

## RETAINING BY-CATCH TO AVOID WASTAGE OF FISHERY RESOURCES: HOW IMPORTANT IS BY-CATCH LANDED BY PURSE SEINERS IN ABIDJAN?

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### SUMMARY

*The by-catch of purse seiners in the eastern Atlantic landed in Abidjan is mostly comprised of small individuals of major tunas (in particular *K. pelamis*), small tuna species, billfish and other bony fish. The average annual amount of fish sold on the local market by the main tuna purse seiners operating in the eastern Atlantic accounts for half of total by-catch which can potentially be used (21,582 t) by the local populations. This document highlights the social and economic importance of these commercial incidental catches for the local populations, in particular in Abidjan, in a context of food security and employability. However this highly ethical, socially sustainable and economically significant landscape can bias objective decision making and prove therefore to be detrimental to the sustainability of exploitation of tuna and tuna-like species. This study therefore draws attention to the potential biological and ecological perverse effects which could occur in this market and suggests a more in-depth analysis of issues relating to the local Abidjan market to better inform decision making by managers for a sustainable fishery in the eastern Atlantic.*

### RÉSUMÉ

*Les prises accessoires des thoniers senneurs de l'Atlantique Est débarquées à Abidjan sont composées majoritairement de petits individus de thons majeurs (en particulier *K. pelamis*), de thonidés mineurs, de poissons porte-épée et autres poissons osseux. La quantité moyenne annuelle de poissons vendus sur le marché local par les principaux thoniers senneurs exerçant en Atlantique Est représente la moitié des prises accessoires totales qui peuvent potentiellement être utilisées (21.582 tonnes) par les populations locales. Ce document met en évidence l'importance sociale et économique que représentent ces captures accidentelles commerciales pour les populations locales, en particulier à Abidjan, dans un contexte de sécurité alimentaire et d'employabilité. Toutefois, ce panorama éthiquement somptueux, socialement soutenable et économiquement considérable peut biaiser l'objectivité décisionnelle et s'avérer ainsi préjudiciable à la durabilité de l'exploitation des ressources thonières et espèces associées. Cette étude attire ainsi l'attention sur les potentiels effets pervers biologiques et écologiques que pourrait induire ce marché et suggère une analyse plus approfondie des questions relatives au marché local d'Abidjan afin de mieux éclairer les prises de décision par les gestionnaires pour une pêche durable en Atlantique Est.*

### RESUMEN

*Las capturas fortuitas de los cerqueros atuneros del Atlántico oriental desembarcadas en Abiyán se componen mayoritariamente de pequeños ejemplares de grandes túnidos (en particular *K. pelamis*), de especies de pequeños túnidos, de peces de pico y otros peces óseos. La cantidad media anual de pescado vendida en el mercado local por los principales cerqueros atuneros que operan en el Atlántico este representa la mitad de la captura fortuita total que puede ser potencialmente utilizada (21.582 t) por las poblaciones locales.*

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*Este documento pone de relieve la importancia económica y social que representan estas capturas accidentales comerciales para las poblaciones locales, en particular en Abiyán, en un contexto de la seguridad alimentaria y del empleo. Sin embargo, este panorama éticamente espléndido, socialmente sostenible y económicamente considerable, puede sesgar la objetividad en las decisiones y convertirse así en perjudicial para la sostenibilidad de la explotación de los recursos atuneros y de especies afines. Este estudio llama así la atención sobre los posibles efectos negativos biológicos y ecológicos que podría generar este mercado, y sugiere un análisis más profundo de los temas relativos al mercado local de Abiyán con el fin de aclarar mejor la toma de decisiones de los gestores para lograr una pesca sostenible en el Atlántico este.*

