B., Hervé, A., Bard, F.X. 1994, Update of quantities of minor tunas and small tunas landed as market fish in Abidjan. Collect. Vol. Sci. Pap. ICCAT, 42(2): 337-380.
- Bard, F.X. et Amon Kothias, J.B. 1985, Evaluation des débarquements de thonidés mineurs et istiophoridés au port d'Abidjan - 1981-1984. Collect. Vol. Sci. Pap. ICCAT, 23(2): 333-336.
- Chavance P., J. B. Amon Kothias, P. Dewals, R. Pianet, Monin-Justin Amandè, A. Delgado de Molina and A. Djoh. 2011 Statistics on tuna surface fisheries by catch landed in Abidjan, Cote d'Ivoire, for the 1982-2009 period. Collect. Vol. Sci. Pap. ICCAT, 66(5): pp 2104-2112
- Fonteneau A., P. J. P. Alayón and E. Chassot 2016. From large fixed to small mobile spatio-temporal strata: Improving estimates of species and size composition of the landings of the European purse seine fishery in the Atlantic Ocean. Doc. ICCAT SCRS/2016/182, 24p.
- Hervé, A. 1997, Mise à jour des quantités de « faux poissons » débarquées par les senneurs à Abidjan. Doc. Interne Centre Recherches Océanologiques, Abidjan.
- Romagny, B., Ménard, F., Dewals, P., Gaertner, D., N'Goran, N. 2000, Le "faux-poisson" d'Abidjan et la pêche sous DCP dérivants dans l'Atlantique tropical Est : circuit de commercialisation et rôle socio-économique. In: Le Gall J.Y. (ed.), Cayré Patrice (ed.), Taquet M. (ed.). Pêche thonière et dispositifs de concentration de poissons. Plouzané : IFREMER, 2000, p. 634-652.

**Table 1.** Yearly landings in Abidjan of tunas sold as faux poissons by the EU&al purse seine fleet, by fleet, as estimated in the present work

