

8.8 SWO-ATL-ATLANTIC SWORDFISH

The last assessment for Atlantic swordfish was conducted in 2009 (SCRS/2009/016). Other information relevant to Atlantic swordfish is presented in the Report of the Sub-Committee on Statistics, included as **Appendix 8** to this SCRS Report, and recommendations pertinent to Atlantic swordfish are presented in Section 15.

SWO-ATL-1. Biology

Swordfish (*Xiphias gladius*) are members of the family *Xiphiidae* and are in the suborder *Scombroidei*. They can reach a maximum weight in excess of 500 kg. They are distributed widely in the Atlantic Ocean and Mediterranean Sea. In the ICCAT convention area, the management units of swordfish for assessment purposes are a separate Mediterranean group, and North and South Atlantic groups separated at 5°N. This stock separation is supported by recent genetic analyses. However, the precise boundaries between stocks are uncertain, and mixing is expected to be highest at the boundary in the tropical zone. Swordfish feed on a wide variety of prey including groundfish, pelagic fish, deep-water fish, and invertebrates. They are believed to feed throughout the water column, and from recent electronic tagging studies, undertake extensive diel vertical migrations.

Swordfish mostly spawn in the western warm tropical and subtropical waters throughout the year, although seasonality has been reported in some of these areas. They are found in the colder temperate waters during summer and fall months. Young swordfish grow very rapidly, reaching about 140 cm LJFL (lower-jaw fork length) by age three, but grow slowly thereafter. Females grow faster than males and reach a larger maximum size. Tagging studies have shown that some swordfish can live up to 15 years. Swordfish are difficult to age, but about 50% of females were considered to be mature by age five, at a length of about 180cm. However, the most recent information indicates a smaller length and age at maturity.

SWO-ATL-2. Fishery indicators

Due to the broad geographical distribution of Atlantic swordfish (**SWO ATL-Figure 1**) in coastal and off-shore areas (mostly ranging from 50°N to 45°S), this species is available to a large number of fishing countries (**SWO ATL-Figure 2**). Directed longline fisheries from Canada, EU-Spain, and the United States have operated since the late 1950s or early 1960s, and harpoon fisheries have existed at least since the late 1800s. Other directed swordfish fisheries include fleets from Brazil, Morocco, Namibia, EU-Portugal, South Africa, Uruguay, and Venezuela. The primary by-catch or opportunistic fisheries that take swordfish are tuna fleets from Chinese Taipei, Japan, Korea and EU-France. The tuna longline fishery started in 1956 and has operated throughout the Atlantic since then, with substantial catches of swordfish that are produced as a by-catch of tuna fisheries. The largest proportion of the Atlantic catches is made using surface-drifting longline. However, many additional gears are used, including traditional gillnets off the coast of western Africa.

Total Atlantic

The total Atlantic estimated catch (landings plus dead discards) of swordfish (North and South, including reported dead discards) in 2009 (25,103 t) represented a slight increase from that in 2008 (23,551 t). As a small number of countries have not yet reported their 2009 catches and because of unknown unreported catches, this value should be considered provisional and subject to further revision.

In an effort to quantify possible unreported catches in the Convention area during the 2009 stock assessment, the ICCAT Statistical Document data base was examined. The use of this information was complicated because of the lack of conversions factors available for products such as loin, fillet, and gilled/gutted swordfish. The comparison between the swordfish Statistical Document System (s.SDS) data from 2003 through 2007 and the reported Task I by flag indicates that Task I catches might not represent the total landed catch of Convention area swordfish, although the extent to which this occurs was highly uncertain. The largest discrepancy between the data sources is for flags with an unknown area of capture, and amounts to nearly 21,000 t over the 2003-2007 time period. Considering only the s.SDS data classified as coming from the Convention area, the discrepancy amounts to an estimate of less than 1,000 t over the time period. The comparison implies that international trade of Convention Area landed swordfish might represent less than 13% of the landed catch recorded in Task I and that a surprisingly low number of Contracting Parties engage in export of Convention area swordfish.

