REPORT OF THE 2010 ICCAT MEDITERRANEAN SWORDFISH STOCK ASSESSMENT MEETING

(Madrid, Spain – June 28 to July 2, 2010)

1. Opening, adoption of agenda and meeting arrangements

The Meeting was held at the ICCAT Secretariat in Madrid from June 28 to July 2, 2010. Dr. Pilar Pallarés, on behalf the ICCAT Executive Secretary, opened the meeting and welcomed participants ("the Working Group").

Dr. George Tserpes (UE-Greece), meeting Chairperson, welcomed meeting participants and proceeded to review the Agenda which was adopted with some adjustments (**Appendix 1**). In the revision of the agenda, the Working Group decided to generate two independent reports for Mediterranean albacore and swordfish, although both meetings were held together and the agenda was shared.

The List of Participants is included in **Appendix 2**. The List of Documents presented at the meeting is attached as **Appendix 3**. The following participants served as rapporteurs:

Items 1 and 11	P. Pallarés
Item 2	T. Ceyhan and P. Peristeraki
Item 3	C. Palma
Item 4	N. Abid
Items 5, 6, 7 and 10	G. Tserpes
Items 6, 7, 8 and 9	L. Kell

2. Description and evolution of the Mediterranean swordfish fisheries

Mediterranean swordfish fisheries are characterized by high catch levels. It should be noted that average annual reported catches (on average about 14,767 t from 1988 to 2008;) are similar to those of the North Atlantic, though the Mediterranean is a much smaller body of water compared to the North Atlantic. However, the potential reproductive area in the Mediterranean is probably relatively larger than that in the Atlantic. Further, the productivity of the Mediterranean Sea is thought to be very high.

Swordfish fishing has been carried out in the Mediterranean using harpoons and driftnets (drifting gillnets) at least since Roman times. Currently, swordfish fishing is carried out all over the Mediterranean Sea. The biggest producers of swordfish in the Mediterranean Sea in recent years (1998-2008) are Italy (45%), Morocco (19%), Greece (10%), and Spain (10%). Also, Algeria, Cyprus, Malta, Tunisia and Turkey have fisheries targeting swordfish in the Mediterranean. Incidental catches of swordfish have also been reported by Albania, Croatia, France, Japan, Libya, Syria and Portugal. The Group recognized that there might be additional fleets taking swordfish in the Mediterranean, for example, Israel, Lebanon, Egypt and Monaco, but no data are reported to ICCAT or FAO.

Mediterranean total swordfish landings showed an upward trend from 1965-1972, stabilized between 1973-1977, and then resumed an upward trend reaching a peak in 1988 (20,365 t). The sharp increase between 1983 and 1988 may be partially attributed to improvement in the national systems for collecting catch statistics. Since 1988, the reported landings of swordfish in the Mediterranean Sea have declined, and since 1990, they have fluctuated between about 11,000 to 16,000 t. In 2008 catches were 12,164 t. Reported catches for 2009 were very incomplete.

In recent years, the main fishing gears used are surface longline (79% of the total catch) and gillnet. Most of the previously mentioned countries operate longline fisheries. In recent years only Morocco reported gillnet catches. Nevertheless, the Group considered that catches reported under other gear categories may include gillnet catches. There are also other countries known to be fishing with gillnets but not reporting their catches at all. **Figure 1** presents the evolution of the catches according to the fishing gear. Swordfish are also caught with harpoons and traps, and also as by-catch in other fisheries (longlines and driftnets targeting albacore, purse seines etc.). It should be noted that since the beginning of 2002 driftnet fishing has been banned in EU countries and this has influenced the catch data beginning in 2002.

There is a high demand for swordfish for fresh consumption in most Mediterranean countries.

ICCAT Recommendation 09-04 establishes a two months closure (October-November) for all gears catching swordfish in the Mediterranean Sea.

Figure 2 shows the Mediterranean areas considered in the fisheries descriptions given below.

EU- Greece

The Greek swordfish fleets operate throughout the eastern Mediterranean basin using exclusively drifting longlines. In 2009, there were 250 vessels were involved in the swordfish fishery. Most of them entered the fishery occasionally, mainly during the summer months. The swordfish fishing season lasts from February to the end of September, as there is a closed season in the Greek seas from October to January, aimed at protecting the recruits. In recent years, a special license is required for a commercial fishing boat to be allowed to fish large pelagic species.

Swordfish comprises the main bulk of the large pelagic catches in the Greek seas and its production during the 2009 fishing season was estimated at 1200 t. The catch and effort of the previous year were lower, mainly due to fishing strategy changes, provoked by the high fuel prices during 2008. The Greek swordfish production has been rather stable over the last decade.

EU- Italy

Italy has a long historical tradition in the swordfish fishery, reflected by the development of several fisheries in more recent times. As a matter of fact, Italy has an important fleet of longliners which provides the bulk of the catches, while minor catches are obtained by the few harpoon vessels still active in the Strait of Messina, the tuna traps, the sport fishery and some other surface gears. The fishery had considerable changes in the past years, after the driftnet ban, because Italy had the most numerous driftnet fleet in the Mediterranean and it was not easy to apply and enforce the new regulation, due to a strong tradition.

The longline fleet is distributed in the various seas around Italy, based at many harbours, with a higher concentration in the southern Italian regions. Most of the vessels are small-medium longliners, usually having various licenses and switching from one gear to the other according to the various seasons and fishing opportunities. Other vessels, medium-large in size, usually carry out a more focused activity, alternatively targeting swordfish and albacore or bluefin tuna and covering various areas in the Mediterranean Sea. Some fleets are active all the year round while the majority of the vessels are active in spring until early autumn. Several longliners are actually using a deeper longline, for the purpose of avoiding the catch of juveniles.

The two-month fishing closure was strictly enforced in 2009. The fishing grounds show moderate yearly variability, depending mostly on oceanographic factors. Concentrations of juveniles show a higher variability, according to the trophic chain in the various areas. The most recent 2010 fishery was heavily affected by the very bad weather, which caused the lack of fishing activity until April. Data have been collected according to the ICCAT rules and within the EC Data Collection Framework Programme, while research activities are also conducted by several research institutes, using various funding.

EU-Spain

The Spanish fishery in the Mediterranean targeting swordfish is carried out by surface longlines and by "piedra-bola" longlines. Swordfish are also caught seasonally as by-catch species on longlines targeting bluefin and the longlines targeting albacore (LLMB). The total catches of swordfish in 2009 were up to 1,994 tons, slightly lower than the catches of the previous year. The surface longline fishery was quite stable in 2009, with a slight increase in catches (1,905 t) as compared to the previous year's catches (1,723 t), while fishing effort was maintained at the same level. Seventy-three (73) fishing vessels were involved in the fishery in 2009. The mean characteristics of the vessels are as follows: length 11 m, HP 145, GRT 25. The number of vessels fluctuates as there are seasonal licenses given to the vessels for different kind of fisheries.

Currently the Spanish swordfish longline fishery in the Mediterranean is regulated, as a minimum size limit has been established at 90 cm (LJFL) and a closed season from 1 October to 30 November, and other measures that affect the limit on fishing effort, as well as other factors that affect fishing technology.

Morocco

The Moroccan swordfish fishery in the Mediterranean Sea has been developed since 1983. About 300 vessels are currently operating in this fishery, using mainly driftnet and surface longlines (Abid and Idrissi, 2007). The vessels characteristics are, on average, 13 m in length, 13 GRT, and have 110 hp engines.

The most important fishing grounds are located in the Strait of Gibraltar and in the southern Alboran Sea. 75% of the whole fleet involved in this fishery is operating in the first area. The fishing activity for swordfish takes place from December to September, with higher activity in the summer time, especially in the Strait of Gibraltar. Minor catches of this species are also taken occasionally by traps and purse seines.

After the peak landings of 4,900 tons recorded in 1997, the swordfish catch showed a downward trend to about 1,800 tons in 2009. The remarkable change in this fishery during the five last years is the significant reduction in driftnet catches and the increase in longline catches, due to the implementation of the National Plan for banning the driftnet activity following the ICCAT Recommendation (Rec. 03-04) aimed at banning driftnets in the Mediterranean Sea.

The by-catches in this fishery include mainly small tunas, sharks, billfishes and bluefin tuna. The size of the landed fish showed differences among the fishing areas. In the Strait of Gibraltar, the mean size of swordfish is larger (145 cm, LJFL) than the one estimated for the southern Alboran Sea (110 cm, LJFL) (Srour *et al*., 2004).

In Morocco, the regulation on swordfish fishing concerns the establishment of a minimum commercial size of 120 cm (25 kg) (Decree No.1154-88 of 3 October 1988); the establishment of 2.5 km maximum length for driftnets; the prohibition of mesh size less than 400 mm (Circular No.1232 of 11 March 1991), and a freeze on fishing effort through the suspension of the investments for vessel construction since 1992 (Circular note No. 3887 of 18 August 1992).

Turkey

The Turkish swordfish fishery in the Mediterranean dates back to the early 17th century. Currently, this fishery is carried out by longline, gillnet and harpoon in both Aegean and Levantine Seas. However, some swordfish are also caught incidentally by purse seines as by-catch. After the driftnet ban in 2006, the fishermen made some modifications to their nets in order to get out of scope of the driftnet definition in Notification 2/1 Regulating Commercial Fishing. It is possible to provide grants and loans to fishermen in order to encourage them to change fishing methods. Furthermore, the Ministry of Agriculture and Rural Affairs (MARA) will prohibit the use of modified gillnet in July, 2011.

About 150 vessels were involved in the swordfish fishery in 2009. The boats were, on average, 12 m in length, 20 GRT and 162 HP engines. The fishing area extends from the Saroz Bay in the northern Aegean to the Gulf of Antalya in the Levantine Sea. This fishery is carried out 6-7 months per year due to the closed season (October and November), meteorological conditions and phases of the moon.

The fishing season and grounds are not stable. A total of 30 vessels from Marmara and Gökçeada Islands are catching swordfish with harpoon in Saroz Bay between April and June. About 40 vessels deploy their longlines in the southern Aegean Sea between December and May. There are 22 boats in northern Aegean ports using gillnets, some of them usually operate in the central Aegean (Sığacık Bay) from May to September. Some vessels from western Levantine fishing ports also use gillnets during April to July. In the Gulf of Antalya, 40 vessels using gillnets target both albacore and swordfish from May to July. Although, purse seines do not target swordfish, sometimes young swordfish can also be caught incidentally in the purse seine fishery, which lasts from September to April.

The catch statistics indicated that there were unstable catch amounts between 7 tons in 1976 and 589 tons in 1988. In 2008, the total catch of swordfish was 386 t.

3. Update of basic information: swordfish

At the beginning of the meeting, the Secretariat presented the most up-to-date information available for the Mediterranean swordfish stock. This covers the Task I nominal catch (T1NC), Task II catch and effort (T2CE), Task II size frequencies (T2SZ) and conventional tagging (TAGC) information related (released and/or recovered) to the Mediterranean.

3.1 Task I catches

The T1NC catches for 2009 are preliminary and still incomplete. Algeria, Syria, Tunisia and Turkey have not reported 2009 data. However, the majority of the ICCAT CPCs reporting 2009 catches have done so within the deadline. Only Morocco presented a provisional T1NC total catch during the meeting of 1735 t (GN: 521 t; LL: 1214 t). Once the missing CPCs have considerable weight in the total catches (about 20% in 2008) the total estimated yield of 2009 is clearly underestimated and the Working Group decided to eliminate 2009 from the analyses.

The T1NC catches of 2008 (current yield) were revised by the Working Group and the missing catches completed with complementary data available in the 2009 Annual Reports (Tunisia: total of 1011t).

The complete SWO-MED summary table is presented in **Table 1**. In 2008 the total yield decreased to 12164 t, a reduction of about 15% when compared to 2007 and also with the most recent years (horizontal catch trend between 2004 and 2007 on the order of 14500 t).

The Working Group noted that, since the last stock assessment, no major improvement was made in the reduction of unclassified gear (UN) in T1NC statistics, in particular in the periods:

- 1965-1975 (60% of the total, mainly EU-Italy, EU-Malta, Libya and Turkey)
- 1984-1991 (36% of the total, mainly EU-Italy)
- 2001-2005 (18% of the total, mainly Algeria and EU-Italy)

This evidence is clearly viewed in **Figure 1** which shows the T1NC yearly cumulative catch trends by year and major gear. The reduction of this "unclassified gear" from T1NC to a residual weight is a goal that a large portion of the ICCAT managed stocks endeavor on the long run (as was done to the "unclassified Stock" Task-I catches, now completely eliminated from the ICCAT database). The SWO-MED stock is among the stock with largest T1NC catches with gear "unclassified". An effort should be made by the national scientists of the relevant CPCs to discriminate T1NC catches by gear for the time periods in question.

3.2 Task II (catch-effort and size samples)

Those CPCs that reported T2CE data for 2009 have done so on time for the meeting. The CPCs with important SWO-MED catches that have not yet reported T2CE data for 2009 are Algeria, Morocco, Tunisia and Turkey. The detailed catalogue of T2CE (see **Table 2**) shows two important drawbacks pointed out by the Working Group: (a) poor coverage (only the datasets having both elements, catch and the correspondent effort) in comparison to the available T1NC catch series; and (b) the large heterogeneity (in particular, time strata, geographic strata, efforts units) of the datasets available. Aiming at a future harmonization of the T2CE datasets, the scientists of the pertinent CPCs should review their own T2CE data series following the SCRS fundamental requirements, and report them to the Secretariat. This revision should facilitate the CPUE standardization studies in the future.

Looking at the spatial distributions of the T1NC catches (also known as CATDIS, in 5x5 degree squares and trimester) presented in **Figure 3** (1950-2008) and **Figure 4** (2000-2008) by major gear, an estimation that uses the T2CE time-space stratification, the maps show some of the problematic issues found in T2CE data (weakness in spatial stratification) and in T1NC catches (considerable weight of gear "unclassified" in the global catch).

The T2SZ information for 2009 was reported on time by the majority of the CPCs that reported these data. The CPCs with important Task I catches that have not yet reported T2SZ data for 2009 are Algeria, Morocco, Tunisia and Turkey. During the meeting, Morocco presented an update for 2006 and 2008. The Working Group noted that T2SZ data has the same problems as T2CE, namely the poor coverage with respect to T1NC, and the large heterogeneity of various series (different time and spatial stratification, various frequency types, class intervals, etc.). Details are presented in the T2SZ data catalogue (**Table 3)**.

The consolidated view of Task I catches and Task II availability (T2CE and T2SZ), presented in **Table 4**, shows in a summarized way (by flag and gear), which CPCs have missing Task II data or any other inconsistencies (gear classifications, etc.). This table can be used by the ICCAT CPCs to revise their respective information, identify the missing Task II datasets and report the omission to the Secretariat for future assessments.

3.3 Catch-at-size update

During the meeting, the Secretariat revised the SWO-MED catch-at-size (CAS) estimations used in the last assessment. The revision included minor adjustments made to the 1985-2005 time-series (breakdown of EU-Greece LL 2004-05 into landings/discards; Turkey 2002 gear breakdown) with no impact on the number of fish, and the enlargement of the CAS series by adding the new estimations for the period 2006-2008. The substitution rules used to produce the 2006-2008 CAS were the ones presented in SCRS/2003/050 and Anon. (2008). A summary of the substitution table used is presented in **Table 5**. The CAS overall matrix estimated is presented in **Table 6** (graphic view by year and 5cm size classes presented in **Figure 5**).

4. Review of the swordfish catch per unit effort series

Three documents concerning the standardized catch rates for the Mediterranean swordfish were presented at this meeting.

Document SCRS/2010/083 presented updated standardized catch rates in weight from the Moroccan driftnet fishery targeting swordfish in the Mediterranean Sea from 1999 to 2009 using the General Linear Modeling approach (GLM). The analysis included 24,436 trips carried out during the same period. The factors: year, month and vessel size as well as their interactions were considered in this analysis. The annual standardized indices did not show any particular trend during the last decade; nevertheless an increase of CPUE could be noted during 2008 and 2009.

SCRS/2010/085 presented annual standardized catch rates from the Italian and Greek fleets operating in the central and eastern parts of the Mediterranean. The analysis included data from the Greek longline fishery operating in the Aegean and Levantine seas, as well as the Sicilian longline and gillnet fisheries operating in the Tyrrhenian Sea and the Straits of Sicily. Data covered the period 1987-2009 and standardized indices were estimated by means of GLM techniques. Results did not demonstrate the presence of any particular trend over time. The Working Group noted the rapid decline of CPUEs in the Italian gillnet fishery which could be attributed to changes in the fishing strategy due to the enforcement of control of this activity banned in 2002, particularly during the main fishing season of this species.

SCRS/2010/087 updated standardized catch rates in number of fish and weight from the Spanish surface longline fleet targeting swordfish in the western Mediterranean for the period 1988-2009. Data included 20,473 trips analyzed by means of General Linear Modeling (GLM). Annual standardized CPUEs did not show any particular trend; however a general increasing trend has been noted since 2003.

5. Review of gear selectivity studies

No new information was presented at the meeting. Past studies have demonstrated higher catch rates for the American-type longline in comparison to traditional longline, although differences on the selection pattern have not been fully documented. Since 2008, the project "MADE" funded by the EU is analyzing gear selectivities and results are expected to be published in the next few years.

6. Review of growth and age determination

6.1 Growth models

Past growth studies carried out by different teams, using both anal fin spines and length frequency data show comparable growth patterns. It is also well known that Mediterranean swordfish have sexually dimorphic growth, with males having a lower length-at-age and achieving a smaller asymptotic size than do females. The growth equations adopted by the GFCM/ICCAT Working Group in 1995 (Anon. 1996) are those published by Tserpes and Tsimenides (1995) and still used as follows:

$L_t = 238.60\ (1 - e^{-0.185\ (t + 1.404)})$ for sexes combined
$L_t = 203.08\ (1 - e^{-0.241\ (t + 1.205)})$ for males
$L_t = 226.53\ (1 - e^{-0.210\ (t + 1.165)})$ for females.