#### KEYWORDS

*By-catch, purse-seine fishery, estimates, local market, ecology, management*

### Introduction

The unintentional catches of marine species are recognized as a serious concern in world's fisheries (Davis 2002; Lewison et al. 2004). Bycatch itself is not necessary a fatality as it is a part of the overall amount of species removed from the ocean by fishing activities. In fact, what is bycatch for a given fishery is a catch elsewhere (Hall et al. 2000) and could be sometimes a treasure (Nunoo et al. 2009). In theory, management issues should be addressed by considering bycatch as a part of the overall removal. The balanced harvesting approach defended by (Garcia et al. 2012) supposes to catch also non-target species to maintain equilibrium of the marine ecosystem. However one big issue for bycatch, particularly discarded ones is the lack of data for assessing adverse ecological impacts of this important component of the overall specie's removal. The ecosystem based management (EBM) promoted by the FAO also suggests management decisions unlighted by biological, environmental, social and economic considerations (Garcia et al. 2003). However, in practice, fishery managers generally ignore the social and economic aspects when final decisions are taken while socio-economical and biological/environmental links have to be considered. Indeed, the availability of market can substantially modify fishing strategies by increasing the amount of bycatch (Hall et al. 2000). In such situation, fisheries management based on stock assessment can be inconsistent when bycatch data are ignored in the data processing. In contrast, optimal management decisions may arise when social and economic data are considered. Obviously, it is not simple to collapse social, economic, biological and environmental objectives. However, in some cases (market incentives) bycatch data can be viewed in stock assessment models as a proxy of social and economic information.

One of the important case studies of bycatch issue in fishery management is what happening in West Africa particularly in Abidjan (Ivory Coast). In this part of the Africa continent, the term bycatch does not really exist as gears are almost involved in multispecies fisheries. All marine animals caught are potentially a source of protein to ensure the food security. Since several decades, the Ivory Coast national production of marine species is less than the third of the seafood consumed by the population. The other two third comprises of fish importation and fish provided by foreign boats landing their catches in Abidjan. The latter comes particularly from foreign purse-seiners historically called « Faux thon » or « Faux poisson ». The expression « Faux-thon » literally translated in English as « false tuna » is a historical term used to call this part of the pelagic species landed by purse-seiners out of the canneries (Amon-Kothias et al. 1996). This landing practice started to be observed early 80's. From the beginning of the fishery to this time, purse-seiners discarded the majority of their accidental catches. No observer data was available for this period to estimate the amount of these unintentional catches. However the level of bycatch was certainly weak as the fishing strategy targeted mostly free-schools (Cayré et al. 1987) known to produce few bycatch. The expression « False tuna » was introduced at this time because the fish landed on the local market was composed mainly of damaged tunas but also small tunas not sorted on board (particularly skipjack) (Chavance et al. 2015). Initially, the « false tuna » was onshore wastage or trash from canneries. Local scientists from the Oceanologic Research Center observed the problem some years later and started to recover data from information previously collected by the harbor's customs officers when sellers across the port entries. The availability of the "false tuna" significantly increased with the beginning of the fishing on floating objects particularly human-made ones called fishing aggregating devices (FAD) (Amon-Kothias et al. 1996; Romagny et al. 2000 and Chavance et al. 2015). This increase can be allowed to the market's demand that remained important permanently and the increase of the incidental catches due to FAD

fishing. Indeed, it appeared like an obvious paradox between the old practices of purse-seiners that consisted in discarding almost all the bycatch and the non-negligible money that could be obtained by crew members if they sell this fish on the local market. « False tuna » became then « false fish » parallel to the increase of the number of species (tunas, tuna-like species, bony fishes, billfishes) landed by purse-seiners on the local market. Nowadays, the prefix « false » is no more appropriated as bycatch sold on the local market arises from different sources. Although some fishes are returning from canneries (mainly unprocessed tunas less than 1.5 kg) they represent a small component of fishes landed on the local market. Fish destined to local market sorted at sea or at the port during landings grew up impressively during the two last decades (Chavance et al. 2015). Bycatch landed by some purse-seiners in Abidjan represented at least the half of their landings or sometimes the full landings.

Development issues faced by West African countries (food security, employment, social, economy etc...), particularly in Ivory Coast where the national production cannot supply the demand, discards at sea is interpreted in ethical way as a wastage of marine resources. From biological and environmental perspectives the sustainability of such a practice is questionable. This debate out of the core of our work merits an in-depth analysis we will further implement. Our study aims to underline the importance of bycatch retained and landed by purse-seiners in Abidjan by displaying overall estimates of the total annual purse-seine bycatch that could potentially be utilized.

## Material and methods

The term bycatch used in our work includes all non-target species and small individuals of target species theoretically untargeted (**Figure 1**).