North Atlantic

For the past decade, the North Atlantic estimated catch (landings plus dead discards) has averaged about 11,332 t per year (**SWO-ATL-Table 1** and **SWO-ATL-Figure 3**). The catch in 2009 (12,655 t) represents a 37% decrease since the 1987 peak in North Atlantic landings (20,236 t). These reduced landings have been attributed to ICCAT regulatory recommendations and shifts in fleet distributions, including the movement of some vessels in certain years to the South Atlantic or out of the Atlantic. In addition, some fleets, including at least the United States, EU-Spain, EU-Portugal and Canada, have changed operating procedures to opportunistically target tuna and/or sharks, taking advantage of market conditions and higher relative catch rates of these species previously considered as by-catch in some fleets. Recently, socio-economic factors may have also contributed to the decline in catch.

Trends in nominal catch rates by fleets contributing to the production model are shown in **SWO-ATL-Figure 4**. Most of the series have an increasing trend since the late 1990s, but the U.S. catch rates remained relatively flat. There have been some recent changes in United States regulations that may have impacted catch rates, but these effects remain unknown.

The 2010 Swordfish Species Group reviewed new information from Canada, which updated its nominal catch rate series for the pelagic longline fishery (SCRS/2010/139). The nominal CPUE increased from 2008 to 2009, continuing the increasing trend that commenced in 1996. The Group agreed with the authors' view that more work was needed to reflect changes in management and targeting practices. It was suggested that since the switch from a competitive fishery to an Individual Transferable Quota based-system occurred in 2002, sufficient time has passed to consider breaking the time series into two, reflecting the two periods of contrasting management approaches.

The most frequently occurring ages in the catch include ages 2 and 3 (**SWO-ATL-Figure 5**). There are reports of increasing average size of the catch in some North Atlantic fisheries, including United States and Canada.

South Atlantic

The historical trend of catch (landings plus dead discards) can be divided in two periods: before and after 1980. The first one is characterized by relatively low catches, generally less than 5,000 t (with an average value of 2,300 t). After 1980, landings increased continuously up to a peak of 21,930 t in 1995, levels that are comparable to the peak of North Atlantic harvest (20,236 t). This increase of landings was, in part, due to progressive shifts of fishing effort to the South Atlantic, primarily from the North Atlantic, as well as other waters. Expansion of fishing activities by southern coastal countries, such as Brazil and Uruguay, also contributed to this increase in catches. The reduction in catch following the peak in 1995 resulted from regulations and partly due to a shift to other oceans and target species. In 2009, the 12,448 t reported catches were about 44% lower than the 1995 reported level (**SWO-ATL-Figure 3**).

The SCRS noted that there was a considerable decline in the magnitude of the catch by Namibia in 2009 compared with 2008 (25 and 518 t, respectively) that appeared inconsistent with recent developments in capacity. Namibian authorities will be contacted with a request for an explanation for this apparent anomaly.

As observed in the 2006 assessment, the CPUE trend from targeted and non-targeted fisheries show different trends and high variability which indicates that at least some are not depicting trends in the abundances of the stock (**SWO-ATL-Figure 6**). It was noted that there was little overlap in fishing area and strategies between the by-catch and targeted fleets used for estimating CPUE pattern, and therefore the by-catch and targeted fisheries CPUE trends could be tracking different components of the population.

Discards

Since 1991, several fleets have reported dead discards (see **SWO-ATL-Table 1**). The volume of Atlantic-wide reported discards since then has ranged from 151 t to 1,139 t per year. Reported annual dead discards have been declining in recent years.

SWO-ATL-3. State of the stocks

North Atlantic

Results from the base case production model are shown in **SWO-ATL-Figure 7**. The estimated relative biomass trend shows a consistent increase since 2000. The current results indicate that the stock is at or above B_{MSY} . The relative trend in fishing mortality shows that the level of fishing peak in 1995, followed by a decrease until 2002, followed by small increase in the 2003-2005 period and downward trend since then. Fishing mortality has been below F_{MSY} since 2005. The results suggest that there is greater than 50% probability that the stock is at or above B_{MSY} , and thus the Commission's rebuilding objective [Rec. 99-02] has been achieved (**SWO-ATL-Figure 8**). However, it is important to note that since 2003 the catches have been below the TAC's greatly increasing the chances for a fast recovery. Overall, the stock was estimated to be somewhat less productive than the previous assessment, with the intrinsic rate of increase, r , estimated at 0.44 compared to 0.49 in 2006.

