



JRC SCIENTIFIC AND POLICY REPORTS

Scientific, Technical and Economic
Committee for Fisheries (STECF)

Review of an assessment of the stock of
black scabbardfish (*Aphanopus* spp.)
around Madeira
(STECF-14-15)

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This report was reviewed by the STECF by written procedure in October 2014

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SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF)

Review of an assessment of the stock of black scabbardfish (*Aphanopus* spp.) around Madeira (STECF-14-15)

THIS REPORT WAS ISSUED BY WRITTEN PROCEDURE IN OCTOBER 2014

Background

Every two years fishing opportunities for a number of deep sea species are established. The Commission's proposal for a Council Regulation for 2015 and 2016 (COM(2014) 613 final) contains TACs (total allowable catches) for 22 stocks, one of which is black scabbardfish in EU and international waters of CECAF 34.1.2. Scientists from Madeira have produced an assessment of this stock. The STECF is asked to review this assessment and advise on the appropriate TAC levels for this stock for 2015 and 2016.

Request to the STECF

STECF is requested to:

1. Review the scientific report and comment on the quality of the data and information contained therein.
2. Identify any data shortcomings to be addressed in order to improve the assessment.
3. Based on the existing assessment and on any other relevant information provide advice in relation to a precautionary TAC level for this stock for 2015 and 2016 which takes into account the state of the stock.

Background document: Report from *Direção de Serviços de Investigação e Desenvolvimento da Pesca* of Madeira Government (see Annex I of this report).

Observations of the STECF

The report presented contains useful background information relating to the Madeira deep-water longline fishery for black scabbardfish (*Aphanopus carbo*). Updated data on landings (in tonnes and number), capacity (number of vessels) and fishing effort (expressed as millions of hooks) are presented for the years 2000 to 2013 as well as the resultant LPUE. In addition, information on the length distribution of the commercial landings (2000 to 2013), maturity ogives, and the estimated age composition of catches per year is also presented. All the data are presented graphically and are not tabulated.

The information indicates general decline in fishing capacity and fishing effort over the available time series (Figure). The number of vessels has declined by 41% (34 to 20 vessels). However, this decline

has not resulted in a commensurate reduction in fishing effort as the number of hooks deployed has only fallen by 14% (16 million to 14 million hooks), meaning that over the time series, individual vessel efficiency has improved through an increase in the average number of hooks deployed from 470,000 per vessel in 2000 to 700,000 per vessel in 2013.

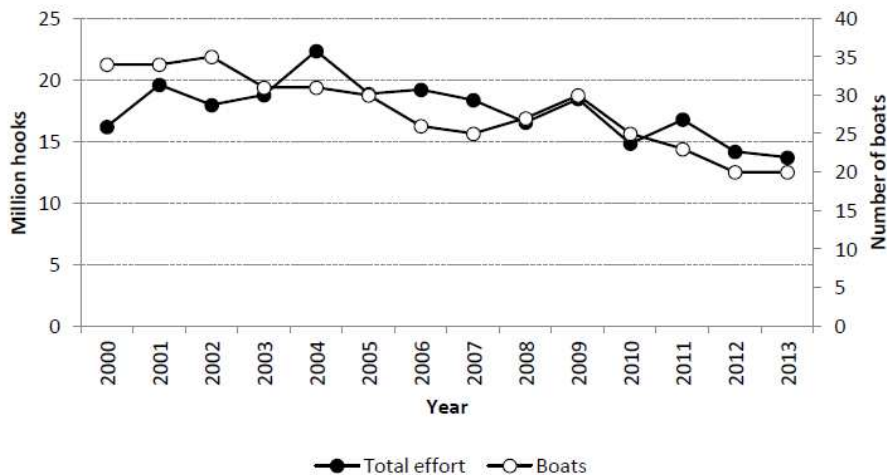


Figure 1. Trends in fishing capacity (number of boats) and fishing effort (number of hooks) 2000 - 2013

Over the time series landings have declined by 56%, which appears to be largely driven by a decline in overall abundance rather than a reduction in fishing effort as LPUE (measured as kg/1000 hooks) has declined by 48% over the time series (Figure).

