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ANALYSIS OF THE SPANISH TROPICAL PURSE-SEINE FLEET'S EXPLOITATION OF A CONCENTRATION OF SKIPJACK (*KATSUWONUS PELAMIS*) IN THE MAURITANIA ZONE IN 2012

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SUMMARY

From August to November 2012, an important concentration of skipjack occurred in the Mauritania zone. This situation was exploited by the Spanish purse-seine fleet, which obtained significant yields over floating objects. We analyze the characteristics and some of the possible causes of this concentration.

RÉSUMÉ

Entre le mois d'août et le mois de novembre 2012, une importante concentration de listaos s'est formée dans la zone mauritanienne. Cette situation a été exploitée par la flottille espagnole de senneurs qui a obtenu des prises importantes avec des objets flottants. Nous analysons les caractéristiques et quelques-unes des causes éventuelles de cette concentration.

RESUMEN

Entre agosto y noviembre de 2012 se produjo una importante concentración de listado en la zona de Mauritania, circunstancia que aprovechó la flota de cerco española para obtener importantes rendimientos con pescas sobre objetos flotantes. Se analizan las características de esta concentración y algunas de sus posibles causas.

KEYWORDS

Skipjack, Tropical purse-seine fishery, Catch/effort, Environmental parameters

1. Introduction

In August, September, October and November 2012, the Spanish tropical purse-seine fleet focused a considerable part of its fishing effort on artificial floating objects in waters close to Mauritania, an uncommon area for this period of the year and for this fishing mode, with extraordinary yields of skipjack.

This document analyzes the characteristics and some of the possible causes of this concentration.

2. Material and methods

We analyzed data from the fishing activity of the Spanish fleet and associate by comparing the characteristics of the sets and yields in the zone examined (between 15ºN and 20ºN) and the rest of the fishing zone, from August to November 2012.

The baseline data for this paper are taken from fishing logbooks, from samplings carried out at the landing ports to obtain composition per species and size distributions of the catch, and from the landing data. Since the 1984 meeting of the Working Group on Tropical Tuna, specific catch composition has been corrected from the data resulting from multi-species sampling and according to the procedure outlined by the group (Anon, 1984). Since 1991, changes in the fishery after the introduction of fishing over floating objects with buoys entailed the revision of error-correcting procedures for specific composition and size distribution, due to important differences in the characteristics of catches obtained over objects or free schools. In 1996 and 1997, a

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coordinated programme (France-Spain-European Union) was developed to analyze the tropical tuna sampling and data processing strategy. Accordingly, a suitable sampling scheme (Pallarés, P. & Ch. Petit, 1997) was devised from a statistical perspective to correct specific composition and to obtain catch size distributions.

Daily high-resolution Sea Surface Temperature (SST) time series are taken from the NOAA-THREDDS Data Server (NOAA-THREDDS, 2012), As Reynolds et al. (2007) reported, these SST time series are obtained by an optimum interpolation method that uses Advanced Very High Resolution Radiometer (AVHRR) infrared satellite SST data, in combination with in situ surface data from ships and buoys. They include a large-scale adjustment of satellite biases with respect to the in situ data. The analyses have a spatial grid resolution of 0.25°. SST monthly average maps show the differences temperatures anomalies in the months analyzed in 2012 and the corresponding months of the previous three years (2009-2011).

3. Results and discussion

Figure 1 shows a map of catches, per species, over floating objects, by the Spanish fleet in the Atlantic Ocean, in 2012. **Figure 2** gives the same information, considering the average catches for 2007-2011. A comparison of both figures reveals that in 2012 there was a high concentration of mostly skipjack, in latitudes above 15ºN and in an area very close to the coast, while in 2007-2011, this same area was virtually barren.

Another of the characteristics observed is the time of year when the concentration occurred. **Figure 3** shows that few catches were obtained in the Mauritania zone from August onwards.

The question that emerges from this figure is why boats went to that unfrequented area at that time.

According to information provided by skippers, several coincidental circumstances led the fleet to that area. On the one hand, that year the fleet did not set sail for Gabon, which would have been normal practice, as there was no fishing agreement in force with that country. On the other hand, Dakar bait boats' frequent entries into port alerted them of the possibility of high productivity in the area. In April and May, several vessels seeded objects in the Guinea Conakry and Guinea Bissau zones, which were recovered in the area and period analyzed. Moreover, according to information provided by the fleet, the objects deposited in the area were highly productive and concentrated significant amounts of fish in a very short time (10 or 15 days).

The left column of **Figures 4, 5, 6** and **7** shows the catches, in tons, made over floating objects during the months analyzed, while the right column gives the fishing effort, in fishing days, corresponding to those months. We see that in August and September, despite important effort values throughout the fishing area, yields are only significant in the Mauritania zone. In October catches in the Mauritania zone are still important but are now observed in other zones. By November, although there continue to be catches over objects in the Mauritania zone, they are lower than those of the previous three months.

Figure 8 shows the number of purse-seiners inside and outside the area in question per month and for all four months, in order to analyze yields both inside and outside the area.

We now compare the Mauritania zone in 2012 with previous years. **Figure 9** shows the total number of sets per month (August, September, October and November) in 2012 and the average for those months from 2000 to 2011, confirming what is shown in **Figure 3** (namely that the fleet is rarely present in this area at that time of the year), and the information about the catches (**Figure 10**).

Figure 11 presents the catch, per species for all four months and areas considered, separating catches made over objects and over free schools. Catches over free schools are minimum in comparison with those obtained over floating objects, skipjack being the dominant species (**Figures 10 and 11**).

In order to track the evolution of skipjack catches over the four months, **Figure 12** shows the catch, per month, for this species, over object and free school, September being the month with the highest catches.

Figure 13 gives the daily catch-per-unit-of-fishing-effort (CPUE) in tons per fishing day for the four months considered. September shows the highest yields, with up to 61 t in one day. **Figure 14** gives the monthly CPUE, which varies between 31.8 t per fishing day for September and 11 t per fishing day for November.

These yields are exceptionally high if we compare them with the annual yields of the Spanish fishery given in **Table 1**. For the period 1991 to 2012, yields are much lower, in the order of 5 t per fishing day, an average of 7 t per fishing day for that period.