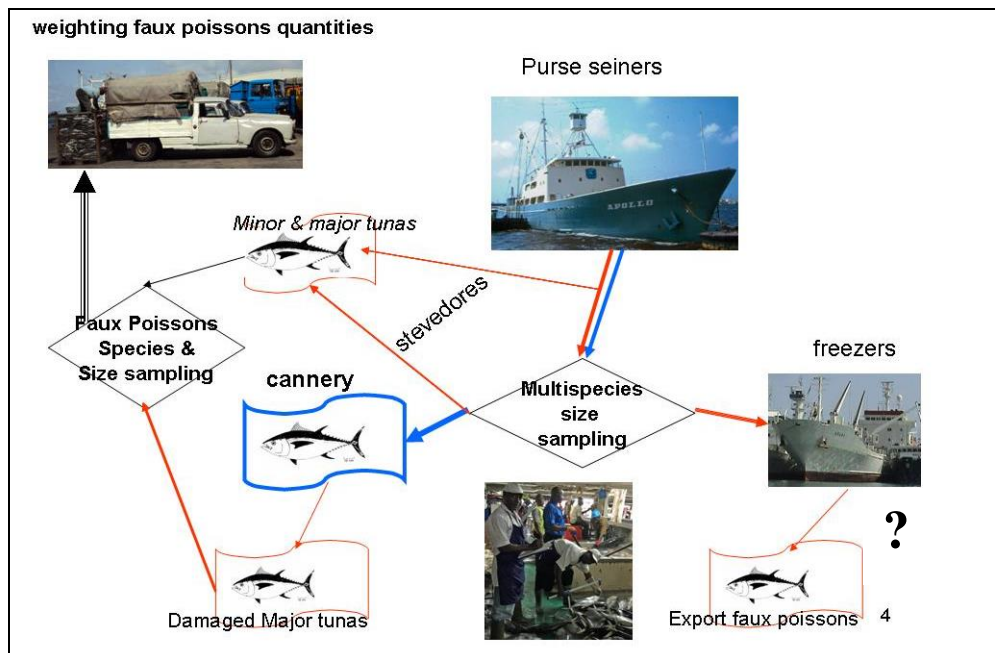
Country	Year	YFT	SKJ	BET	Total Majc	LTA	FRI	Total minc	Total tunas
France	2 006	230	913	150	1 293	149	616	765	2 057
France	2 007	94	498	53	645	132	287	420	1 065
France	2 008	87	418	59	564	111	216	327	892
France	2 009	207	1 230	184	1 620	143	391	534	2 154
France	2 010	195	879	162	1 237	539	881	1 420	2 656
France	2 011	317	1 751	539	2 607	717	1 032	1 750	4 356
France	2 012	411	1 978	246	2 635	838	1 568	2 406	5 041
France	2 013	139	662	126	926	496	1 211	1 708	2 634
France	2 014	158	711	118	987	298	584	882	1 872
Spain	2 006	226	718	109	1 053	72	427	499	1 552
Spain	2 007	149	858	101	1 107	198	472	670	1 777
Spain	2 008	322	1 425	238	1 985	658	1 198	1 856	3 841
Spain	2 009	282	2 289	325	2 897	677	1 436	2 112	5 009
Spain	2 010	317	1 649	359	2 325	718	1 615	2 333	4 657
Spain	2 011	257	2 301	460	3 018	800	1 502	2 302	5 320
Spain	2 012	152	1 340	172	1 664	392	1 083	1 475	3 139
Spain	2 013	114	1 309	186	1 609	343	1 011	1 354	2 962
Spain	2 014	445	2 886	413	3 744	759	1 370	2 129	5 873
Mixed associated flags	2 006	381	1 590	238	2 209	336	1 141	1 478	3 687
Mixed associated flags	2 007	441	2 210	299	2 951	744	1 373	2 117	5 068
Mixed associated flags	2 008	228	1 498	224	1 950	545	1 148	1 692	3 642
Mixed associated flags	2 009	384	2 777	416	3 577	754	1 515	2 269	5 846
Mixed associated flags	2 010	317	2 385	453	3 154	721	1 655	2 376	5 529
Mixed associated flags	2 011	273	2 364	394	3 031	553	1 190	1 743	4 773
Mixed associated flags	2 012	277	1 956	244	2 477	948	1 395	2 343	4 820
Mixed associated flags	2 013	271	2 634	378	3 282	671	1 526	2 197	5 479
Mixed associated flags	2 014	692	3 803	308	4 802	881	1 242	2 123	6 925
<b>EU&amp;al</b>	<b>2 006</b>	<b>837</b>	<b>3 221</b>	<b>497</b>	<b>4 555</b>	<b>558</b>	<b>2 184</b>	<b>2 741</b>	<b>7 296</b>
<b>EU&amp;al</b>	<b>2 007</b>	<b>684</b>	<b>3 566</b>	<b>453</b>	<b>4 703</b>	<b>1 074</b>	<b>2 132</b>	<b>3 206</b>	<b>7 910</b>
<b>EU&amp;al</b>	<b>2 008</b>	<b>638</b>	<b>3 340</b>	<b>521</b>	<b>4 500</b>	<b>1 314</b>	<b>2 562</b>	<b>3 875</b>	<b>8 375</b>
<b>EU&amp;al</b>	<b>2 009</b>	<b>873</b>	<b>6 296</b>	<b>925</b>	<b>8 094</b>	<b>1 574</b>	<b>3 341</b>	<b>4 915</b>	<b>13 009</b>
<b>EU&amp;al</b>	<b>2 010</b>	<b>829</b>	<b>4 912</b>	<b>974</b>	<b>6 715</b>	<b>1 977</b>	<b>4 151</b>	<b>6 128</b>	<b>12 843</b>
<b>EU&amp;al</b>	<b>2 011</b>	<b>847</b>	<b>6 416</b>	<b>1 392</b>	<b>8 655</b>	<b>2 069</b>	<b>3 725</b>	<b>5 794</b>	<b>14 449</b>
<b>EU&amp;al</b>	<b>2 012</b>	<b>840</b>	<b>5 274</b>	<b>661</b>	<b>6 775</b>	<b>2 178</b>	<b>4 046</b>	<b>6 224</b>	<b>12 999</b>
<b>EU&amp;al</b>	<b>2 013</b>	<b>524</b>	<b>4 604</b>	<b>689</b>	<b>5 817</b>	<b>1 510</b>	<b>3 748</b>	<b>5 258</b>	<b>11 075</b>
<b>EU&amp;al</b>	<b>2 014</b>	<b>1 294</b>	<b>7 400</b>	<b>839</b>	<b>9 533</b>	<b>1 938</b>	<b>3 196</b>	<b>5 135</b>	<b>14 670</b>



