SKIPJACK (*KATSUWONUS PELAMIS*) BY-CATCH ESTIMATES FROM THE ALBACORE SPANISH SURFACE FISHERY IN THE NORTH EAST ATLANTIC: 2005-2012 YEARS

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SUMMARY

*Data on by-catch of skipjack (*Katsuwonus pelamis*) caught by the Spanish surface fleets, troll and bait boats, targeting albacore (*Thunnus alalunga*) in the Bay of Biscay and northeastern Atlantic fishing grounds are presented here. Monthly catch statistics and samples of fork length were collected at the main landing fishing ports along the north Spanish coast during the summer fishery seasons from 2005 to 2012. Estimates of Task I and Task II size data were compiled and processed. Results were presented in this document.*

RÉSUMÉ

Le document présente des données sur les prises accessoires de listao (Katsuwonus pelamis) *réalisées par les flottilles de surface (ligneurs et canneurs) de UE-Espagne ciblant le germon* (Thunnus alalunga) *dans les zones de pêche du golfe de Gascogne et de l'Atlantique Nord-Est. Les statistiques de capture mensuelle et des échantillons de longueur à la fourche ont été recueillies dans les principaux ports de débarquement le long de la côte septentrionale espagnole pendant les saisons de pêche estivales de 2005 à 2012. Les estimations des données de taille de la Tâche I et II ont été compilées et traitées. Les résultats ont été présentés dans ce document.*

RESUMEN

*En este documento se facilitan datos sobre captura fortuita de listado (*Katsuwonus pelamis*) capturado por las flotas de superficie españolas, curricaneros y cañeros, que se dirigen al atún blanco (*Thunnus alalunga*) en el golfo de Vizcaya y en los caladeros del Atlántico nororiental. Las estadísticas de captura mensuales y las muestras de longitud a la horquilla se recopilaron en los principales puertos de desembarque a lo largo de la costa septentrional española durante la temporada de pesca de verano desde 2005 a 2012. Se recopilaron y procesaron las estimaciones de datos de talla de Tarea I y Tarea II. Los resultados se presentan en este documento.*

KEYWORDS

Thunnus alalunga, By-catch, Skipjack, Katsuwonus pelamis*,*
Surface fishery, Size distribution, North Eastern Atlantic, Bay of Biscay

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1. Introduction

The Spanish albacore fishery develops during summer-autumn months, in the Bay of Biscay area and adjacent waters of Northeastern Atlantic. Two fleets target albacore in this area: trollers and bait boats. The activity of these fleets are monitored annually in the main landing fishing ports where information on trips is recorded and length sampling of the landed catch is done. The summer fishing grounds for trollers and bait boats were represented in **Figure 1** by Ortiz de Zárate *et al*. (2013). Albacore is the target species for both fleets, nevertheless other tuna species are caught as incidental catch during the albacore fishing season in these waters. Among those are: bigeye (*Thunnus obesus*) and skipjack (*Katsuwonus pelamis*) tunas. Bigeye information of Task I and Task II data has been reported on regular bases since 1998 (Ortiz de Zárate *et al*., 2011). In the 2012 fishing season, it was noticed an exceptionally high catch of skipjack landed by these fleets, likewise a considerable high number of fish were measured to the fork length at main ports by the IEO sampling network. Therefore a retrospective work was conducted to recover all the information collected by the monitoring network located at the main Cantabrian fishing ports that carried out enquires to skippers of the albacore fishery activity and sampling procedures of the catch landed to obtain the size composition. The information of skipjack sample size and catch landed by fleet was recovered from 2005 to 2012, then compiled and processed.

Skipjack estimates of Task I and Task II size samples statistics were obtained for the period 2005-2012. In this paper the results are presented according to Task I and Task II (size samples) statistical requirements of ICCAT.

In addition, warming caused by the NAO positive anomalies has influenced the sea surface temperature in the northern latitudes of the North east Atlantic (Hurrel and Dickson, 2001; Hurrel, 2013). Those results might be interpreted as being caused by variation on the oceanographic conditions thus a change of northern limit area distribution of tropical species shifting its distribution to northern latitudes in the North Atlantic waters. Consequently relationship between the skipjack captures locations and sea surface temperature (SST) images were explored in this document.

2. Material and methods

Information of albacore fishery is collected at main landing fishing ports in the Bay of Biscay and North western coast on weekly (daily in some fishing ports) bases in order to monitor the activity of both fleets: trollers and bait boat in the summer surface fishery (Ortiz de Zárate *et al.* 2012). Besides the main target albacore, other tuna species were caught as by-catch were kept on board and landed as accidental catch at main fishing ports.

The skipjack information gathered is not equally collected through all the fishing ports and within years, therefore the statistics presented represent the best estimate in the main fishing ports. Landings records were collected from sales notes and revised, when necessary with sampler's information.