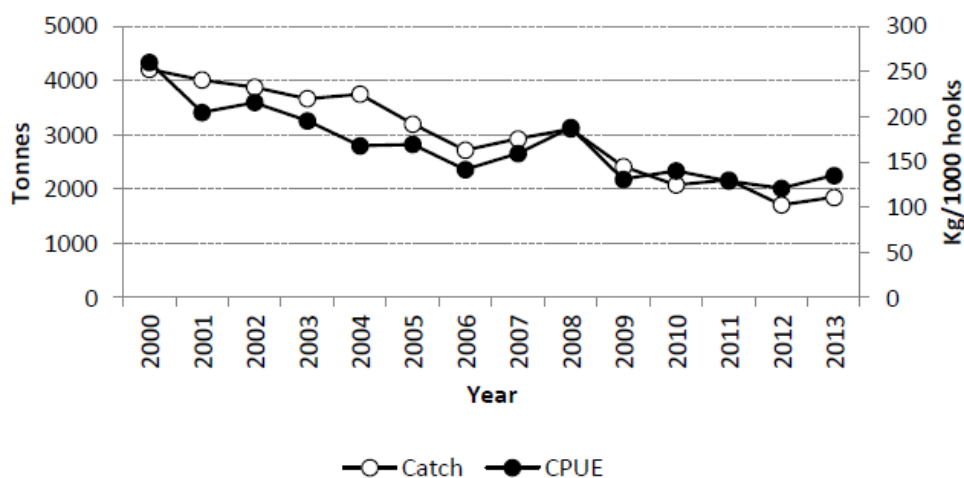


Figure 2. Trends in catch (landings) and CPUE (LPUE) presented in the background report. Some aspects of black scabbardfish (*Aphanopus spp*) fisheries and biology from the Madeira Islands. Note that this figure was used to digitally generate numerical estimates of landings in 2013 and a time series of LPUE for the years 2000 to 2013. These data have been subsequently used to provide landings advice using the ICES DLS approach.

The analysis is based on fishery dependent time series of catch and effort with no fishery independent information presented. The analysis presented is solely based on nominal LPUE and some standardization would be necessary to account for possible changes in vessel efficiency over time, failure to do so could result in underestimating the potential rate of decline in the stock. Over or sole reliance on commercial LPUE as an indicator of abundance or biomass can mask true trends in population abundance or biomass due to hyper-stability or hyper-depletion. Hyper-stability means that

trends in commercial LPUE can significantly underestimate true declines in population as a result of fishermen targeting “pockets” where fish remain concentrated, and hence catch rates remain higher, but where the underlying or overall population range is contracting and declining. Consequently, assuming that the LPUE index reflects the true trend in population, can result in underestimates of exploitation rate and total population decline. Conversely, hyper-depletion describes the situation where the catch rate declines faster than population biomass. This can occur when fishing effort is concentrated on a subset of the population that may be depleted, while a significant subset of the population remains unaccounted for in the catch rate index. Ultimately, this means that trends in commercial LPUE as an indicator of actual population trends should not be overly interpreted unless additional information is available that indicates spatial and temporal stability in fishing effort over time.

The increasing trend in the number of hooks deployed per vessel would also indicate that unless the relationship between the number of vessels (fishing capacity) and the number of hook deployed (fishing effort) can be established and managed, then regulating capacity alone is unlikely to achieve commensurate or desired reductions in fishing effort.

STECF observed that the stock structure of black scabbardfish is not clear in the distributional range of the species in the east Atlantic. STECF also notes that, for stock assessment and fishery advice, ICES currently considers three assessment units, namely (i) northern (Divisions Vb and XIIB and Subareas VI and VII), (ii) southern (Subareas VIII and IX), and (iii) all other areas (Divisions IIIa and Va Subareas I, II, IV, X, and XIV). STECF notes that the waters around Madeira and Canary Islands occurs in CECAF area 34.1.2 and that the population in CECAF area 34.1.1, 34.1.2, and 34.2 is treated as a separate stock unit.

However, the population of black scabbardfish around Madeira are likely to be part of a wider North East Atlantic population (ICES, 2013 and Santos, 2013) and the only know spawning areas are in the CECAF areas around Madeira and the Canary Islands. STECF therefore considers that the assessment and management of black scabbardfish would be improved if CECAF areas of 34.1 2; 34.1.1; 34.2 are considered together with ICES Subareas I, II, IV, VI, VII, VIII, X, and XIV, and Divisions IIIa, Va, Vb, IXa, and XIIB.

Data on combined annual landings from Madeira and the Canary Islands CECAF 34.1 and 34.2 are available on-line from the “FAO CECAF Capture Production 1980-2012” data base (<http://www.fao.org/fishery/statistics/cecaf-capture-production/query/en>). The CECAF data series is longer than that provided in the background document “*Some aspects of black scabbardfish (Aphanopus spp) fisheries and biology from the Madeira Islands*”, but the report does contain landings information for 2013 which is absent in the FAO CECAF database. However the data is only presented graphically. Landings and LPUE values were recovered from the background document using the following application <http://arohatgi.info/WebPlotDigitizer/app/> which permits numerical values to be extracted from graphically presented data. STECF notes that the trends in landings data in the two data sets are similar where the data series overlap (2000-2012), albeit with some slight discrepancy in 2010 and 2011 (Figure 3). It is therefore considered that the total landings of black scabbardfish in Madeira represent the total landings in CECAF 34.1 and 34.2 and that the digitally extracted information can be used as a basis for obtaining landings estimates for 2013 and to generate a time series of LPUE values.

