ON THE POTENTIAL USE OF SIZE MEASUREMENTS BY OBSERVERS IN THE FARMS FOR THE ESTIMATION OF MEDITERRANEAN BFT CATCH AT SIZE

Alain Fonteneau[1]

SUMMARY

This paper analyzes the size data collected on farmed bluefin tuna (BFT) caught in 2008 and 2009. The sizes at the catching dates of individual are estimated for all tunas measured at known fishing and killing dates, simply assuming that these tunas had the typical growth in length estimated by Cort. It was assumed that during the limited duration of the farming process, the growth in length was probably similar to this growth model, even if the growth in weight is very fast and important. These results would tend to show that the average weights estimated from these size samples in 2008 and in 2009 are much larger, about twice as large, than the average weight in the CAS used by SCRS. If this result is significant, it could also indicate that the total catches declared by PS during recent years, then the ICCAT BFT Task I, could have been seriously underestimated in terms of their weights. The paper recommends carrying out the same analysis since 2003 and using a well stratified extrapolation taking into account the number of ICCAT bluefin tuna certificates.

RÉSUMÉ

Le présent document analyse les données de taille de spécimens de thon rouge engraissés capturés en 2008 et 2009. Les tailles au moment de la capture ont été estimées pour tous les thons mesurés aux dates connues de capture et de mise à mort, en postulant simplement que la taille de ces thons avait augmenté selon la courbe de croissance de Cort. Il a été postulé que pendant la durée limitée du processus d'engraissement, la croissance en longueur était probablement similaire à ce modèle de croissance, même si la croissance en poids était très rapide et importante. Ces résultats font apparaître que les poids moyens estimés à partir de ces échantillons de tailles en 2008 et 2009 étaient beaucoup plus élevés, environ deux fois plus, que le poids moyen de la CAS utilisé par le SCRS. Si ce résultat est significatif, cela pourrait également indiquer que les prises totales déclarées par les senneurs ces dernières années, et ensuite la Tâche I de l'ICCAT concernant le thon rouge, pourraient avoir été grandement sous-estimées en termes de poids. Le document recommande de procéder à la même analyse à partir de 2003 et d'appliquer une extrapolation correctement stratifiée tenant compte du nombre de certificats ICCAT de thon rouge.

RESUMEN

En este documento se analizan los datos de talla recopilados en atún rojo criado en granjas capturados en 2008 y 2009. Se estimaron las tallas en el momento de captura para todos los ejemplares que se midieron en fechas conocidas de pesca y sacrificio, asumiendo simplemente que estos atunes tenían el crecimiento típico en longitud estimado por Cort. Se asumió que durante el periodo limitado del proceso de cría, el crecimiento en longitud era probablemente similar a dicho modelo de crecimiento, aunque el crecimiento en peso es muy rápido e importante. Estos resultados tenderían a mostrar que los pesos medios estimados a partir de estas muestras de talla en 2008 y 2009 son muy superiores, casi el doble, que el peso medio de la CAS utilizada por el SCRS. Si este resultado es significativo, podría indicar que las capturas totales declaradas por la pesquería de cerco en años recientes, y por tanto la Tarea I de atún rojo de ICCAT, podrían haber sido objeto de una importante subestimación términos de peso. En este documento se recomienda que se realice este mismo análisis desde 2003 y que se utilice una extrapolación bien estratificada teniendo en cuenta el número de certificados de atún rojo de ICCAT.

KEYWORDS

Bluefin, Sizes, Farms, Mediterranean Sea

[1]Alain Fonteneau, IRD EMERITUS scientist, 9 Bd Porée, 35400 Saint Malo, France; alain.fonteneau@ird.fr

1. Introduction

The SCRS 2012 report contains the following statement that:

"Progress has been made over the last years, but current information that consists in individual weight after fattening remain too uncertain to be used within stock assessment models. Therefore, real size samples at time of the catch are still required"

We would totally agree that sizes at capture (CAS) are deeply needed by SCRS scientists to do the BFT stock assessments. However:

a) when there was a severe lack of real size data on the BFT catches during recent years, due to the farming process of BFT caught by PS, there is a serious danger that the BFT CAS data presently estimated and used by SCRS have no real scientific value and remain widely questionable.
b) we hypothesize that the large numbers of size measurement that have been done during recent years (since 2003?) under a full scientific control of observers should allow to estimate sizes at the fishing date: at least for the sub sample of tunas that have been measured by scientists at a known date and with a known fishing date.

