UPDATED BLUEFIN CPUE AND CATCH STRUCTURE FROM THE BALFEGÓ PURSE SEINE FLEET IN BALEARIC WATERS FROM 2000 TO 2016

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SUMMARY

This study updated the unstandardized CPUE index of the Balfegó purse seiners, as its standardization was last year proved unreliable. The CPUE index is contrasted, as has been done previously, with the Japanese longline standardized CPUE series to examine its reliability. The results showed that Balfegó CPUE series highly correlates with Japanese indices and coefficients are similar and slightly stronger that those obtained last year. As more years are added the correlation between both series is getting stronger and we conclude that the CPUE series of Balfegó vessels is a reliable abundance index of the ABFT eastern population and should be considered in the upcoming assessment. Moreover, it will correct the deficient spatial representativeness of abundance indices used to date. On the other hand, the age structure of purse seiners showed that at the end of May in the Balearic ground the fully recruited age is 11 years.

RÉSUMÉ

Cette étude a mis à jour l'indice de CPUE non standardisée des senneurs de Balfegó, car sa standardisation réalisée l'année dernière s'est révélée peu fiable. L'indice de CPUE est comparé, comme cela a été fait précédemment, avec la série de CPUE standardisée des palangriers japonais pour examiner sa fiabilité. Les résultats ont montré que la série de CPUE de Balfegó est en étroite corrélation avec les indices japonais et que les coefficients sont similaires et légèrement plus forts que ceux obtenus l'année dernière. Au fur et à mesure que davantage d'années sont ajoutées, la corrélation entre les deux séries est de plus en plus forte et nous concluons que la série de CPUE des navires de Balfegó est un indice d'abondance fiable de la population de thon rouge de l'Atlantique Est et qu'elle devrait être prise en compte dans l'évaluation à venir. En outre, elle corrigera la représentativité spatiale déficiente des indices d'abondance utilisés à ce jour. D'autre part, la structure par âge des senneurs a montré que, à la fin du mois de mai, l'âge de plein recrutement dans les zones Baléares, est de 11 ans.

RESUMEN

Este estudio actualizaba el índice de CPUE no estandarizada de los cerqueros de Balfegó, ya que el año pasado se demostró que su estandarización no era fiable. El índice de CPUE se compara, como se ha hecho previamente, con la serie de CPUE estandarizada del palangre japonés para examinar su fiabilidad. Los resultados demostraron que la serie de CPUE de Balfegó se correlaciona mucho con el índice japonés y que los coeficientes son similares y ligeramente más fuertes que los obtenidos el año pasado. A medida que se añaden más años la correlación entre ambas series va siendo más fuerte y concluimos que la serie de CPUE de los buques de Balfegó es un índice de abundancia fiable de la población oriental de atún rojo del Atlántico y debería considerarse en la próxima evaluación. Además, corregirá la deficiente representatividad espacial de los índices de abundancia utilizados hasta la fecha. Por otra parte, la estructura por edad de los cerqueros demostró que, a finales de mayo, en el caladero de Baleares la edad de reclutamiento total es de 11 años.

KEYWORDS

Bluefin tuna, Eastern Stock, CPUE, Western Mediterranean, Purse seiners, Age

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Introduction

The upcoming assessment of Atlantic bluefin tuna will be improved by incorporating better-quality data and by enhancing their spatial representativeness. Despite that the eastern stock of ABFT is mostly harvested in Mediterranean waters all the indices used for the eastern stock comes from Atlantic fisheries due to the length of their time series. Moreover, the so called new fisheries as purse seiners are no longer new and the historical time series are losing spatial representativeness or continuity. The Japanese longline fishery data is becoming unique and essential because of its length and continuity. Although fishing patterns and areas of this fishery have changed in recent years, the abundance indices of this fishery are still reliable as a result of the continuous improvement in the standardization of catch rates (Kimoto 2014; Kimoto *et al.* 2015). Consequently, this abundance index was considered the reference for assessing the reliability and representativeness of catch rates index in Balearic waters (Gordoa and Bahamón 2016).

The annual catch rates of Balfegó purse seiners have been repeatedly updated and presented at the Bluefin tuna species working group with the aim of being accepted and included as an additional index of the ABFT eastern stock (e.g. Gordoa 2010; Gordoa & Bahamón 2016). This index, systematically rejected because it was not standardized, was highly correlated with Japanese longline index while the product of a GLM standardisation revealed that none of the considered factors were significant but the year. Moreover, the standardised series was also discarded because it merely explained 22% of CPUE variability and exhibited annual trends unobserved in any other fishery. On the contrary, the unstandardized CPUE showed high correlation with Japanese index and indicative of its plausibility as abundance index.

