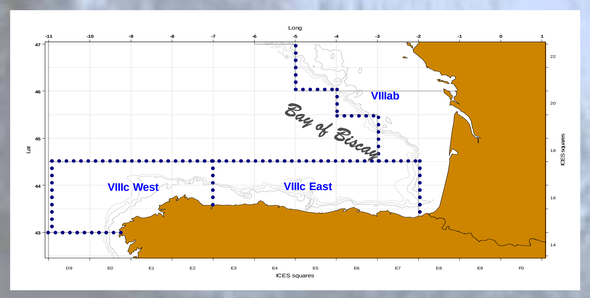
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Analysis horse mackerel catches in the Cantabrian sea and Bay of Biscay (2000-2010)

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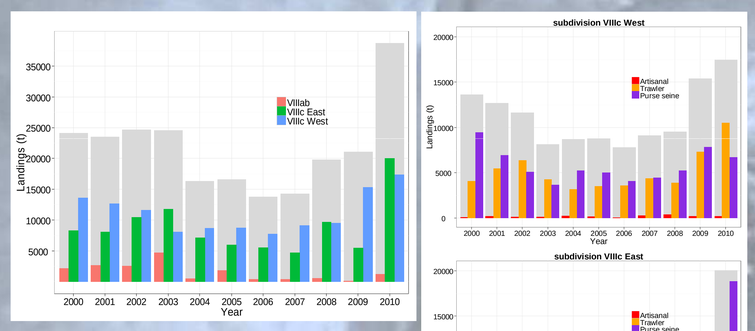
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Atlantic horse mackerel (*Trachurus trachurus*) is a pelagic species belonging to the *Carangidae* family. The geographical distribution of the Atlantic horse mackerel covers the whole platform and slope of the European and African coasts from Norway to Cape Verde (Whitehead et al., 1986). In the International Council for the Exploration of the Sea (ICES) horse mackerel in the north-east Atlantic is considered to be separated into three stocks: The Southern stock , the North Sea stock and the Western stock. Western stock on the northeast continental shelf of Europe, stretching from the Bay of Biscay to Norway. (ICES, 2011)

The horse mackerel on Western stock fisheries are important traditional fisheries in the Northeast Atlantic, with estimated mean landings of around 176,000 (±28,000) t from 2000 to 2010 (ICES, 2011). The population dynamics of western horse mackerel are characterized by sporadic, strong year classes, such as the very strong 1982 year class constituting the bulk of catches from the mid-1980s to well into the 1990s.

This study is based on horse mackerel catches made by the Spanish fishing fleet operating in the Cantabrian Sea and Bay of Biscay area (ICES divisions VIIIab and VIIIc) for the period 2000 to 2010. This area corresponds to the southern fraction of the Western Stock. In this area horse mackerel catches are made up of different fishing gears (purse seine, different trawling methods, long-line and gillnet). Spanish mean landings of horse mackerel Western stock representing more than 12% (around 21,000 t) of the total Western stock landings for the period 2000-2010. Spanish landing data are monthly collected by the "Instituto Español de Oceanografía" (IEO) and by "Instituto Tecnológico y Alimentario" (AZTI) from different sources. In addition a routine landing and biological sampling program on a monthly basis is carried out to estimate length distribution for the landing data. These length distributions are then transformed into age distributions, using age-length keys. In order to analyze Spanish horse mackerel landings the geographic area was divided into three areas: Subdivision VIIIc East, Subdivision VIIIc West and Division VIIIab.



