Note on the size frequencies of the YFT & BET catches by PS used in the SS3 model

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Summary

While the SS3 stock assessment model used by the IOTC in order to estimate the stock status of YFT and BET should be using samples of size distribution of the quarterly catches by gear and by area, it appears that the current SS3 models have been running on size distribution of PS catches that are questionable. This technical note will examine and discuss the size frequencies presently estimated by the IOTC and used in the assessment model, and it will propose alternate series of size distribution that are solely based on the sampled size distribution of PS catches by fishing mode. The yearly numbers of these samples are widely different from the samples used in SS3. It is concluded that these real sizes sampled should solely by used in the 2016 YFT & BET stock assessment analysis.

1- Introduction

It was noted during the 2015 IOTC scientific committee that the size frequencies of PS catches used in the SS3 stock assessment were more or less the extrapolated catch at size, and not the original sample sizes, at for all the other gears and as recommended when using statistical models as SS3. These extrapolated data were introduced in the SS3 model because the original sampling data of the PS catches were not available in 2015, but it was then recommended that all the original sampling data should be available to the IOTC secretariat and solely be used in future SS3 stock assessment analysis.

However it was noticed again in 2016 that the 2016 SS3 models were still using one kind of extrapolated size data, and not the real raw sampling data. The goal of this paper is to make a quick overview of the PS size data used in the today SS3 YFT and BET models, and to compare these size data with the original or real "raw sampling data" of the international PS fleet operating from Seychelles Islands, where the EU and SFA scientists have been permanently managing the sampling of the PS catches and the data processing of this information.

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2- Sizes data used in the SS3 model and "raw sampling data".

Total yearly numbers of YFT and of BET used in the SS3 analysis as being the size samples of the PS fleets are shown by figure 1 and 2.

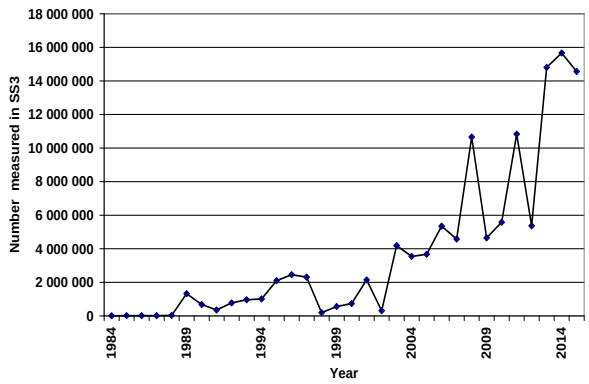

Figure 1: Yearly numbers of YFT in the today SS3 sampled sizes of PS

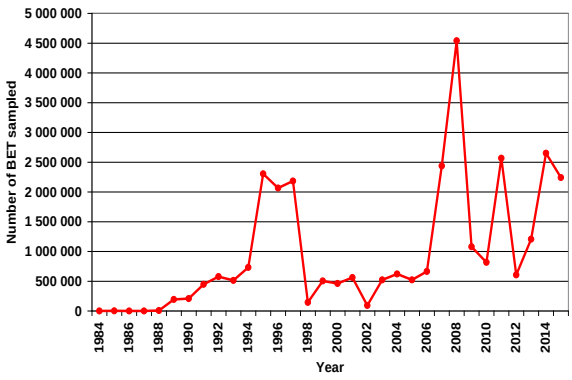

Figure 2: Yearly numbers of BET in the today SS3 sampled sizes of PS

These number of tunas sampled for sizes were estimated by the IOTC secretariat based on the catch at size of the PS catches that have been declared yearly by the EU & Seychelles scientists. The following method has been used by the IOTC secretariat in order to estimate the size frequencies used today by SS3.

"the only information received by the IOC on PS catches are (1) raised lengths by size class and strata (i.e., fishing mode, month and 5 degree grid); and (2) the original number of samples for each strata. To prepare the files for SS3, which use the original samples, the raised lengths are scaled down to the original sample size provided to the IOTC".

The results of this method are clearly questionable, for instance because of the very large numbers of tunas in these sampled sizes: these numbers of tunas are of course much larger than the size of the real sized sampled, and the trend in the yearly numbers of tuna sampled is not at all realistic. As a result, the yearly levels in the SS3 sample sizes appear to be widely questionable, for instance comparing these numbers to the real numbers of YFT and of BET that have been sampled on the PS landings (figure 3).