Figure 15 gives the distribution per size and month for the period and area considered, while **Figures 16** and **17** compare size and weight distributions, respectively, inside and outside the Mauritania zone. The area analyzed reveals a significant rate of larger and heavier specimens than the rest.

Figures 18, 19, 20 and **21** show the differences in surface temperatures when comparing 2012 with 2009 (left), 2010 (centre) and 2011 (right), for August (**Figure 16**), September (**Figure 17**), October (**Figure 18**) and November (**Figure 19**). In the four months analyzed, we observe that 2011 was a much colder year than 2012, with a difference of three degrees in many cases. For the three years compared, September 2012 had the highest temperature. In general, 2012 had higher temperatures in this area and in these months, when compared with the three previous years.

This type of specific concentrations is not new. There are many examples in the history of the tropical tuna purse-seine fishery (Fonteneau, 1986; Fonteneau, 1991, Ménard et al. 1998, Ravier et al. 2000), with numerous references to skipjack, affecting the abundance (large concentrations in time and space strata) and the catchability of the species (intense exploitation).

The CPUE will be affected not only by the abundance of the resource but also by environmental variables (which facilitate the concentrations) and by the fishing strategy (Andrade et al, 2005).

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Table 1. CPUE (tons/fishing days) of skipjack for the Spanish purse-seine fleet in the East Atlantic.

YEAR	*SKJ*
1991	8.66
1992	4.93
1993	6.82
1994	5.56
1995	6.44
1996	4.96
1997	5.47
1998	4.82
1999	6.83
2000	6.64
2001	5.74
2002	4.63
2003	9.18
2004	8.15
2005	7
2006	6.71
2007	6.33
2008	7.47
2009	6.42
2010	7.84
2011	10.79
2012	13.23

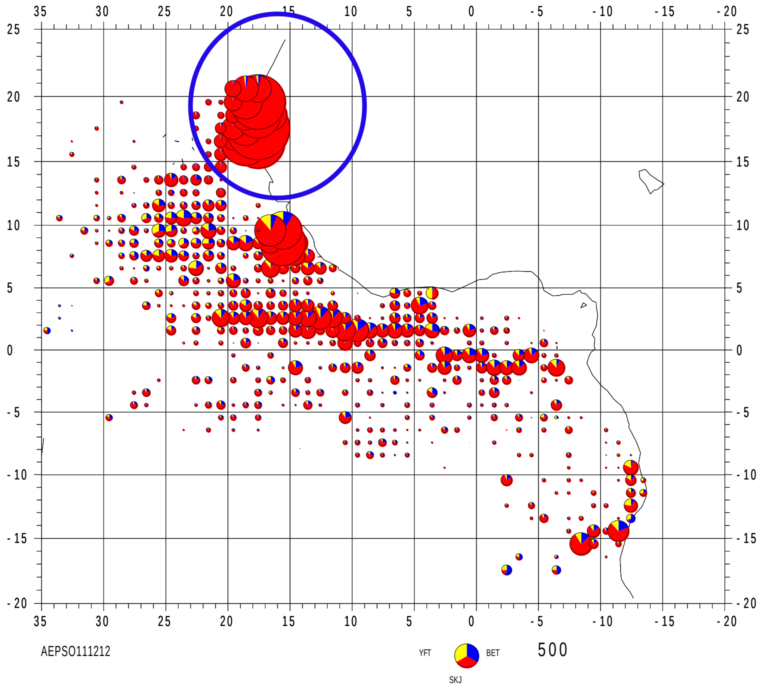


Figure 1. Distribution of bigeye, skipjack and yellowfin catches over **floating objects** of the Spanish tuna purse-seine fleet in 2012.

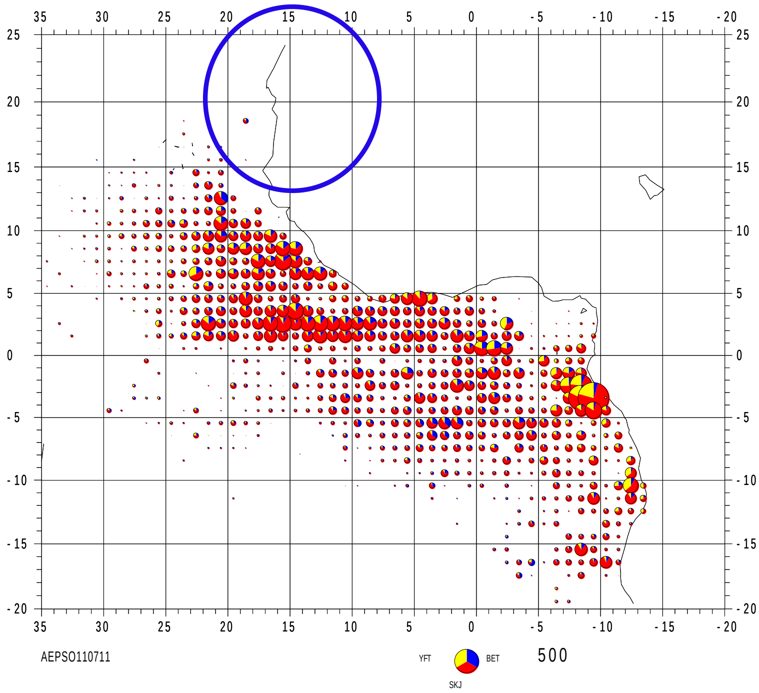


Figure 2. Average distribution of bigeye, skipjack and yellowfin catches over **floating objects** of the Spanish tuna purse-seine fleet for 2007-2011.