The sample unit was random individual trip either bait boat or troll vessels accordingly to the activity of the albacore fishery being monitored at a given fishing port. When skipjack was landed, the specimen length (fork length, FL) was measured to the lower centimeter and the weight (kg) was recorded when possible. Length measurements of all trip samples were recorded and aggregated on monthly bases. The length-weight relationship for skipjack (Cayré and Laloë, 1986) was used to estimate the weight (kg) of each trip sample size. Likewise mean length and mean weight were estimated for all the fish sampled after being aggregated by month.

The nominal catch (kg) obtained from the monitoring of albacore fleets activity was processed by gear, bait boat and troll fleets on monthly basis from the trip sampled. However as the percentage of coverage of monitoring is highly variable between years, the Task I data of nominal catch was estimated for the two fleet combined. The source of information was the sales note from local fishing markets compiled by the producer organization. Similarly, the length distribution of samples by trip were added for the two fleets combined to produce Task II size data statistics of ICCAT (ICCAT, 2006-2010).

NOAA High-resolution blended analysis of daily sea surface temperature (SST) were downloaded from their web site at http://www.esrl.noaa.gov/psd/ selecting the summer season months for 2010, 2011 and 2012 years. Resolution pixel size of 0.25 degree and daily SST data set were obtained (Reynolds *et al*., 2007). Daily raster were processed with QGIS 2.0 Dufour (Quantum GIS Development Team 2014) and monthly mean was calculated using raster calculator. The observed catch from the monitored trips containing geographical information and the SST monthly means in the fishing area were processed by month to explore a potential relationship with the sea surface temperature range between years and/or months within years.

3. Results and discussion

The annual catch (Task I) of skipjack reported by the professional organizations and fishing markets for the period 2005 to 2012 is shown in **Table 1**. Meanwhile the time series of catch estimated by means of monitoring of the two fleets and their correspondent coverage is presented in **Table 2**. It is observed that for most of the years nearly 100% of catch was done by troll fleet, with the exception of the 2011 fishing season with a 56% of total catch reported by bait boats and 2012 fishing season, when the highest proportion of catch 83% was obtained by the bait boat fleet. The annual evolution of nominal catch is shown in **Figure 1**.**a** for both fleets troll and bait boat aggregated and in **Figure 1.b** was presented the results of the monthly distribution of landings for the time series 2005 to 2012 reported. It is observed that for the years 2006, 2011 and 2012 with total nominal catch above the mean trend, the highest catches are registered the autumn season, in October and November, being remarkable high in the last two fishing seasons and taken by the bait boat fleet localized in the Bay of Biscay area. In **Table 3,** are summarized the annual and monthly geographical area covered by the skipjack observation obtained from the single trip enquires carried out. Likewise it is included the month with the highest catch registered. It is highlighted the month when the highest catch was obtained for the most recent years 2010, 2011 and 2012 along with the sea surface temperature (SST) range obtained from the processed NOAA images describing monthly SST.

The length frequency distribution of the sampled catches by month and gear (Task II- size) results were communicated to ICCAT. It is presented the length distribution for the most recent years: 2011 and 2012 representing the highest levels of catch registered. In **Figure 2.a** was shown the total annual length distribution of samples of 566 skipjack measured, where it is observed a clear mode in the 50 cm length class. As well the mean size and mean weight by month for 2011 is presented in **Figure2.b**, where it is seen that the largest skipjack were caught in October, with a main weight of 2.9 kg and a mean size of 51 cm. Similarly, in **Figure 3.a** was presented the total annual length distribution of the 998 skipjack measured. In this case the profile is more truncated and the mode is localized in the 47 cm length class. Moreover, the mean size and mean weight by month for 2012 is presented in **Figure 3.b**, where it is seen that the largest skipjack were caught in October, with a main weight of 2.4 kg and a mean size of 49 cm. As overall from the samples obtained in 2012, it seems that skipjack were of smaller size than in 2011.

Monthly length frequency distribution of catches for 2011 and 2012 years, showed a monthly variability in length distribution within years and between years. The size range of the length of skipjack caught by surface fleets varied from 47 to 51 cm length and from 46 to 47 cm length respectively. In general, those averaged sizes do not differ from the average size reported for the bait boat fleet targeting skipjack in the Canary Islands (Delgado de Molina *et al*. 2012). However, according to the results in this paper, this by-catch data coming from the Cantabrian sea fishing area showed a larger mean size and mean weight that the results presented for 2010 bait boat fishery in the Canary Islands fishing area (**Table 5 and Figure 7** in Delgado de Molina *et al*. 2012).

Once explored the most abundant captures by month, October was found, in most of the years, the month with highest catch landed (**Figure 1.b)**. Based on these data, sea surface temperature (SST) was explored in October from three different years: 2010, 2011 and 2012 as well as the month of November in 2011, to search for some relationship between these SST in the area and location of skipjack catches.

In the **Figure 4.a, Figure 4.b** and **Figure 4.c**, were represented the October monthly mean SST and the locations of skipjack accidental catches, meanwhile in **Figure 4.d** was presented the results of the November observations in 2011. The SST range from these images was obtained (**Table 3**). There was not a clear pattern on SST related to the abundance of skipjack observation that would merit a further study taking into account the nature of the skipjack data collected. Nevertheless, it is identified the month of October in 2010 (**Figure 4.a**) as being the most colder situation in relation to skipjack catches and the most septentrional location observed in the information collected and presented in this document.