In this paper we updated the annual catch rates of Balfegó purse seiners with 2016 data and compared with the most updated Japanese longline published index (Kimoto *et al.*, 2016). In addition, the age frequency distributions of catches from 2013 to 2015 estimated from video techniques measurements are also shown. Unfortunately 2016 data had not yet been received by the time this document was finalised. Additionally and independently, the annual average individual weight was estimated from the skipper's estimation of tuna size of each haul over the period 2003-2016.

Material and Methods

The Balfegó purse seiners' annual catch rates are estimated by dividing the total catch (kg) of the Balfegó vessels by the total number of days spent at sea, out of port, in the Balearic fishing ground over the period 2000-2016. This CPUE series we present it split it into two: the first one over the whole spawning fishing season (Balfegó index 1) and the second considering the period until the 8th of June (Balfegó index 2), which is more representative of the fishing season in the most recent years (more details in Gordoa 2010). After taking the natural logarithm of both series they were correlated with Japanese LL indices: the standardised and nominal indexes updated with 2015 CPUE (Kimoto *et al.*, 2016) and the split Japanese index previously estimated (Kimoto *et al.*, 2014).

The length frequency distribution of catches from 2013 to 2015 was based on the individual length estimated by video techniques carried out by Spanish fisheries inspectors at the time of transferring tuna from the transport vessels to the fattening facilities. The measured subsample represented 17.9% of the tuna transferred in 2013 and 20% from 2014 to 2015. The annual catch at age was estimated by applying the inverse of the von Bertalanffy growth length at age equation estimated by Cort (1991) for the East Atlantic - Mediterranean stock and adopted by ICCAT (2010).

Additionally and independently, the annual average individual weight was estimated from the skipper's estimation of tuna size of each haul over the period 2003-2016. A total of 317 hauls were analysed and in order to assess the reliability of this time series, the annual individual weight estimated over the last three years was compared with the most precise estimations measured by video techniques.

Results

The results show that the unstandardized Balfegó CPUE series highly correlates with all Japanese LL indices (**Table 1**). The updated correlation coefficients are similar and slightly stronger that those obtained last year.

Since 2011 JP LL index fluctuates around values at least 5 times higher than those observed at the beginning of this century (**Figure 1**). This is also observed in Balfegó index but the signs of stock recovery were evidenced earlier by Japanese LL fleet. Differences might be expected associated with differences in the age composition

between fisheries. According to the age structures, estimated from individual sizes measured by video technique, the age currently fully recruited to this fishery is around 11 yearrs (**Figure 2**). As the stero cameras were implemented in 2013 we have thus far been able to observe the fully recruitment of three year classes: 2002, 2003 and 2004, 2005 will be included as soon as 2016 data arrived. Contrary of what was observed by others eastern indices the strongest year class observed in this fishery was the 2002.

The average fish weight estimated from skippers visual observations and from stero cameras measurements were slightly different but the interannual variability was similar (**Figure 3**). Thus, we presume and according to 2016 skippers observations that the age structure in 2016 will be again distributed around age 11.

Conclusions

The results showed that Balfegó CPUE series highly correlates with Japanese indices and is getting stronger as the time series is getting longer. We conclude that the CPUE series of Balfegó vessels is a reliable abundance index of the ABFT eastern population and should be considered in the upcoming assessment.

References

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Table 1. Correlation between Japanese abundance index of LL fishery and Balfegó CPUE.