To produce these preliminary estimates of the potential bycatch from the Eastern Atlantic purse seine fishery that can be considered a seafood products for West African populations we focused on the main purse seine fishery operating in the Eastern Atlantic Ocean i.e. Spain, Ghana and France. Data considered to calculate the overall bycatch are:

- The ratio of bycatch, the percentage of discarded and conserved bycatch. We did not attempt to re-estimate previous bycatch ratios and estimates published in Amandè et al. (2007) were considered. Bycatch ratio and percentage of discarded/conserved bycatch were derived from Spanish and French observer data. This bycatch ratio was used as a proxy for Ghanaian purse seiner's bycatch ratio. Details and/or additional information about ratio estimates/estimators and data in general can be found in Amandè et al. 2007.
- The total tuna landed by Spanish, Ghanaian and French purse seiners from 2000 to 2014. We used Task 1 data from ICCAT database. Task 1 data are nominal annual catch by species, region, gear and flag. These data are provided to ICCAT by the flag states (for more details see <http://iccat.int/en/accesingdb.htm>).
- The local market fish database. These data were collected since 1982 through a collaboration between Ivory Coast (CRO), France (IRD) and Spain (IEO). Annual estimates of fish landed and sold through the local market are published yearly at the ICCAT SCRS Species Groups meetings by scientists from these institutes. Data from 2000 to 2014 are processed to calculate the average annual estimates of local market fish by group of species. Details information about the estimates and methodology used can be found in Chavance et al. (2015).

The total bycatch by purse seiners were calculated by multiplying the ratio by the total tuna landings derived from Task 1 database. Discarded and conserved bycatch are estimated by simply applying the proportion of each component. We assume that observer at sea and those at the port have the same skills and abilities to evaluate a given amount of fish and consequently the conserved bycatch should be similar to the quantity landed on the local market. Finally we calculate the overall potential bycatch by adding discarded bycatch to the highest estimate between bycatch conserved (from observer data) and the quantity of bycatch landed (from local market database).

## Results

The overall annual bycatch from the main purse seine fisheries that can be utilized is estimated to 21,582 tons (table 1). These bycatch are composed on average of 18,768 tons of small size of target tuna and tuna-like (86.9%), 2239 tons of finfishes (10.5%) and 575 tons of billfishes (2.6%). The analysis showed that bycatch was highly underestimated by observer at sea compared to data collected at port. Tunas kept onboard (small tuna-like species and small skipjack, yellowfin and bigeye) are more than ten times underestimated. Also the amount of finfishes observed is three less important than that landed. However the amount of billfishes conserved are higher than landing estimates. The analysis of the size structure of species extracted from the local market fish database show that the main tuna species landed are *Katsuwonus pelamis* and *Auxis spp.* with fork lengths ranged from 31 cm and 43 cm with a mode at 38 cm (Chavance et al. 2015). A similar size distribution was observed for discards of these species using observer data.

## Discussion and Conclusion

The incidental catches by purse-seiners are discarded at sea or conserved for consumption on board (small part) or sold on the Western African's markets particularly in Abidjan. The main reasons of discards in this fishery are related to the status of fish (fish caught are of the wrong species, undersized or damaged); to the lack of space on board and/or to ICCAT regulations (e.g. for sharks, ICCAT [Rec. 05-05, and Rec. 04-10]). Moreover, one additional reason that has appeared recently is the best practices promoted by boat owners. These best practices voluntarily implemented by purse-seiners are, in some way, the results of some NGO actions. It can also be related to the general context of ISSF; the ProActive Vessel Register (PVR, see <http://issf-foundation.org/knowledge-tools/databases/proactive-vessel-register/>). However, economic reasons (for example non valuable species) cannot justify discarding practices by this fishery because all species caught could be sold on Western African markets. But marine species landed in Abidjan and sold on the local market are only teleost (billfishes, tunas and others bony fishes).

The conserved bycatch appeared highly underestimated by observers because the overall conserved target tunas comprises also small individual particularly small skipjack. Obviously, the differentiation by observers of the fate of fish conserved on board (destined to canneries versus fishes for local market) is not an easy task. Aboard some purse-seiners, catches are globally put in wells without any sorting.