Aknowledgements

The authors would like to thank all the network sampling staff involved in the collection of data and information at fishing ports. The work related to this document was partly supported by the IEO project PNDB 2011-2013 funded by DG MARE of European Union.

NOAA High Resolution SST data provided by the NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, from their Web site at http://www.esrl.noaa.gov/psd/.

Thanks are extended to Pilar Cordoba for her assistance in the images processing.

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Table 1. Skipjack Task I data, nominal catch (kg) landed by the Spanish albacore surface fishery: 2005-2012.

Year	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
Catch (kg)	29133	70859	9321	5882	27575	44347	240033	336354

Table 2. Skipjack nominal catch (kg) by gear obtained by the monitoring network of landings by Spanish albacore surface fishery: 2005-2012.

Year	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
TR	5216	9101	2538	241	1300	1000	9687	33748
BB	656	1011	58	0	0	0	125265	163022
Total TR + BB	5872	10112	2596	241	1300	1000	134952	196770
TR %	89	90	98	100	100	100	44	17
BB %	11	10	2				56	83

Table 3. Annual location fishing area and highest month catch recorded of skipjack for the period 2005-2012. Likewise SST range for 2010 to 2012.

Year	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
SST images						Oct	Oct & Oov	Oct & Oov
SST º C range						14º- 17º C	17º- 20º C & 16º - 17º C	16º - 20º C & 16º - 17º C
Monthly highest catch	oct	oct	oct	aug & sept	oct & nov	oct & nov	oct & nov	oct
Monthly Latitude range	43º - 48º N	43º - 46º N	43º -51º N	43º - 45º Nº & 45º - 50º N	44º - 48º N & 44º N	43º - 52º N & 45º - 51º N	43º- 46º N & 43º - 45º N	43º - 46º N
Monthly Longitude range	2º -10º W	2º - 5º W	3º - 16º W	3º - 8º W & 9º - 12º W	6º -17º W & 7º - 8º W	6º - 14º W & 5º - 15º W	2º - 9º W & 2º - 6º W	1º - 9º W
Annual Latitude range	43º - 48º N	43º - 49º N	43º - 51º N	43º - 50º N	44º - 51º N	43º - 52º N	43º - 51º N	43º - 52º N
Annual Longitude range	2º - 10º N	2º - 12º W	3º - 16º W	3º - 12º W	5º - 17º W	5º - 18º W	2º - 18º W	1º - 12º W

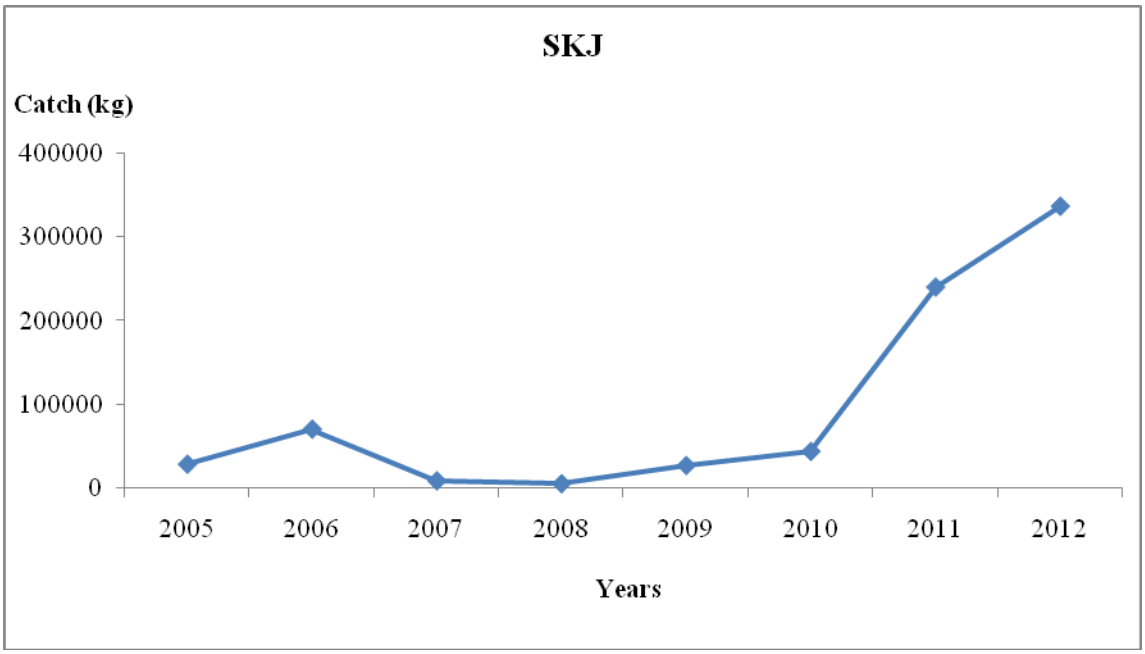

Figure 1.a Annual time series of Task I nominal catch of skipjack landed by Spanish albacore surface fishery: bait boat and troll fleets, for the period 2005-2012.