This paper will try to do a first review of this prospect. This work done by a tropical tuna scientist will be solely indicative and preliminary, due to our lack of knowledge in the BFT farming process and because most of the size data from farm observers are nor yet fully available to scientists. This first analysis will be done on the subset of size data available for the years 2008 and 2009.

2. Data and method

The size data available in October 2012 for the years 2008 and 2009 have been used. This work has been done on all the size data of tunas measured with a known fishing date and then known durations in the farms. A total of 5494 and of 2641 individuals have been kept following these rules during the years 2008 and 2009. Their average farmed durations was of 6.2 and 5.8 months. The size at the fishing date has been estimated for each individual tuna assuming that these tunas have been following the Cort 1992 growth curve. It has been assumed that the growth in length of BFT during their farming time (most often less than 1 year) was not heavily biaised by the farming process, even if of course the condition factors and the weight of these tuna are extremely variable, the weight of these farmed BFT being probably larger than for most tunas caught at sea. These sizes of measured BFT have been extrapolated to the total TASKI of PS, assuming that this today catches are OK, and compared to the official CAS of PS presently estimated by SCRS for the same 2 years. It is clear that a real data processing of farm sizes should be stratified by fishing zones in the future data processing of farms size measurements to take into account the geographical heterogeneity of BFT sizes caught in the Med.

3. Results

The observed size at killing and the estimated sizes at the fishing dates are shown for the 2 studied years by figure 1 and 2. These figures are showing that the histograms of sampled sizes are showing a moderate variance and few anomalies. They are also showing that the estimated growth in size between catch and killing in the farms would be quite moderate (if farmed BFT are following Cort's growth). These sampled sizes have been extrapolated to the declared catches of PS, and these CAS estimated for 2008 & 2009 are shown by figure 3. These CAS estimated from farm measurements can usefully be compared to the present CAS of SCRS for the 2 studied years 2008 and 2009, and this comparison is shown by figures 4 & 5. These figures are showing that the today SCRS CAS are quite chaotic in their numbers caught, at least using 1 cm size intervals. This extreme variability was not fully visible in SCRS reports, but it would appear to be totally unrealistic, being probably due to the artificial process allowing to estimate the sizes of fish caught: most of these sizes are artificial ones, and not based on real scientific size sampling (Labelle et al) as the sampling done in the farms. The comparison between the SCRS CAS 2012 and our CAS estimated from farms also shows major differences in the size distribution and average weights in the 2 data sets: much more large BFT in the farm samples than in the SCRS CAS, and estimated average weights at the fishing dates that are multiplied by a factor of 2 in the farm samples.

4. Discussion

Catch at size of Mediterranean BFT caught by PS constitute a unique case in fishery statistics worldwide, because all these BFT are declared to ICCAT and registered one by one. In such context, if the size sampling process in the farms do allow to estimate the sizes at the fishing dates, the yearly catch at size can be estimated directly. This "direct knowledge" of the CAS is totally different from the traditional way to estimate CAS, starting from a small size sample and extrapolating it to a given known total catch. This major peculiarity of the Medit BFT CAS should always be kept in mind and fully used in the data processing. This peculiar process should for instance allow to validate or not the total numbers of BFT estimated during recent years in the CAS used by SCRS: these numbers should be consistent with the numbers of ICCAT certificates and the size of these fishes should be compatible with the measured sizes at killing and with the expected growth of BFT tunas. It should easily be accepted by SCRS scientists that when the growth in weight of farmed tuna is very large and fast during the period of farming for instance a 30% of increase in few months. However, there are strong reasons to assume that the growth in length is probably similar to the theoretical growth of BFT, or simply showing a growth rate in length 10% of 20% faster that at liberty, but during the short period of time in the farms. This basic uncertainty in the growth in length of the farmed tunas should then be quite easily incorporated in the estimation of the CAS. These rules would not apply well to the peculiar case of BFT in the Serbian farms that are caught at small sizes and farmed during long period.