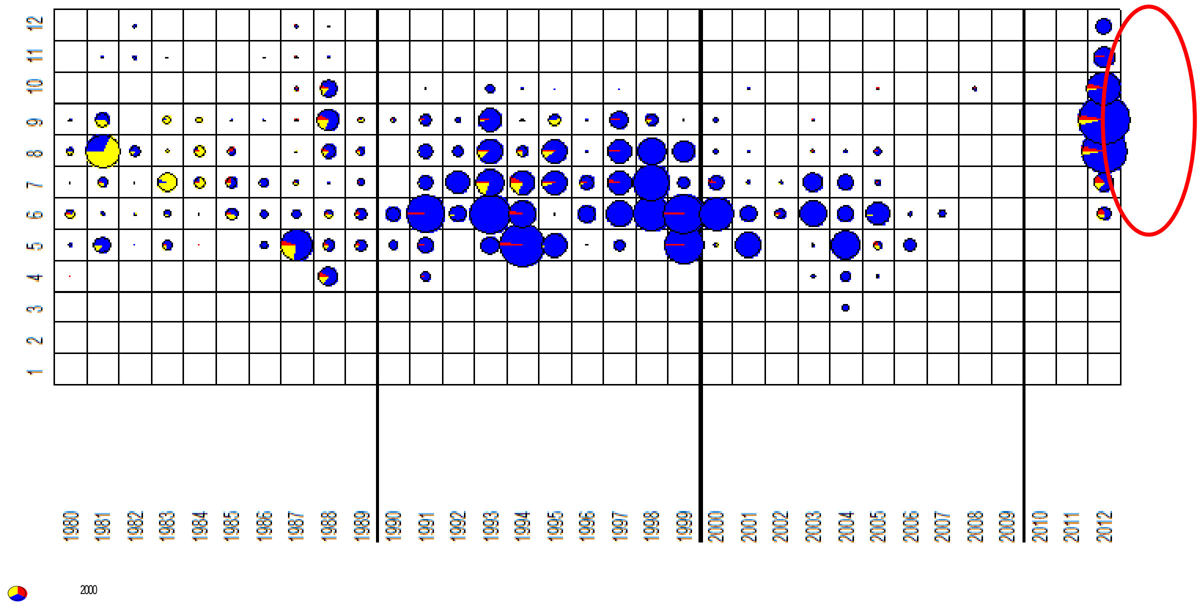


Figure 3. Monthly catches for the European purse-seine fleet in the Mauritania zone (>15ºN) for 1980-2012.

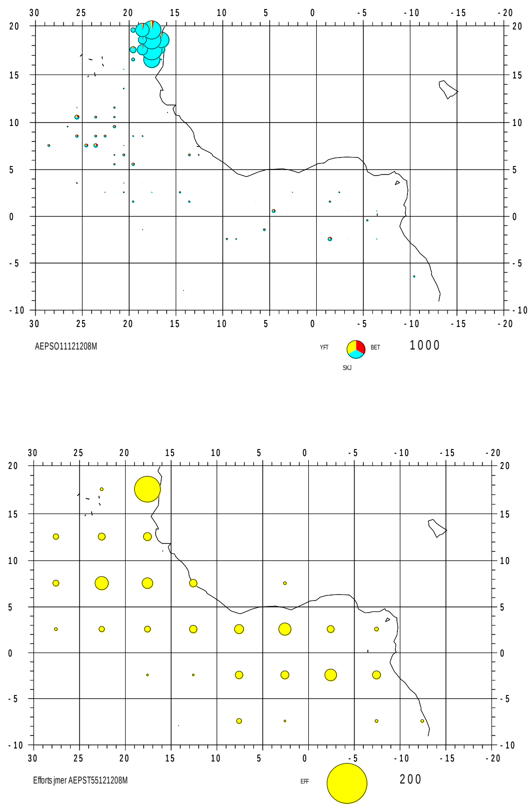
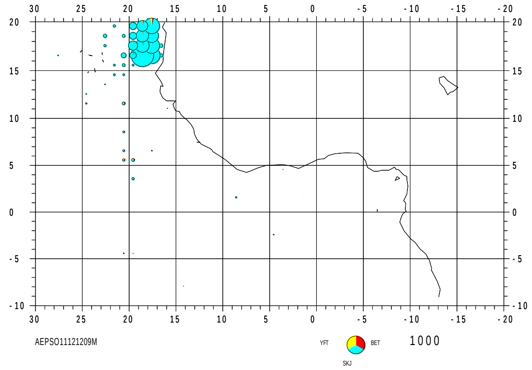


Figure 4. Distribution of catches (left) over **floating objects** and fishing effort (right) of the Spanish tuna purse-seine fleet in **August** 2012.



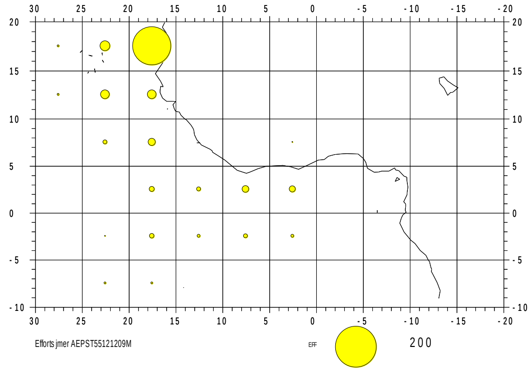


Figure 5. Distribution of catches (left) over **floating objects** and fishing effort (right) of the Spanish tuna purse-seine fleet in **September** 2012.

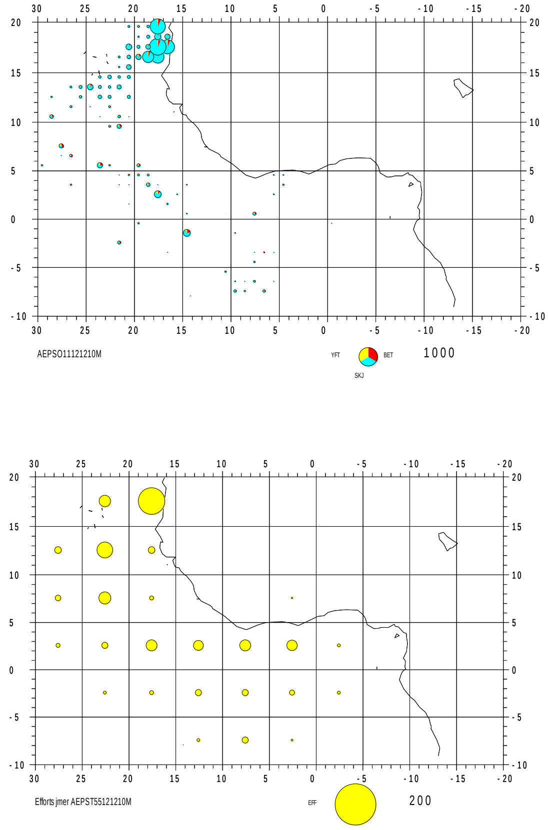


Figure 6. Distribution of catches (left) over **floating objects** and fishing effort (right) of the Spanish tuna purse-seine fleet in **October** 2012.