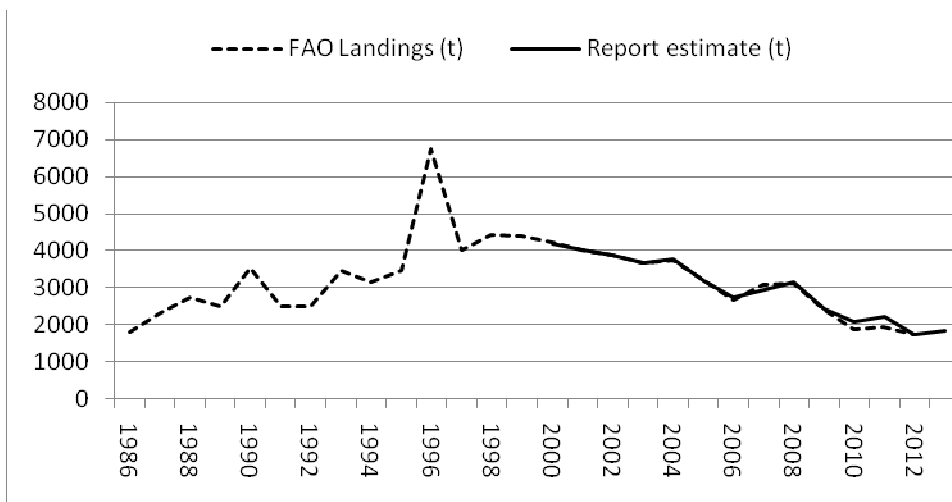


Figure 3. Trends in landings from the FAO CECAF fishery production database (dashed line) and landings estimates digitally recovered from the background report (solid line)

Council Regulation (EU) No 1262/2012 fixes for 2013 and 2014 the fishing opportunities for EU vessels for fish stocks for black scabbardfish with a TAC of 3,674 and 3,490 tonnes respectively in area CECAF 34.1.2. Catches in Madeira; which seems to correspond to the TAC opportunities laid down in Council Regulation 1262/2012, have been lower than the TAC since 2005 at least.

Given the lack of analytical assessment and associated reference points, STECF has no objective scientific basis to determine what is likely to be a suitable level of catch to ensure sustainable exploitation or indeed whether the current level of exploitation is sustainable. The short time series of fishery dependent catch and effort data limits its utility as it is not possible to determine how the current LPUE relates to earlier periods. Ideally the stock should be subject to an analytical assessment and given that information on catch number, age information and maturity this is theoretically possible. However, issues associated with age determination for this species are evident in the available literature, with considerable disagreement between studies (Santos, 2013). STECF reiterates its advice given in PLEN 10-03, noting that that appropriate data and information be made available either through collation of existing information and collection of additional information, so that a reliable assessment of the resources of black scabbard in CECAF 34.1.2 can be undertaken.

STECF notes that landings have been declining from about 4,000 t in 2000 to an historical low of less than 2,000 t in 2012 and 2013. The LPUE has been continuously declining since 2000 up to 2009 and LPUE in recent years (2009 – 2013) has stabilised, but at a level which is the lowest in the time series, which indicates that some degree of precaution is warranted in setting fishing opportunities.

Year	Landings (t)	LPUE (Kg/1000 hooks)
2000	4171	261.81
2001	4007	205.10
2002	3876	216.93
2003	3661	195.98
2004	3746	169.06
2005	3183	170.96
2006	2737	142.06
2007	2938	158.86
2008	3122	187.58
2009	2410	130.87
2010	2063	140.72
2011	2198	129.69
2012	1718	120.66
2013	1836	134.48

Table 1. Estimates of landings and LPUE digitally recovered from Figure

STECF notes however, that if managers agree that the application of the ICES approach to Data Limited Stocks is appropriate i.e. using the relative change in recent LPUE (e.g. 2012-2013 relative to 2009-2011), then this could be used to determine future fishing opportunities by modulating recent average catches based on the relative trends in LPUE (Table 2). Using the data recovered from the graphs presented (see above), shows a moderate 5% decline in LPUE, implying that using the ICES approach to Data Limited Stocks, fishing opportunities would be set at a level consistent with recent average landings (2011 – 2013), which would imply a landings TAC in 2015 of 1917 t.