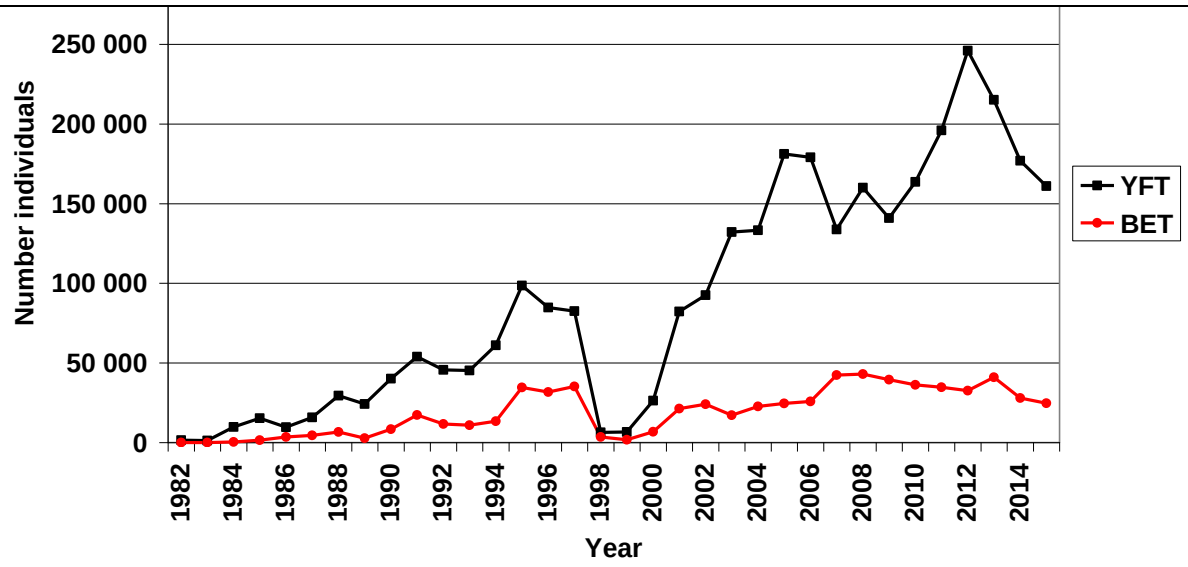

Figure 3: Yearly numbers of YFT and of BET sampled yearly on the PS catches in the western IO.

These numbers of tunas sampled yearly on PS catches should also be compared to the number of tunas in the "weighted samples", where each sample has been raised to the weight of the sampled sets. These numbers are shown by figure 4 for YFT and 5 for BET, that are also showing the numbers of tunas in the SS3 sampled sizes.

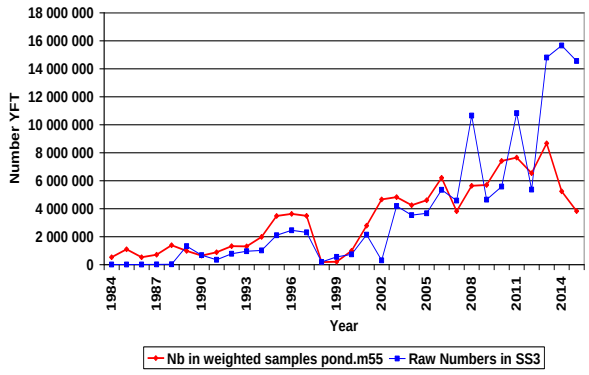

Figure 5: Yearly numbers of YFT sampled on the PS catches active in the western IO weighted to the sampled catches and SS3 numbers of sampled YFT.

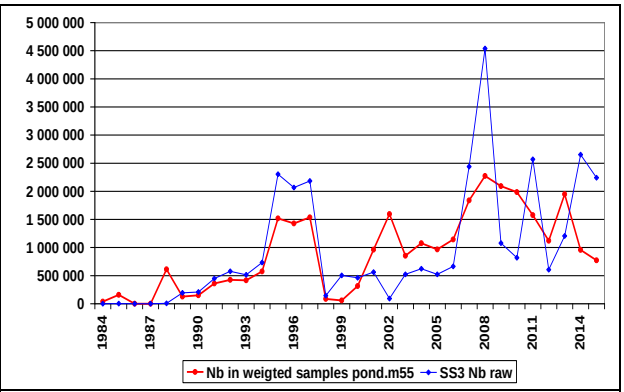

Figure 6: Yearly numbers of BET sampled on the PS catches active in the western IO weighted to the sampled catches and SS3 numbers of sampled YFT.

The numbers of tuna sampled shown by these last 3 figures are simply taken from the basic size data collected by scientists in the area since early years of the PS fishery in 1982.