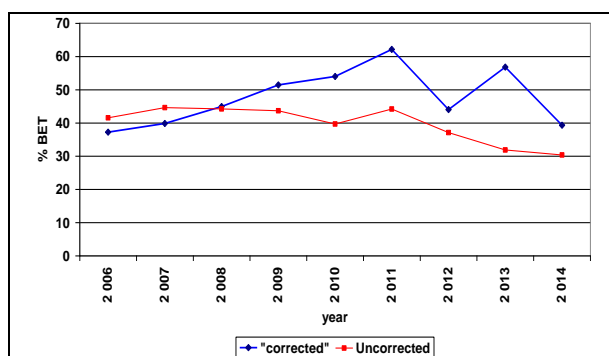
**Figure 1.** Yearly landings (tunas and total) in the Faux Poissons Abidjan market estimated by CRO scientists since its beginning in 1982



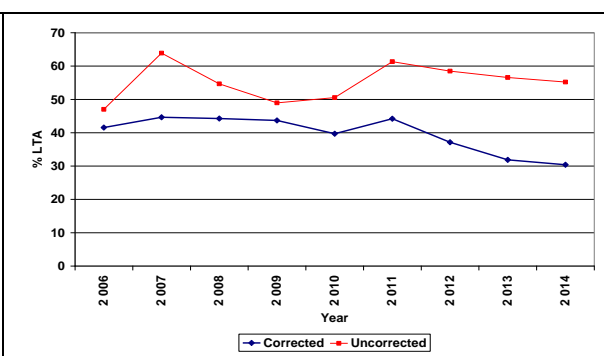
**Figure 2.** Yearly tuna landings by fishery in the Faux Poissons Abidjan market, estimated by CRO scientists.



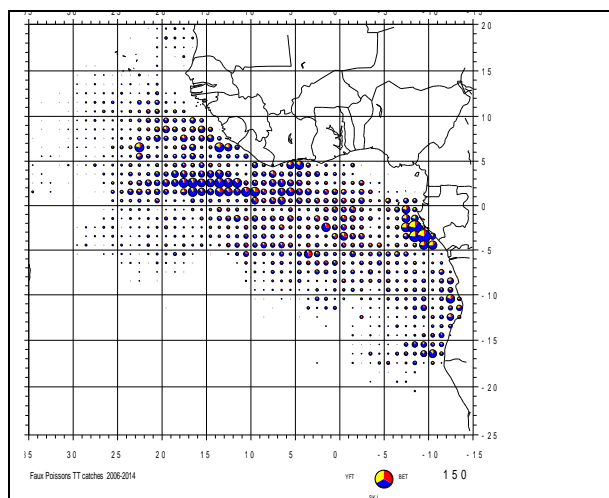
**Figure 3.** Landing scheme and sorting steps of the tuna landings and their various stages of sorting tunas between purse seiners, the canneries and the faux poissons market.