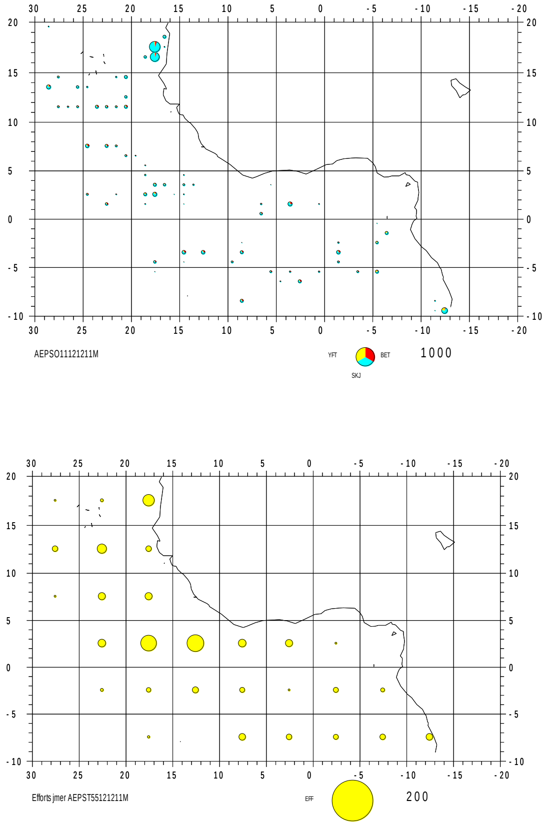


Figure 7. Distribution of catches (left) over **floating objects** and fishing effort (right) of the Spanish tuna purse-seine fleet in **November** 2012.

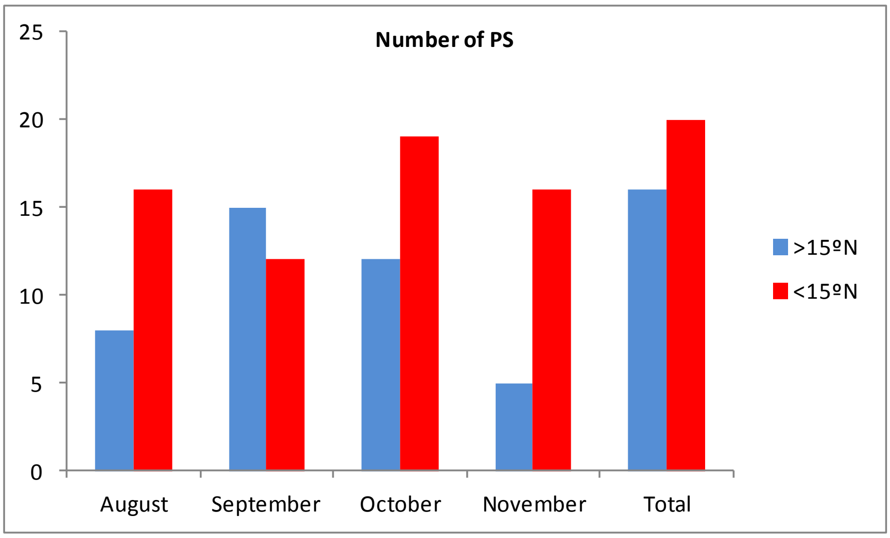


Figure 8. Number of purse-seiners in the Spanish fleet and associates inside and outside the area considered, per month and in total.

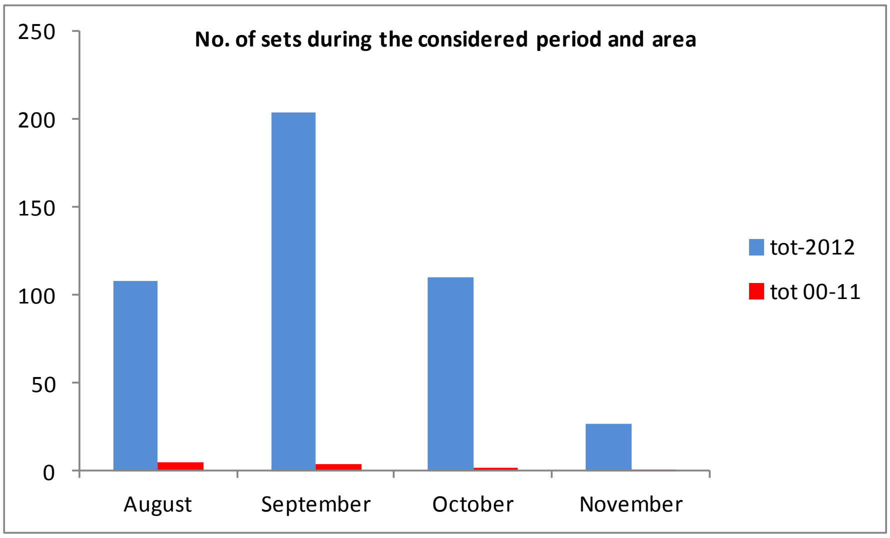


Figure 9. Total number of sets in the months and area considered for 2012 and average number, in the same area, for 2000-2011.