It should be noted that while the average numbers of yearly numbers are equivalent in the original file of weighted samples and in the SS3 data set, these sampled numbers are clearly very distinct during many years, for instance in the following examples:

- 1) **initial years 1982-1988**: in the initial period of 7 years, the SS3 sampled sizes are clearly the original numbers of tunas measured and not the weighted numbers as in all the other years, as it is shown by fig. 7 for YFT and fig. 8 for BET.

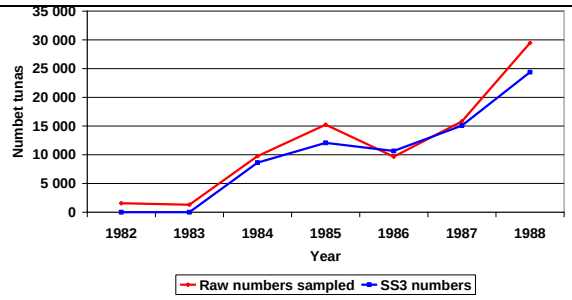

Figure 7: Period 1982-1988: yearly numbers of YFT sampled on the PS catches weighted to the sampled catches and SS3 numbers.

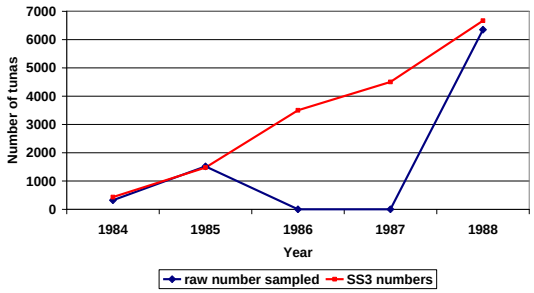

Figure 8: Period 1982-1988: yearly numbers of BET sampled on the PS catches weighted to the sampled catches and SS3 numbers.

These 2 figures are showing well 2 types of distinct problems: (1) showing the fact that the sizes samples from the early period have not been properly weighted to the sampled catches (as for all other years) and (2) some samples collected during this early period have been lost (YFT sizes in 1982 & 1983 and BET sizes in 1986 & 1987).

- 2) **2002 CAS?**: similar problem are also observed in 2002: when the 2012 SS3 size samples are showing very low numbers (but higher than the raw samples), they are clearly underweighted, because the numbers of tunas sampled in 2002 where normal (or above the average numbers of the period). It should also be noted that the profile of the 2002 SS3 PS sizes seems to be widely questionable, this profile being widely outside the profile of weighted and of extrapolated sizes of the PS catches, see figure 9. As a consequence, the average weight of PS catches in SS3 was reaching 13.8 kg while the average weight in the weighted samples and is the CAS was at only 7.2 kg. It should be noted that during most years the 3 sets of sizes are always very similar, as an example see figure 10 showing the sizes data in 2003 estimated from various sources.

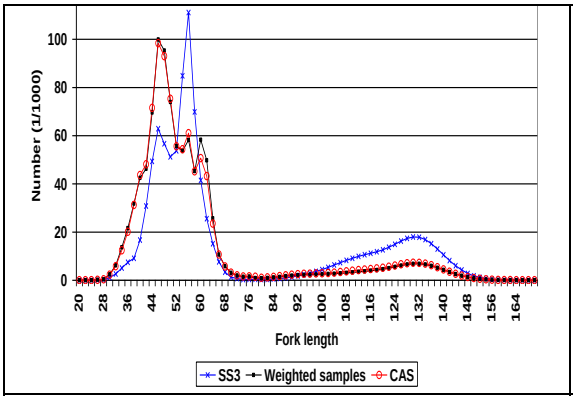

Figure 9: Numbers at size of YFT caught by PS in 2002 in 3 distinct data set

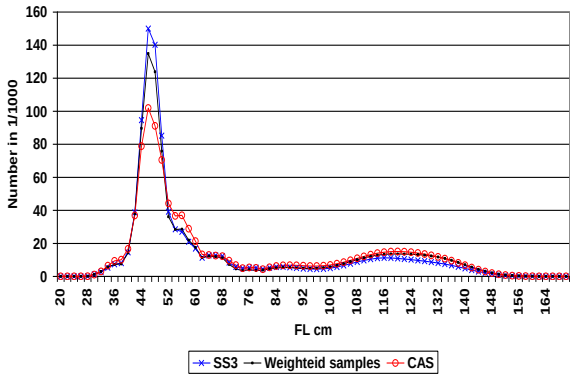

Figure 10: Numbers at size of YFT caught by PS in 2003 in 3 distinct data set

It can then be hypothesized that there was some serious "anomaly" in the building of the 2002 PS SS3 sizes.