However, the observed LPUE over the past few years is considerably lower than observed at the start of the time series and the effective LPUE could be lower than observed if increased fishing efficiency of vessels is taken into account in the LPUE standardization process. Hence setting TACs in line with the recent average landings implies stabilising landings at a level that has resulted in a decline in LPUE to the lowest observed level. STECF **recommends** that a more precautionary approach would be appropriate, so that catches of Black scabbard fish in CECAF 34.1.2 in 2015 and 2016 be restricted to less than 1917 t.

STECF **advises** that if the ICES DLS approach is to be used as the basis of setting fishing opportunities in 2015 and 2016, then the year range used in determining the average changes in LPUE should be expanded to cover the available LPUE time series. A comparison of the average LPUE for the years 2009 – 2013 relative to the average LPUE of the years 2000 – 2008 shows a 31% reduction between the two reference periods. Following the ICES DLS approach and applying a maximum 20% change in catch advice, would imply fishing opportunities for 2015 and 2016 be set at 1534 t i.e. a 20% reduction on average landings over the last 3 years and a reduction of 66 % from the 2014 TAC.

Average 2012-2013	Average 2009 - 2011	% Change
127.57	133.76	-5%
Average 2009 – 2013	Average 2000 - 2008	% Change
131.28	189.82	-31%

Table 2. Percentage changes in average LPUE estimates for different reference periods. Comparison of average LPUE for the previous 2 years relative to the previous 3 years (upper row) and comparison of average LPUE for the past 5 years relative to the previous 8 years (bottom row)

Furthermore, given that recent LPUE estimates are at the lowest the time series, the observed increases (up to 1996) and subsequent decrease in landings and also that the exploitation rate is unknown, managers may also want to consider an additional precautionary reduction in fishing opportunities.

As noted in STECF PLEN 12-02, STECF notes that the fishery for black scabbard around Madeira has been active for more than 150 years and that it should be possible to construct a longer time series of catch and effort data than is currently available. Extending the time series of fishery dependent data, especially catch and effort for as long as possible would most likely permit a clearer indication of the relative trends in exploitation rate which could be used as a basis for future management advice. Any available fishery-independent data on black scabbard would also be informative.

STECF notes that landings of black scabbard in Madeira are composed of two different species (*A. carbo* and *A. intermedius*). However, the EU TAC relates only to *A. carbo*, and the proportion of *A. intermedius* has increased during recent years as the Madeira fleet has extended its fishing range to the south towards the Canary Islands. STECF suggests that managers take these observations into account when setting TACs or agreeing other management measures.

Conclusions of the STECF

With the limited knowledge available black scabbard fish, STECF is unable to advise on current status of the black scabbard stock component around the waters of Madeira. Furthermore, in the absence of relevant quantitative information, STECF is unable to determine precisely what level of catch in 2015 and 2016 is likely to prevent any further decline in stock abundance.

Given that reported landings have been declining since mid-1990s following an expansion in the 1980's; that LPUE has declined at a faster rate than the reduction in fishing effort and; recent LPUE is stable but at lowest recorded levels- all indicate that the fishery in Madeira waters is much less productive than hitherto and a likely consequence of stock overexploitation. If that is the case, some degree of precaution is warranted and fishery managers may wish to consider restricting catches and effort in an attempt to reduce exploitation rates in the area. The magnitude of any reduction in catches or effort is dependent on the level of risk that managers consider acceptable.

STECF notes that if managers agree that the ICES approach to data limited stocks developed in WGLIFE (ICES, 2012) provides an acceptable level of precaution and risk, such an approach would imply that landings in 2015 and 2016 should be restricted to a level no greater than 1917 tonnes when most recent (2009 – 2013) LPUEs are used.

However, in an attempt to avoid further declines in stock abundance, **STECF recommends** the use of a longer reference period (2000 – 2013) for the application of the ICES data limited approach by comparing the average LPUE of the last 5 years with the previous 8 years. This shows a 31% reduction in LPUE. Following the ICES approach, this corresponds to a 20% reduction in recent average catches implying a TAC for 2015 and 2016 of 1534 t, a 66% reduction on the current TAC. Furthermore, given that the current level of exploitation relative to F_{msy} is unknown managers may also want consider larger reduction in TAC.

STECF also concludes that black scabbardfish in CEAFCA areas of 34.1.2; 34.1.1; 34.2 and ICES Subareas I, II, IV, VI, VII, VIII, X, and XIV, and Divisions IIIa, Va, Vb, IXa, and XIIb should be managed as a single stock unit.