6.2 Catch-at-age generation

Conversion of CAS to CAA via statistical catch-at-age estimation was compared with age slicing in SCRS/2010/088. This included a validation of a new algorithm in R with the Excel "age slicing" algorithm used in the previous assessment; both algorithms gave identical results. The CAS and the two methods are summarised in **Figure 6**, which shows the observed size frequencies (blue), fitted modes (red) and the estimated size distributions (green) and length-at-age (green vertical lines); only 5 modes can be clearly identified (ages 0 to 4).

The catch proportions-at-age obtained by age slicing and statistical estimation are shown in **Figure 7**. Catch-at-age within a year is scaled by the maximum within a year. Statistical catch-at-age estimation generates larger catches at younger ages.

In order to evaluate the consequences for population estimates, a catch curve analysis was also conducted on the estimates of CAA, **Figures 8** and **9**. For statistical catch-at-age estimation, estimates of Z are slightly higher at younger ages and more uncertain at older ages. The consequences for MSY based reference points are evaluated in **Figure 10**. This shows that statistical age estimation produces slightly lower estimates for MSY, F_{MSY} and B_{MSY}.

In summary, statistical catch-at-age estimation estimates younger fish than age slicing. This is because peak catches are at ages 1 and 2 and age slicing incorrectly allocates some of these ages to younger and older ages. Therefore, estimates of Z at younger ages from CAA obtained from age slicing are negatively biased and this results in an over-estimation of reference points. However, statistical catch-at-age estimation shows that catch proportions are very uncertain in the older ages (i.e. greater than 5).

7. Stock status results

7.1 Production models

As in the 2007 assessment (Anon. 2008), a non-equilibrium Schaefer production model was applied based on the approach indicated in Tserpes (2008). The model used total catch data for the 1987-2008 period and a combined CPUE index based on the standardised CPUE series of Greek longliners, Italian longliners, Spanish longliners and Moroccan gillnetters. XSA mortality estimates were utilized to fix an input value for the biomass ratio at the beginning of the examined period and, consequently, biomass and catchability parameters were estimated for a given range of r values. Final estimates of model parameters (k, q) were obtained using a least squares criterion of fit assuming normally distributed residual errors between the observed and expected abundance indices. Confidence intervals (95%) were obtained through bootstrapping and model runs were performed under the R language environment.

Based on the ICCAT XSA assessment, the values of F and M for the beginning of the period were fixed to 0.18 and 0.20, respectively. The best fit was provided for r = 0.52 (0.36-0.68) and k = 112421 (79755-145088) t. Observed and predicted indices are shown in **Figure 11**. Based on the above estimates, equilibrium MSY was found to be equal to 14628 t. The corresponding rates (with 95% confidence intervals) for fishing mortality and biomass are: F_{MSY} = 0.26 (0.18-0.34) and B_{MSY} = 56210 (39877-72544) t. Annual catches in the latest years are around MSY, while stock biomass levels, although not far from optimum (but with high confidence intervals), are about 30% lower than those at the beginning of the period (**Figures 12** and **13**). Fishing mortality in 2008 was lower than F_{MSY} (**Figure 14**).

7.2 Age structured models

XSA Model

The 2007 XSA assessment was performed in R using the FLXSA package (part of the FLR-project, Kell *et al.*, 2007; http://www.flr-project.org/) with catch-at-age generated using age slicing. Fish first mature at age 3 (when 50% are mature) and are fully mature at older ages; natural mortality was assumed equal to 0.2. Five tuning data sets are available: Italian longliners–IT_LL (SCRS/2010/107), Greek longliners-GR_LL (Tserpes *et al.*, 2008), Moroccan gillnetters-MO_GN (Abid and Idrissi 2008), Italian gillnetters-IT_GN (Tserpes *et al.*, 2004), Spanish longline-SP_LL (Oritz de Urbina *et al.*, 2008).

In the previous assessment a plus group of 10 was used. However, CPUE indices are not differentiated by age and statistical catch estimated showed that there was little information in the length distributions to justify splitting CAS into ages greater than 5. Therefore, in line with the Atlantic swordfish assessments a run was conducted with a plus group of 5, **Figure 15** contrasts the 2007 assessment with plus groups of 10 and 5.

CPUE series were considered as representative of the 2-4 age-group abundances (the plus group is not used calibrated within XSA). Fleet catchability was assumed to be independent of year-class size for all terminal years and ages, numbers-at-age were estimated using population and F shrinkage. Catchability residuals by fleet and age are presented in **Figure 16**, Spanish and Greek longlines showed contrasting residual patterns in the early period.

XSA estimates the survivors (i.e. terminal Ns by age and year) for each observed value of CPUE. This is done by calibration regression to predict population numbers-at-age by year for each series and then projecting along the cohort to the oldest age or most recent year. In addition shrinkage to the mean is performed, e.g. the terminal Fs include a weighting related to the recent Fs or Fs at younger ages and numbers-at-age (shrinkage to the mean F) for recruiting age classes are estimated from the geometric mean of recent recruitments (shrinkage to the mean n). The influence of the CPUE series and shrinkage is evaluated in **Figure 17**, where for each series and F and N shrinkage the relative weight for each terminal age (panel row) and year is shown. It can be seen that the Japanese longline (JALL) has little influence on the VPA estimates, while Italian driftnets (ITDN) has little influence on the younger ages. The most important effect influencing the VPA calibration is shrinkage as this always has the highest weighting.

The surplus production curves from the 2007 assessment with a plus group of 10 is compared to the most recent assessment with a plus group of 5 are compared in **Figure 18**. The weight at age in the plus group is modeled to take into account the mean age of individuals. Changing the plus group, reduced the historical estimates of F and increased the estimates of recruitment and SSB. It also decreased the B_{MSY} and MSY reference points.

The effect of the updated CAA had little effect on the assessment; the XSA of the statistically estimated CAA produced great variability in stock estimates.

The final XSA assessment covered the period up to 2008 and **Tables 7** and **8** present the estimates of fishing mortality and population numbers-at-age, respectively. Based on the previous trials, four standardised CPUE series were used: Italian longliners, Greek longliners, Spanish longliners and Morrocan gilnetters (**Figure 19**). As in the previous (2003 and 2007) assessments, recruitment appears to be consistent without any especially strong or weak year classes. The mean Fs for ages 2-4 are plot against year in **Figure 209**. Both total and spawning stock biomass estimates remained stable during the last 15 years (**Figure 21**).

Equilibrium yield-per-recruit analyses

The XSA results were used as the basis for yield-per-recruit analyses which are a form of long-term projection. The resulting equilibrium estimates for several biological reference points are given in **Table 9** assuming a Beverton-Holt S/R relationship calculated from the XSA estimates. Equilibrium curves are illustrated in **Figure 22.** The current (2008) SSB and F levels suggest that the stock is overfished (**Figure 23**).

7.3 Stock status summary

Both forms of assessment, indicated that current SSB levels are much lower than those in the mid-1980s, although no trend appears in the last 15 years. The extent of the decline differ among models, with the production model suggesting a decline of about 30%, while XSA results indicate that current SSB level is about 1/4 of those in the mid-1980s. Results indicate that the fishery underwent a rapid expansion in the late 1980s resulting in Fs and catches above those that could support MSY. Estimates of population status from production modeling indicated that current stock level is slightly lower to the optimum needed to achieve the ICCAT Convention objective, but these estimates have a high degree of uncertainty (CV~30%). Additionally, it should be noted that production model biomass estimates are very sensitive to the assumption made about the initial stock biomass ratio.

Results of equilibrium yield-per-recruit analyses based on the analytical age-structured assessment in which we have more confidence indicated that the stock is in overfished condition and slight overfishing is taking place. Current (2008) SSB is 46% lower than the value that would maximize yield per-recruit. Current F is slightly higher to the estimated F_{MSY}. A reduction of current F to the $F_{0.1}$ level would result to a substantial (about 40%)

long-term increase in SSB. Note, however, that these conclusions are based on deterministic analyses of the available data. The level of uncertainty in these estimates has not been evaluated.

8. Evaluation of management scenarios

The XSA model outcomes were projected forward under several different exploitation scenarios. Similarly to previous projections each management scenario was simulated 100 times for a period of 20 years considering ten age-classes. Fishing mortality for ages 6-10 was considered to be equal to that estimated for the 5-plus age group. Population size and volume of landings were estimated from the commonly used exponential decay and catch equations. In addition it was assumed that: (a) annual natural mortality equals to 0.2 for all ages and (b) annual recruitment is either independent of stock size and equals to the mean of the assessment period, or it derives from a Beverton-Holt stock-recruitment (BH S/R) model estimated from the assessment data. A log-normally distributed error with a coefficient of variation (CV) equal to 30% was assumed for the annual recruitment rates. Thus, recruitment values were drawn randomly from the assumed distribution.

In each simulation the total catch, recruitment, harvest and spawning stock biomass (SSB) by year were estimated. Following the approach described in SCRS/2010/086, for each scenario the risk of stock collapse was estimated as the probability of SSB decline at any given year by: (a) 10 and (b) 20% with reference to the current (2008) levels. All scenarios were accomplished using the Fisheries Library in R (FLR) framework (http://www.flr-project.org/, Kell *et al.* 2007).

8.1 Exploitation scenarios

Six Mediterranean-wide management scenarios were examined and specific details for each of them are given below. The first scenario assumes a continuation of the current situation that includes a two-month closure. Two of the scenarios attempt to examine the effects of further fishery closures during the recruitment period. Based on existing information it has been assumed that such closures would drastically reduce the fishing mortality of zero-age fish (up to 71cm of LJFL in the catch-at-age table used in the assessment). The fourth scenario assumes a 20% reduction in capacity while the last two scenarios examine the effect of setting different quotas.

Scenario 1 (base case): Current situation

It was assumed that fishing mortality (F) at age for the entire projection period will be equal to that of 2008 (last assessment year.

Scenario 2: An additional two-month fishery closure during the peak of the recruitment period (four-month closure in total).

Based on the fish growth pattern, it was assumed that such a closure would reduce selection, and consequently mortality for zero-age fish by 50%. Taking into account that all over the Mediterranean much more fishing pressure is exerted on the stock from late spring to middle autumn it was considered that this two-month closure out of the peak fishing season will reduce global fishing effort only by 10%. By assuming that fishing effort is proportional to fishing mortality, a similar reduction in fishing mortality is expected.

Scenario 3: Fishery closure for the entire recruitment period (six month closure in total).

It has been assumed that fishing mortality of zero-age fish will be practically eliminated. The global fishing effort and the subsequent fishing mortality would be reduced by 40%.

Scenario 4: Capacity reduction of 20%.

It has been assumed that fishing mortality will be reduced accordingly.

Scenario 5: Quotas equal to the mean yield of the last decade. Based on ICCAT Task I data this scenario assumes annual catch quotas equal to 14269 t.

Scenario 6: Quotas equal to the 80% of the mean yield of the last decade. Based on ICCAT TaskI data this scenario assumes annual catch quotas equal to 11415 t.

8.2 Summary of Projections

Figures 24 and **25** illustrate trends in recruitment, harvest, catch and SSB rates for the examined scenarios. Scenarios assuming a B/H recruitment relationship suggest that the stock can be rebuild to the mid-1980s high SSB levels only in the cases of six month closures, 20% capacity reduction, or low quotas (80% of the mean yield of the last decade). The scenarios assuming recruitment independent of stock size gave slightly different results, as the above SSB levels were only met in the case of six month closures and 20% capacity reduction. In general, the aforementioned results are in line with previous evaluations which have shown that stock rebuild to the 1980s SSB levels can be achieved only with drastic fishery closures (over four months).

However, SSB increases up to the optimum levels suggested by the yield-per-recruit analyses can be achieved even under the current management status (two-month closure), provided that fishing mortality is kept on 2008 levels, which were quite lower than the previous years, especially for older age groups (>3 yr). Risk assessment, however, indicates that in this case a small probability (<5%) of stock collapse exists under both recruitment assumptions.

9. Recommendations

9.1 Statistics and research

- *Data submission.* Data must be reported by the ICCAT deadlines, even when no analytical stock assessment is scheduled. Historical catch, effort and CPUE data, if revised or when requested by the Secretariat, should also be provided, if possible. If the catch and size data are provided to the Secretariat by the specified deadlines, then the Secretariat will provide the catch-at-size and the adopted substitution table to the relevant scientists for review in advance of the meeting. This will then allow the stock assessment session to proceed immediately with analyses, without the delay associated with recalculating the catch-at-size during the meeting due the late submission of new data on the first day of the meeting. This continuing problem caused difficulty for the current assessment, requiring the Group to make assumptions such as the carry-forward of catch from one year to the next or substitutions for Task II data for those countries who did not report as required.

- *Participation by ICCAT Contracting Parties in the Assessment Working Group.* The Group noted that several Contracting Parties, in spite of having significant swordfish fisheries, did not send national scientists to the 2010 assessment. This has obvious negative consequences for the Group's ability to accurately interpret fisheries trends, and provide better advice to the Commission.

- *Catch*. All countries catching swordfish (directed or by-catch) should report catch, catch-at-size (by sex) and effort statistics by as small an area as possible (5-degree rectangles for longline, and 1-degree rectangles for other gears), and by month. It is recommended that at least the order of magnitude of unreported catches be estimated. The Group noted that it is important to collect size data together with the catch and effort data to provide meaningful CPUEs. .

- *Discards*. Participating countries should improve their estimates of discards of juvenile swordfish, when applicable, and submit such information to the ICCAT Secretariat.

- *CPUE*. CPUE series should be developed to take into account the geographic stratification of the catch by gear and month using standard measures of effort for each gear (*e.g.*, number of hooks for longline, length of nets for gillnet), on as fine a scale as possible (5-degree rectangles for longline, and 1-degree rectangles for other gears). Although CPUE by age is the usual input for the age-structured analyses, the Group recognized that this must be based on an increased level of sampling, not merely substitution of the current data. Therefore, it is recommended that increased sampling take place so that CPUEs can be developed by age. To achieve this goal, the Group noted that it is important to collect size data together with the catch and effort data to provide meaningful CPUEs.

- *Environment.* The Group recommended continued work to better identify the effects of the environment on swordfish biology, ecology and fisheries. Future CPUE analyses should focus on developing additional methods to explicitly incorporate environmental variability into the model, and the influence of environment on the distribution of spawners and juveniles.

- *Gear selectivity studies.* Further research on gear design and use is encouraged in order to minimize catch

of age-0 swordfish and increase yield and spawning biomass per recruit from this fishery.

- *Stock mixing and management boundaries.* Considering differences in the catch and CPUE patterns between different Mediterranean fisheries, further research, including tagging investigations, in defining temporal variations in the spatial distribution pattern of the stock will help to improve stock assessment and management.
- *Next Mediterranean swordfish stock assessment.* It is recommended that the next swordfish stock assessment be conducted no sooner than 2013 so long as there is no signal from the stock indicating a dramatic decline. This allows time to increase the time series of catch and effort data, and to advance basic research and assessment methods. It should be noted that the data required for that session should be up to and including the year prior to the meeting.

9.2 Management

The Commission should adopt a Mediterranean swordfish fishery management plan which ensures that the stock will be rebuilt and kept at levels that are consistent with the ICCAT Convention objective. Given the uncertainties on optimum SSB level estimates and the rapid fishery expansion in the 1980s, which resulted in severe stock biomass declines, the SSB levels in the late 1980s may be also considered as a good proxy for the stock. Analysis has suggested that the seasonal closures have beneficial effects and can move the stock condition to the level which will support MSY, but the effect of the recently employed two-month closure could not be evaluated due to incomplete 2009 data.

Following the results from recent studies (SCRS/2006/163), technical modifications of the longline fishing gears, as well as, the way they are operated can be considered as an additional technical measure in order to reduce the catch of juveniles. The Working Group recommends this type of measures be considered as part of a Mediterranean swordfish management plan. Management measures aimed at reducing fleet capacity should also be considered as part of a Mediterranean swordfish management plan adopted by the Commission.

10. Other matters

No other matters were discussed by the Group.

11. Adoption of the report and closure

The report was adopted during the meeting.

The Chairman thanked the participants for their hard work.

The meeting was adjourned.