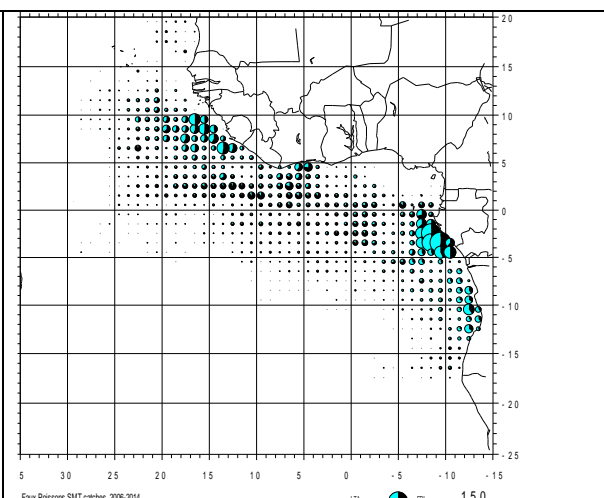
**Figure 4.** Yearly percentages of bigeye in the yellowfin+bigeye catches by the EU&al purse seiners, in the faux poissons statistics and corrected for species composition.



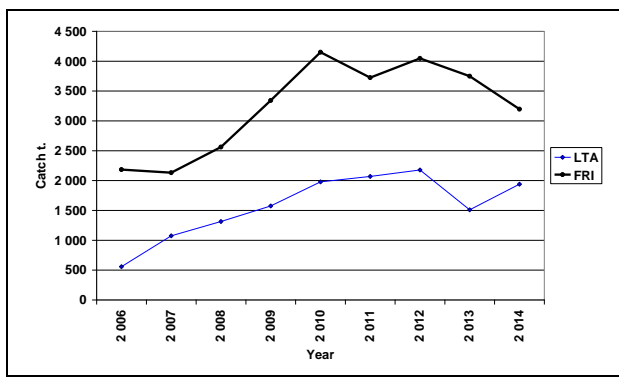
**Figure 5.** Yearly percentages of Euthynnus in the catches of minor tunas by the EU&al purse seiners, in the faux poissons statistics and corrected for species composition.



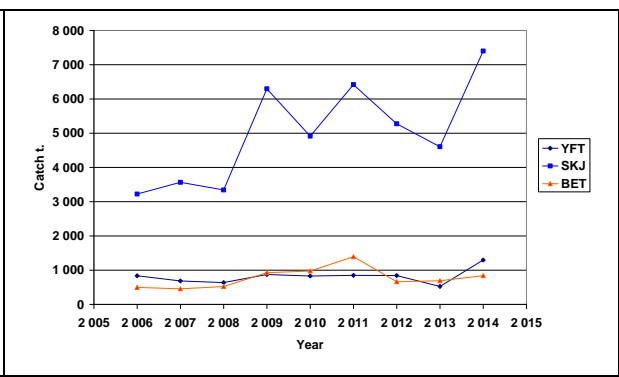
**Figure 6.** Average catches by 1° square of major tunas sold as faux poissons, estimated for the EU&al purse seine fleet during the 2006-2014 period



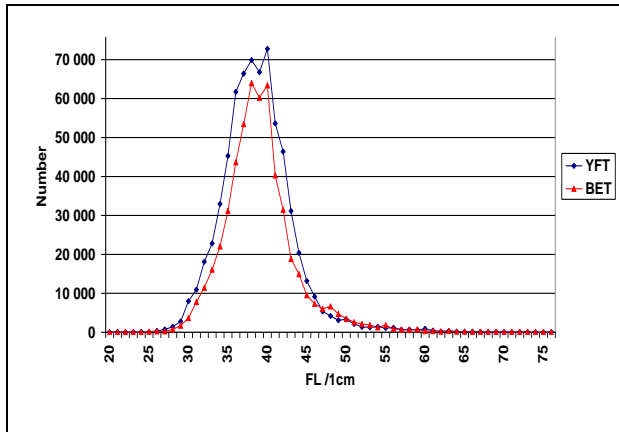
**Figure 7.** Average catches by 1° square of minor tunas sold as faux poissons, estimated for the EU&al purse seine fleet during the 2006-2014 period