There is today a wide uncertainty in the knowledge of exact fishing dates of BFT killed in the farms, especially during recent years (2010-2012). If this problem of knowing the fishing dates of killed fishes cannot be solved, an alternate "sub-optimal" solution would possibly be to assume that all tunas caught by PS have been fished at a given artificial date, for instance on June 15th, (or using an alternate better date), at the peak date of the spawning season. This alternate hypothesis would allow to use all size data collected in the farms, and it would probably induce only minor potential bias, as there is no doubt that the fishing season of PS in the Mediterranean Sea is always of very limited duration, in relation with the short spawning season of this species.

One of the major remaining difficulty will be to estimate the total yearly catches in weight (or TASKI), at the fishing dates of these estimated CAS: there is no doubt that the condition factors of BFT are widely fluctuating before, during and after the spawning season, in relation with the large amount of energy needed for the large scale spawning migration and the maturation of the gonads. As a result, it will be quite uncertain to estimate the theoretical weight of the CAS at the fishing dates based on an average length weight relationship: if the tuna were exhausted and lean at the date of fishing, their real weight would me much lower that this average weight It will be impossible to solve this basic biological uncertainty. Our recommendation is that SCRS should decide to work on the artificial but strong hypothesis that the weight of the CAS should be estimated using an average length weight relationship to estimate the weight caught, based on a realistic CAS. The average relationship estimated for BFT caught by PS during the spring fishing season should preferably be used. At this stage, it can be hypothesized based on the 2008 & 2009 size data, that recent BFT catches by PS could have been OK in term of the numbers of fish caught, but that their average weight could have been widely underestimated by skippers: voluntarily, in order to catch more fish than the individual TAC of their vessels, or involuntarily, because the real sizes of the tunas swimming in the net may be difficult to estimate, by the skipper and the divers. A subsequent fundamental question is that the total catches of BFT declared during recent years by purse seiners could have been under declared. Consequently, alternate potential TASKI of Mediterranean BFT should be estimated during recent years, based (1) on the known total number of fishes sold by the farms (ICCAT certificates) and (2) on the CAS at the fishing dates estimated from the size measurements done at killing in the farms. Then there is no doubt that SCRS should do as soon as possible and before its next stock assessment this full scale comprehensive analysis of the sizes of BFT that have been sampled in the farms by scientists since 2003, potentially leading to a revision of PS BFT TASKI. This work should of course be done using all the commercial data available today: ICCAT certificates and import of BFT to Japan (Bregazzi files).

5. Conclusion

These results are preliminary and solely indicative, but very well in phase with previous an. Work submitted to SCSR in 2010. These estimated sizes based on large numbers of well measured BFT are very strong and they would strongly contradict the SCRS conclusion that size data from the farms cannot be used to estimate the CAS of Mediterranean BFT caught by PS. These sizes measured in the farms are clearly totally different from the sizes caught used by SCRS to estimate the BFT stock status. This paper would then pressure the SCRS:

a) to do as soon as possible an in depth analysis of all size data collected in farms during the last 10 years and to extrapolate these samples to potentially revised & increased catches, and

b) to use these results in its future stock assessments, based on the following cascading facts:

- That the presently estimated CAS of Medit PS appears to be widely or totally unrealistic, due to multiple reasons
- That since 2003, large and increasing high quality size numbers of samples are permanently available from the farms,
- That the growth in length of these tunas can be easily and well estimated without major bias during the quite limited periods of the farming in most farms (outside Croatia),
- That a well stratified data processing of sizes caught in the farm should combine the 3 sets of size data that are now (and surprisingly?) quite independent in the ICCAT data bases (sizes submitted by countries, by inspectors and obtained from the GBYP). A potential risk of redundancy between these data sets should not impede to do this data processing, as this potential redundancy in the sizes sampled cannot introduce a significant bias in such a stratified data processing.