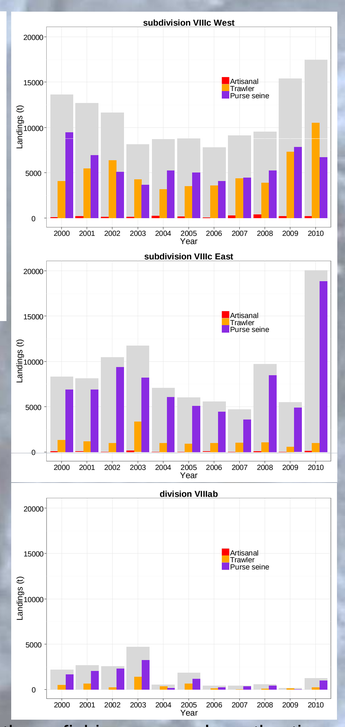


Figure 1. Bar graphs showing annual landings by area and gear for the period 2000-2010. The pattern of total Spanish landings by year (overlapped grey bars) show a similar value (23000 t) in the first years (2000-2003), then a slight decrease (2004-2007) and a rising in the lasts years. During this period, landings of Subdivision VIIIc West were slightly higher than of Subdivision VIIIc East. Landings of Division VIIIab represented a small fraction of the total landings from the study area. In Subdivision VIIIc West the horse mackerel landings are mainly made by purse-seiner and trawler. The landings are distributed similarly between these fishing gears along the time series. The artisanal fleet (long-line and gillnet) represented a very low catch (<2%). In 2009-2010 there has been an increase in total landings. In Subdivision VIIIc East and Division VIIIab purse seiner fleet represented the largest amount the horse mackerel landings. Trawl fleet in these areas were responsible for about 15% of total landings and hardly artisanal fleet landings were noticed (<1%). In the last years a significant increase in the purse seine landings was observed.

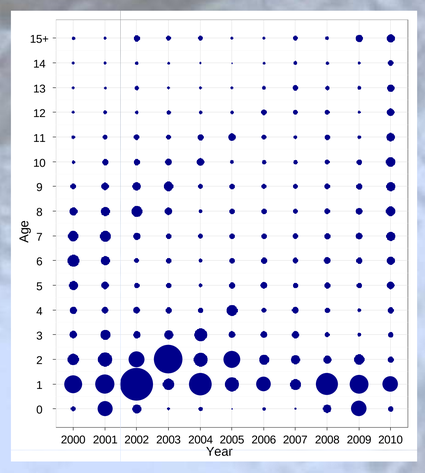


Figure 2. Bubble plot represents catch proportions in abundance (numbers) at age during the period 2000-2010. With Larger bubbles corresponding to larger values. In general, catches are dominated by juveniles (ages 1 to 2), although in recent years there is an increment in catch of older ages. The age 0 is not completely recruited by the fishery and its presence in landings is also influenced by the application of harvest policies like the minimum landing size. The 2001 year class appears to have been strong, although not as strong as the 1982 year class.

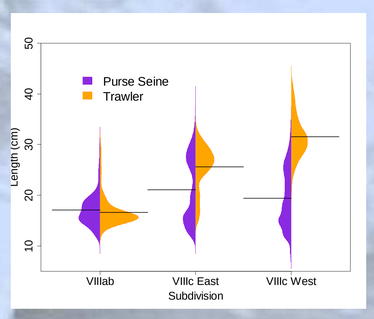


Figure 4. Asymmetric beanplots for comparison of horse mackerel landing size frequency distributions between gear and area. Beanplots show distribution densities and the overall means (solid horizontal black line). These frequency distributions are aggregated over time. Purse seine fleet landings in Subdivisions VIIIc West and VIIIc East and trawl fleet landings in Subdivision VIIIc West showed a special asymmetric beanplot. On the other hand trawl fleet in Subdivision VIIIc West and VIIIc East showed a bigger mean length in landings.