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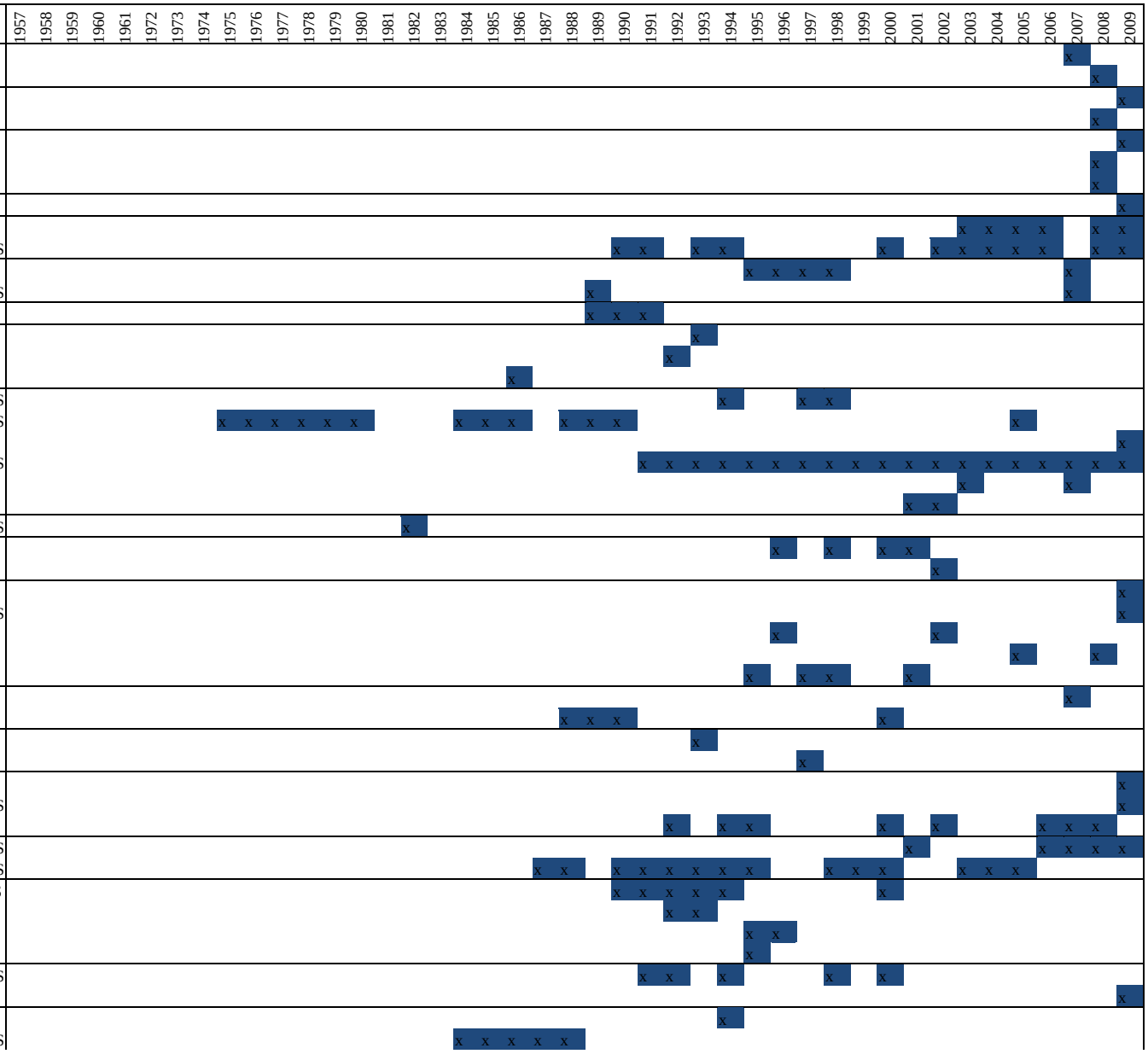
Table 1. Task I summary table for the Mediterranean swordfish (*Xiphias gladius*) stock: total catch (t) by major gear and flag (2009 data is preliminary).

		1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MED total		586	580	337	0	452	340	393	250	914	200	112	206	300	318	394	1760	1752	1317	3440	3723	3341	4975	5973	4809	5043	4314	4637	5285	5966	5547
Landings	Longline	586	580	337	0	452	340	393	0	414	0	0	94	188	94	282	1423	1192	869	1196	1350	1114	1426	1544	1390	1103	728	4143	4611	5046	4877
	Other surf.	0	0	0	0	0	0	0	250	500	200	112	112	112	224	112	337	560	448	2244	2373	2227	3549	4429	3419	3940	3586	494	674	920	670
Discards	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landings	Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Algerie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	196	500	368	370	320	521
	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	EU.Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	59	95	82	98
	EU.España	586	580	337	0	452	340	393	0	414	0	0	0	0	0	0	1200	1000	700	1000	1100	900	1100	1300	1105	700	89	89	667	720	800
	EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	EU.Greece	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	EU.Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1568	2240	2016	3248	4144	3136	3730	3362	3747	3747	4514	3930
	EU.Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112	224	224	224	192	214	175	223	136	151
	EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	2	9	13	1	5	2	3
	Libya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	224	224	336	560	0	0	0	0	0	0	0	0	0	0	0
	Maroc	0	0	0	0	0	0	0	0	0	0	0	94	188	94	282	224	192	170	197	250	214	327	230	183	196	118	186	144	172	0
	NEI (MED)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Syria Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tunisie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	5	0	0	0
	Turkey	0	0	0	0	0	0	0	250	500	200	112	112	112	224	112	112	336	111	115	133	99	76	60	59	15	10	7	34	20	44
Discards	EU.Greece	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MED total		6579	6814	6343	6896	13666	15292	16765	18320	20365	17762	16018	15746	14709	13265	16082	13015	12053	14693	14369	13699	15569	15006	12814	15674	14405	14600	14893	14227	12164	9336
Landings	Longline	5115	5419	5770	6313	6749	6493	7505	8007	9476	7065	7184	7393	7631	7377	8985	6319	5884	5389	6496	6097	6963	7180	7767	10765	11053	11273	11638	11451	10662	7348
	Other surf.	1464	1395	573	583	6917	8799	9260	10313	10889	10697	8834	8353	7078	5888	7097	6696	6169	9304	7873	7602	8606	7826	5047	4909	3343	3214	3239	2756	1474	1988
Discards	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	113	16	19	27	
Landings	Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	13	13	0	0	0	0	0	0	0	0	0	
	Algerie	650	760	870	877	884	890	847	1820	2621	590	712	562	395	562	600	807	807	807	825	709	816	1081	814	665	564	635	702	601	802	
	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	3	0	0	0	0	0	0	0	0	0	0	0	**0**
	Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	20	0	0	0	0	0	0	0	0	4	3
	EU.Cyprus	72	78	103	28	63	71	154	84	121	139	173	162	56	116	159	89	40	51	61	92	82	135	104	47	49	53	43	67	67	38
	EU.España	750	1120	900	1322	1245	1227	1337	1134	1762	1337	1523	1171	822	1358	1503	1379	1186	1264	1443	906	1436	1484	1498	1226	951	910	1462	1697	2095	1130
	EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	27	0	19	0	0	14	14	15
	EU.Greece	0	91	773	772	1081	1036	1714	1303	1008	1120	1344	1904	1456	1568	2520	974	1237	750	1650	1520	1960	1730	1680	1230	1120	1311	1358	1887	962	1132
	EU.Italy	4143	3823	2939	3026	9360	10863	11413	12325	13010	13009	9101	8538	7595	6330	7765	7310	5286	6104	6104	6312	7515	6388	3539	8395	6942	7460	7626	6518	4549	5016
	EU.Malta	222	192	177	59	94	172	144	163	233	122	135	129	85	91	47	72	72	100	153	187	175	102	257	163	195	362	239	213	260	266
	EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	115	8	1	120	14	16	0	0	**0**
	Japan	1	1	5	6	19	14	7	3	4	1	2	1	2	4	2	4	5	5	7	4	2	1	1	0	2	4	0	3	1	1
	Libya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	8	6	0	10	2	0	14	0	0	
	Maroc	0	0	0	43	39	38	92	40	62	97	1249	1706	2692	2589	2654	1696	2734	4900	3228	3238	2708	3026	3379	3300	3253	2523	2058	1722	1957	1735
	NEI (MED)	728	672	517	532	771	730	767	828	875	979	1360	1292	1292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Syria Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	28	
	Tunisie	0	7	19	15	15	61	64	63	80	159	176	181	178	354	298	378	352	346	414	468	483	567	1138	288	791	791	949	1024	1011	
	Turkey	13	70	40	216	95	190	226	557	589	209	243	100	136	292	533	306	320	350	450	230	370	360	370	350	386	425	410	423	386	
Discards	EU.Greece	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	113	16	19	27	

Table 2. Task II catch and effort (T2CE) detailed catalog associated with SWO-MED stock (shaded cells indicate availability of a corresponding dataset).

Status	Flag	Gear group	Time Strata	Geog. Strata	Effort Type
CP	Algerie	LL	mm	1x1	D.FISH
					-none-
	Croatia	HL	mm	5x5	D.AT SEA
					-none-
		LL	mm	5x5	D.AT SEA
					D.FISH
					-none-
		PS	mm	5x5	-none-
	EU.Cyprus	LL	mm	1x1	D.FISH
					NO.HOOKS
				5x5	D.FISH
					NO.HOOKS
	EU.España	GN	mm	5x5	D.FISH
		HL	mm	1x1	SUC.D.FI
				5x5	D.FISH
					-none-
		LL	mm	1x1	NO.HOOKS
				5x10	NO.HOOKS
				5x5	D.FISH
					NO.HOOKS
					NO.TRIPS
					-none-
			yy	5x10	NO.HOOKS
		SU	mm	1x1	-none-
				5x5	-none-
		TP	mm	5x5	D.FISH
					NO.HOOKS
					NO.TRAPS
					-none-
					TRAP D
			yy	5x5	-none-
					TRAP D
		UN	mm	1x1	D.FISH
					-none-
				5x5	D.FISH
					NO.HOOKS
					-none-
	EU.Greece	LL	mm	5x10	NO.HOOKS
				5x5	NO.HOOKS
	EU.Italy	GN	mm	1x1	NO.BOATS
			yy	1x1	D.FISH
					NO.LINES
					-none-
		LL	mm	1x1	NO.HOOKS
				5x5	NO.TRIPS
			qq	1x1	D.FISH
					NO.HOOKS



			yy	1x1	NO.HOOKS	
					-none-	
		TP	yy	1x1	D.FISH	
		UN	yy	1x1	-none-	
	EU.Malta	LL	mm	10x10	D.FISH	
				1x1	D.FISH	
					NO.HOOKS	
				5x5	D.FISH	
					NO.HOOKS	
					-none-	
	EU.Portugal	LL	mm	1x1	-none-	
				5x5	-none-	
		SU	mm	1x1	-none-	
	Japan	LL	mm	5x5	NO.HOOKS	
	Korea Rep.	LL	mm	5x5	NO.HOOKS	
	Libya	LL	mm	5x5	NO.HOOKS	
	Maroc	GN	mm	5x5	D.FISH	
		SU	mm	1x1	-none-	
	Tunisie	LL	mm	5x5	-none-	
	Turkey	HP	mm	5x5	-none-	
NCC	Chinese Taipei	LL	mm	5x5	NO.HOOKS	

Table 3. Task II size frequencies (T2SZ) detailed catalog associated with SWO-MED stock (shaded cells indicate availability of a corresponding dataset).

Size Info	Status	Flag	Gear group	Time Strata	Geo Strata	Freq Type	Size classes
siz	CP	Algerie	LL	qu	ICCAT	LJFL	2 cm
		EU.Cyprus	LL	mm	1x1	WGT	2 kg
						LJFL	5 cm
					5x5	LJFL	5 cm
				qu	1x1	LJFL	5 cm
		EU.España	GN	mm	5x5	LJFL	5 cm
			HL	mm	5x5	LJFL	5 cm
			LL	mm	1x1	WGT	1 kg
					5x10	LJFL	5 cm
					5x5	LJFL	5 cm
					ICCAT	LJFL	5 cm
			UN	mm	5x5	LJFL	5 cm
		EU.Greece	LL	mm	5x5	LJFL	1 cm
				qu	5x10	LJFL	5 cm
					5x5	LJFL	5 cm
				yy	ICCAT	LJFL	5 cm
		EU.Italy	GN	mm	1x1	LJFL	1 cm
							5 cm
					5x5	LJFL	1 cm
							5 cm
					ICCAT	LJFL	5 cm
				qu	1x1	LJFL	1 cm
					5x5	LJFL	1 cm
				yy	1x1	LJFL	1 cm
							5 cm
					5x5	LJFL	5 cm
					ICCAT	LJFL	5 cm
			HP	mm	1x1	LJFL	5 cm
				qu	1x1	LJFL	5 cm
					ICCAT	LJFL	5 cm
			LL	mm	1x1	LJFL	1 cm
							5 cm
					5x5	LJFL	1 cm
							5 cm
					ICCAT	LJFL	1 cm
							5 cm
				qu	1x1	LJFL	5 cm
					5x5	LJFL	1 cm
					ICCAT	LJFL	1 cm
							5 cm
				yy	1x1	LJFL	1 cm
							5 cm
					5x5	LJFL	5 cm
					ICCAT	LJFL	1 cm
							5 cm
			TP	yy	1x1	LJFL	5 cm
			UN	mm	1x1	LJFL	1 cm
				qu	ICCAT	LJFL	1 cm
							5 cm
				yy	1x1	LJFL	5 cm
					ICCAT	LJFL	1 cm
		EU.Malta	LL	mm	10x10	LJFL	1 cm
					1x1	LJFL	1 cm
					5x5	LJFL	1 cm
		Japan	LL	mm	10x20	EYEFORK	5 cm
					5x10	EYEFORK	5 cm
				qu	10x20	EYEFORK	1 cm
							5 cm
						LJFL	1 cm
		Maroc	GN	mm	5x5	LJFL	5 cm

					ICCAT	LJFL	1 cm	
		Tunisie	LL	yy	5x5	LJFL	5 cm	
					ICCAT	LJFL	5 cm	
		Turkey	GN	yy	5x5	LJFL	5 cm	
			HP	yy	5x5	WGT	5 kg	
	NCC	Chinese Taipei	LL	mm	5x5	LJFL	5 cm	
				qu	ICCAT	LJFL	5 cm	
CAS	CP	EU.Cyprus	LL	qu	5x5	LJFL	5 cm	
		EU.España	GN	mm	ICCAT	LJFL	5 cm	
			LL	mm	5x5	LJFL	5 cm	
					ICCAT	LJFL	5 cm	
				yy	ICCAT	LJFL	5 cm	
		EU.Italy	LL	qu	5x5	LJFL	5 cm	
		EU.Malta	LL	mm	5x5	LJFL	1 cm	
							5 cm	
		Maroc	GN	mm	5x5	LJFL	5 cm	
			LL	yy	5x5	LJFL	5 cm	

Table 4. SWO-MED consolidated catalogue of Task I (T1, tones) and Task II (T2, presence of catch & effort [**a**], size/CAS data [**b**], both datasets a&b [**ab**], or, none[**-1**]) by stock/flag/gear and year (1980-09). Task II catch and effort datasets [a] without effort were removed. A "zero" Task I catch in a given position indicates that, Task II exists (at least one of [a] or [b]) without a significant (>=0.5t) correspondent Task I catch.

Stock	Status	Flag	Gear	T1/T2	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MED	CP	Albania	UN	T1																	13	13	13	13										
				T2																	-1	-1	-1	-1										
		Algerie	GN	T1																			590	531	599	642	467		233	311	87	108		
				T2																			-1	-1	-1	-1	-1		-1	-1	-1	-1		
			HL	T1																									112	175	72	1		
				T2																									-1	-1	-1	-1		
			LL	T1	650	760	870	877	884	890	847	1820	2621	590	173	173	6	173	185	247	247	247				133	99		52	93	496	492		
				T2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	-1	-1	-1	-1	-1	-1	-1				-1	-1		-1	-1	-1	a		
			PS	T1																									45	56	47	1		
				T2																									-1	-1	-1	-1		
			TL	T1																			57	52	51									
				T2																			-1	-1	-1									
			UN	T1											539	389	389	389	415	560	560	560	178	126	166	306	248	665	122				802	
				T2											-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1				-1	
		Croatia	HL	T1																													0	0
				T2																												-1	a	
			LL	T1																			10	20								4	1	
				T2																			-1	-1								a	a	
			PS	T1																													2	
				T2																													-1	
		EU.Cyprus	LL	T1	72	78	103	28	63	71	154	84	121	139	173	162	56	116	159	89	40	51	61	92	82	135	104	47	49	53	43	67	67	38
				T2	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	a	a	-1	a	a	a	a	a	a	-1	a	-1	a	a	a	a	ab	ab	ab	ab
		EU.España	GN	T1										87	85	39																		
				T2										ab	ab	ab																		
			HL	T1						1																								
				T2						-1							ab	a																
			LL	T1	750	1120	900	1321	1243	1219	1337	1134	1760	1250	1438	1132	790	1293	1402	1351	1040	1184	1409	867	1396	1402	1421	1165	930	860	1405	1648	2063	
				T2	ab	b	ab	-1	ab	ab	ab	-1	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab
			SU	T1						2											10		24	10	16	5	19							
				T2						-1											-1		-1	-1	-1	-1	-1							
			TP	T1				1	2	3			2							2	2	1	2	3	1	4	2	3	1	3	1	1	2	
				T2				-1	-1	-1			a	a	a					a	a	a	a	-1	a	a	a	-1	-1	-1	-1	-1	-1	a
			TW	T1						1																								
				T2						-1																								
			UN	T1						1							32	65	101	26	134	79	8	26	23	73	56	58	20	46	56	48	30	1130
				T2						-1							b	ab	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a
		EU.France	BB	T1																														0
				T2																														-1
			GN	T1																														1
				T2																														-1
			LL	T1																														10
				T2																														-1
			PS	T1																0														0
				T2																-1														-1
			TW	T1																														4
				T2																														-1
			UN	T1																						12	27		19			14	14	1
				T2																						-1	-1		-1			-1	-1	-1
		EU.Greece	LL	T1		91	773	772	1081	1036	1714	1303	1008	1120	1344	1904	1456	1568	2520	974	1237	750	1650	1520	1960	1730	1680	1230	1129	1424	1374	1907	989	1132
				T2		-1	-1	-1	-1	-1	b	ab	ab	-1	ab	ab	ab	ab	ab	ab	-1	-1	ab	ab	ab	b	ab	ab	ab	ab	ab	ab	ab	ab
		EU.Italy	GN	T1					1459	1540	1620	1749	1846	2542	4353	3142	4077	3070	3921	4264	2657	3632	3632	3632	4863						2342	1948		
				T2					-1	-1	-1	-1	-1	-1	ab	ab	ab	ab	ab	ab	ab	b	b	b	ab	b		b	b	b	b	-1		