- 3) **Variance of SS3 sampled numbers?:** the very large variance of the SS3 sampled numbers should also be noted: numbers sampled showing since 2001 "yoyo fluctuations" (especially for BET but also for YFT) that have not been observed in the real numbers of tunas sampled (raw or weighted numbers), see figure 5 & 6. For instance when the real weighted numbers of YFT sampled in 2010 & 2011 were almost identical (7.4 & 7.6 million), they are widely distinct in the SS3 numbers: 5.6

and 10.8 millions of fishes This excessive variability is difficult to understand, when the sampling level was quite stable; it should at least be understood, and if necessary corrected.

- 4) **period 1998-2000**: these 3 years were a period when very few samples have been collected on the PS catches, these numbers being especially low in 1999, while the numbers of BET sampled in SS3 were much higher than the observed weighted numbers sampled, see figure 11. The origin of these unexpected samples should be understood.

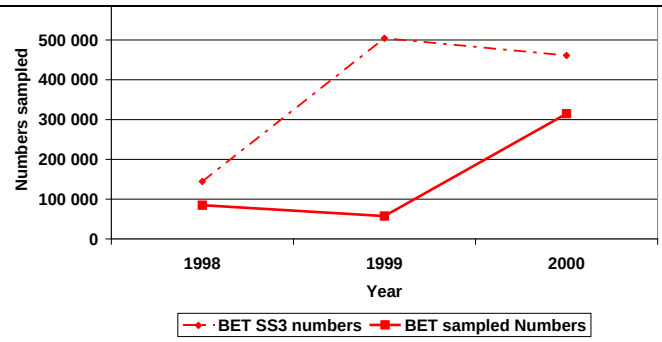

Figure 11: Weighted numbers of BET sampled in the original samples and in SS3 during the period 1998-2000

- 5) **2014 & 2015 CAS:** figures 5 & 6 are also showing that the numbers of YFT & BET sampled during recent years (2014 & 2015) may also be questionable: while the SS3 numbers were at their highest level in 2014 & 2015, they are only at average and much lower levels in the original weighted samples (the observed numbers being at less than 50% of the SS3 numbers). This difference between the 2 series concerning the numbers of samples tunas should be explained and if necessary they should be corrected.
- 6**) Missing Spanish sample**s: the analysis of the PS sizes data during the period 1983-1989 period are solely based of French samples. However, it should be noted that during this period Spanish PS were also very active in the area (catching yearly similar amount of tunas) and that these landings have been sampled by Spain during each year of this period, measuring a total of 29400 YFT, 48600 SKJ and 8400 BET. These size samples should be recovered & incorporated in future stock assessment analysis.

3- Conclusion and recommendation

The positive point is that the profiles of the sampled sizes are of course quite similar in the SS3 size data and in the original sampled sizes, and consequently all these potential errors should play minor effects of the profile of sizes caught.

However scientists should always follow the basic principle that when significant errors have been identified, they should always be corrected when it is possible. Following this rule, scientists should identify the causes of the serious heterogeneity in the PS CAS files: are they due to lost data, to inadequate POND file used, to an inadequate data preparation of the SS3 size files (for instance the lack of weighting in the 1982-1988 data) or to data handling errors by the authors of this document. When possible, all the potential errors should be solved as soon as possible when they have been confirmed.

In addition to this basic work on the catch at size data, scientists should also question upon the potential effects on the SS3 results of these technical problems in the data handling of the PS size data, because this data set appears to be of great importance in the SS3 analysis, being widely dominant in term of numbers of fished measured and during a long period.

The original size samples collected by scientists should possibly be used in the SS3 stock assessments of the BET & YFT stocks, using either the weighted or the raw sizes, because the yearly numbers of tunas sampled in these series are the only ones that are clearly representative of the real sizes of samples Our view is that at least these original data sets of

sizes caught by PS (the raw or the weighted files) are more realistic the today SS3 sizes, and that they should at least be used in sensitivity alternate runs of the today SS3.

Furthermore, all the detailed sampling data, i.e. the raw samples and the weighted samples, should of course be submitted to the IOTC secretariat (in addition to the extrapolated CAS data that have been always submitted) for all the PS samples, since the early years of the PS fishery, and for the 4 main species of tunas landed by the PS fishery (YFT, SKJ, BET and ALB, and ensuring that these data sets are well covering all the samples that have been collected by scientists, even in historical times of the fishery) in order to be used when necessary in statistical stock assessment models.