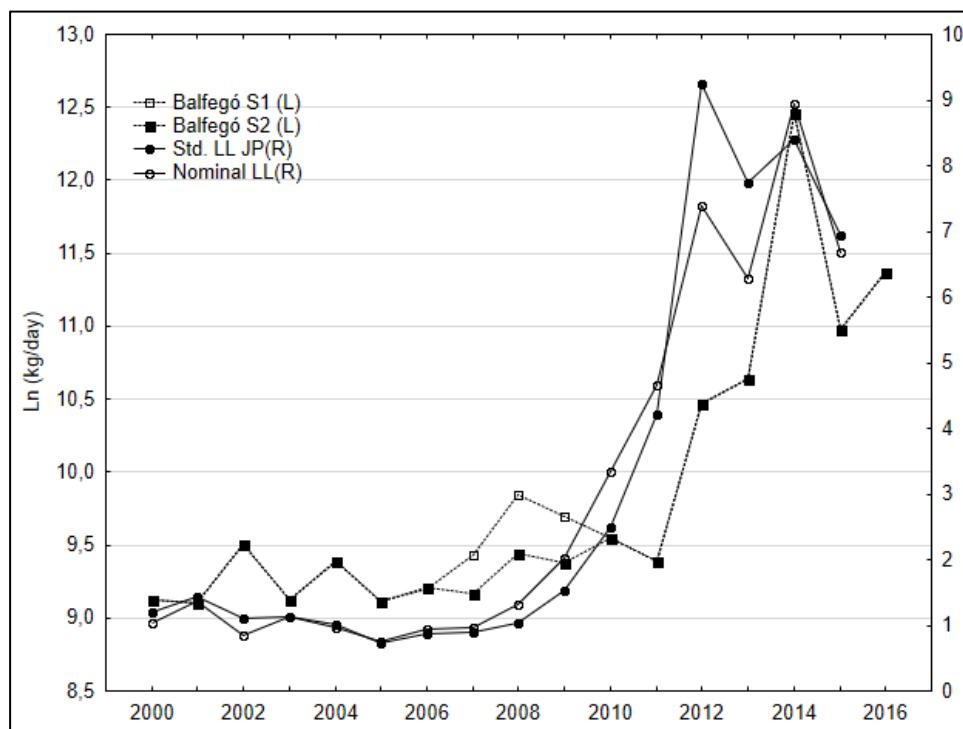|	Balfegó S1(Ln kg day⁻¹)	Balfegó S2(Ln kg day⁻¹)
Std LL Jp split (2000-2014)	0.89*	0.92*
Nominal LL Jp (2000-2015)	0.88*	0.91*
Std. LL JP (2000-2015)	0.83*	0.86*

*(p<0,0001)