		HP	T1	501	461	356	366													10	12	12		8			7	5	6			23	
			T2	-1	-1	-1	-1													-1	-1	-1		-1			b	b	b	b	b	-1	
		LL	T1	3642	3362	2583	2660	2759	2493	2622	2831	2989	2989	2454	2470	3518	3260	3844	3035	2617	2458	2458	2680	2639	2236	1841	5844	5452	5560	5253	4564	4521	4687
			T2	-1	-1	-1	-1	a	ab	ab	a	a	-1	b	ab	ab	b	ab	ab	ab	b	ab	b	ab	b	b	b	b	b	b	b	b	ab
		PS	T1																											32	7	0	0
			T2																											-1	-1	-1	-1
		SP	T1																								2	2	2				
			T2																								-1	-1	-1				
		TP	T1					3												2	2	2		2			2	1	2				
			T2					-1								a	ab	b	b	-1	-1	-1		-1			-1	-1	-1				
		UN	T1					5139	6830	7171	7745	8175	7478	2294	2926				11					3	4152	1698	2540	1483	1891			5	329
			T2					-1	b	b	b	b	b	-1	-1				-1					b	-1	b	b	-1	b	b		-1	-1
	EU.Malta	LL	T1				59	94	172	144	163	233	122	135	129	85	91	47	72	72	100	153	187	175	102	257	163	195	362	239	213	260	266
			T2				-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	-1	-1	-1	ab	b	ab	ab	ab
		UN	T1	222	192	177																											
			T2	-1	-1	-1																											
	EU.Portugal	LL	T1																					13	115	8	1	120	14	16			
			T2																					-1	-1	-1	-1	-1	-1	-1			
	Japan	LL	T1	1	1	5	6	19	14	7	3	4	1	2	1	2	4	2	4	5	5	7	4	2	1	1		2	4	0	3	1	1
			T2	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a	a	ab	a	ab	a	a	a	a		a	a	a	a	ab	a
	Korea Rep.	LL	T1																														
			T2																a	a	a												
	Libya	LL	T1																			11		8	6		10	2		14			
			T2																			-1		a	a		-1	-1		-1			
	Maroc	GN	T1											866	1186	1883	2068	2109	1518	2461	4653	2905	2979	2503	2266	2230	1629	1299	722	603	615	587	
			T2											-1	-1	-1	-1	b	-1	-1	-1	b	b	ab	ab	b	b	b	b	b	b	b	
		LL	T1				43	39	38	92	40	62	97	371	508	807	517	527	169	273	245	323	259	205	754	1149	1670	1954	1801	1455	1107	1370	
			T2				-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	-1	-1	-1	-1	-1	
		PS	T1																						4								
			T2																						-1								
		TP	T1											12	12	2	4	18	9		2				2		1						
			T2											-1	-1	-1	-1	-1	-1		-1				-1		-1						
	Syria Rep.	LL	T1																												22	17	
			T2																												-1	-1	
		PS	T1																												15	11	
			T2																												-1	-1	
	Tunisie	LL	T1		7	19	15	15	61	64	63	80	159	176	181	178	354	298	378	352	346	414	468	483	567	1138	285	791	791	949	1024		
			T2		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	-1	-1	-1	-1	b	-1	-1	-1	-1	-1	-1	-1	-1		
		PS	T1																								2						
			T2																								-1						
		TP	T1																								0						
			T2																								-1						
		TW	T1																								0						
			T2																								-1						
	Turkey	GN	T1						190	226	557	589	209	243	100	136	292	533	306	320	350	450	230	370	360	300							
			T2						-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	-1							
		LL	T1																							70	350	386	425	410	423	386	
			T2																							-1	-1	-1	-1	-1	-1	-1	
		UN	T1	13	70	40	216	95																									
			T2	-1	-1	-1	-1	-1																									
NCC	Chinese Taipei	LL	T1														1	1		1	3												
			T2														-1	-1		-1	a		a	a	ab	a				ab			
NCO	NEI (MED)	GN	T1					219	231	243	262	277	381	442	559	559																	
			T2					-1	-1	-1	-1	-1	-1	-1	-1	-1																	
		LL	T1			517	532	552	499	524	566	598	598	918	733	733																	
			T2			-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1																	
		UN	T1	728	672																												
			T2	-1	-1																												

Table 5. SWO-MED. Substitution table used for the estimation of the CAS of the period 2006-2008. Shaded [grey] cells indicates a substitution.

Task-I						Task-II (size)												
Year	Fleet	Gear	L/D	Yield(t)	RF	Year	Fleet	Gear	L/D	Yield(t)	Num	Li(range)	Li(avg)	Wi(avg)	SizeInfo	TimeStrata	Remarks	Actions
2006	DZA	GILL	L	87	0.08	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	DZA	HAND	L	72	0.06	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	DZA	LL	L	465	0.41	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	DZA	LL-B	L	31	0.03	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	DZA	PS	L	47	0.04	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	EU.CYP	LL	L	43	11.91	2006	EU.CYP	LL	L	4	40	105-279	172	90	sz	mm	<>99%	raise
2006	EU.ESP	LLALB	L	101	0.09	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	EU.ESP	LLJAP	L	7	0.01	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	EU.ESP	LLPB	L	236	0.21	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	EU.ESP	TRAP	L	1	0.00	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	EU.ESP	UNCL	L	56	0.05	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	EU.ESP-ES-SWO	LLHB	L	1060	0.94	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	<>99%	raise
2006	EU.GRC	LL	D	16	0.30	2006	EU.GRC	LLSWO	L	52	1384	30-214	132	38	sz	qq	no sz/cs	sub-raise
2006	EU.GRC	LL	L	1358	25.93	2006	EU.GRC	LLSWO	L	52	1384	30-214	132	38	sz	qq	<>99%	raise
2006	EU.ITA	GILL	L	2342	61.79	2006	EU.ITA-IT-TYRREN	GILL	L	38	969	85-239	136	39	sz	mm	<>99%	raise
2006	EU.ITA	PS	L	32	1.33	2006	EU.ITA-IT-TYRR.S	HARP	L	24	424	95-224	151	56	sz	qq	<>99%	raise
2006	EU.ITA	LL	L	5253	42.22	2006	EU.ITA-IT-ADRI.C	LL	L	11	461	85-194	119	24	sz	qq	6 series	join-raise
2006	EU.ITA	LL	L		42.22	2006	EU.ITA-IT-ADRI.S	LL	L	7	214	65-219	126	33	sz	qq	6 series	join-raise
2006	EU.ITA	LL	L		42.22	2006	EU.ITA-IT-IONIAN	LL	L	25	1200	45-269	103	21	sz	qq	6 series	join-raise
2006	EU.ITA	LL	L		42.22	2006	EU.ITA-IT-SIC.ST	LL	L	25	1223	75-194	114	20	sz	mm	6 series	join-raise
2006	EU.ITA	LL	L		42.22	2006	EU.ITA-IT-TY.LI	LL	L	10	342	64-197	125	30	sz	qq	6 series	join-raise
2006	EU.ITA	LL	L		42.22	2006	EU.ITA-IT-TYRREN	LL	L	46	763	60-254	149	60	sz	mm	6 series	join-raise
2006	EU.MLT	LLSWO	L	239	7.51	2006	EU.MLT	LLSWO	L	32	1743	13-219	109	18	cs	mm	<>99%	raise
2006	EU.PRT-PT-MAINLND	LLHB	L	16	0.01	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	LBY	LL	L	14	0.01	2006	EU.ESP-ES-SWO	LLHB	L	1133	55425	70-234	114	20	cs	mm	no sz/cs	sub-raise
2006	MAR	GILL	L	603	7.52	2006	MAR	GILLSWO	L	80	1563	85-239	145	51	sz	mm	<>99%	raise
2006	MAR	LL	L	1455	18.14	2006	MAR	GILLSWO	L	80	1563	85-239	145	51	sz	mm	no sz/cs	sub-raise
2006	TUN	LL	L	949	38.56	2006	EU.ITA-IT-SIC.ST	LL	L	25	1223	75-194	114	20	sz	mm	no sz/cs	sub-raise
2006	TUR	LLSWO	L	410	7.83	2006	EU.GRC	LLSWO	L	52	1384	30-214	132	38	sz	qq	no sz/cs	sub-raise
2007	DZA	GILL	L	108	0.09	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	DZA	HAND	L	1	0.00	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	DZA	LL	L	492	0.43	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	DZA	PS	L	1	0.00	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	EU.CYP	LL	L	67	0.96	2007	EU.CYP	LL-deri	L	36	1297	75-174	125	28	cs	qq	2 series	join-raise
2007	EU.CYP	LL	L		0.96	2007	EU.CYP	LLSWO	L	34	1830	60-174	105	19	cs	qq	2 series	join-raise
2007	EU.ESP	LLALB	L	109	0.09	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	EU.ESP	LLJAP	L	10	0.01	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	EU.ESP	LLPB	L	340	0.29	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	EU.ESP	TRAP	L	1	0.00	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	EU.ESP	UNCL	L	48	0.04	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	EU.ESP-ES-SWO	LLHB	L	1190	1.03	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	<>99%	raise
2007	EU.FRA	UNCL	L	14	0.01	2007	EU.ESP-ES-SWO	LLHB	L	1157	68394	70-199	107	17	cs	mm	no sz/cs	sub-raise
2007	EU.GRC	LL	D	19	0.62	2007	EU.GRC	LLSWO	L	31	1125	55-199	123	28	sz	qq	no sz/cs	sub-raise
2007	EU.GRC	LL	L	1887	60.05	2007	EU.GRC	LLSWO	L	31	1125	55-199	123	28	sz	qq	<>99%	raise
2007	EU.ITA	GILL	L	1948	51.40	2006	EU.ITA-IT-TYRREN	GILL	L	38	969	85-239	136	39	sz	mm	no sz/cs	sub-raise
2007	EU.ITA	LL	L	4564	34.38	2007	EU.ITA	LL	L	133	4703	50-244	120	28	sz	qq	<>99%	raise
2007	EU.ITA	PS	L	7	0.41	2007	EU.ITA	HARP	L	16	291	85-224	151	55	sz	qq	<>99%	raise
2007	EU.MLT	LLSWO	L	213	27.21	2007	EU.MLT	LLSWO	L	8	668	56-198	94	12	sz	mm	<>99%	raise
2007	JPN	LLHB	L	3	9.30	2008	JPN	LLHB	L	0	5	118-199	148	56	sz	qq	no sz/cs	sub-raise
2007	MAR	GILL	L	615	1.23	2007	MAR	GILL	L	501	8869	100-239	151	57	sz	mm	<>99%	raise
2007	MAR	LL	L	1107	2.21	2007	MAR	GILL	L	501	8869	100-239	151	57	sz	mm	no sz/cs	sub-raise

2007	SYR	LL	L	22	0.64	2007	EU.CYP	LLSWO	L	34	1830	60-174	105	19	cs	qq	no sz/cs	sub-raise
2007	SYR	PS	L	15	0.44	2007	EU.CYP	LLSWO	L	34	1830	60-174	105	19	cs	qq	no sz/cs	sub-raise
2007	TUN	LL	L	1024	7.72	2007	EU.ITA	LL	L	133	4703	50-244	120	28	sz	qq	no sz/cs	sub-raise
2007	TUR	LLSWO	L	423	13.46	2007	EU.GRC	LLSWO	L	31	1125	55-199	123	28	sz	qq	no sz/cs	sub-raise
2008	DZA	UNCL	L	802	0.44	2008	EU.ESP-ES-SWO	LLHB	L	1811	84135	65-274	113	22	cs	mm	no sz/cs	sub-raise
2008	HRV	LL	L	4	0.03	2007	EU.ITA	LL	L	133	4703	50-244	120	28	sz	qq	no sz/cs	sub-raise
2008	EU.CYP	LL	L	67	0.92	2008	EU.CYP	LL	L	72	2750	75-199	120	26	cs	qq	<>99%	raise
2008	EU.ESP	LLALB	L	98	1.03	2008	EU.ESP	LLALB	L	96	6829	60-194	100	14	cs	mm	<>99%	raise
2008	EU.ESP	LLJAP	L	16	0.92	2008	EU.ESP	LLJAP	L	17	302	80-219	149	57	cs	mm	<>99%	raise
2008	EU.ESP	LLPB	L	226	0.98	2008	EU.ESP	LLPB	L	232	13708	70-209	107	17	cs	mm	<>99%	raise
2008	EU.ESP	TRAP	L	2	0.00	2008	EU.ESP-ES-SWO	LLHB	L	1811	84135	65-274	113	22	cs	mm	no sz/cs	sub-raise
2008	EU.ESP	UNCL	L	30	0.02	2008	EU.ESP-ES-SWO	LLHB	L	1811	84135	65-274	113	22	cs	mm	no sz/cs	sub-raise
2008	EU.ESP-ES-SWO	LLHB	L	1723	0.95	2008	EU.ESP-ES-SWO	LLHB	L	1811	84135	65-274	113	22	cs	mm	<>99%	raise
2008	EU.FRA	UNCL	L	14	0.01	2008	EU.ESP-ES-SWO	LLHB	L	1811	84135	65-274	113	22	cs	mm	no sz/cs	sub-raise
2008	EU.GRC	LL	D	27	2.92	2008	EU.GRC	LLSWO	L	9	455	45-174	113	20	sz	qq	no sz/cs	sub-raise
2008	EU.GRC	LL	L	962	103.56	2008	EU.GRC	LLSWO	L	9	455	45-174	113	20	sz	qq	<>99%	raise
2008	EU.ITA	HARP	L	23	0.17	2007	EU.ITA	LL	L	133	4703	50-244	120	28	sz	qq	no sz/cs	sub-raise
2008	EU.ITA	LL	L	4521	6.22	2008	EU.ITA	LL	L	727	35003	65-254	114	21	cs	qq	<>99%	raise
2008	EU.ITA	UNCL	L	5	0.01	2008	EU.ITA	LL	L	727	35003	65-254	114	21	cs	qq	no sz/cs	sub-raise
2008	EU.MLT	LL	L	260	10.50	2008	EU.MLT	LLSWO	L	25	1668	52-280	96	15	cs	mm	<>99%	raise
2008	JPN	LLHB	L	1	5.39	2008	JPN	LLHB	L	0	5	118-199	148	56	sz	qq	<>99%	raise
2008	MAR	GILL	L	587	1.36	2008	MAR	GILLSWO	L	432	7108	95-234	154	61	cs	mm	<>99%	raise
2008	MAR	LL	L	1370	3.17	2008	MAR	GILLSWO	L	432	7108	95-234	154	61	cs	mm	no sz/cs	sub-raise
2008	SYR	LL	L	17	0.24	2008	EU.CYP	LL	L	72	2750	75-199	120	26	cs	qq	no sz/cs	sub-raise
2008	SYR	PS	L	11	0.16	2008	EU.CYP	LL	L	72	2750	75-199	120	26	cs	qq	no sz/cs	sub-raise
2008	TUN	LL	L	1011	1.39	2008	EU.ITA	LL	L	727	35003	65-254	114	21	cs	qq	no sz/cs	sub-raise
2008	TUR	LLSWO	L	386	41.55	2008	EU.GRC	LLSWO	L	9	455	45-174	113	20	sz	qq	no sz/cs	sub-raise

Table 6. SWO-MED catch-at-size (CAS) overall matrix.