Other analyses conducted by the SCRS (Bayesian surplus production modeling, and Virtual Population Analyses) generally support the results described for the base case surplus production model above.

South Atlantic

The results of the base case production model indicated that there were conflicting signals for several of the indices used. The model estimated overall index was relatively stable until the early 1980s when it started declining until the late 1990's and it reversed that trend about 2003. Estimated relative fishing mortality (F_{2008}/F_{MSY}) was 0.75 indicating that the stock is not being overexploited. Estimated relative biomass (B_{2009}/B_{MSY}) was 1.04 (**SWO-ATL-Figure 9**), indicating that the stock was not overexploited.

Because of the high level of uncertainty associated with the south Atlantic production models results, the SCRS conducted catch-only modeling analysis, including two explorations using different assumptions concerning the intrinsic rate of population increase. The distribution for MSY was skewed for both runs (**SWO-ATL-Figure 10**). The median of MSY estimated for RUN 1 was 18,130 t and for RUN 2 was 17,934 t. **SWO-ATL-Figure 11** summarizes recent stock status, as determined from the catch-only model.

SWO-ATL-4. Outlook

North Atlantic

The base production model was projected to the year 2018 under constant TAC scenarios of 10, 11, 12, 13, 14 and 15 thousand tonnes. Catch in year 2009 was assumed to be the average of the last three years (2006-08) (11,515 t). The actual reported landings in 2009 were 12,655 t. Median trajectories for biomass and fishing mortality rate for all of the future TAC scenarios are plotted in **SWO-ATL-Figure 12**.

Future TACs above MSY are projected to result in 50% or lower probabilities of the stock biomass remaining above B_{MSY} over the next decade (**SWO-ATL-Figure 13**) as the resulting probability of F exceeding F_{MSY} for these scenarios would trend above 50% over time. A TAC of 13,000 t would provide approximately a 75% probability of maintaining the stock at a level consistent with the Convention objective over the next decade.

South Atlantic

Projections for the base case production model were performed for catch levels from 10,000 t to 16,000 t by increments of 1,000 t for 2010-2020. For 2009, all projection scenarios assumed a catch equal to the average catch for 2006-2008 (13,658 t). **SWO-ATL-Figure 14** shows the results of the projections. Because the SCRS considers that the production model estimated benchmarks are poorly estimated, the projections are shown as biomass changes rather than relative biomass. In general, catches of 14,000 t or less will result in increases in the biomass of the stock; catches on the order of 15,000 will maintain the biomass of the stock at approximately stable levels during the period projected. Catches on the order of 16,000 t or more will result in biomass decrease. The current TAC is 17,000 t.

For the catch only model projections, constant catch scenarios were evaluated ranging from 10,000 to 17,000 t, incremented by 1,000 t for a period of 10 years. For 2009, all projection scenarios assumed a catch equal to the average catch for 2006-2008 (13,658 t). In general, catches of 15,000 t will result in the biomasses being higher

than B_{MSY} 80% of the time. **SWO-ATL-Figure 15** summarizes the probability of $B > B_{MSY}$ and $F < F_{MSY}$ for the constant catch scenarios indicated over time. Catches on the order of 17,000 will result in a probability of 0.67 of the biomass being above B_{MSY} in ten years.

SWO-ATL-5. Effects of current regulations

In 2006, the Committee provided information on the effectiveness of existing minimum size regulations. New catch regulations were implemented on the basis of Rec. 06-02, which entered into effect in 2007 (Rec. 08-02 extended the provisions of Rec. 06-02 to include 2009). Finally, Rec. 09-02 came into effect in 2010 and extended most of the provisions of Rec. 06-02 for one year only.

Catch limits

The total allowable catch in the North Atlantic during the 2007 to 2009 period was 14,000 t per year. The reported catch during that period averaged 12,096 t and did not exceed the TAC in any year. Reports for 2009 are considered provisional and subject to change.