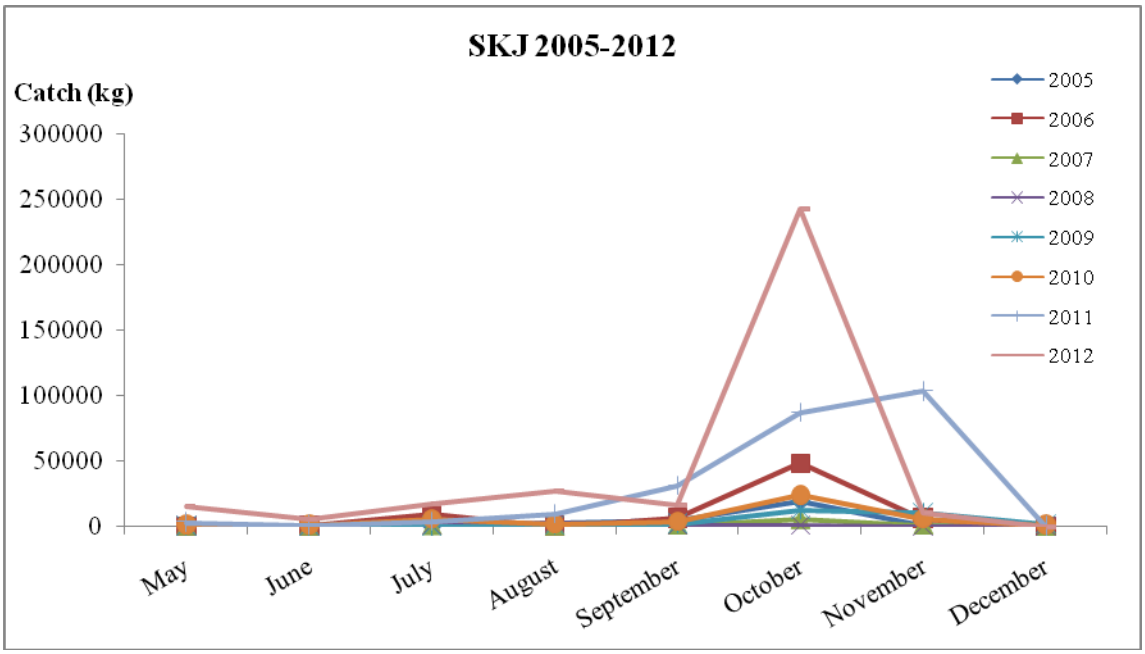

Figure 1.b Seasonality of Spanish skipjack catches by bait boat and troll fleet combined for the period 2005-2012.

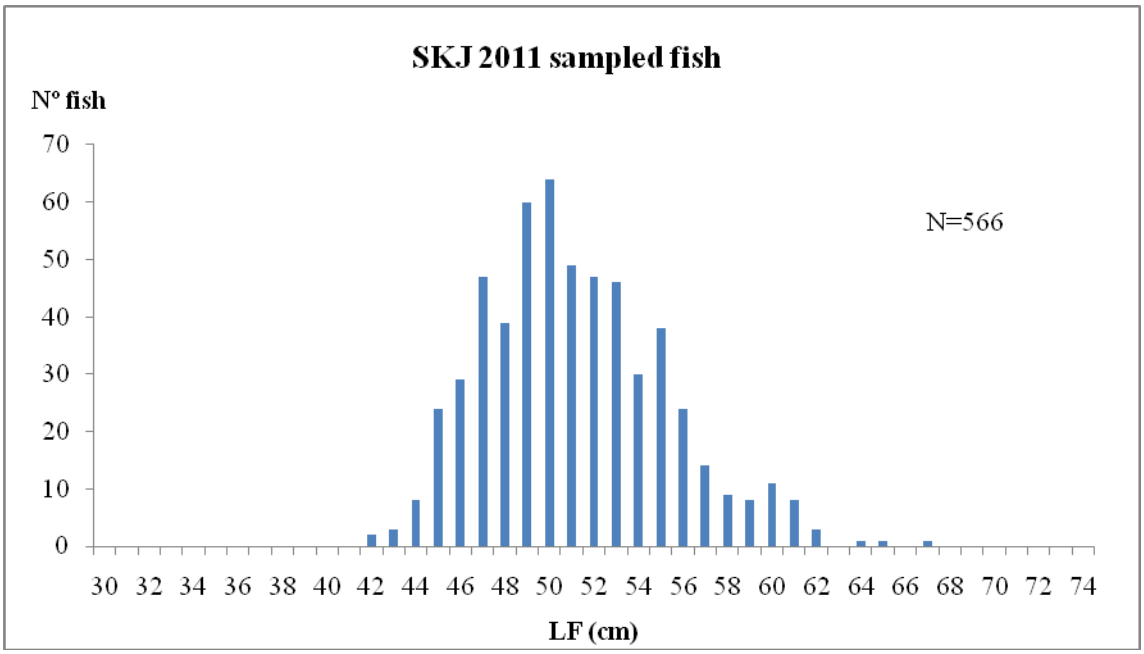

Figure 2.a Length distribution of sampled skipjack caught by albacore surface fishery in 2011.