Length (cm)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
35	0	0	0	0	0	0	0	0	0	0	1115	0	0	0	41	0	0	0	0	0	0	49	0	0
40	49	0	807	0	3490	82	0	54	0	173	1246	1	1	0	0	0	10	0	1438	0	0	0	0	0
45	496	332	0	440	1996	82	0	157	0	0	274	0	0	0	0	0	20	0	226	116	23	42	0	148
50	1268	1721	0	757	3715	175	231	1333	676	520	284	0	0	679	275	0	105	24	2467	1195	925	633	42	11
55	732	1453	2262	1636	5249	205	443	2465	1272	829	2230	133	44	5950	52	93	218	71	3672	2869	3726	908	1599	1060
60	1039	2996	1570	2091	8461	496	1709	6085	3418	3506	7934	210	1032	7289	510	401	405	154	9877	3880	972	3548	2582	1056
65	2572	2965	6060	4798	6532	2445	2901	10563	6563	8855	7942	1387	1985	3327	2437	1213	812	808	13028	14399	893	7510	2996	1204
70	4000	3965	9856	17416	12701	4343	8709	12268	11005	19596	9961	12286	8954	10004	11940	3725	10942	2235	10117	20592	1546	6669	2776	638
75	7351	4286	15570	20722	16227	8380	11126	12596	17583	21730	15047	10465	9893	16843	11467	5285	7018	9450	6579	12660	2992	4575	2638	4607
80	14266	6855	22931	36847	22965	15606	13110	16961	22804	16438	22578	14524	13687	23804	12777	12971	12306	22049	8133	19691	8958	5031	8389	12018
85	15203	11290	21179	33964	22505	29897	19653	17972	28551	11403	32709	19746	17651	47539	18334	23308	20539	35567	14535	36245	16625	11362	17784	19046
90	23075	15964	34150	53565	36622	45209	26277	17813	33707	23079	40882	32765	26167	53251	30274	38664	31562	65224	31567	74121	35605	19519	49901	47854
95	22770	19756	29244	51714	36975	41158	33165	26821	40499	31967	52035	39212	31493	46525	35183	40952	39155	50921	40235	44463	46090	24432	55460	49771
100	34296	21578	34523	62083	48641	51955	41512	48095	56420	65700	58235	39652	38909	43977	40204	49383	45477	56132	61056	43677	60994	37254	49672	56529
105	28847	19395	19941	45087	47257	50071	43139	60376	63960	59031	46353	37649	32642	37139	45542	41023	43974	56006	62920	34924	56919	43290	30428	49290
110	30257	33073	24176	36776	39544	64073	42040	65523	72351	73148	40637	34490	34439	39861	39276	43291	49167	68030	78404	43296	68562	57182	33298	60587
115	26992	34814	33384	40707	40861	60740	43702	55952	46461	62386	34593	32068	41396	38572	39972	39997	46150	55709	61124	37026	50224	41423	35635	45281
120	29897	42255	23781	36050	37933	73163	46412	43678	35382	50955	37230	38290	43432	32689	33230	42564	42730	34554	55377	35032	34858	35868	32591	31975
125	29454	39849	29188	32290	37531	57000	35715	31782	28706	37168	27193	32510	45167	27857	28551	34305	38671	33907	42236	32460	31851	33386	34741	31474
130	25013	32335	26908	27267	23868	39349	35997	25723	22592	29773	30273	28908	38824	24333	22205	33224	32692	26445	34825	29989	28603	29737	32605	25941
135	25216	24557	28630	25745	26480	26872	32711	19943	14875	25879	21606	22359	31330	17825	21371	24598	26259	17682	26154	22799	21954	22429	21527	19916
140	20227	22025	20742	18736	25653	21715	25537	15983	13693	17948	17130	19094	25039	16370	17439	21076	21920	11511	20327	17542	16467	16557	19381	14775
145	20607	14890	16738	25916	22039	12405	18174	13643	9975	13071	10317	12268	14484	12715	14595	16108	18493	9355	15756	13487	13122	12255	14361	11333
150	16353	20485	23857	24549	17897	12609	15980	13419	9250	10976	8095	11787	17263	11458	13732	15983	13967	6349	13781	13098	12387	12319	14137	9686
155	14281	11603	17741	23569	18766	8165	13845	9358	8040	8818	9047	8867	10172	11590	13736	12262	9676	5974	10898	10637	9681	11272	14033	7227
160	14760	14619	19574	16304	16830	9058	10477	10116	7496	9728	8391	6246	17504	9967	9526	12126	8596	6434	9067	9681	8821	9748	8947	6310
165	9999	15121	19225	20563	15231	5193	8096	7543	6524	7060	5307	5420	7547	9678	8779	9425	8206	5488	6216	8401	7639	8480	8934	5162
170	12454	14798	15095	12372	9931	5610	9016	7577	5916	6991	5576	4884	5180	8750	7781	9212	5367	4130	5411	7687	6044	8300	5985	4256
175	9401	9491	13803	13137	7855	5011	5460	5156	4077	6405	4458	3949	4337	6183	5193	5423	4773	3121	2655	4702	4935	5906	4859	2995
180	11154	10106	11439	7480	5964	3885	3705	4716	3775	4628	3481	2606	4609	5925	5705	5420	3488	2406	3305	4620	3474	5933	4236	2493
185	3457	4977	5016	4948	2840	1530	3365	2964	2384	3823	3576	2547	2915	3601	3718	3585	3198	2195	1889	2592	3661	5357	3875	1549
190	2907	4359	3146	2955	3878	1688	2149	2087	2353	2926	1332	1602	839	2959	3001	3375	2979	1405	2038	2402	1693	2932	1668	1026
195	1468	688	1419	2444	3334	1305	1687	2422	1697	2304	1343	1277	729	2304	991	1741	1842	1317	1197	1643	1459	2895	2252	816
200	1215	1196	1746	2473	1187	886	1379	2358	1384	1417	1071	920	915	1186	949	1139	802	910	774	1346	1268	2082	1247	656
205	839	2406	1255	666	661	243	1076	938	718	729	872	666	467	801	460	1051	749	439	1163	829	799	1642	912	480
210	395	2185	659	1975	1141	468	512	215	519	963	512	501	230	603	546	476	1261	574	578	563	620	1084	843	383
215	612	363	1809	1060	644	313	146	95	104	389	434	181	143	426	255	212	750	237	93	309	829	578	313	242
220	571	110	451	451	10	66	222	98	161	196	186	266	99	175	165	341	312	214	85	315	504	556	617	224
225	0	5	8	13	511	74	181	132	174	292	64	8	58	181	48	0	143	237	89	96	271	26	166	0
230	0	5	807	442	2	0	254	183	34	166	16	2	86	143	42	58	114	95	0	114	163	98	35	238
235	0	0	0	0	0	0	55	35	15	62	51	4	0	36	7	88	209	71	43	192	124	87	86	31
240	3	4	0	0	0	0	0	29	2	61	25	1	1	28	7	44	0	0	0	23	77	42	84	21
245	0	0	0	0	0	0	0	0	44	7	42	0	0	23	96	4	0	0	0	0	12	0	0	0
250	3	0	0	0	3	0	0	0	0	0	25	0	0	0	0	44	0	0	0	0	59	127	0	36
255	0	0	0	0	0	0	0	0	21	0	25	1	1	0	48	0	20	24	0	0	12	0	0	0
260	0	0	0	0	0	0	0	0	0	0	25	1	1	62	41	0	0	0	0	0	12	0	0	6
265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0	42	0	10
270	0	0	0	0	0	0	0	0	0	0	0	1	1	0	17	0	0	0	0	0	0	0	0	6
275+	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	8	0	0	0	0	0	12	0	10
TOTAL	463497	468876	538688	710008	633928	661525	559868	575229	585180	641094	571761	479749	529665	582627	500517	554196	555077	597456	659337	609751	566453	493180	521634	528379

Table 7. Fishing mortality by age estimates obtained from the XSA model.

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
0	0.01	0.01	0.01	0.01	0.03	0.00	0.01	0.02	0.01	0.02	0.02	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.03	0.02	0.01	0.01	0.01	0.00
1	0.07	0.06	0.15	0.19	0.14	0.17	0.12	0.11	0.15	0.13	0.18	0.14	0.11	0.21	0.13	0.13	0.12	0.18	0.11	0.20	0.12	0.08	0.12	0.14
2	0.14	0.17	0.18	0.41	0.30	0.47	0.41	0.48	0.49	0.51	0.38	0.32	0.33	0.32	0.34	0.40	0.40	0.48	0.52	0.33	0.46	0.38	0.33	0.37
3	0.13	0.17	0.18	0.22	0.40	0.40	0.44	0.37	0.29	0.42	0.32	0.34	0.48	0.28	0.26	0.36	0.43	0.31	0.47	0.35	0.30	0.34	0.36	0.30
4	0.08	0.10	0.13	0.21	0.22	0.26	0.26	0.25	0.20	0.22	0.21	0.21	0.28	0.25	0.24	0.24	0.28	0.16	0.26	0.28	0.23	0.20	0.27	0.19
5+	0.08	0.10	0.13	0.21	0.22	0.26	0.26	0.25	0.20	0.22	0.21	0.21	0.28	0.25	0.24	0.24	0.28	0.16	0.26	0.28	0.23	0.20	0.27	0.19

Table 8. Estimates of stock abundance (in thousands of t) at the beginning of the year, obtained from the XSA model.

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
0	1395	1227	1591	1409	1207	1263	1263	1447	1285	1291	1212	1259	1341	1208	1241	1305	1464	1227	1482	1225	1133	1453	1294	1143
1	1305	1136	995	1291	1142	959	1030	1027	1164	1039	1041	971	1026	1093	971	1011	1066	1196	1003	1181	979	921	1177	1052
2	1232	995	878	702	876	810	663	750	754	823	748	709	690	751	727	696	723	772	821	733	793	709	695	851
3	930	880	690	600	381	532	413	359	380	377	406	420	423	408	445	422	383	396	393	398	430	410	396	408
4	820	672	610	473	395	210	291	218	203	234	202	241	246	215	253	281	240	203	238	201	231	259	240	226
5+	977	960	898	540	414	176	242	240	234	280	226	191	225	274	255	289	201	224	176	211	239	347	223	180

Table 9. Equilibrium biological reference points.

Refpt	**F**	**Catch (t)**	**R**	**SSB**
$F_{0.1}$	0.189	16059	1.3479e+06	9.5977e+07
F_{max}	0.319	16707	1.3131e+06	5.2545e+07
SPR.30	0.221	16520	1.3406e+06	8.2032e+07
MSY	0.281	16792	1.3250e+06	6.2397e+07

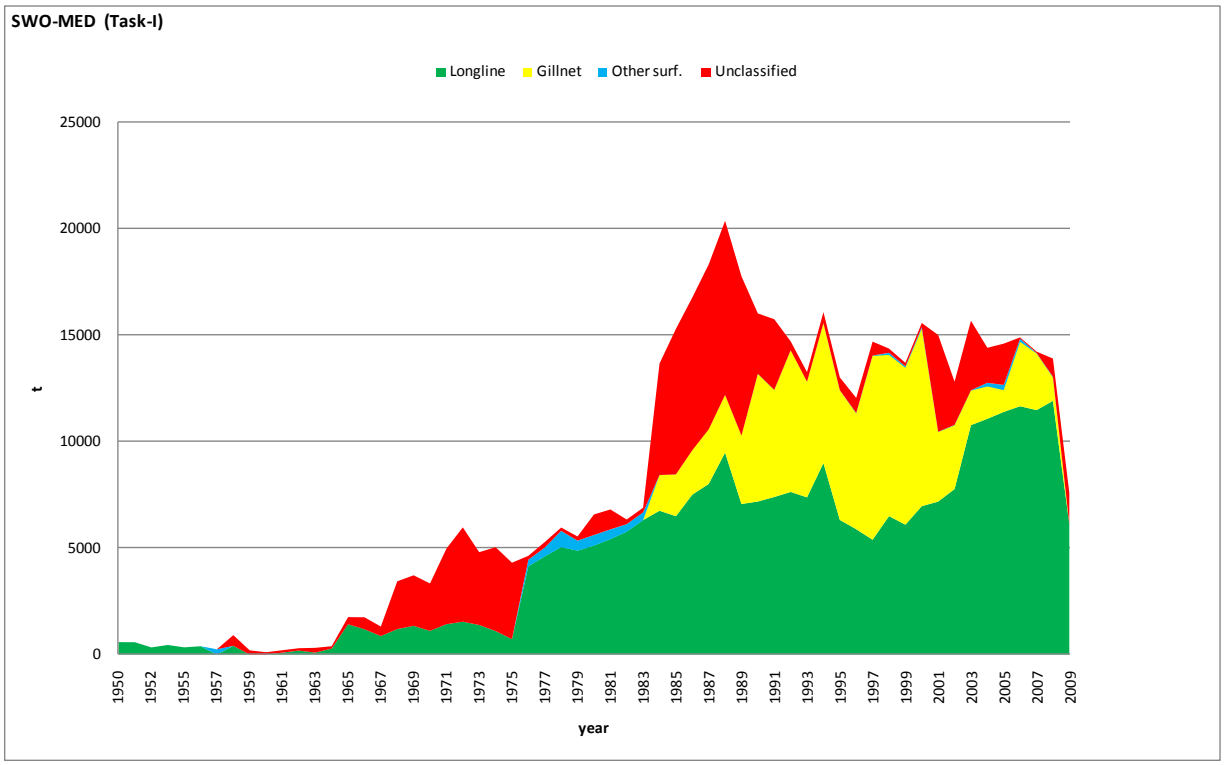


Figure 1. SWO-MED Task I cumulative catches (t) by gear and year.

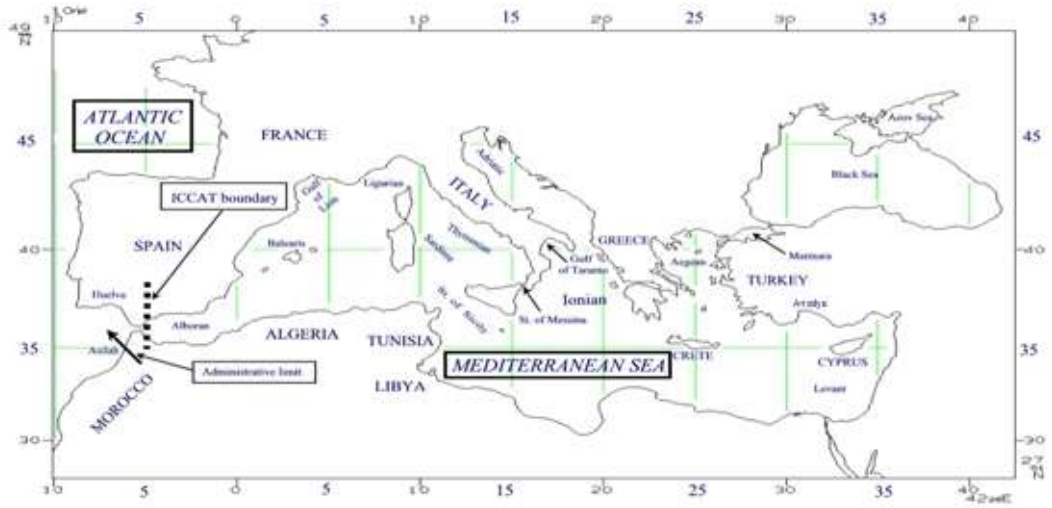


Figure 2. Map of the Mediterranean Sea with the main locations referred to in the Report. The Mediterranean/Atlantic boundary used by ICCAT is at 5ºW longitude. The approximate provincial administrative limit for the Mediterranean used by Morocco is also shown.

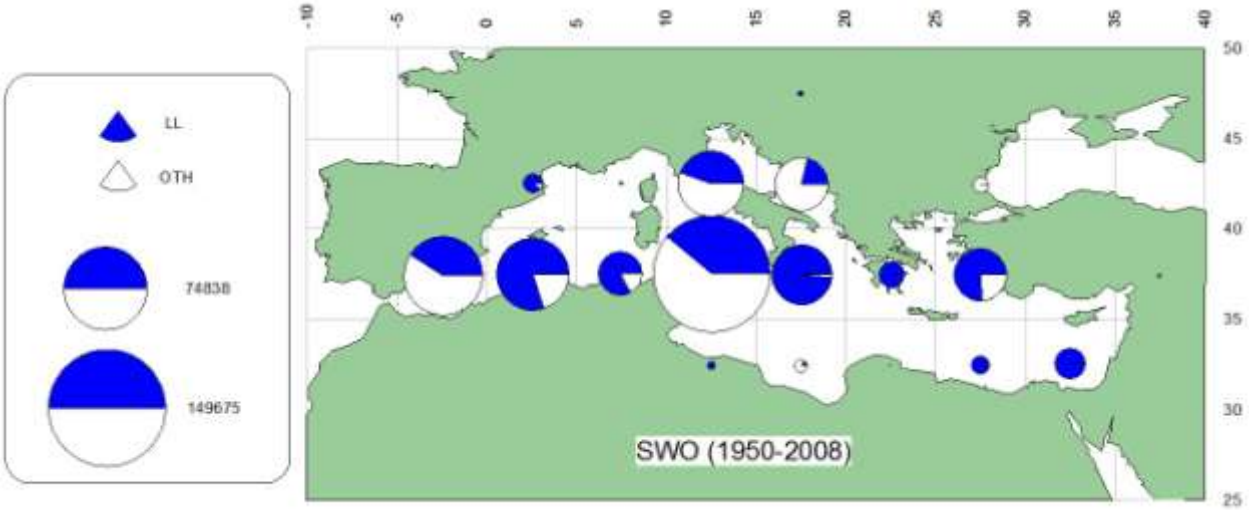


Figure 3. Geographical distribution (5x5 degree squares) of the SWO-MED catches by major gear (1950-2008). Source: CATDIS

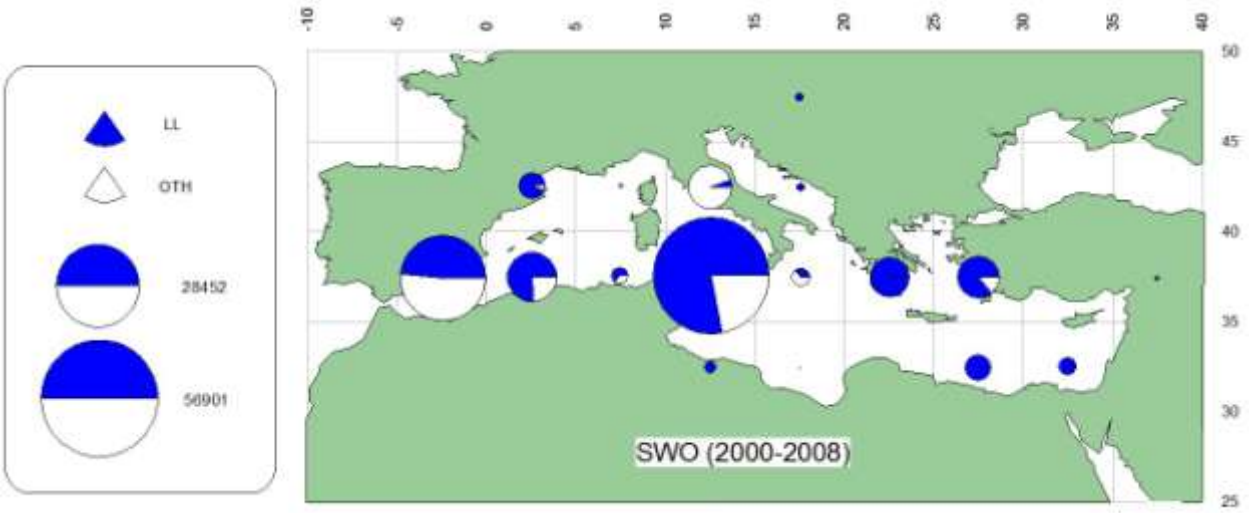


Figure 4. Geographical distribution (5x5 degree squares) of the SWO-MED catches by major gear (2000-2009). Source: CATDIS