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Annex I - Report from *Direção de Serviços de Investigação e Desenvolvimento da Pesca* of Madeira Government

Some aspects of black scabbardfish (*Aphanopus spp*) fisheries and biology from the Madeira Islands

REPORT

September 2014

Direção de Serviços de Investigação e Desenvolvimento da Pesca

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Introduction

The fishery in Madeira Island for deepwater species is one of the most ancient seas fishing activities in the world and has a high historical, cultural and socio-economic value. This fishery, which target species is the black scabbardfish (*Aphanopus carbo* Lowe, 1839)¹, has centuries-old historical roots and is emblematic for Câmara de Lobos, where it has arise. This nearby fishery was later extended to other to fishing areas throughout the Madeira Economic Exclusive Zone (EEZ). The black scabbardfish fishery in Madeira has such unique characteristics because it is one of the oldest fisheries exploitation of an abysmal resource, in the world.

The vessels involved in these fisheries in the Madeira EEZ and international adjacent waters (CECAF 34.1.2 area) are licensed to use a drifting horizontal longline, which is locally known as "espinhel ou aparelho de espada ". The longline is a gear of passive fishing submerged in the water column between 1000-1200 meters depth, however, in areas of ocean fishing, the depths may change between 1200 and over 3000 meters.

This is the only way to capture this resource in Madeira. This fishery is well developed, in an artisanal way, by a recognized selective fisheries gear that capture adult black scabbardfish, with a habitually low bycatch that consist mostly of species of no commercial value, with the exception of deep-sea sharks. Nevertheless, the madeiran longline type usually has low rates of sharks by catch, when used in the traditional way, i.e. not anchored and placed in the water column distant from the bottom.

¹ It was now known that in reality catches of black scabbard fish Madeiran fleet also include sympatric species *A. intermedius*, cf Biscoito, M., Delgado, J., González, J. A., Stefanni, S., Tuset, V. M., Isidro, E., Mederos, G. M., & Carvalho, D. (2011). Morphological identification of two sympatric species of Trichiuridae, *Aphanopus carbo* and *A. intermedius*, in NE Atlantic. *Cybium*, 35(1):19-32.

The black scabbardfish fisheries fleet carries on its activity predominantly inside the Madeira subdivision, at depths usually situated starting from 1000 meters isobath, i.e. at distances usually higher than at least 2 nautical miles away from the coast. This segment of the fisheries fleet operates mostly in the northern and southern coasts of Madeira and Porto Santo Islands and fishing banks (Seine, Lion, Unicorn, Dragon, Susanna and Ampere).

Recently, especially in the second half of the last decade, some vessels of black scabbardfish fishery fleet with more autonomy began to hold a few fishing grounds located outside the EEZ of Madeira, mainly off the Canaries and submarine banks located to the south of the Azores (Meteor, Irving, Cruiser and Hyères).

MATERIALS AND METHODS

Catch, Effort and CPUE

The information processed in this report includes the period from 2000 to 2013.

Catches in number and weight of black scabbard fish are totals landed, sold at auction. The fishing effort (in total number of hooks) of black scabbardfish fisheries fleet from Madeira, was calculated according to the procedure adopted in previous years, i.e. by size classes of vessels and the total from the following information:

- 1) Annual landings by weight per vessel (statistics fishing DRP);
- 2) The number of landings performed during the year, per vessel (statistics fishing DRP);
- 3) Rules of operation (number of handsets, number of hooks per set and number of days at sea per trip) resulting from fishing logbooks of their respective vessels.

The total effort was obtained from the product of the effort calculated for the black scabbard vessels through the ratio of the total catch of the fleet and the capture of the respective vessels by size class of vessels and for the total.

Based on the total annual catch and fishing effort it was calculated the catch per unit effort (CPUE) per thousand hooks. The operating vessels with less than 10 annual landings were not considered in the fishing effort calculation.

Fishing regime

The black scabbardfish fishery fleet regime from Madeira (duration of fishing trips and number of hooks per haul) was estimated with the data available from the diaries fishing (fishery) vessels.

Landings length composition

The annual landings length composition of black scabbardfish, from the black scabbardfish fleet operating in Madeiran waters, was estimated using a simple amplification process.

According to this process, the lengths frequency distributions (in cm below and without distinction of sex) obtained monthly from random samples of black scabbard fish landings, suffered successive amplifications. First the sample was amplified to the capture of the sampled vessels, then to the capture of the fleet in the sampled days and finally to the monthly landings of the fleet, using appropriate factors for this amplification. Annual landings length composition results from the sum of the monthly compositions. This composition was then structured in classes of 5 cm in length and lengths frequencies over 140 cm were grouped in a single class, 140 +.

Annual landings age composition

A total of 6429 pairs of sagitta otolith were used for age determination (94-153 cm TL) between 2000 and 2013.

Sexual maturity ogives

The annual sexual maturity ogives were estimated, according to the total length (cm) for males and females combined from 2000 to 2013. In order to determine the length at first maturity (length at which 50% of individuals are mature), were considered as sexually mature individuals those who were in the states of maturation II to V through the years (2000-2013). The data have been adjusted to the curves through a simple linear regression analysis (King, 1995).