Literature

An. ATRT, Greenpeace, MarViva & WWF 2010. Size structureof the Atlantic bluefin tuna fished and farmed in the Mediterranean between 2002 & 2009 as revealed by the Japanese fresh market. Collect. Vol. Sci. Pap. ICCAT, 66(3): 1142-1151.

Carter, C. G., Seeto, G. S., Smart, A., Clarke, S., & van Barneveld, R. (1998). Correlates of growth in farmed juvenile southern bluefin tuna thunnus maccoyii (castelnau). *Aquaculture*, *161*(1-4), 107-119.

Cort, J. L., 2009. Growth and the equation applied to the Eastern bluefin tuna (*Thunnus thynnus*) stock of the North Atlantic, 20 years on ICCAT. SCRS/2009/124, 29p.

Labelle, M., Hoch, T., & Liorzou, B. (1997). Analysis of the 1970-95 bluefin sale records from french seine catches in the mediterranean. Rec Doc Scient ICCAT, *46*(2) 140-149

Gordoa, A. (2010). Estimating the fattening factor of atlantic bluefin tuna (thunnus thynnus) on tuna farms: Ametlla de mar facility as a case study. *ICCAT Rec Doc Scient*, *65*(3), 848-857.

Percin, F., & Akyol, O. (2009). Length-weight and length-length relationships of the bluefin tuna, thunnus thynnus L., in the turkish part of the eastern mediterranean sea. *Journal of Applied Ichthyology*, *25*(6), 782-784.

Rubio A.J. and M. Ortiz 2012. Review and preliminary analysis of size frequency samples of bluefin tuna 1952-2010. Doc. SCRS/2012/116.

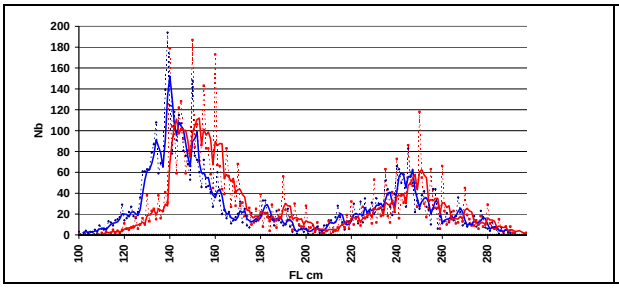

Figure 1. Measured sizes at killing in the farms and corresponding estimated size at the fishing dates in 2008

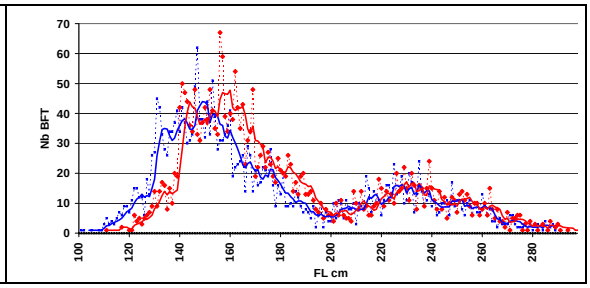

Figure 2. Measured sizes at killing in the farms and corresponding estimated size at the fishing dates in 2009