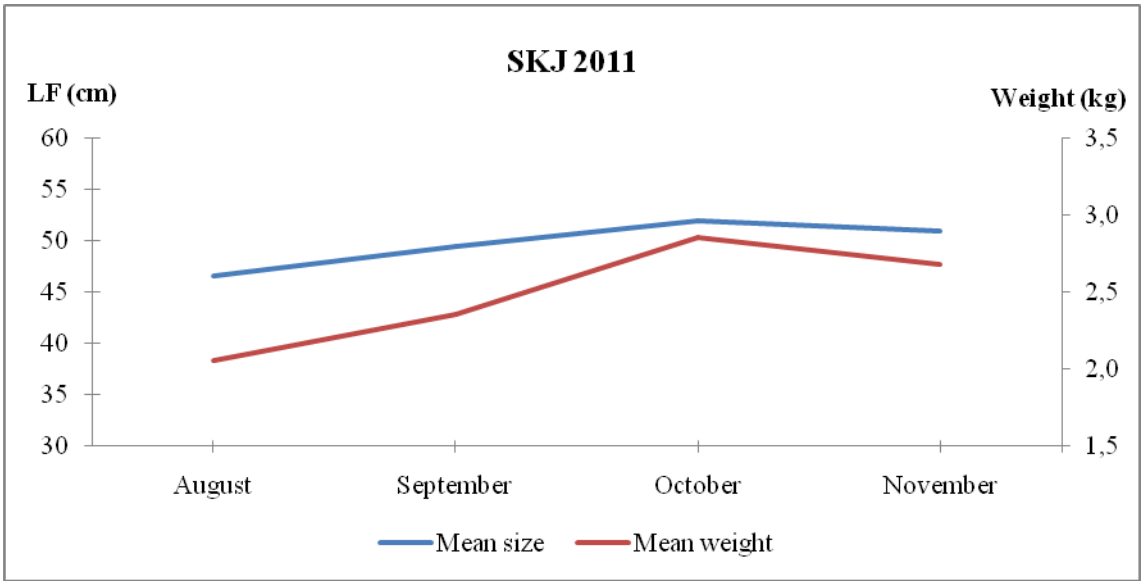

Figure 2.b Estimated mean size and mean weight of skipjack obtained by month by means of the sampling procedures applied in 2011.

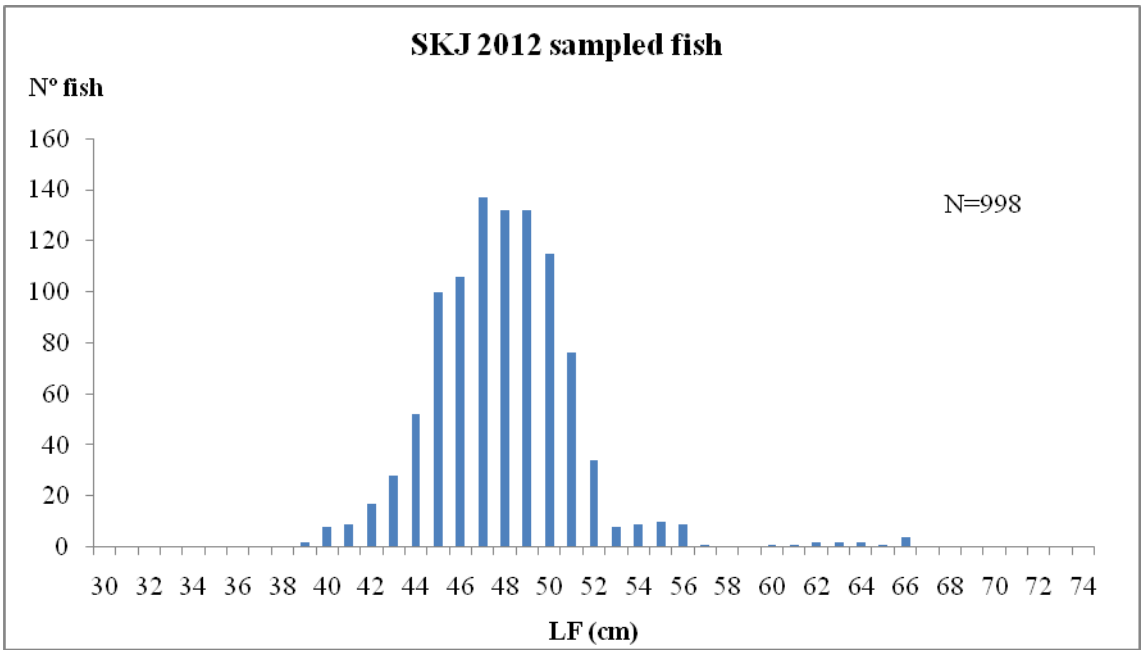

Figure 3.a Length distribution of sampled skipjack caught by albacore surface fishery in 2012.