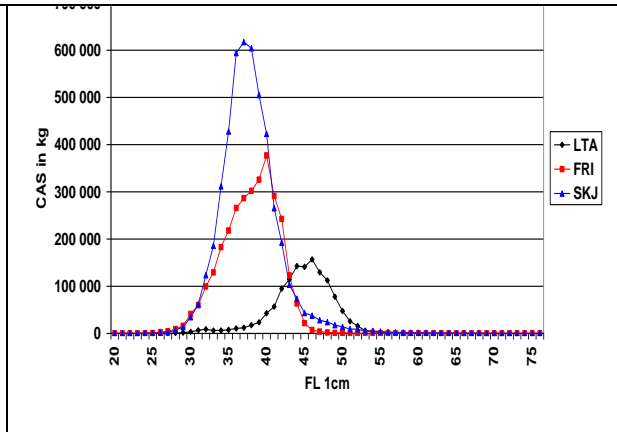
**Figure 8a.** Yearly landings of small tunas estimated by species for the EU&al purse seine fleet during the 2006-2014 period (SMS method)



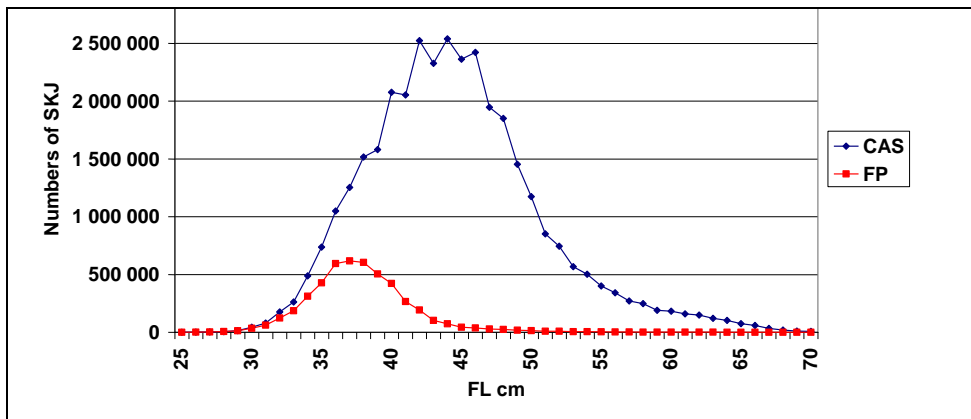
**Figure 8b.** Yearly landings of major tunas estimated by species for the EU&al purse seine fleet during the 2006-2014 period



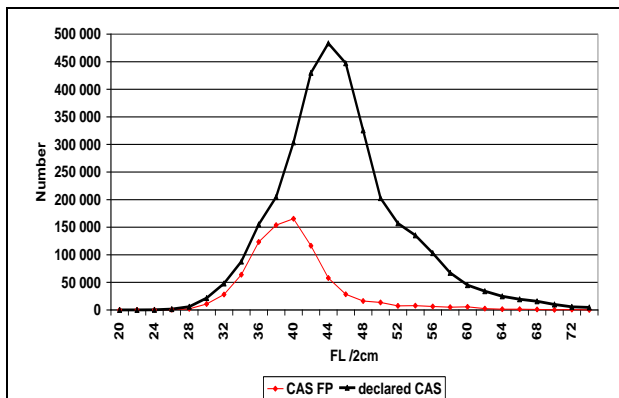
**Figure 9.** Average CAS (in numbers) of yellowfin and bigeye by 1 cm class estimated in the faux poissons market during the average period 2006-2014



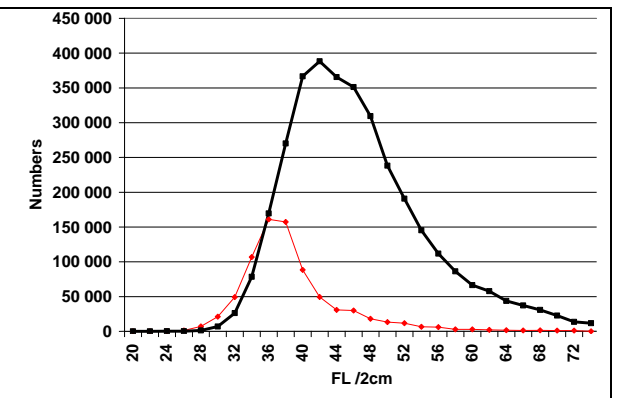
**Figure 10.** Average CAS (in numbers) of skipjack, Euthynnus and frigate tuna, by 1 cm class, estimated in the faux poissons market during the average period 2006-2014