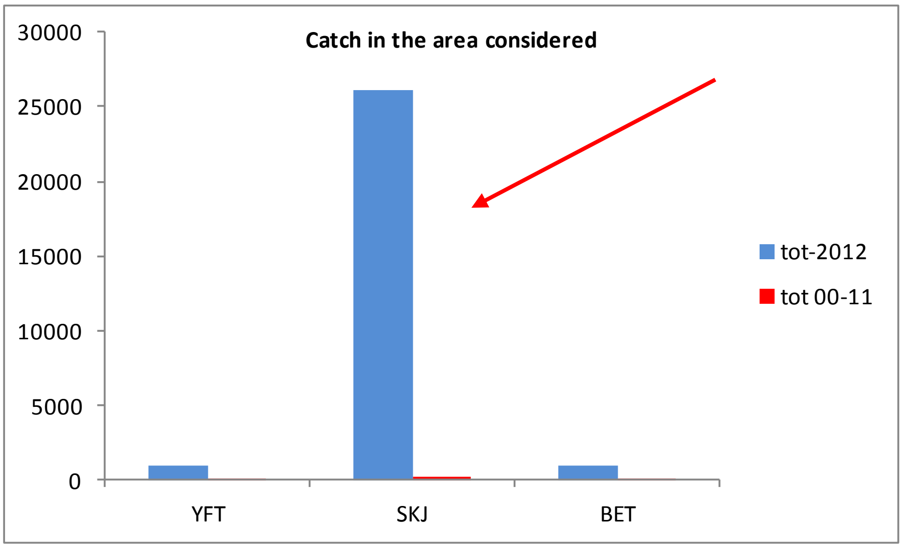


Figure 10. Catch, per species, in the months and area considered for 2012 and average number, in the same area, for 2000-2011.

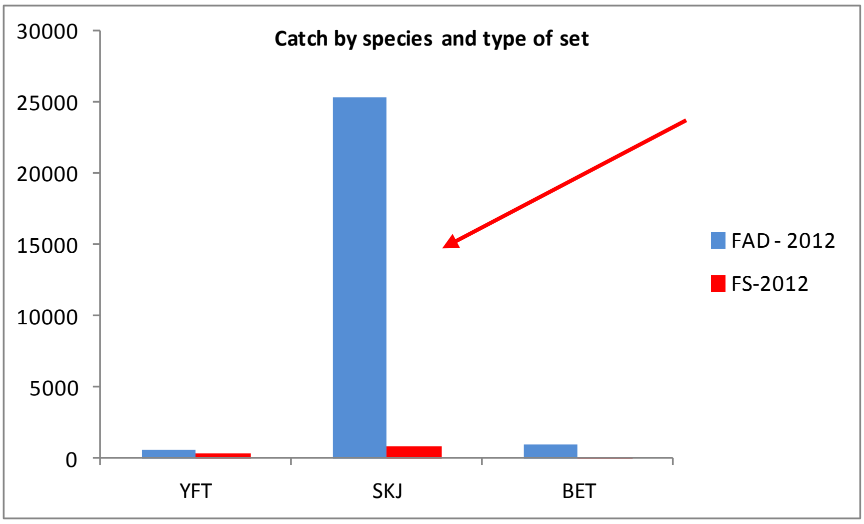


Figure 11. Catch, per species, in the months and area considered for 2012, according to fishing mode.

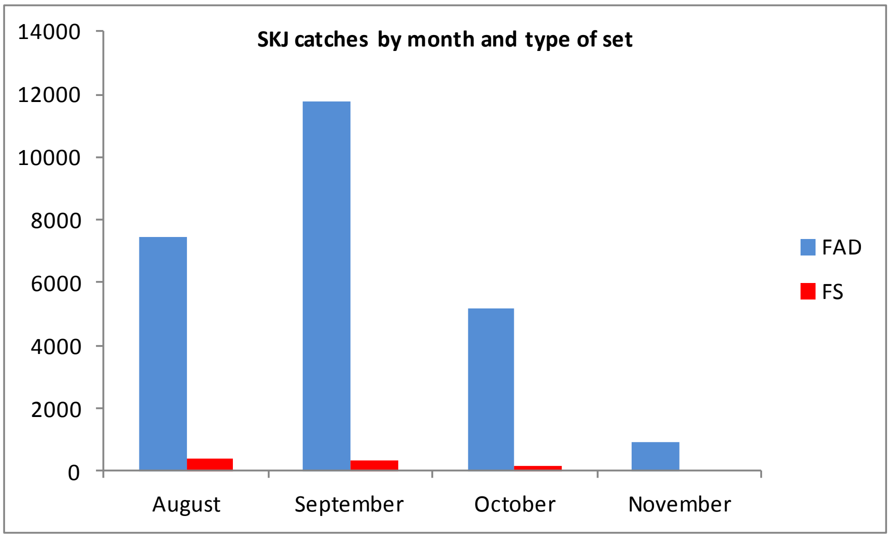


Figure 12. Skipjack catch in the months and area considered for 2012, according to fishing mode.

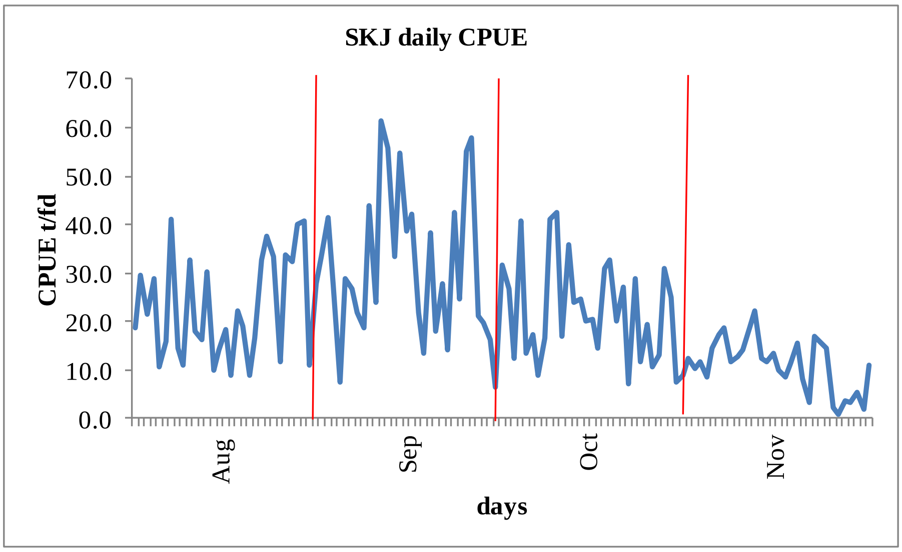


Figure 13. Daily catches per CPUE (tons/fishing days) for the Spanish purse-seine fleet and associates in the zone and period analyzed.