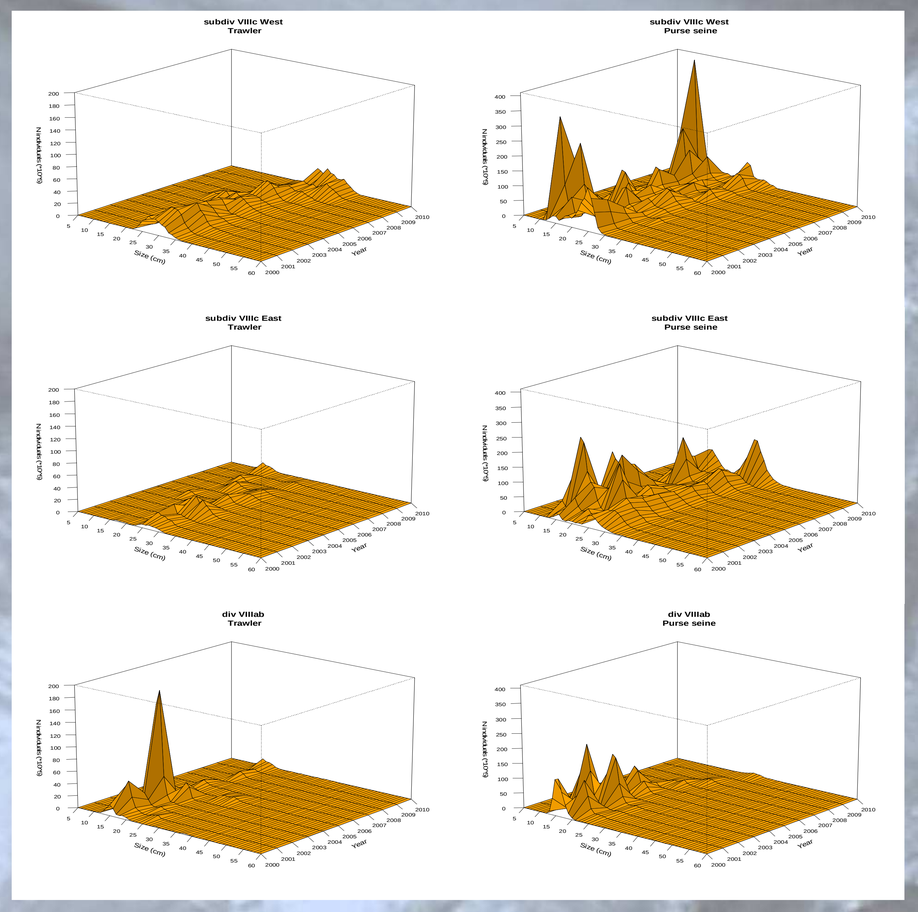


Figure 3. Annual length distributions of horse mackerel landings by gear and area. The results show a first approximation to the exploitation pattern of purse seiner and trawler operating for horse mackerel in this area along the period (2000-2010). There is a gradual increase in landing length from Division VIIIab purse seine fleet and in Subdivision VIIIc West trawl fleet. However there is a decrease in landing lengths in Subdivision VIIIc East trawl fleet. It is worth to mention the gap found in purse seine length distributions in the range 18-23 cm.
the ranges of length frequencies were quite similar at the beginning in trawl fleet from Subdivisions VIIIc West and VIIIc East, although in the lasts years the VIIIc West trawl fleet range was shifted towards bigger sizes whereas the VIIIc East range toward as smaller ones. Purse seine catches show a wide range in length frequencies with a large abundance of the smaller sizes.

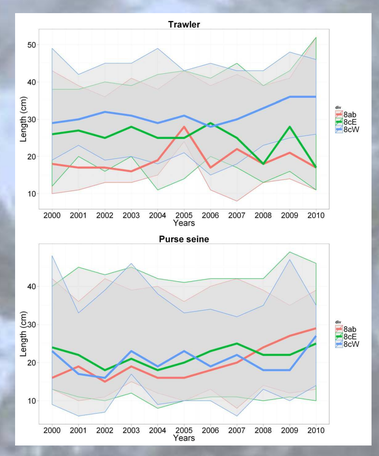


Figure 5. Annual mean length in landings by fishing gear and area along this period (thick solid line). The semitransparent grey areas bounded by dotted line represent the length range (max – min) in each year. In Subdivision VIIIc West Trawl fishery, in recent years an increasing trend in the mean length is observed, however, this trend is the opposite (decreasing) in Subdivision VIIIc East and Division VIIIab. Purse seine fishery shows an increasing trend in the mean length in all areas, although in Subdivision VIIIc West there is a more uneven track record in this period. In addition, length distribution of landings showed a wider length range in purse seine fishery than in trawl fishery.