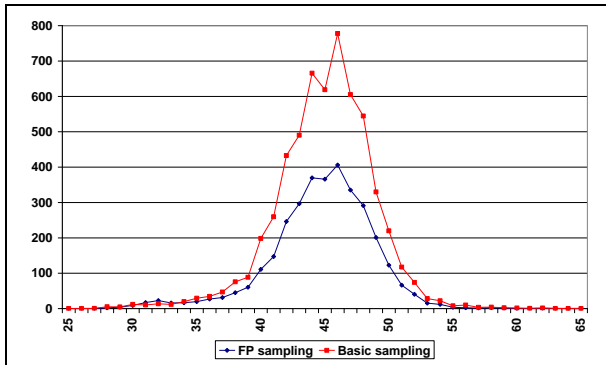
**Figure 11.** Numbers of skipjack caught yearly by 1 cm of fork length by the EU&al PS fleet, average 2006-2014: in the EU&al CAS and estimated in the faux poissons market



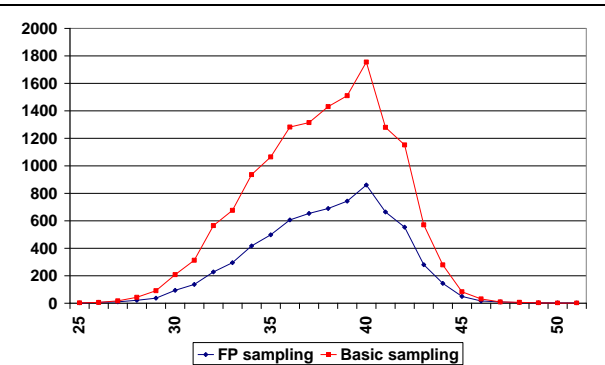
**Figure 12.** Numbers of yellowfin caught yearly by 1 cm of fork length by the EU&al purse seine fleet, average 2006-2014: in the EU&al CAS and estimated in the faux poissons market



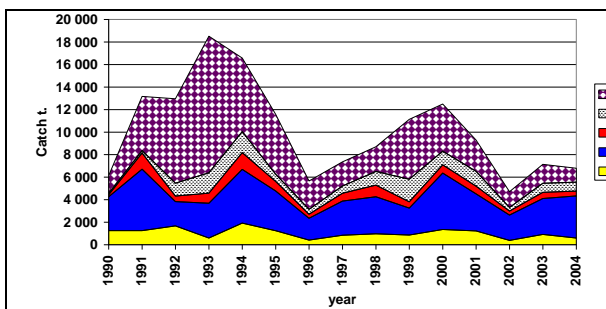
**Figure 13.** Numbers of bigeye caught yearly by 1 cm of fork length by the EU&al purse seine fleet, average 2006-2014: in the EU&al CAS and estimated in the faux poissons market



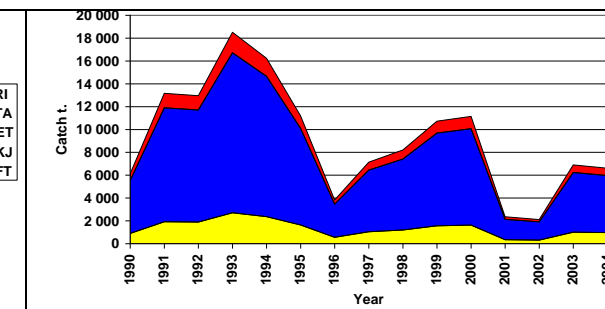
**Figure 14.** Average numbers of Euthynnus measured yearly in the basic multispecies sampling and in the Faux Poissons size sampling