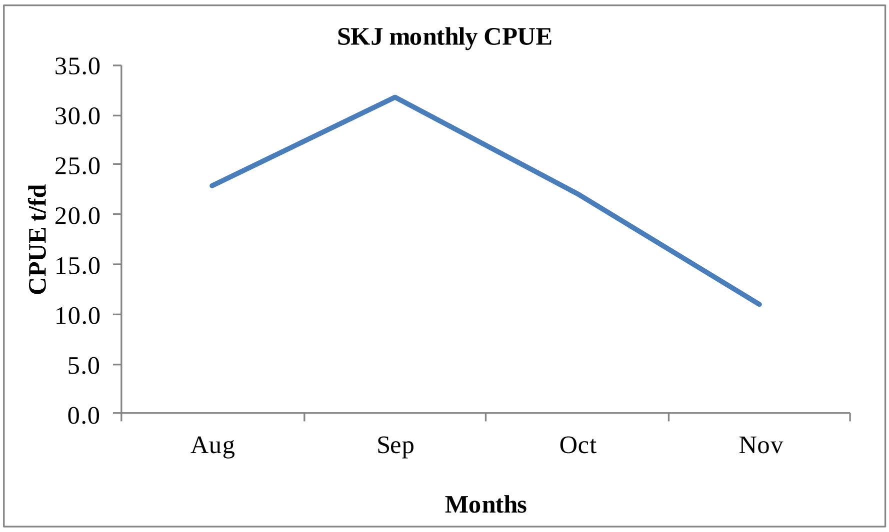


Figure 14. Monthly catches per CPUE (tons/fishing days) for the Spanish purse-seine fleet and associates in the zone and period analyzed.

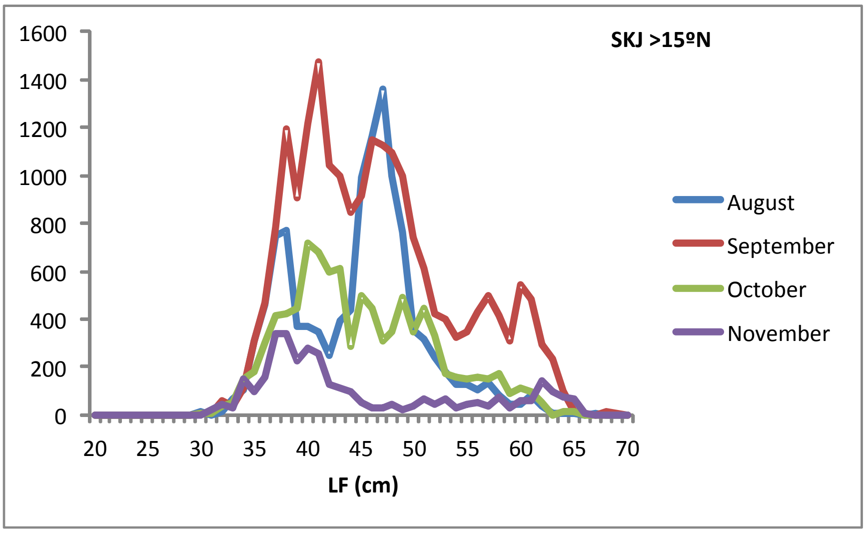


Figure 15. Distribution of sizes, per month, over floating objects, in the period and area considered for 2012.

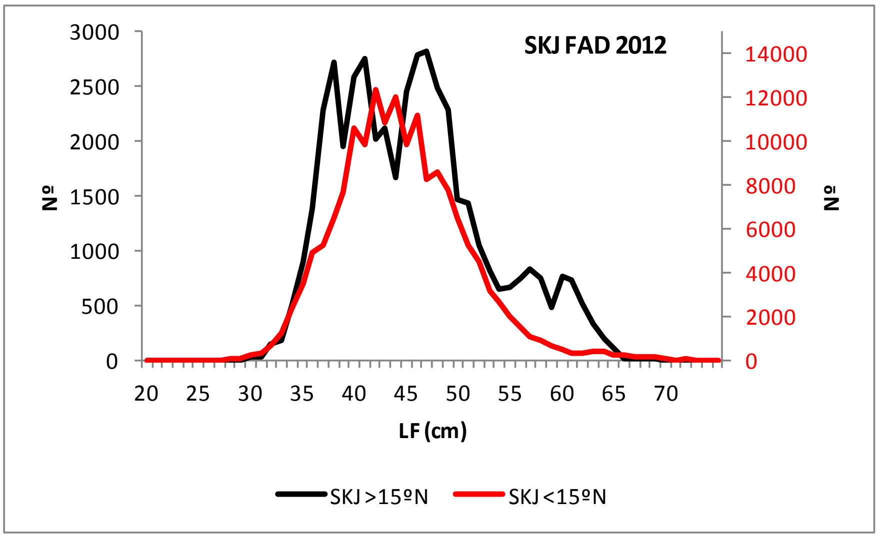


Figure 16. Distribution of sizes over floating objects, inside and outside the area and period considered for 2012.

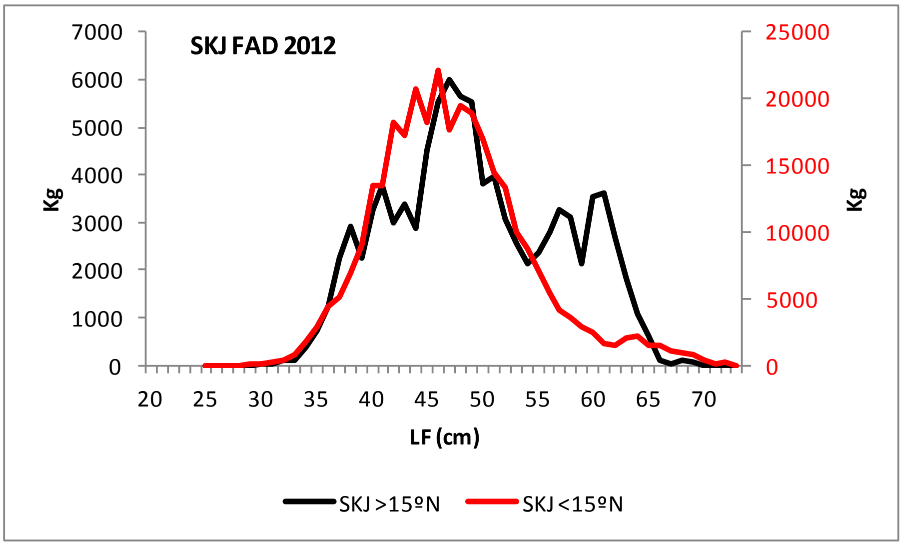


Figure 17. Distribution of weights over floating objects, inside and outside the area and period considered for 2012.