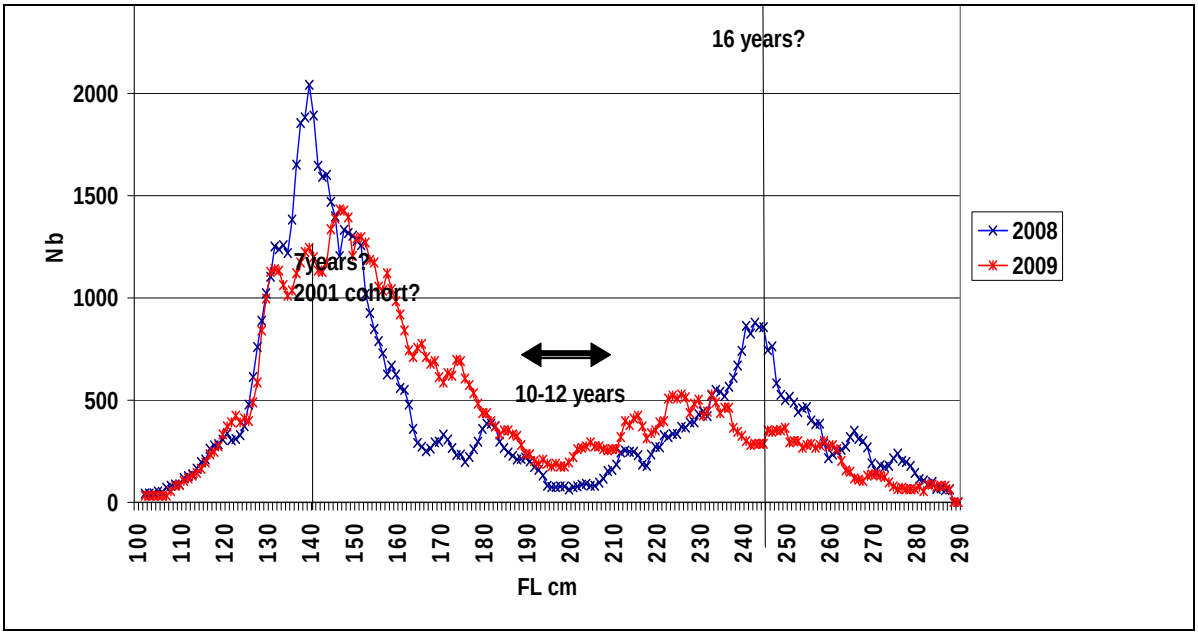

Figure 3. Comparison of the 2008 and 2009 catch at size of PS estimated from size data in the farms (extrapolated to ICCAT PS TASKI)

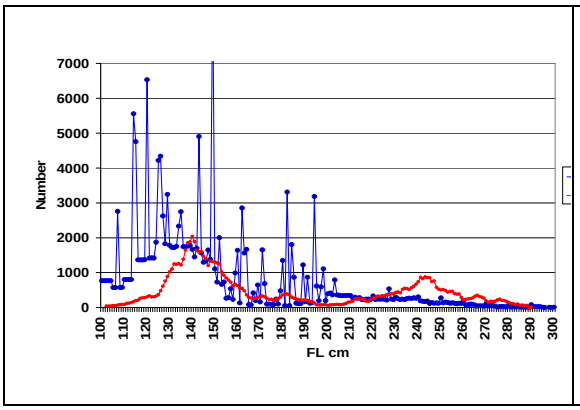

Figure 4. Catch at size estimated from farm size in 2008 compared to the 2008 CAS of PS estimated and used by SCRS

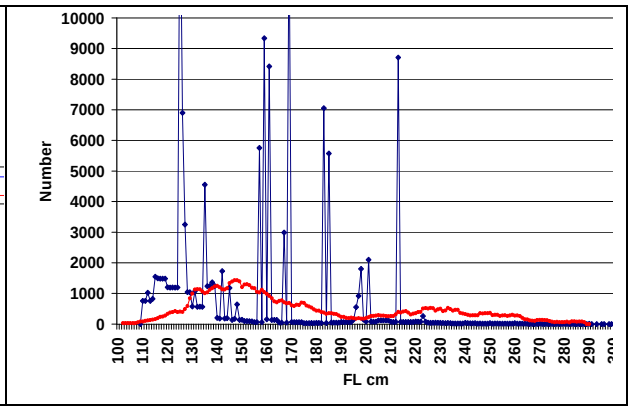

Figure 5. Catch at size estimated from farm size in 2009 compared to the 2009 CAS of PS estimated and used by SCRS