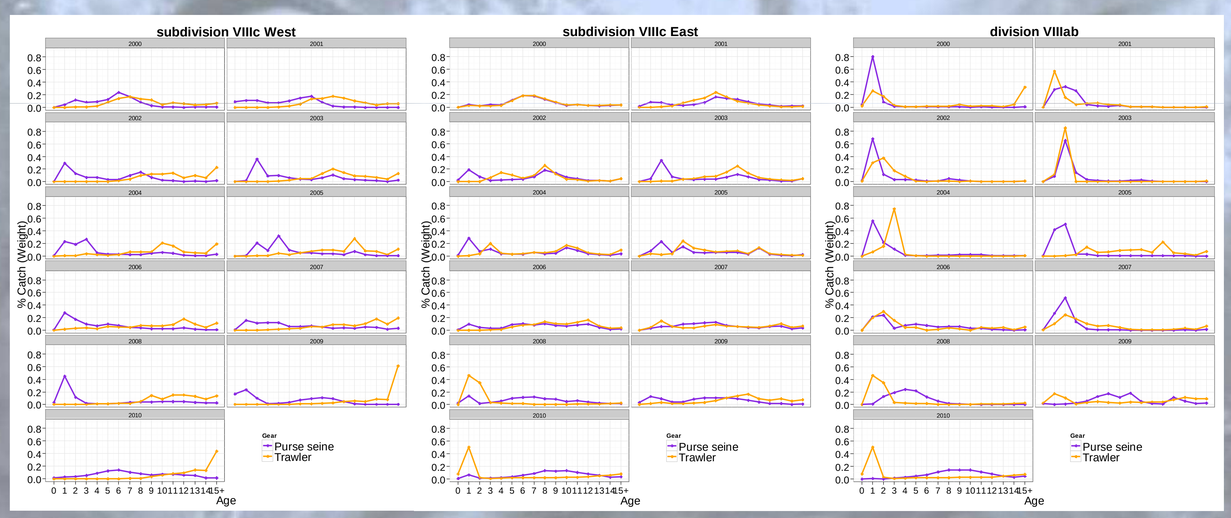
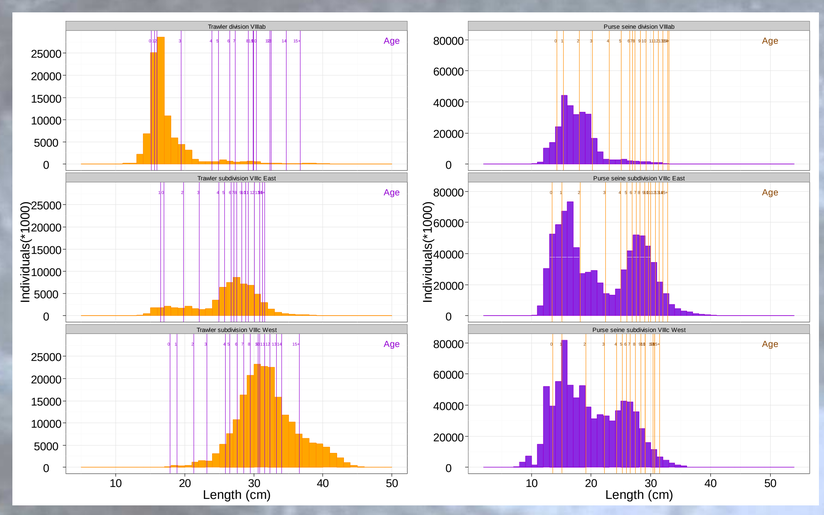


Figure 6. Percentage of purse seine and trawler landings by age group, area and year. In purse seine fishery the main percentage in catch (weight) was for young ages in all areas although in recent years the percentage of older ages increased. In bottom trawl fishery there is not a general pattern. In Subdivision VIIIc West the main percentage in catch has been for older ages especially in last years. However in Subdivision VIIIc East the main percentage in catch was for medium ages in the beginning of this period whereas in last years the main percentage moved to younger ages. Bottom trawl fishery in Divisions VIIIab showed a greater proportion of younger ages in its horse mackerel catch composition.

Figure 7. Histograms of length frequency data of landings by area and gear aggregated over time. The solid vertical lines marks are the estimated mean lengths at age. Landing length distributions for purse seine fleet were showed wider and bimodal compared with trawl fleet. In trawl fleet the old ages were the most important for the landings in Subdivisions VIIIc West and VIIIc East, while, in Division VIIIab the young ages were largely significant in landings. In purse seine landings were dominated young ages (ages 0-2) in Subdivisions VIIIc East and VIIIc West although there were a significant occurrences of older ages (> 4 years old). It is worth to mention the considerable decrease in landings for ages 2 to 4, mainly in purse seine.



Discussion:

- Trawler y purse seine fleets present a different fishing pattern in all areas. In general catch length distribution in purse seine presents an asymmetric distribution and a wide length range. In purse seine landings the smaller sizes (younger ages) are majority whereas in trawl fleet landings this is no so evident. (Figs 3, 4,5, 7)
- There is a trend in the presence of older ages (above 4 years old) to become more abundant in the western area (Figs 3,6,7). In addition, young fish are caught mainly in waters shallower such as Division VIIIab (Figs 3, 4, 6, 7). All this pattern s has already been described by several authors (Murta et al., 2008).
- It is worth to mention the gap in size-classes 18-23 cm (ages 2-3) found in landings distributions (Figs 3 and 7) , which roughly corresponds to the length at which the horse mackerel attain the sexual maturity (Abaunza et al., 2003). This produces some difficulty for the tracking of year classes at juvenile and young adult ages in the catch in numbers at age time series. (Fig. 2).
- In recent years in purse seine landings there has been a shift in landing composition towards older ages. This shift is also notorious in Subdivision VIIIc West trawl landings (Figs 2,6,7). This results in an increase in mean length in landings (Fig. 5). It should be noted that in last years there has been a high increase in purse seine landings and in Subdivision VIIIc West trawl landings (Fig. 1).

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