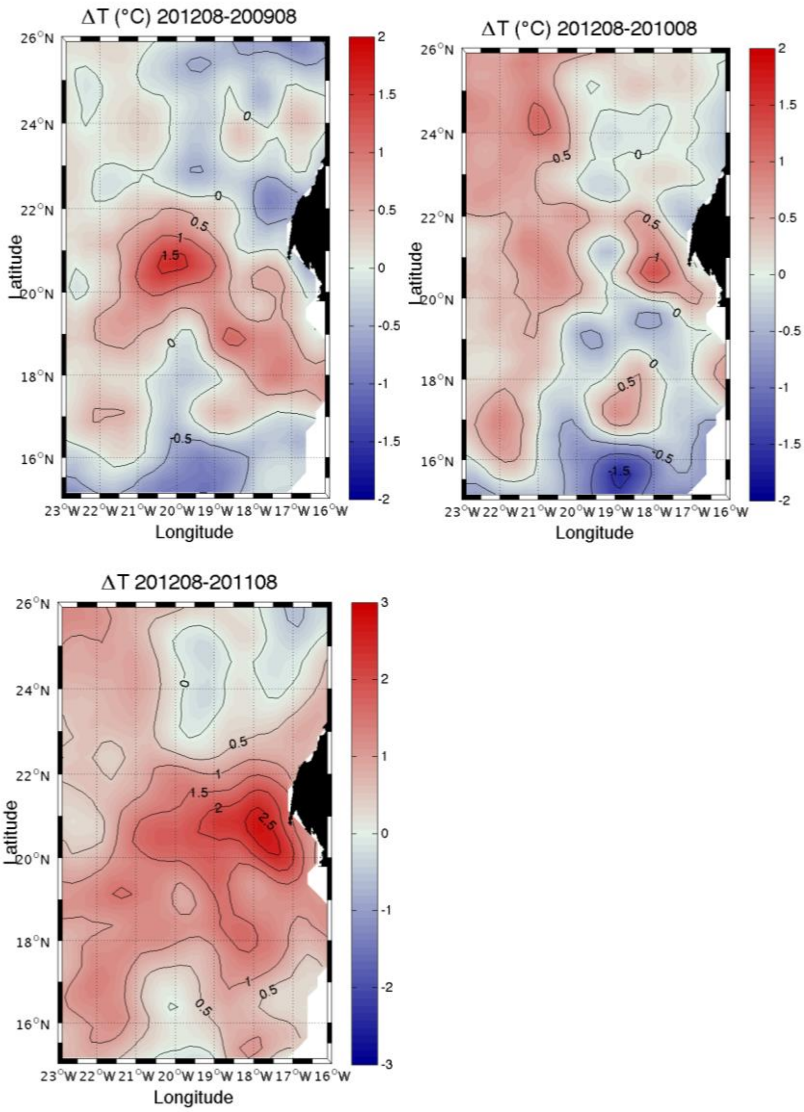


Figure 18. Differences in temperature between 2012 and 2009 (left), 2010 (centre) and 2011 (right) in August.

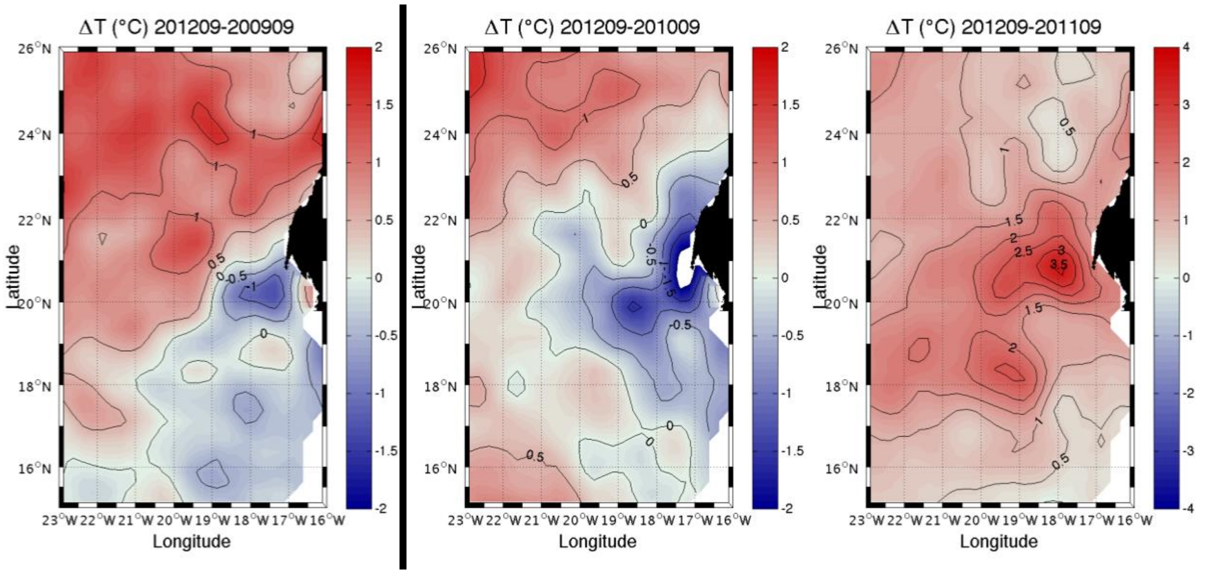


Figure 19. Differences in temperature between 2012 and 2009 (left), 2010 (centre) and 2011 (right) in September.