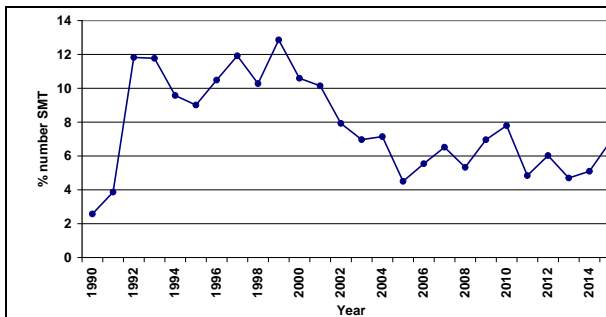
**Figure 15.** Average numbers of frigate tuna measured yearly in the basic multispecies sampling and in the Faux Poissons size sampling



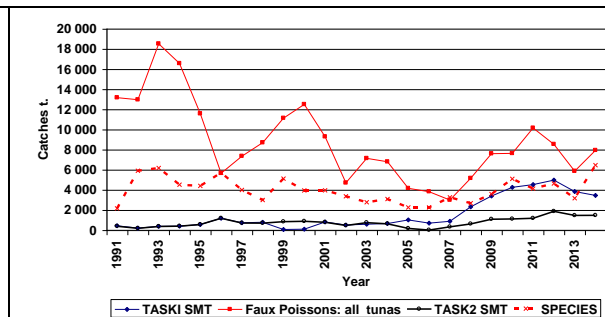
**Figure 16.** First preliminary estimates of yearly tuna catches by species of faux poissons estimated from the multispecies sampling



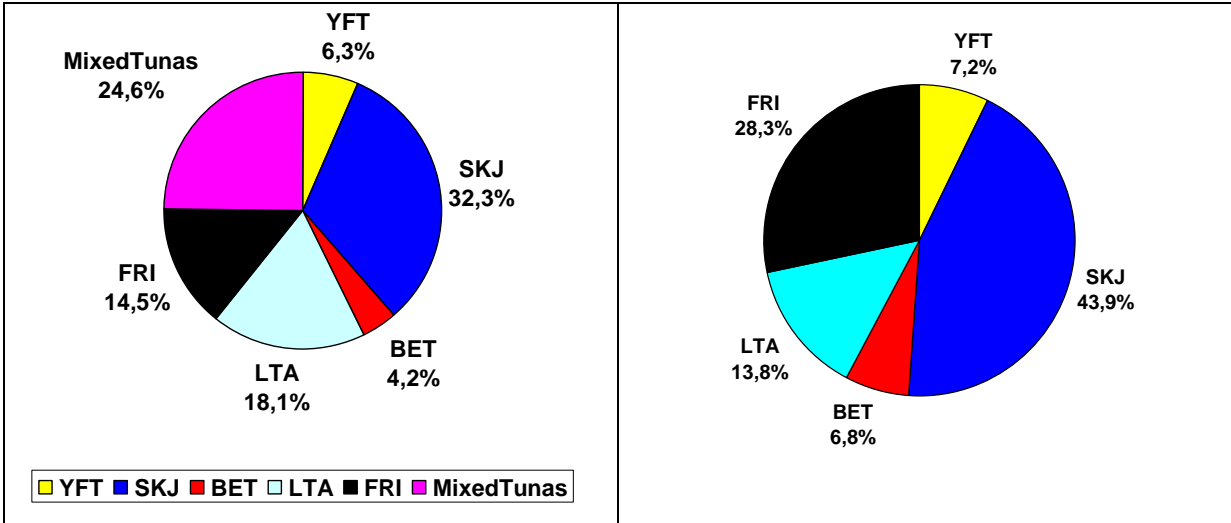
**Figure 17.** Yearly catches of faux poissons tunas in the today ICCAT TASKI 1990-2004



**Figure 18.** Yearly percentages of minor tunas (FRI and LTA) sampled in the FAD multispecies catches of the EU&al PS fleet.



**Figure 19.** Landings of minor tunas by the EU purse seiners: TASK1 and TASK2 of SMT, total landings of Faux Poissons tunas and sampled catches of minor tunas (SPECIES file, weighted samples).



**Figure 20.** Average landings by species (2006-2014) of Faux Poissons (major and minor tunas) by the EU and associated flags purse seiners in Abidjan, average = 11400 t. in the landing statistics

**Figure 21.** idem fig. 20, but corrected for species composition