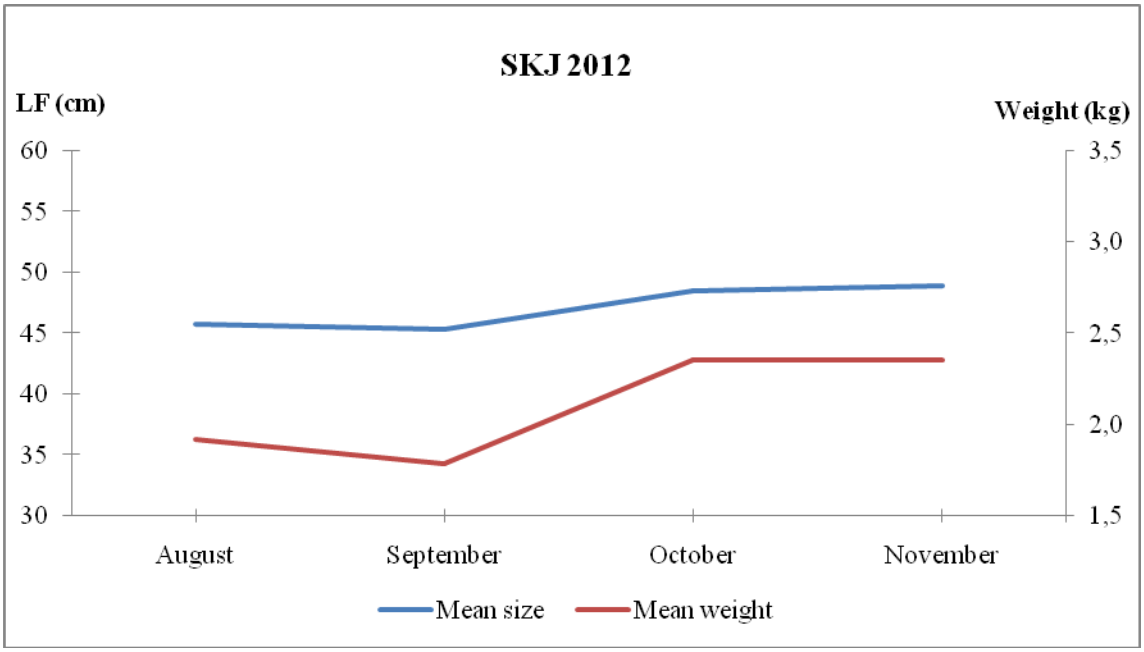

Figure 3.b Estimated mean size and mean weight of skipjack obtained by month by means of the sampling procedures applied in 2012.