The fish landed by purse-seiners out of canneries is well monitored by the local team of CRO in collaboration with IRD and IEO funding this data collection. The quality of data has been improved and at present local market fish information are declared and included in ICCAT databases as well as tunas landed in canneries. Socially, the landing of some bycatch species is an unexpected source of employment for unqualified people (*coming communication on social and economic impacts*) and supports in that way the social and economic development. The economic value of the local market system is also monitored and future result will be provided to help managers to take appropriate decisions. On the other hand, these positive social and economic aspects can influence and/or induce change in fishing strategies. Almost all fish landed on the local market are caught under FAD sets (Amandè et al. 2010). Generally, the product is paid cash at a price (including tunas) raising an attractive price for sellers of 1 €/kg (*unpublished information*). Compared to the constraining trading procedures of canneries the sale of bycatch on the local market is simple. Moreover the national seafood production satisfying only one third of the seafood consumption the demand is permanently high. In some situation, the sale of overall catch on the local market including big tunas might represent substantial advantages (rapid trade, no or low tax). Inversely, encouraging such a trade practice might influence fishing strategies and induce a perverse ecological effect. Fishing on FADs would likely increase without any attention to the aggregated school size and the amount of discarded bycatch might grow up particularly if small aggregations were dominant among operated sets (Dagorn et al 2012). The last stock assessment for skipjack that is the main fish landed on this market concludes on a good state for western and eastern stocks of skipjack. Certainly a kind of trade-offs can be search between the social and economic benefits provided by the local market and the expected perverse effects on the pelagic ecosystem. In depth analysis should be carried out to evaluate how to balance positive and negative impacts (social, economic, ecological and biological) of the local market in Abidjan.

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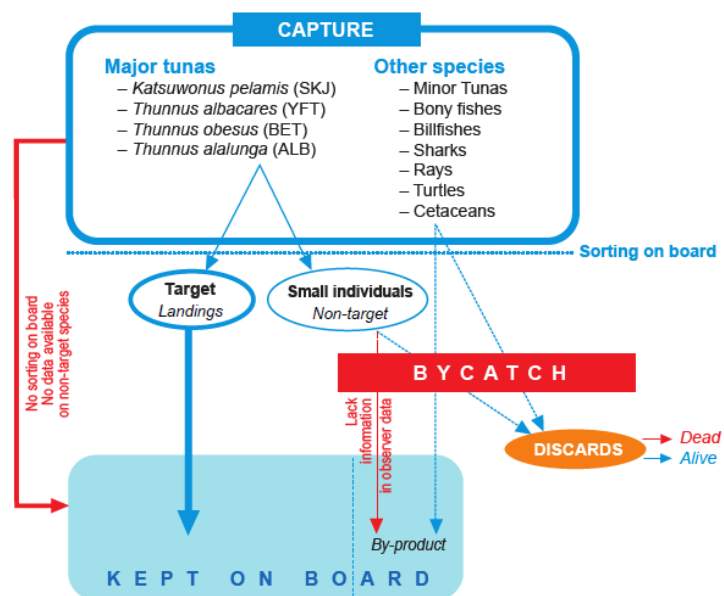
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**Table 1.** Estimates of annual by-catch by purse seiners that can be utilized.

SPECIES GROUP	By-catch characteristics <sup>(1)</sup>			Final estimates of average annual by-catch			LM database <sup>(2)</sup>	Utilizable by-catch
	Ratio (%)	Percentage conserved	Percentage discarded	Total estimates	Total discarded	Total conserved	Local Market Fish	Final estimates
Billfishes	0.4	67	33	<b>575</b>	190	385	204	575
Finfishes (without tunas)	0.78	48	52	<b>1 121</b>	583	538	1 656	2 239
Tunas (By-catch)	6.72	8	92	<b>9 659</b>	8 886	773	9 882	18 768
<b>TOTAL UTILIZABLE BY-CATCH</b>								<b>21 582</b>

<sup>(1)</sup> Information from *Amandè et al. 2010*

<sup>(2)</sup> Estimates from Local Market Fish database (knows as Faux-Poisson). Average weight landed annually by French, Spanish and Ghanaian purse seiners in Abidjan



**Figure 1.** Classification of the overall capture by tropical tuna purse-seiners.