RESULTS

Catch, effort and fishing yields

The analysis of the fishing effort evolution of black scabbardfish from Madeira shows a gradual decrease in the number of active vessels (from 34 in 2000 to 20 in 2013) and in the total fishing effort (16 million to 14 million hooks), with slight annual fluctuations (Figure 1).

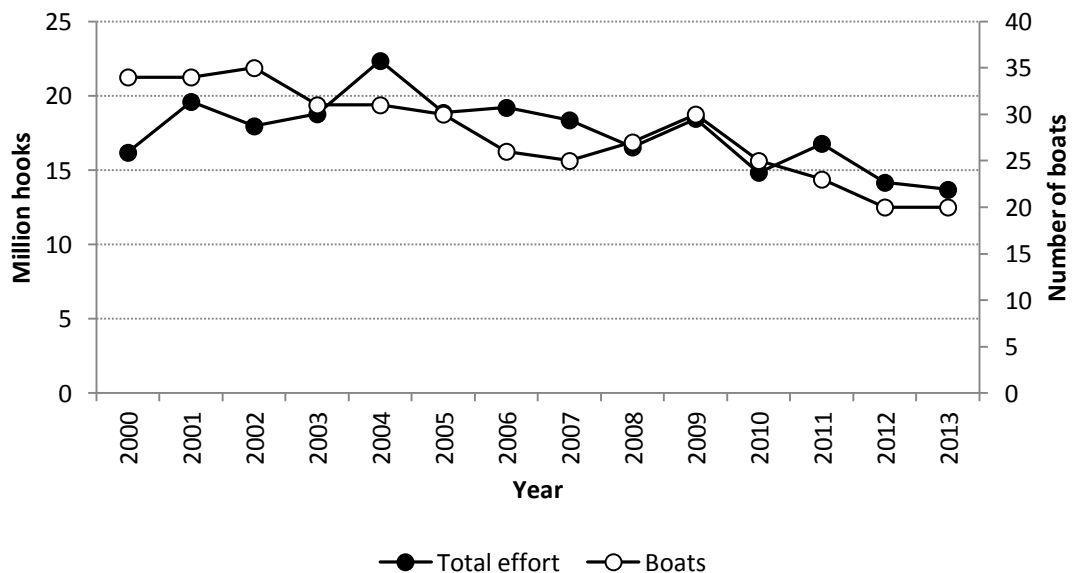


Figure 1- Total effort estimated (million hooks) and number of active vessels (with more than 10 annual landings).

The catches and the CPUE decreased in the period analyzed (Figure 2). The variation observed in the years 2000-2006 was about -35% in catches and -45% in CPUE,

corresponding to an increase of 18% in the fishing effort. From 2006 to 2008 there was a slight recovery of the catch and the CPUE. From 2008 to 2012 the decreasing trend was again registered both in catches and CPUE. Analyzing the entire study period there was a decrease in landings (56%), in CPUE (48%) and in fishing effort (15%).

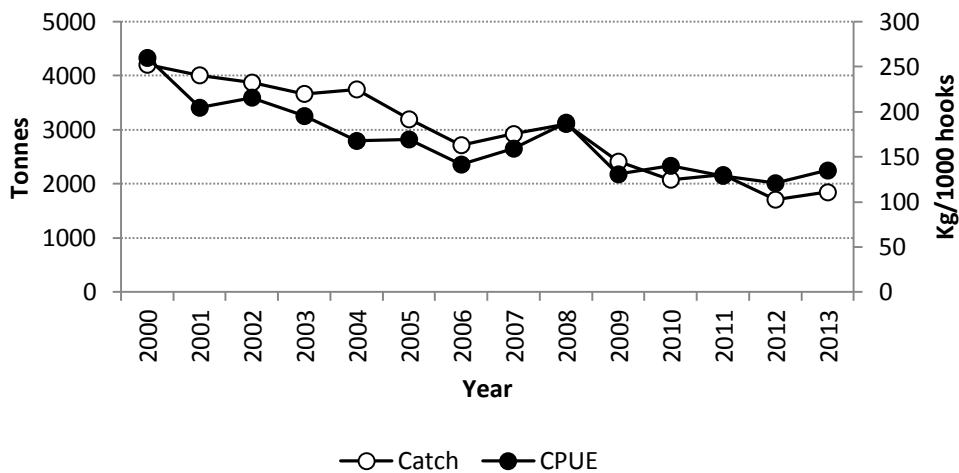


Figure 2-Total catch (tonnes) and catch per unit effort, CPUE (kg / thousand hooks).