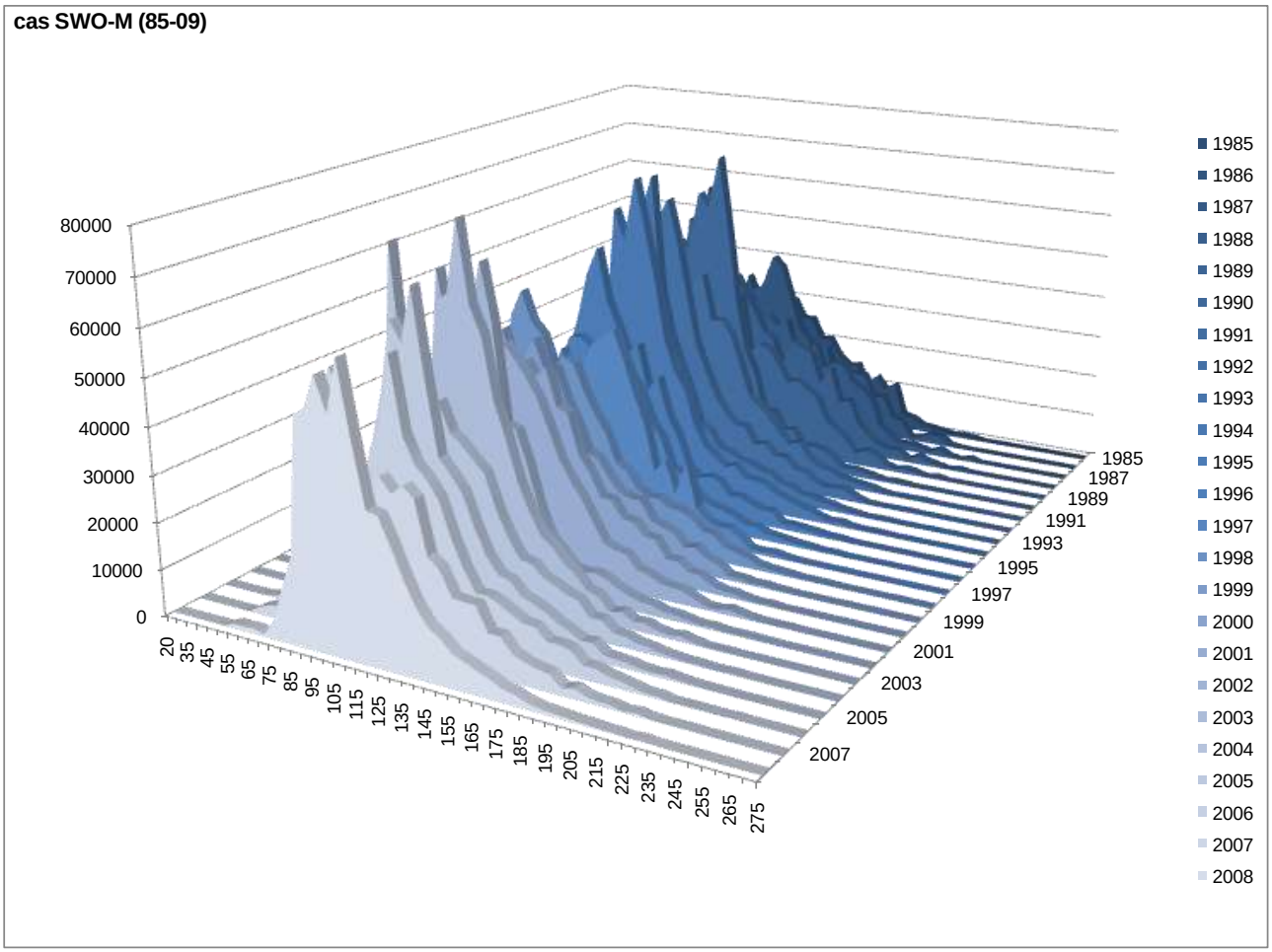


Figure 5. SWO-MED overall catch-at-size (size composition of the catches) matrix by year and length (5 cm lower limit intervals).

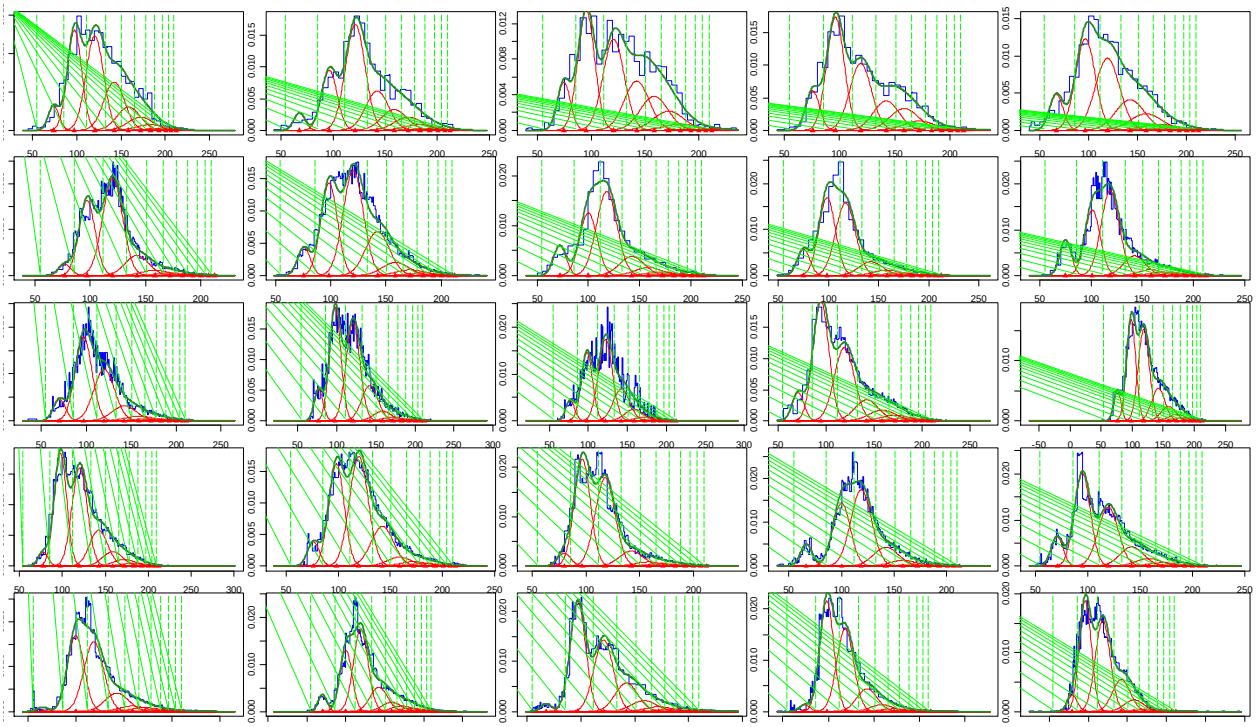


Figure 6. Observed size frequencies (blue), fitted modes (red) and the estimated size distributions (green) and length-at-age (green vertical lines),

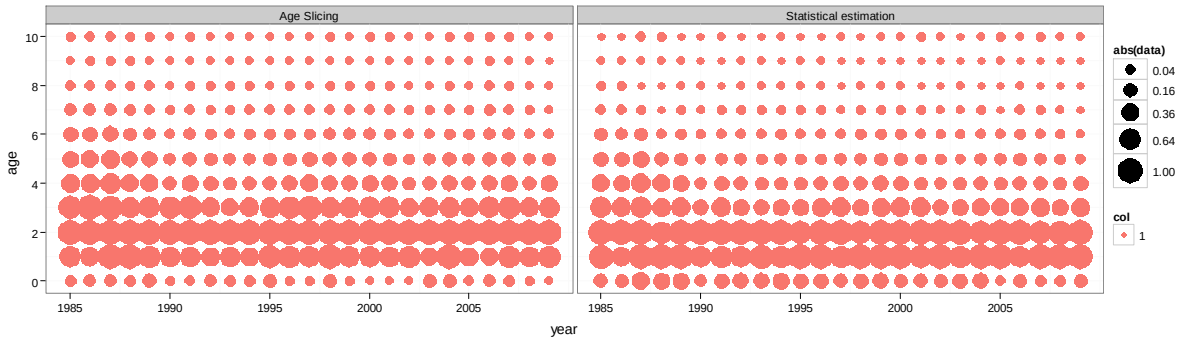
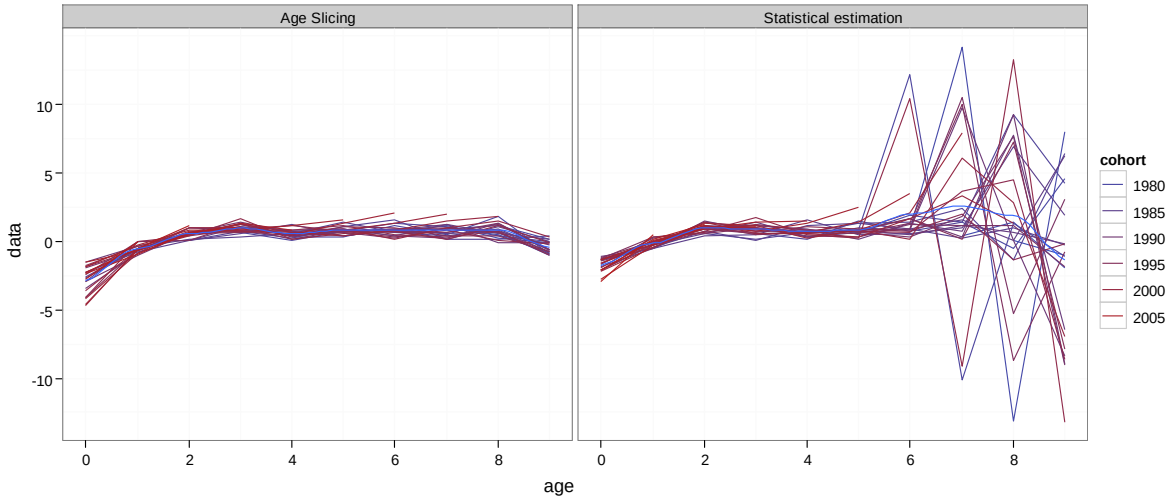
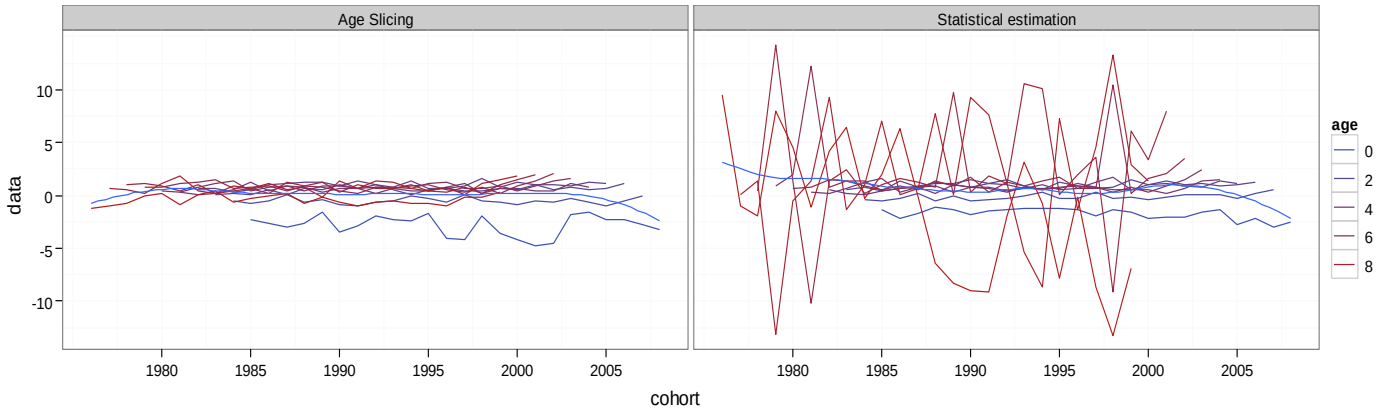


Figure 7. Catch-at-age estimated from age slicing and statistical estimation, within a year catch is scaled by the maximum within a year.



Figures 8. Catch curve analysis estimates of Z by age.



Figures 9. Catch curve analysis estimates of Z by year.

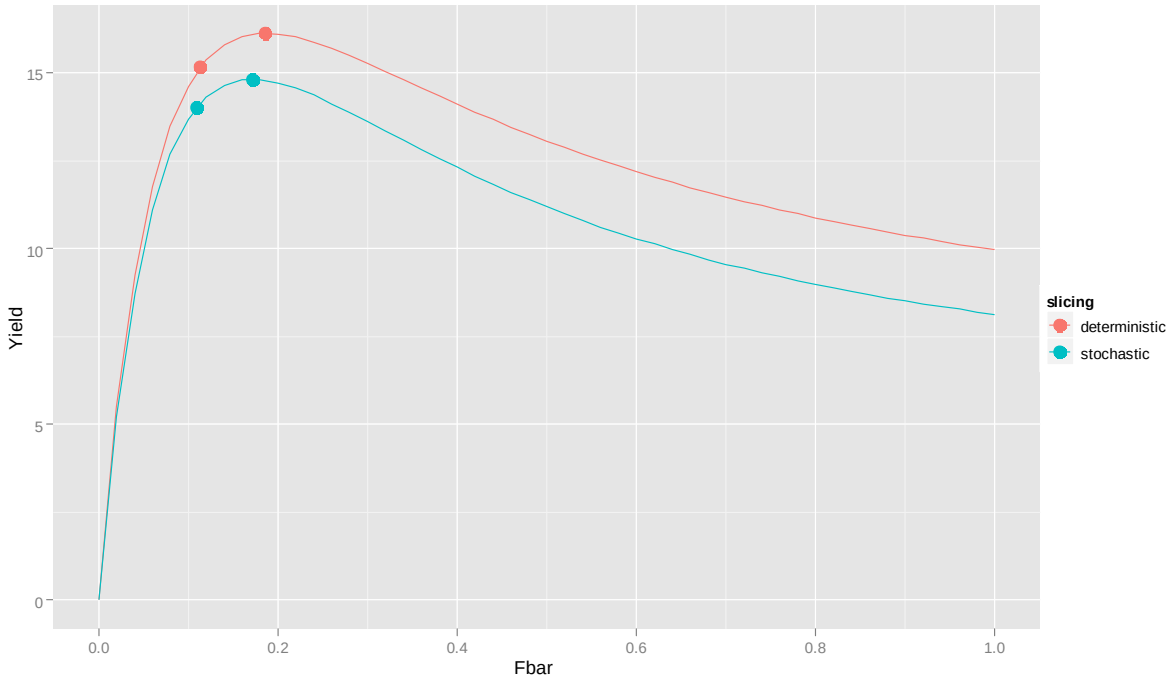


Figure 10. A comparison of yield curves corresponding to age slicing estimates (red) and statistical estimation (green), points correspond to $F_{0.1}$ and F_{Max}.

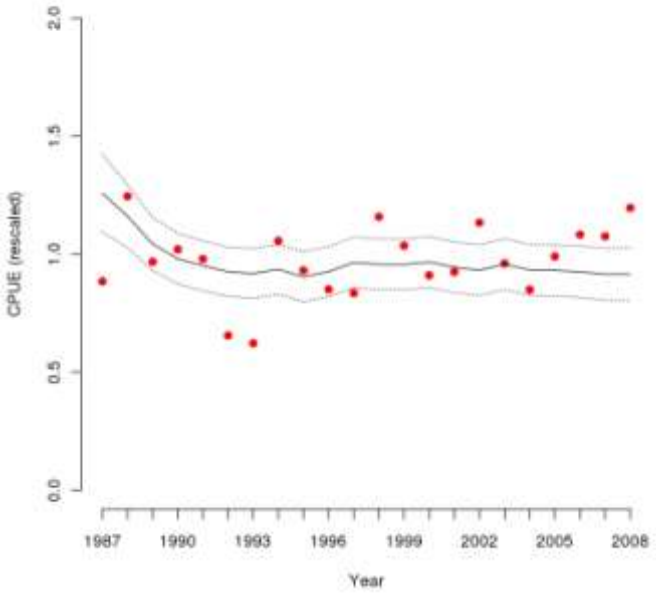


Figure 11. Observed (dots) and model predicted (with 95% confidence intervals) CPUE rates by year.

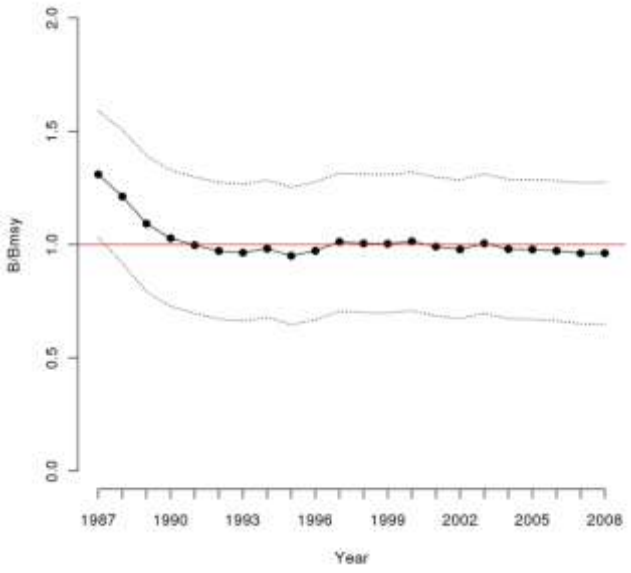


Figure 12. B/B_{msy} estimates by year. Dotted lines indicate the 95% confidence intervals. Horizontal line indicates the optimum level.

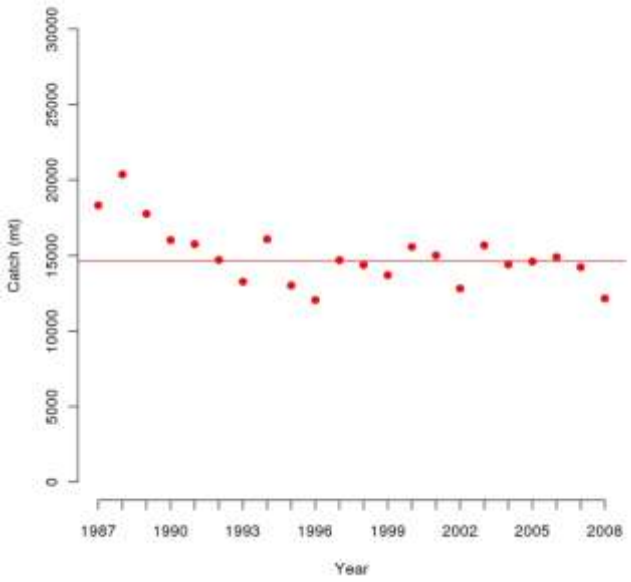


Figure 13. Catch estimates by year. Horizontal line indicates MSY level.