Figure 1. Annual trends of Japanese LL nominal and standardised indices and Balfegó CPUE.
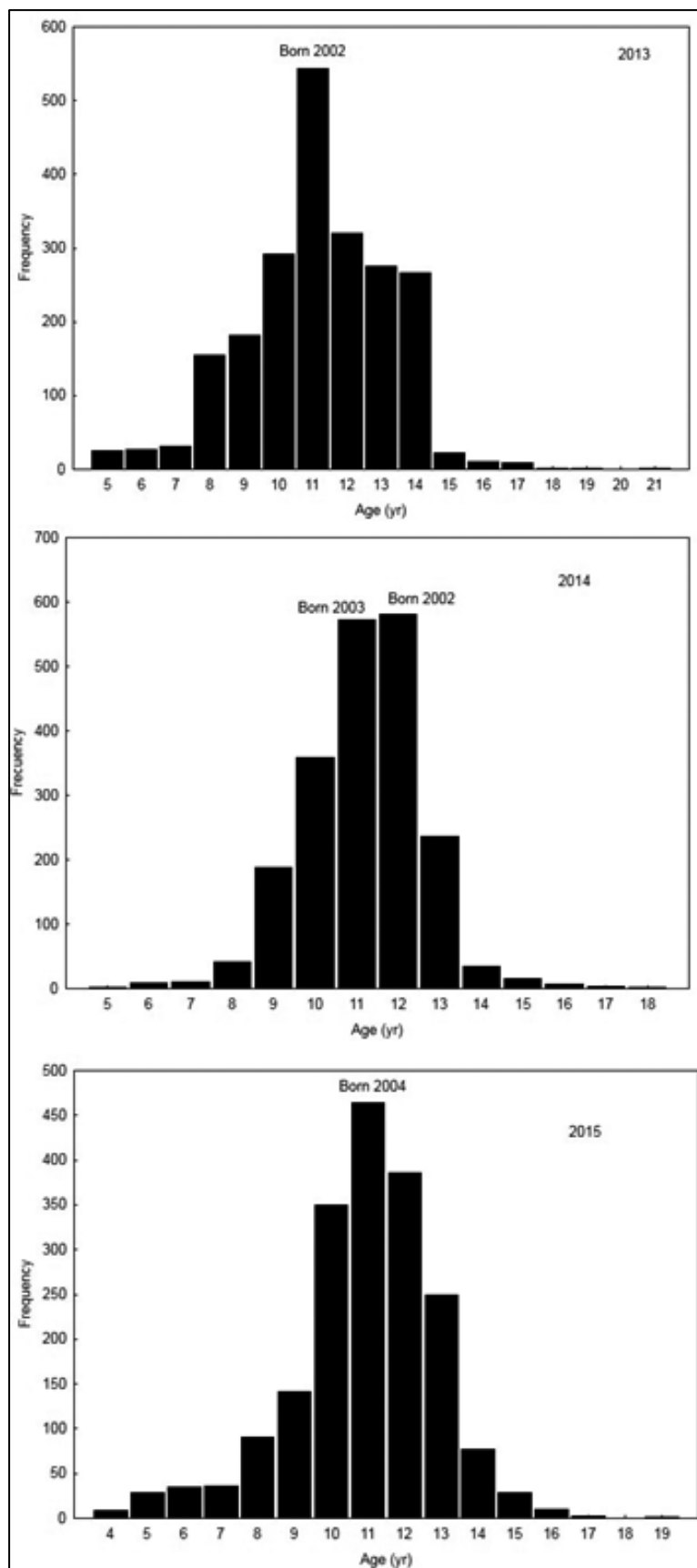
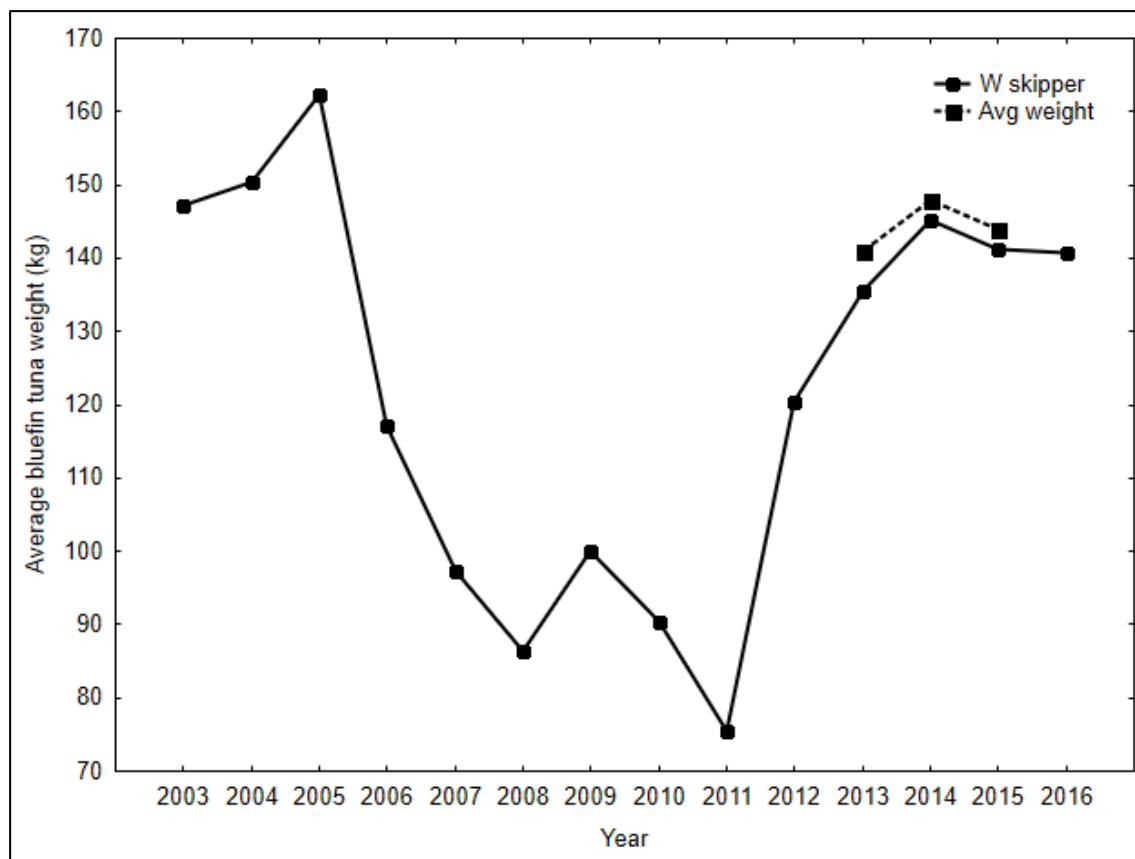**Figure 2.** Age structure of Balfegó joint fishing fleet catch (2013-2015).

Figure 3. Annual individual weight of ABFT caught by the Balfegó joint fishing fleet in Balearic grounds. Average weight from skippers visual observations (2003-2016) and from video techniques (2013-2015).