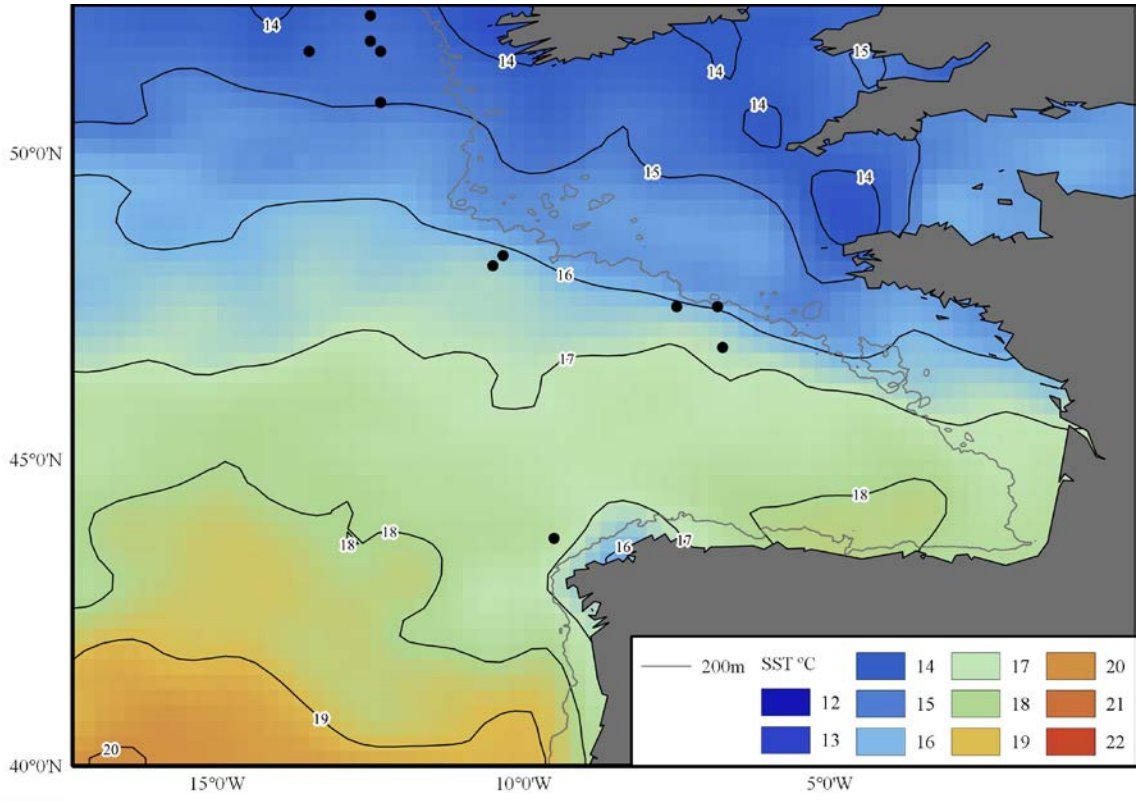

Figure 4.a Sea surface temperature (SST) and locations of skipjack catches in October 2010.

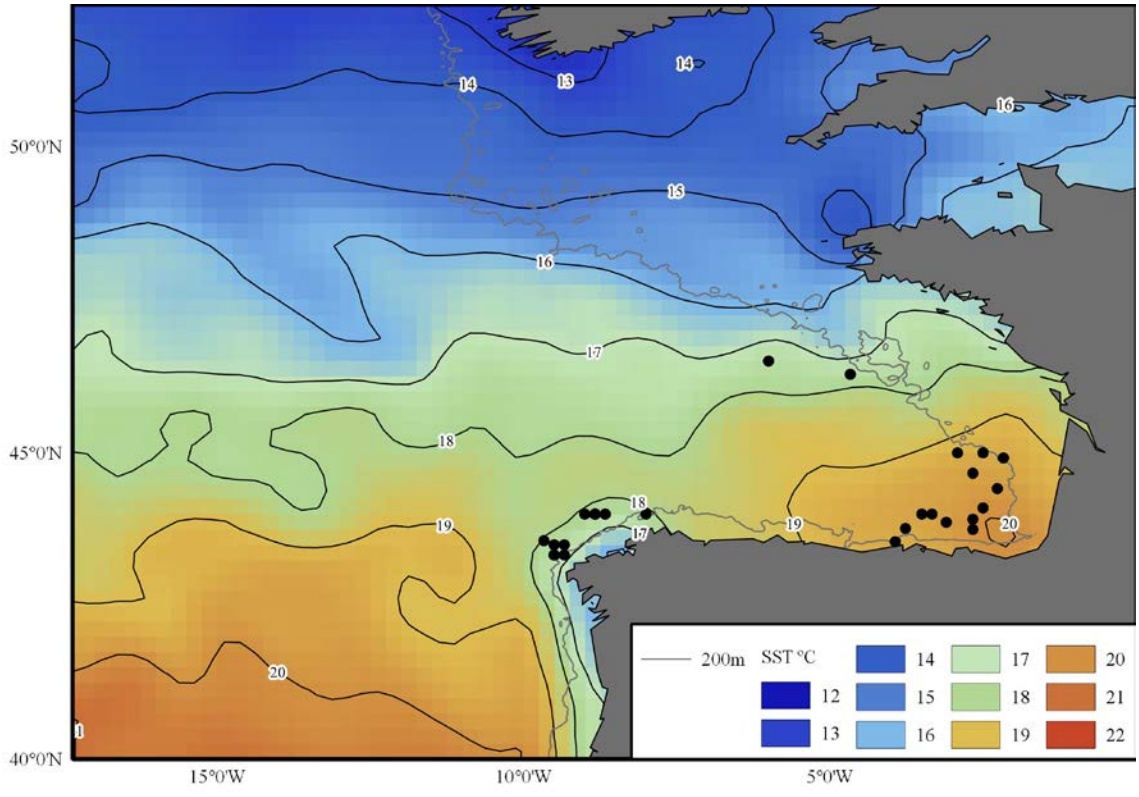

Figure 4.b Sea surface temperature (SST) and locations of skipjack catches in October 2011.