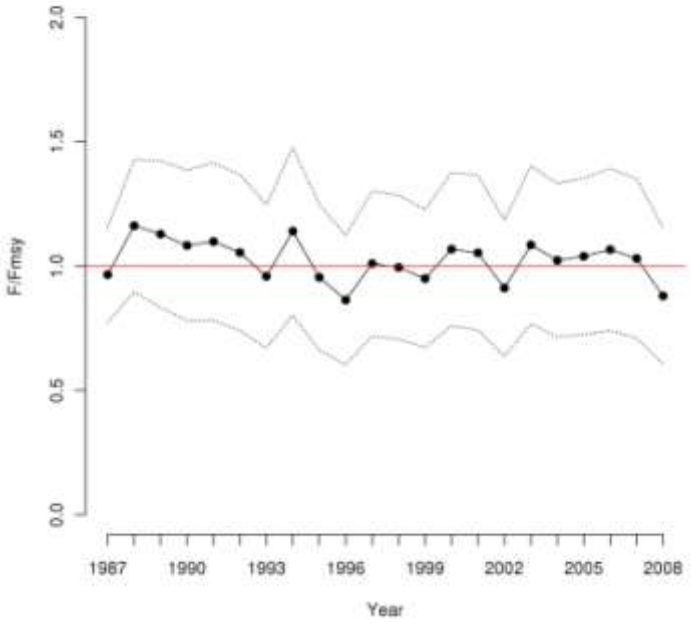
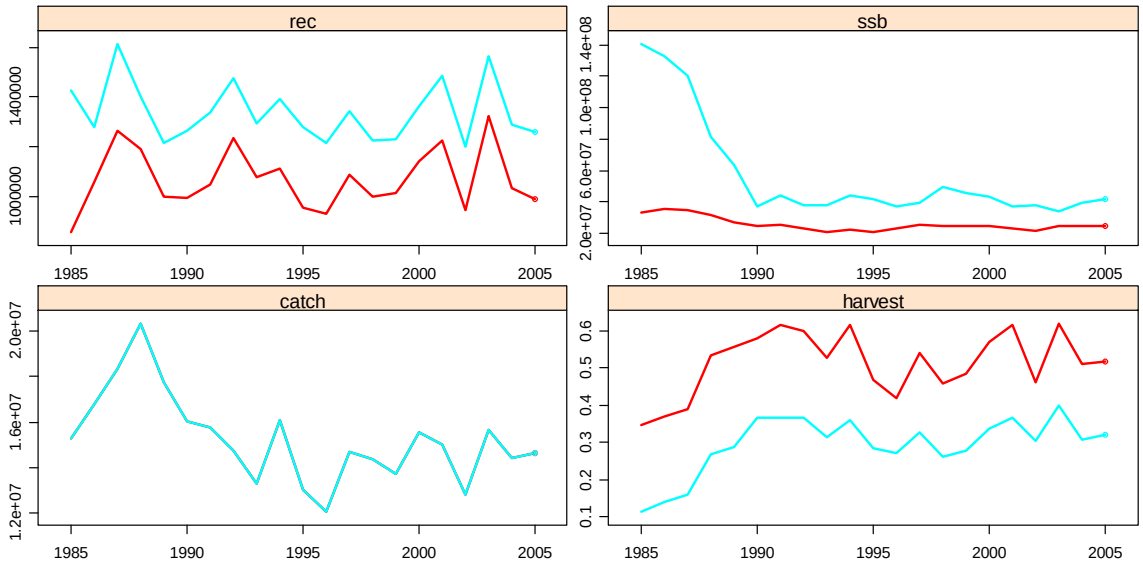


Figure 14. F/F_{msy} estimates by year. Dotted lines indicate the 95% confidence intervals. Horizontal line indicates the optimum level.



Figures 15. Comparison of XSA results based on a plus group of 10 (red) and 5 (blue).

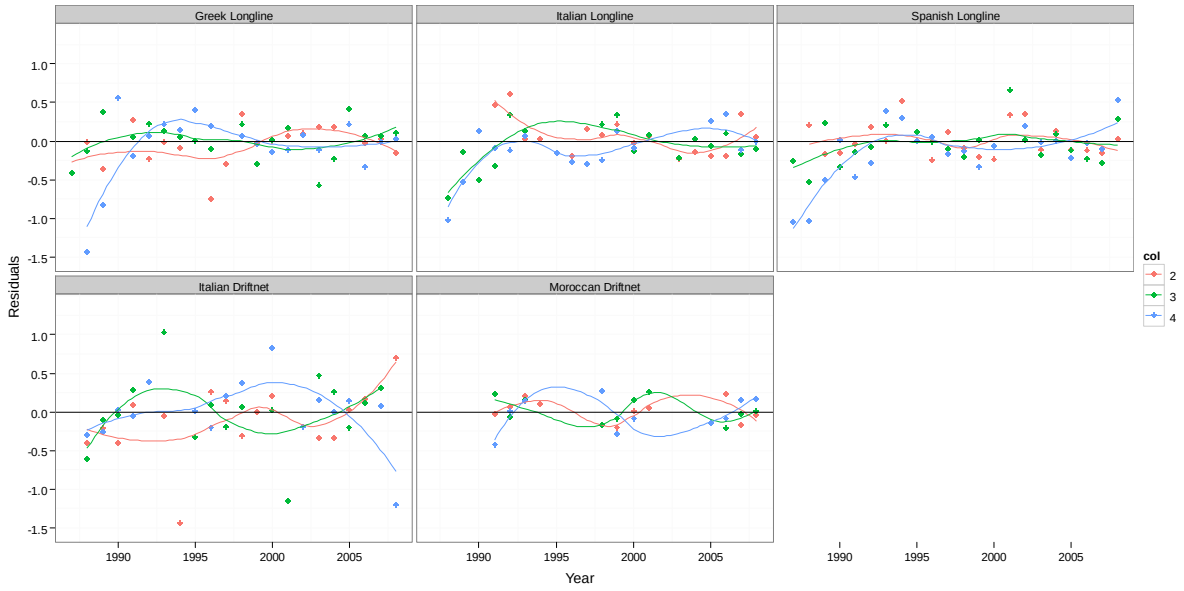


Figure 16. Catchability residuals plotted by gear (panel) and age (colours) for the most recent assessment.

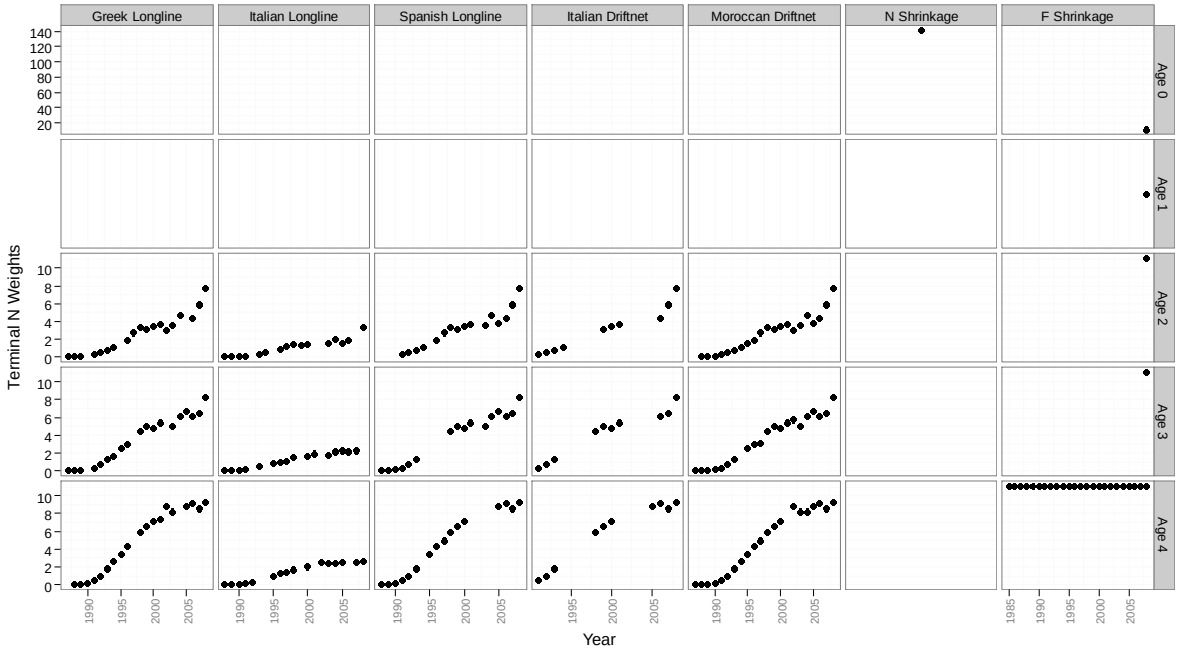


Figure 17. Comparison of weights used to estimate terminal Ns, based on most recent assessment.

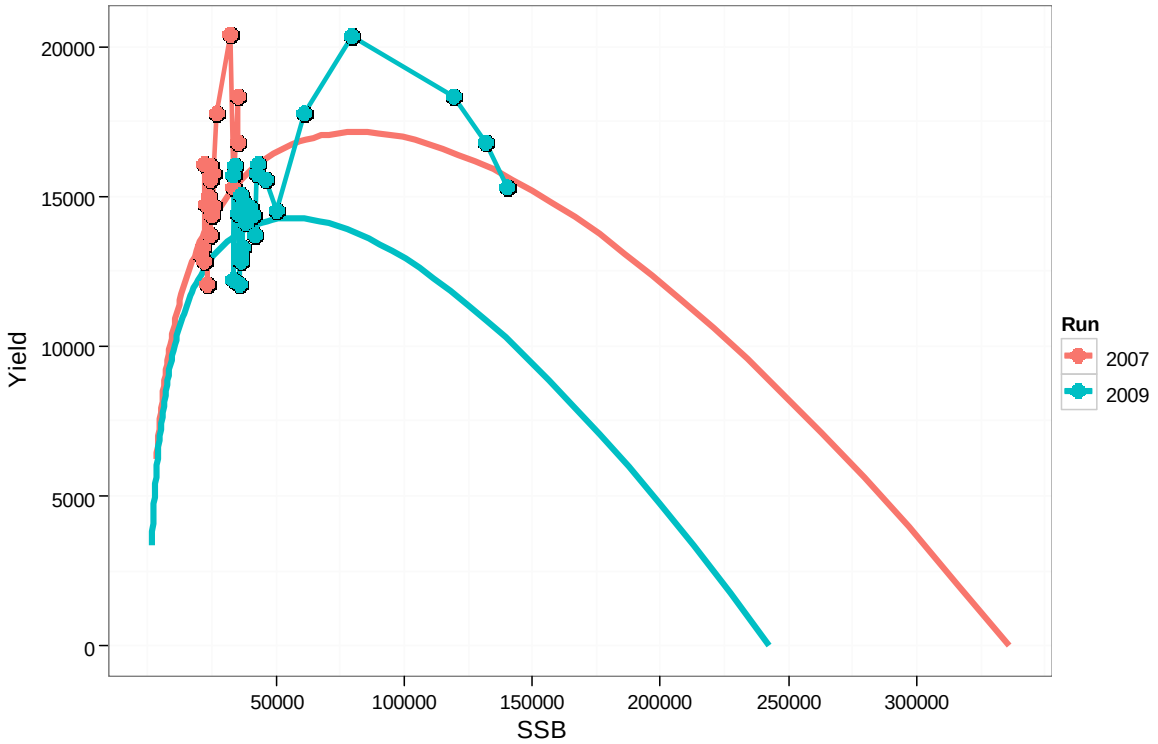


Figure 18. Comparison of surplus production curves from 2007 and 2009 assessments with plus groups of 10 and 5 (red and blue, respectively).

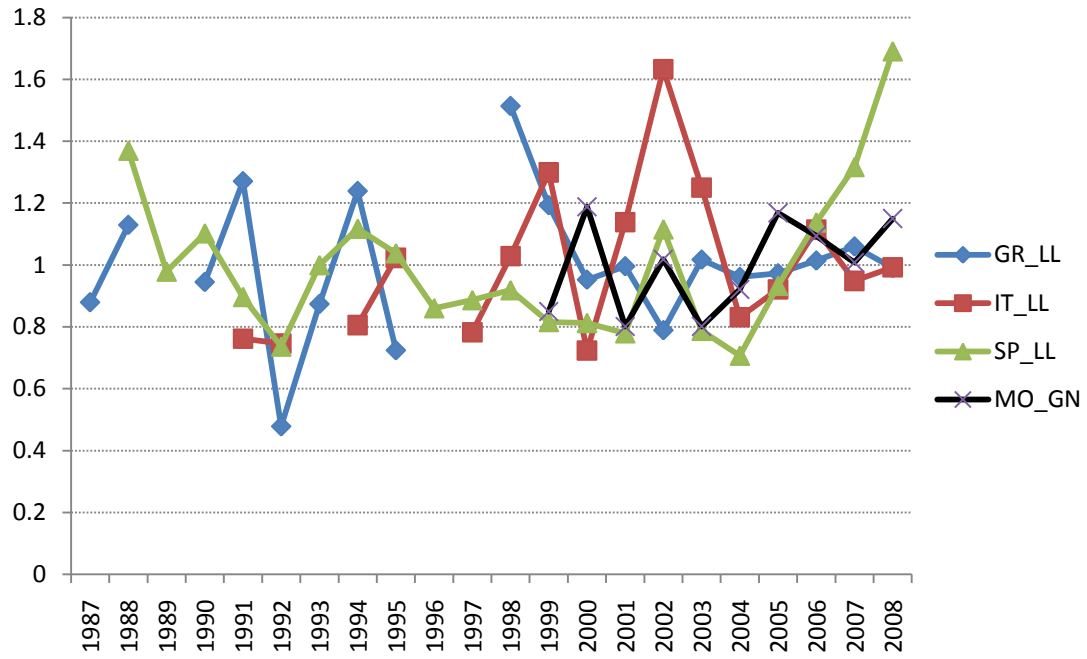


Figure 19. Time series of standardized CPUE rates scaled to the corresponding mean value for the Spanish longliners (SP_LL), Italian longliners (IT_LL), Greek longliners (GR_LL), and Moroccan gillnetters (MO_GN).

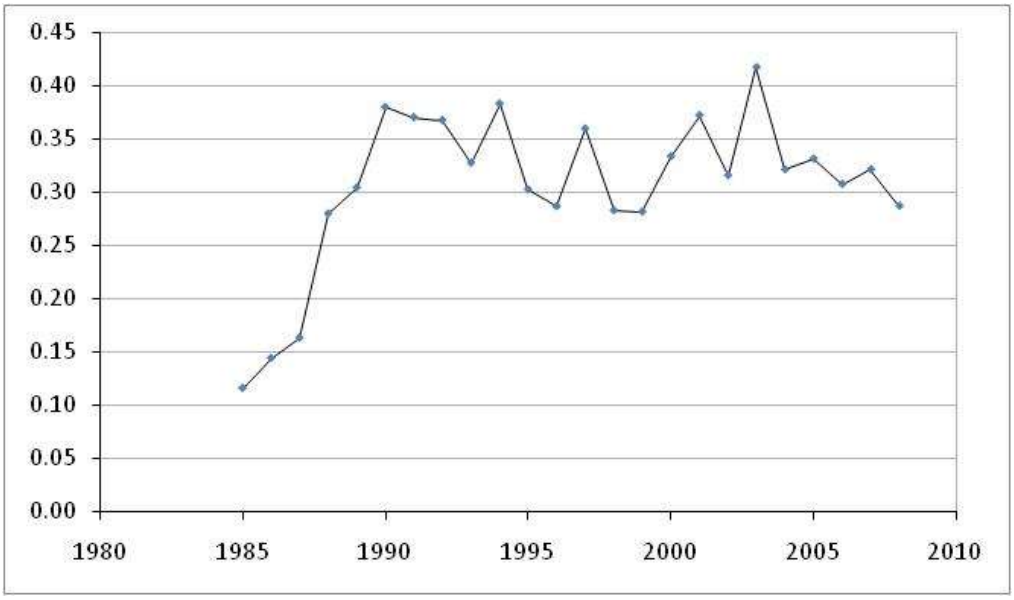


Figure 20. Mean Fs (ages 2-4) by year estimates obtained with the XSA model.

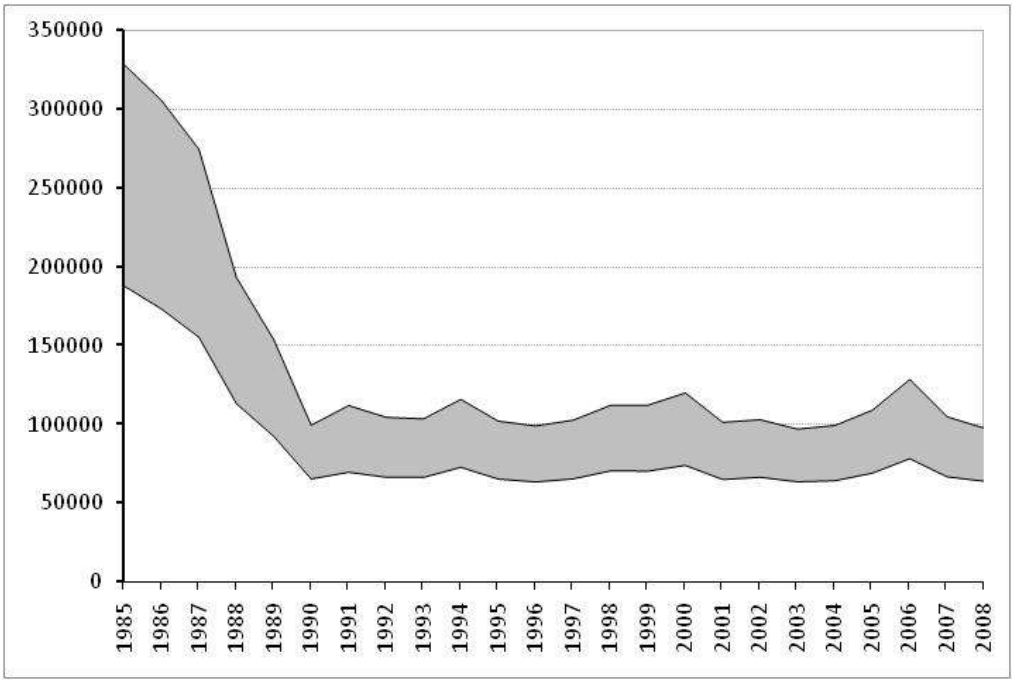


Figure 21. Total and spawning stock biomass (SSB) estimates (grey color) obtained with the XSA model.