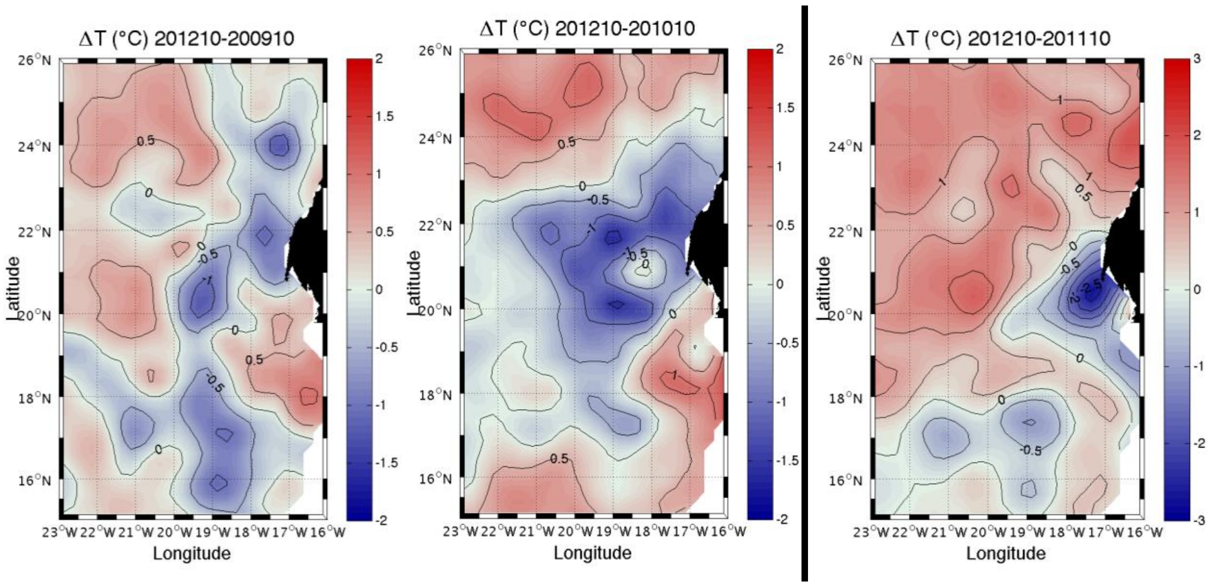


Figure 20. Differences in temperature between 2012 and 2009 (left), 2010 (centre) and 2011 (right) in October.

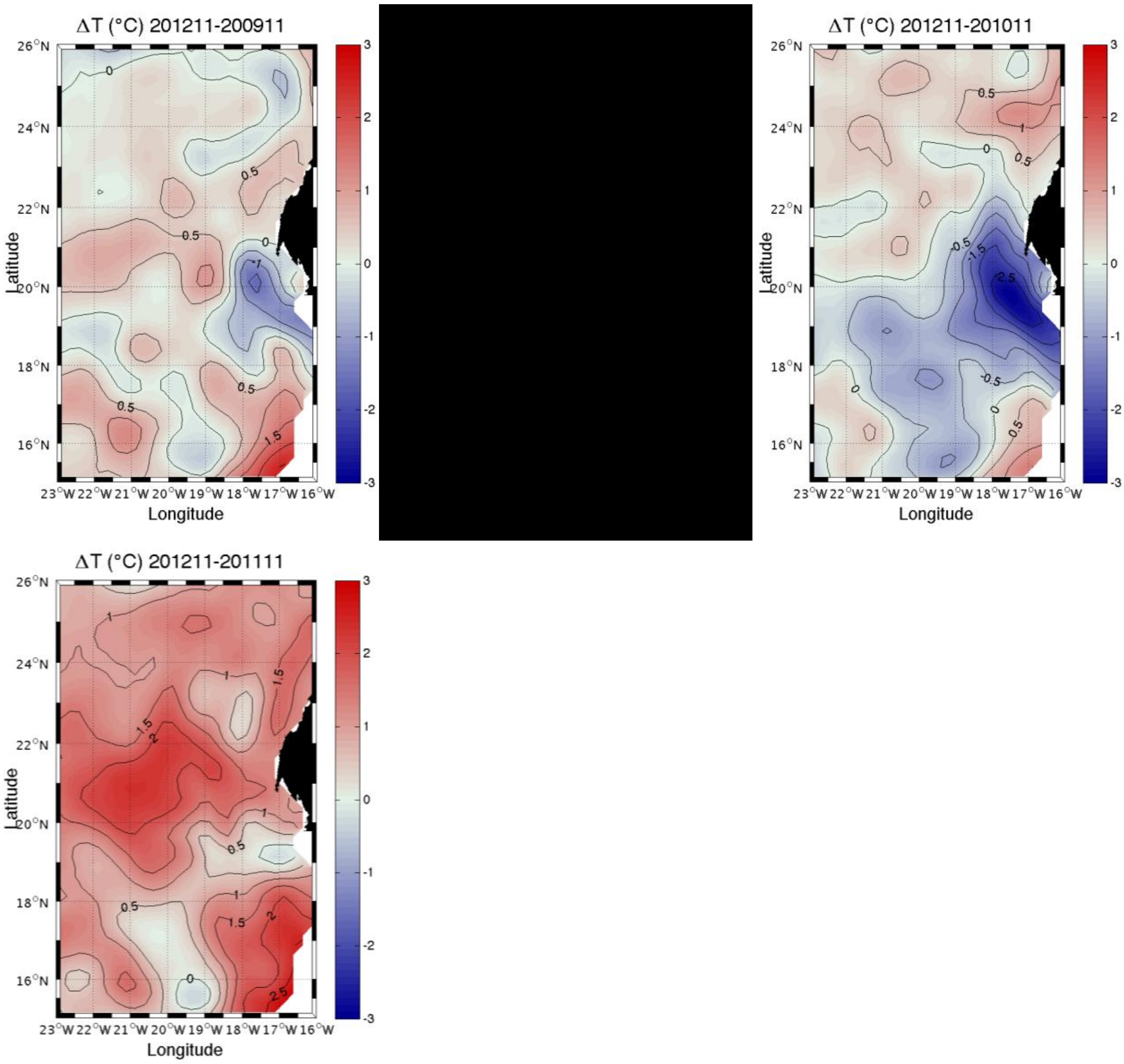


Figure 21. Differences in temperature between 2012 and 2009 (left), 2010 (centre) and 2011 (right) in November.