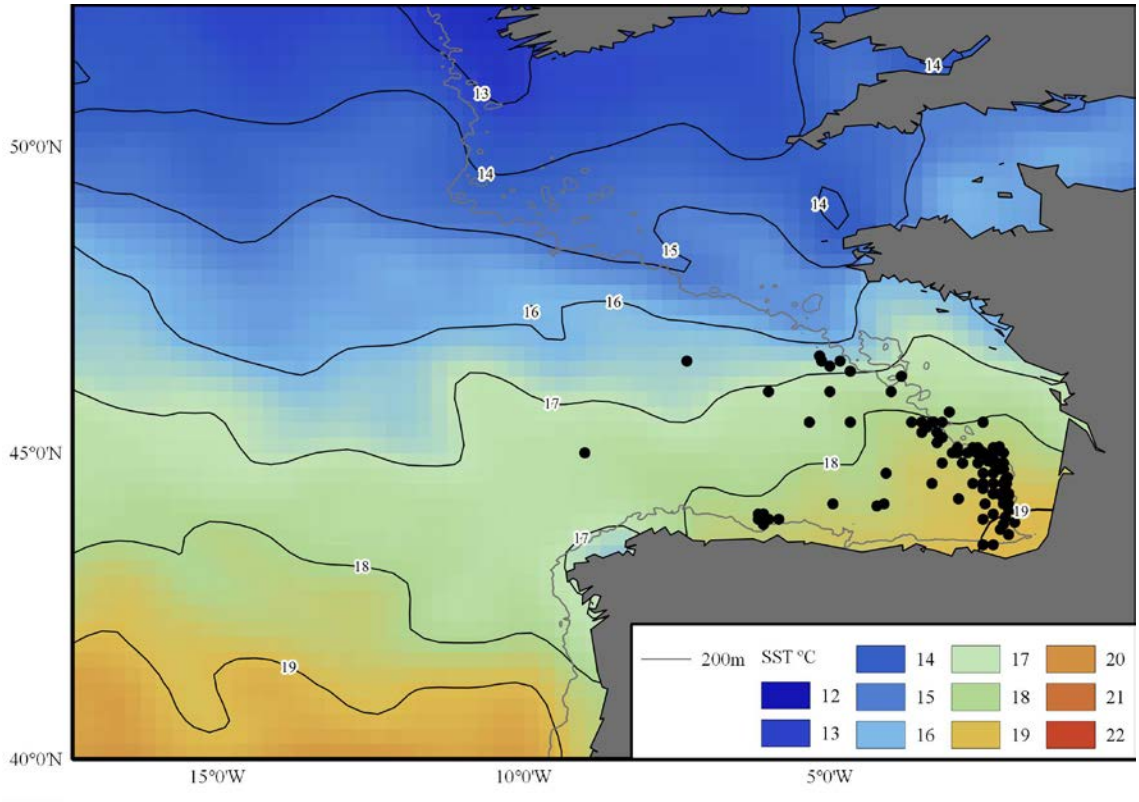

Figure 4.c Sea surface temperature (SST) and locations of skipjack catches in October 2012.

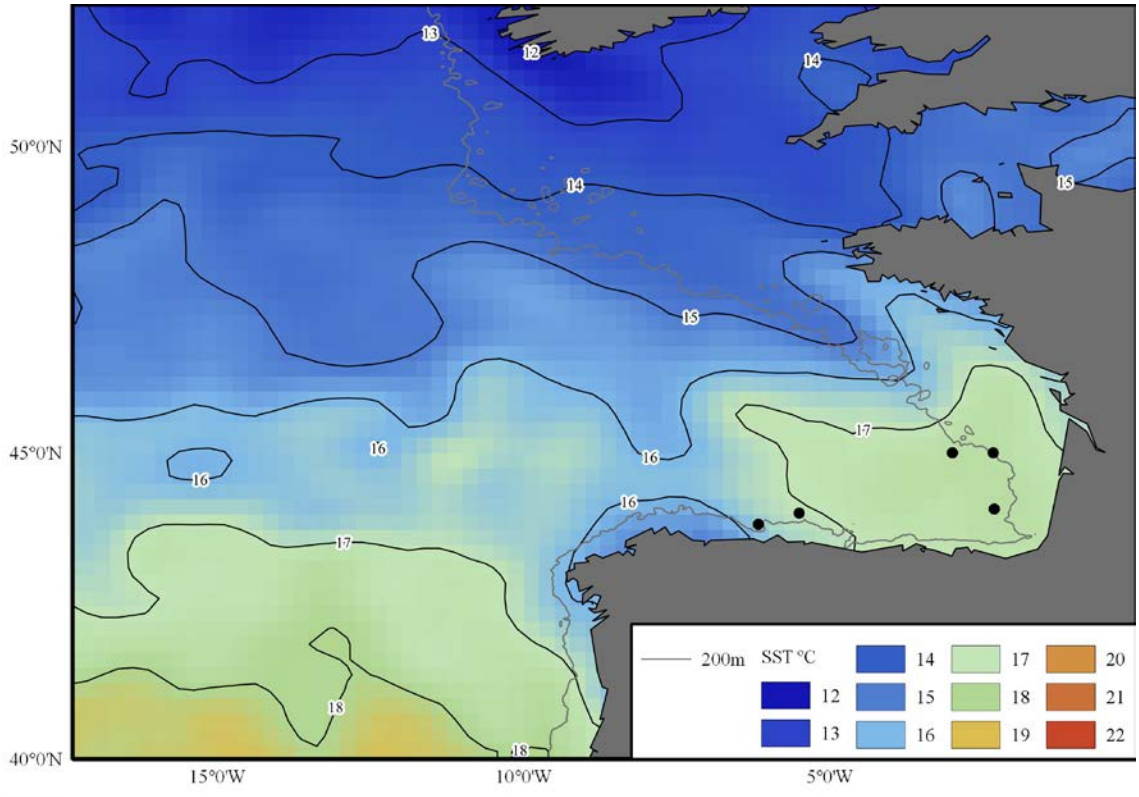

Figure 4.d Sea surface temperature (SST) and locations of skipjack catches in November 2011.