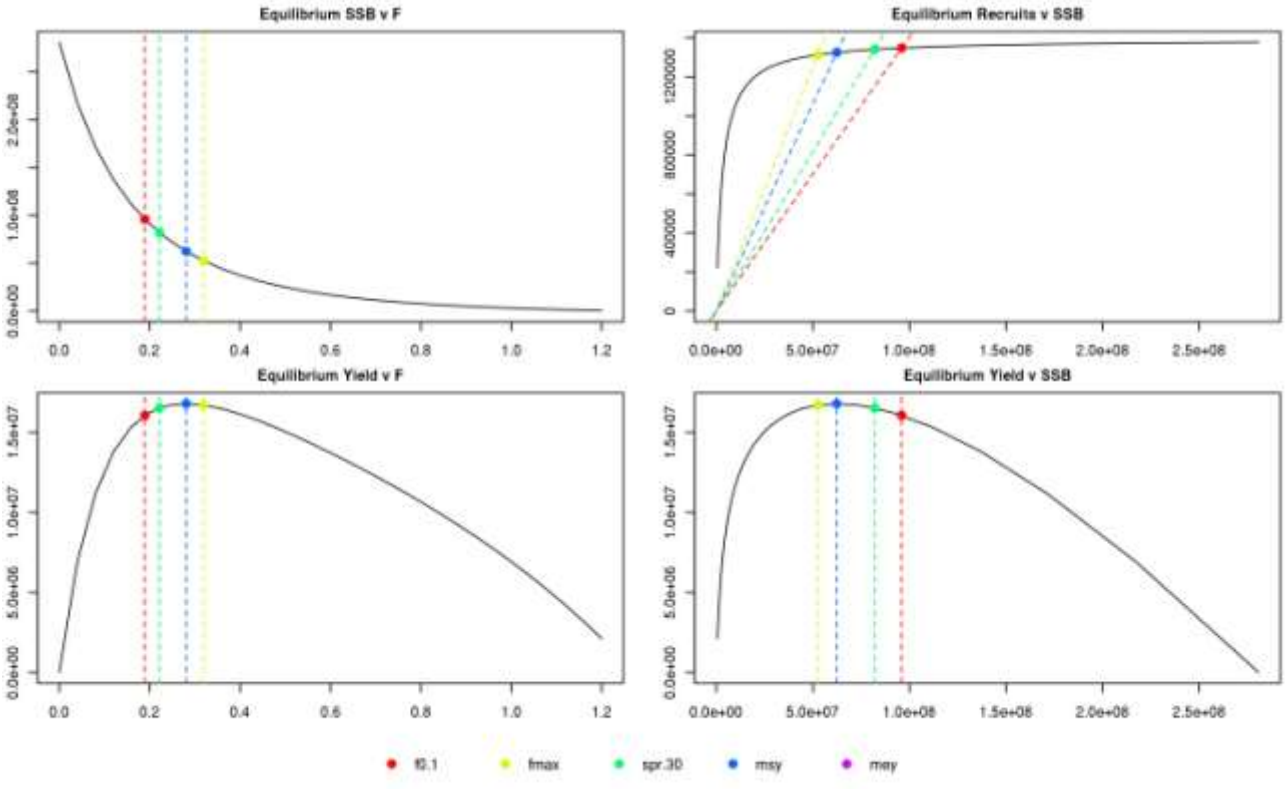


Figure 22. Equilibrium curves estimated from the yield per recruit analysis.

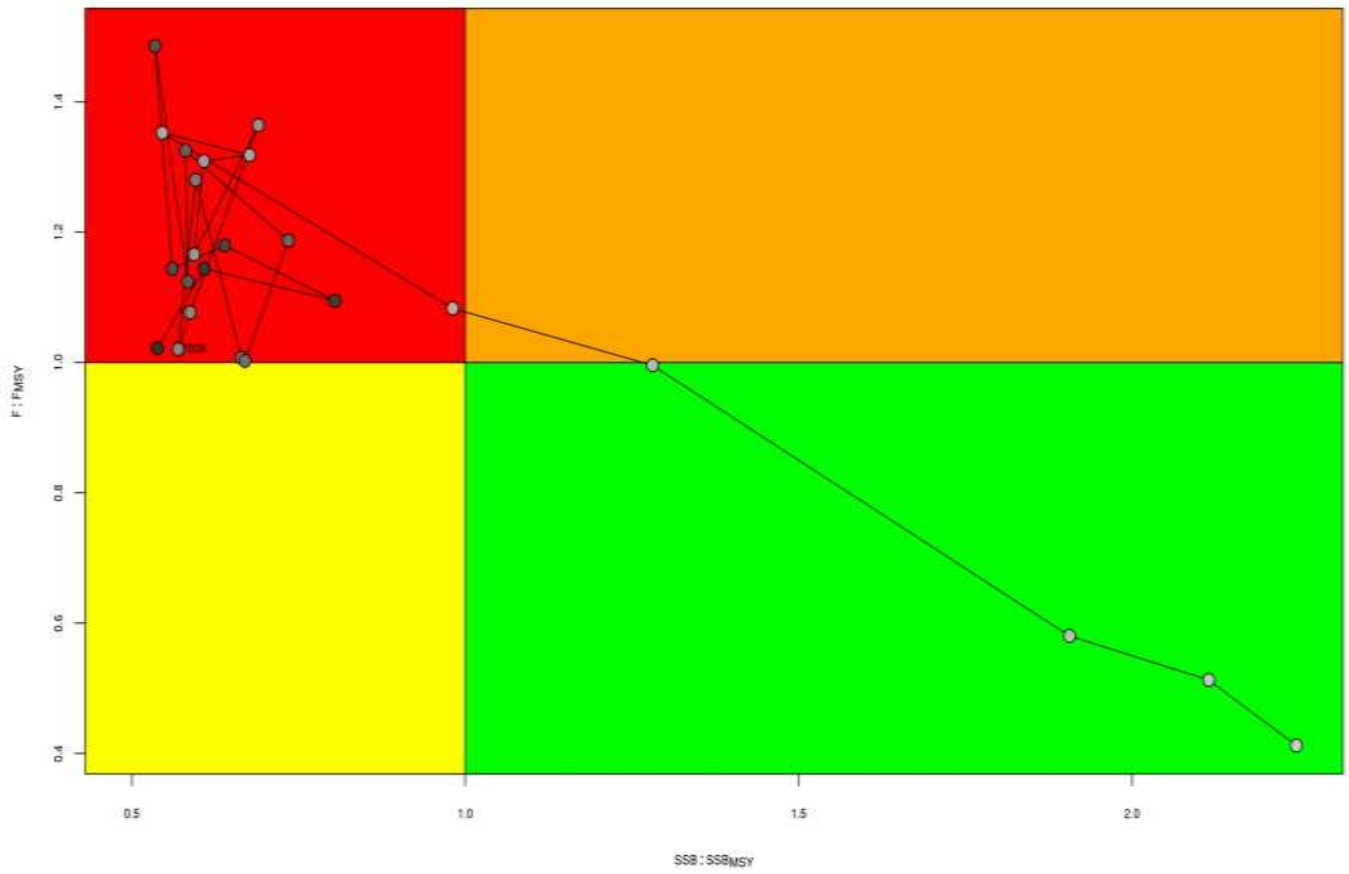


Figure 23. Time trends for stock status (B/B_{MSY} and F/F_{MSY}) based on XSA and yield per recruit analysis.

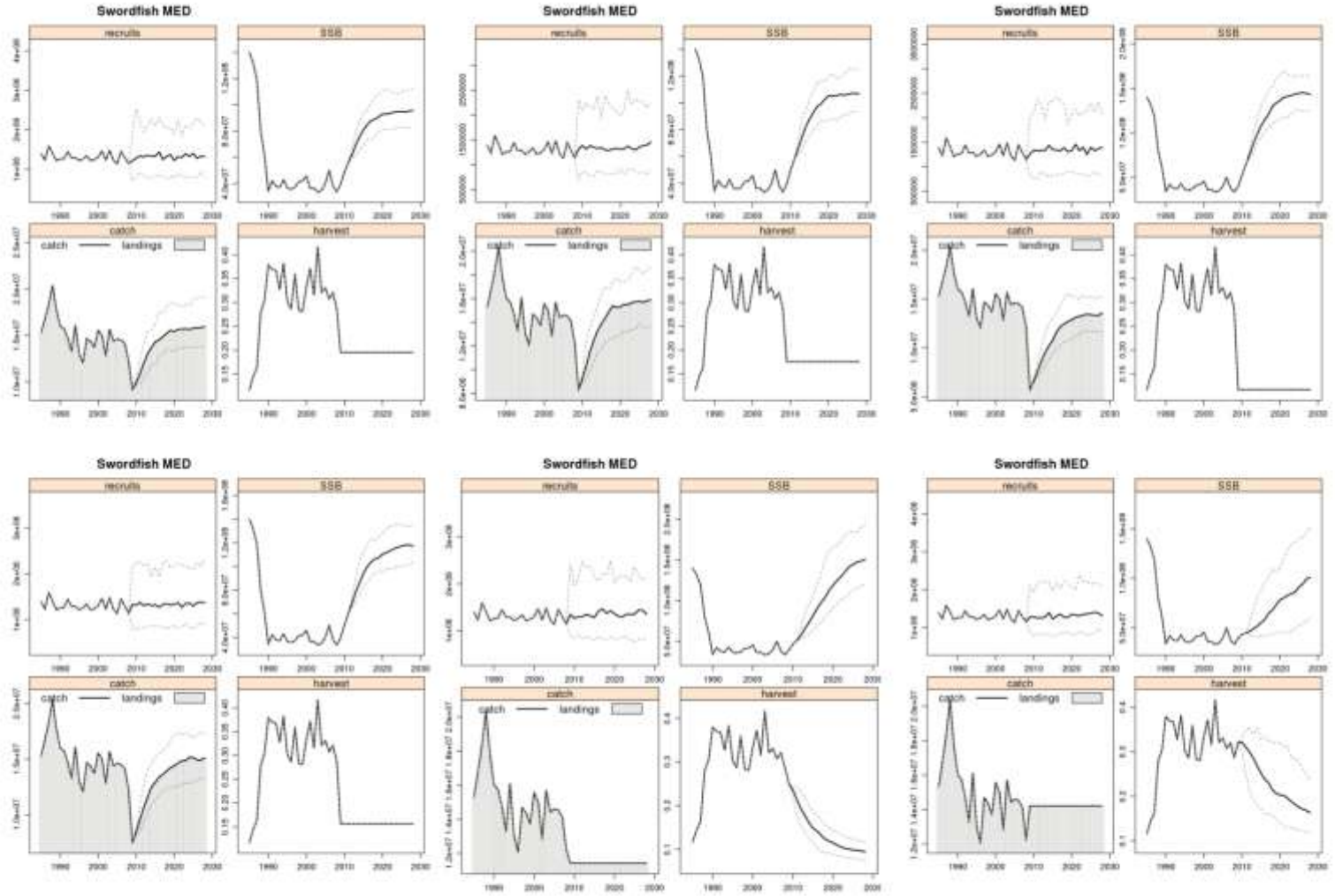


Figure 24. Scenario estimates assuming a Beverton/Holt recruitment model. From left to right and top to bottom: current, 4-month, 6-month, capacity reduction, 80% of mean catch quota, mean catch quota. (see text for details).

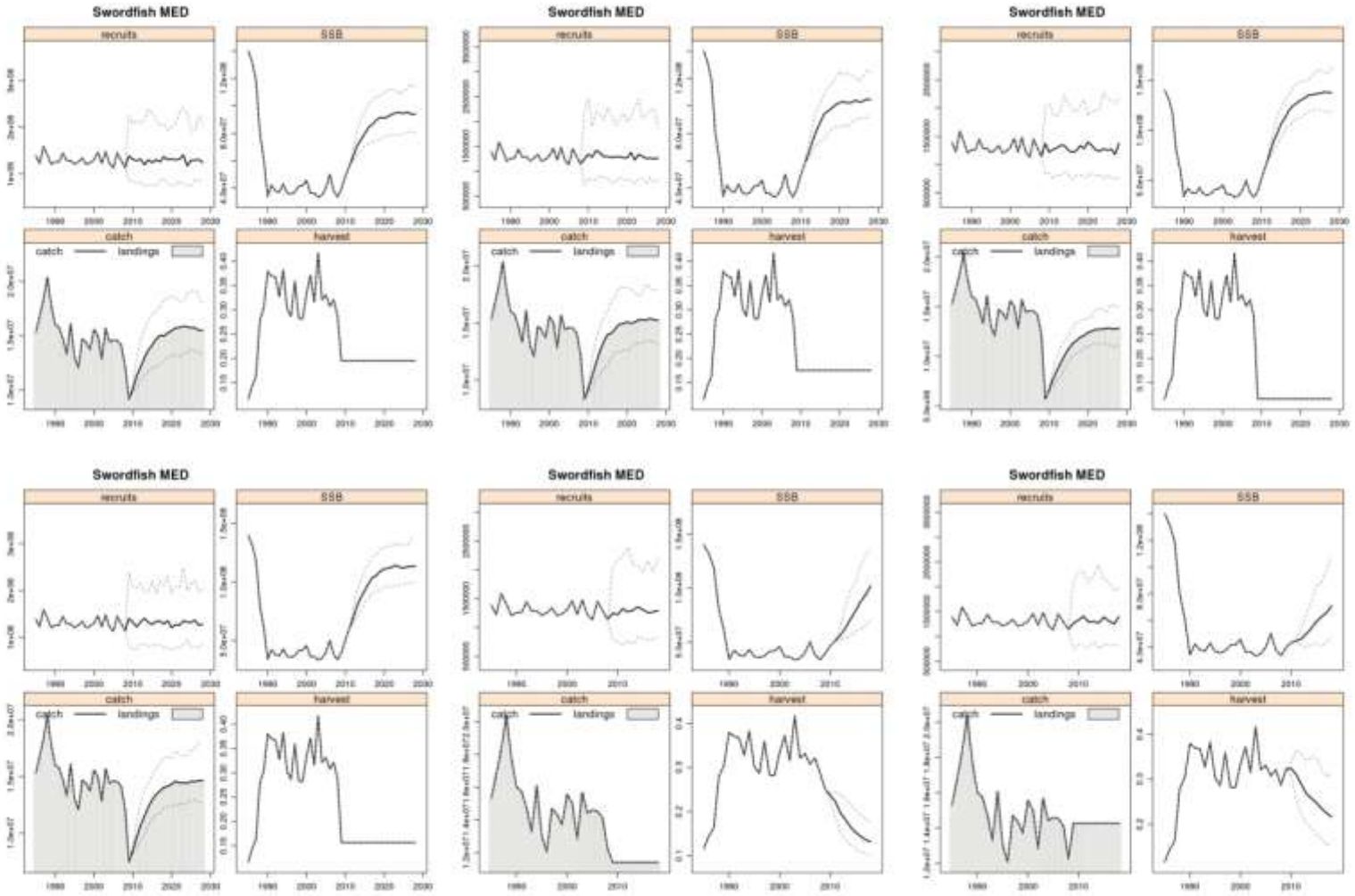


Figure 25. Scenario estimates assuming recruitment independent of stock size. From left to right and top to bottom: current, 4-month, 6-month, capacity reduction, 80% of mean catch quota, mean catch quota (see text for details).

Appendix 1

AGENDA

1. Opening, adoption of the Agenda and meeting arrangements.
2. Description and evolution of the Mediterranean swordfish fisheries
3. Update of basic information: swordfish
4. Review of the swordfish catch per unit effort series
5. Review of gear selectivity studies
6. Review of growth and age determination
   - 6.1 Growth models
   - 6.2 Catch-at-age generation
7. Stock Status Results
8. Evaluation of management scenarios
9. Recommendations
   - 9.1 Statistics
   - 9.2 Research
10. Other matters
11. Adoption of the report and closure

Appendix 2

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Appendix 3

LIST OF DOCUMENTS

.

SCRS/2010/072 Turkish swordfish fishery. Akyol, O. and Ceyhan, T.

SCRS/2010/083 Standardized catch rates of swordfish *(Xiphias gladius)* caught by the Moroccan driftnet fleet in the Mediterranean sea. Period 1999-2009. Abid, N. and Idrissi, M.

SCRS/2010/084 Inclusion of stock reproductive potential in the evaluation of management scenarios for the Mediterranean swordfish stock. Tzanatos, E. and Tserpes, G.

SCRS/2010/085 Analysis of swordfish *(Xiphias gladius)* catch rates in the central-eastern Mediterranean. Tserpes, G., Peristeraki, P., Di Natale A. and Mangano, A.

SCRS/2010/086 Use of risk analysis for the evaluation of different management strategies for the Mediterranean swordfish stock. Tserpes, G., Tzanatos, E. and Peristerak,i P.

SCRS/2010/087 Updated standardized catch rates in number and weight for swordfish (*Xiphias gladius* L.) caught by the Spanish longline fleet in the Mediterranean Sea, 1988- 2009. Ortiz de Urbina, J.M., de la Serna, J.M., Mejuto, J. and Macías, D.

SCRS/2010/088 A comparison of age slicing with statistical age estimation for Mediterranean swordfish *(Xiphias gladius)*. Kell L.