The annual catch evolution in number (Figure 3) for the all period also shows a decreasing pattern, despite the slight increase verified between 2006 and 2009.

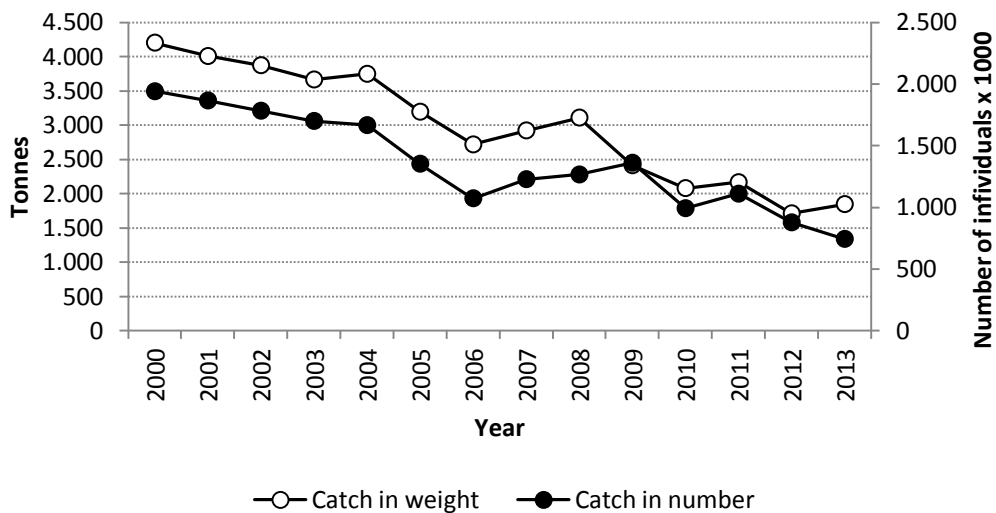


Figure 3-Total catch in weight (tonnes) and total catch in number (x1000).

Landings structure

The landings age composition showed that the catches are composed by individuals between 5 and 13 years old (85-150 cm in length, TL). However, the landings are mainly composed by individuals of ages between 7 and 10 years (105-125 cm TL) (Figures 4 and 5).

If the landings length composition showed a remarkable stability through the years (Figure 4) the same was not verified in the landings age composition, with age distribution shifting to younger ages (Figure 5).

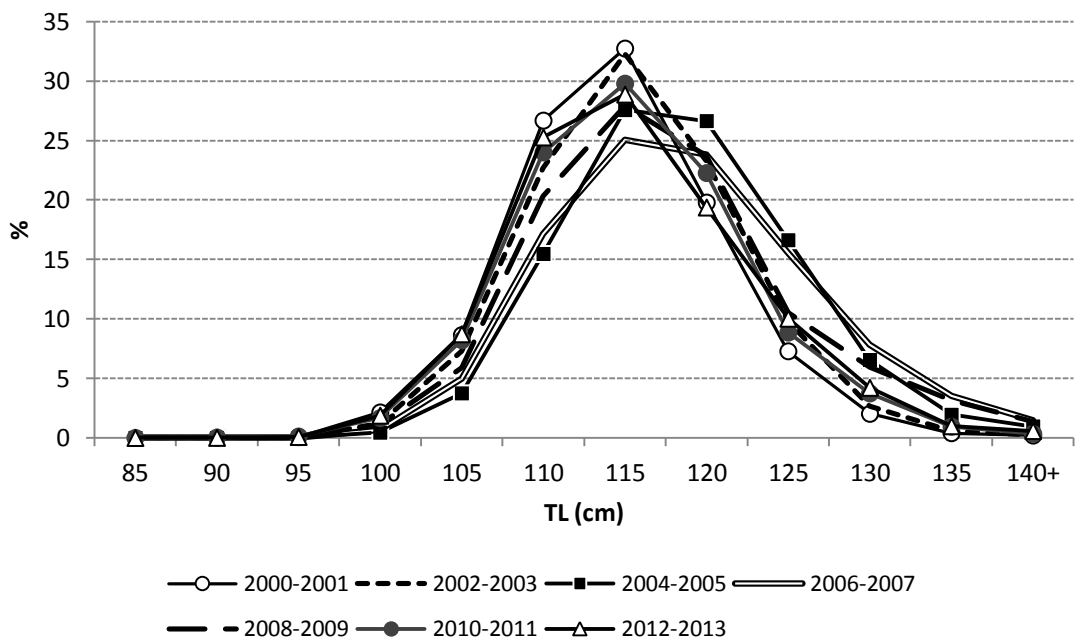


Figure 4- Annual landings length composition of black scabbardfish, from the black scabbardfish fishery fleet of Madeira between 2000 and 2013.

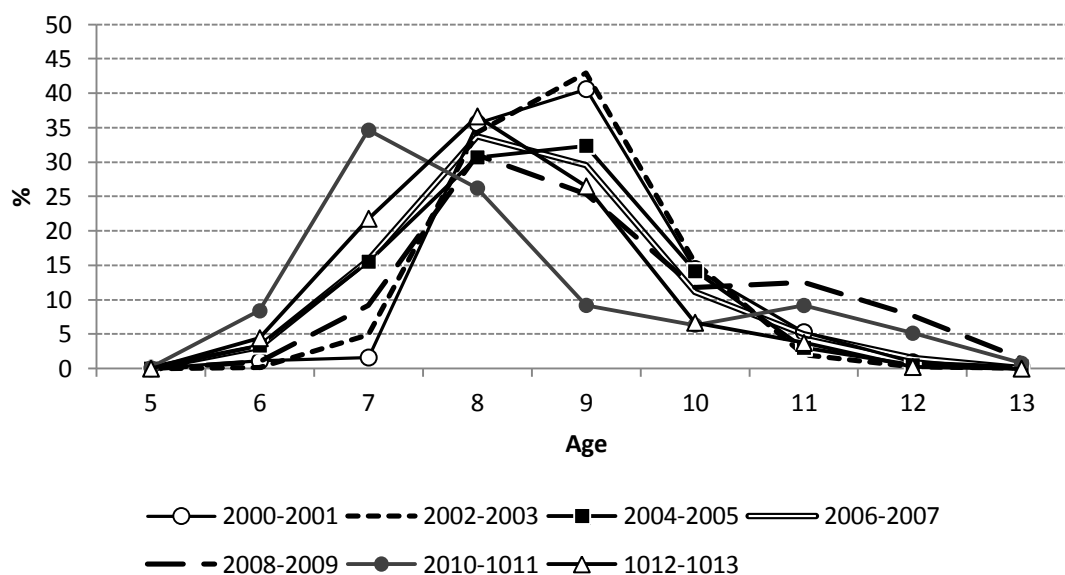


Figure 5- Annual landings age composition of black scabbardfish, from the black scabbardfish fleet of Madeira between 2000 and 2013.

Size at first maturity

The total length at first maturity calculated annually, i.e., the total length at which 50% of the individuals reached sexual maturity ranged between 100.02 cm (2012 year) and 102.15 cm (2009 year). This slight variation (about 2 cm) throughout the analyzed period, showed no tendency, so it can be ignored. In practical terms it was used the total length of 100.61 cm, average value estimated from the last eight years (2006-2013).

Final considerations

Currently, it remains a widespread ignorance about the structure and distribution of the exploited *stocks* of black scabbardfish. The working group of ICES for deep-sea species, considers uncertain the structure of the *stock* of *A. carbo* and uses three management areas (northern, southern and other areas) not including the Madeira area.

However, several recent studies showed that the life cycle of the black scabbardfish occurs along the northeast Atlantic, with predominance of immature fish off the British, French

and Sesimbra Islands and adult breeder specimens off the Macaronesian islands (Figueiredo *et al*, 2003;. Pajuelo *et al*, 2008). It seems clear, in the light of current knowledge the existence of a migration of this species in the eastern Atlantic (Neves *et al*, 2009).

In Madeira, the fishing effort of black scabbardfish fleet has been gradually reduced by the effect of the adjustment plan of the fleet fishing capacity, carried out by this Regional Directorate, between 2009 and 2011.

However, isolated measures aiming the effort reduction are probably not sufficient to recover the CPUE to previous levels, because, as stated in the above mentioned studies, it is becoming more likely the existence of a larger stock of black scabbardfish, with unknown migration circuits ending in Madeiran waters. It is known that it's just in Madeira that adult individuals (reproductive) are captured, which seems to indicate that this resource comes to this Atlantic area to spawn with 6-7 years old. Landings of black scabbardfish from Madeira fleet are therefore essentially composed by adult individuals, oversized (between 85 and 150 cm TL) and with 6 to 13 years old.

In our perspective, the scientific evidences that emerged in recent years show that the assessment of the resource and the management of the exploitation, should be made integrating the different European fleets acting on it and taking into due account the different fishing methodologies employed as well as the different phases of the life cycle that are captured.

Currently existing restrictions on this fishery should not be aggravated without consideration for the social impact and the enormous importance of this fishery in the economic context of the outermost region of Madeira, especially if its implementation is of dubious effectiveness for conservation of the resource.

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Abstract

The STECF provided advice in relation to a precautionary TAC level for black scabbardfish (*Aphanopus* spp.) around Madeira for 2015 and 2016 by written procedure in October 2014.

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