The total allowable catch in the South Atlantic for the years 2007 through 2009 was 17,000 t. The reported catch during that period averaged 13,455 t, and did not exceed the TAC in any year. Reports for 2009 are considered provisional and subject to change.

Minimum size limits

There are two minimum size options that are applied to the entire Atlantic: 125 cm LJFL with a 15% tolerance, or 119 cm LJFL with zero tolerance and evaluation of the discards.

For the 2006-2008 period, the estimate of the percentage of swordfish reported landed (throughout the Atlantic) less than 125 cm LJFL was about 24% (in number) overall for all nations fishing in the Atlantic (28% in the northern stock and 20% in southern stock). If this calculation is made using reported landings plus estimated dead discards, then the percentage less than 125 cm LJFL would be of the same order given the relatively small amount of discards reported. These estimates are based on the overall catch at size, which have high levels of substitutions for a significant portion of the total catch.

Other implications

The Committee is concerned that in some cases national regulations have resulted in the unreported discarding of swordfish caught in the North stock and, to a certain extent, could have influenced similar behavior of the fleet that fishes the South Atlantic swordfish stock. The Committee considers that these regulations may have had a detrimental effect on the availability and consistency of scientific data on catches, sizes and CPUE indices of the Atlantic fleet. The Committee expressed its serious concern over this limitation on data for future assessments.

SWO-ATL-6. Management recommendations

North Atlantic

Consistent with the goal of the Commission's swordfish rebuilding plan [Rec. 96-02], in order to maintain the northern Atlantic swordfish stock at a level that could produce MSY, with greater than 50% probability, the Committee recommended reducing catch limits allowed by Rec. 06-02 (15,345 t) to no more than 13,700 t, which reflects the current best estimate of maximum yield that could be harvested from the population under existing environmental and fishery conditions. Should the Commission wish to have greater assurance that future biomass would be at or above B_{MSY} while maintaining F at or below F_{MSY} , the Commission should select a lower annual TAC, depending on the degree of precaution the Commission chooses to apply in management.

The Committee noted that allowable catch levels agreed in [Recs. 06-02 and 08-02] exceeded scientific recommendations. The successful rebuilding of this stock could have been compromised if recent catches had been higher than realized.

South Atlantic

Until sufficiently more research has been conducted to reduce the high uncertainty in stock status evaluations for the southern Atlantic swordfish stock, the Committee emphasizes that annual catch should not exceed the provisionally estimated MSY (15,000). Considering the unquantified uncertainties and the conflicting indications for the stock, the Committee recommends a more precautionary Fishery Management approach, to limit catches to the recent average level (~15,000 t), which are expected to maintain the catch rates at about their current level.

ATLANTIC SWORDFISH SUMMARY

	North Atlantic	South Atlantic
Maximum Sustainable Yield ¹	13,730 t (13,020-14,182) ³	~15,000 t
Current (2009) TAC	14,000 t	15,000 t
Current (2009) Yield ²	12,655 t	12,448 t
Yield in last year used in assessment (2008)	11,188 t ⁵	12,363 t ⁵
B _{MSY}	61,860 (53,280-91,627)	47,700
F _{MSY}	0.22 (0.14-0.27)	0.31
Relative Biomass (B ₂₀₀₉ /B _{MSY})	1.05 (0.94-1.24)	1.04 (0.82-1.22)
Relative Fishing Mortality (F ₂₀₀₈ /F _{MSY} ¹)	0.76 (0.67-0.96)	0.75 (0.60-1.01)
Stock Status	Overfished: NO Overfishing: NO	Overfished: NO Overfishing: NO
Management Measures in Effect:	Country-specific TACs [Recs. 06-02, 08-02 and 09-02]; 125/119cm LJFL minimum size	Country-specific TACs [Rec. 06-03 and 09-03]; 125/119cm LJFL minimum size

¹ Base Case production model (Logistic) results based on catch data 1950-2008.

² Provisional and subject to revision.

³ 80% bias corrected confidence intervals are shown.

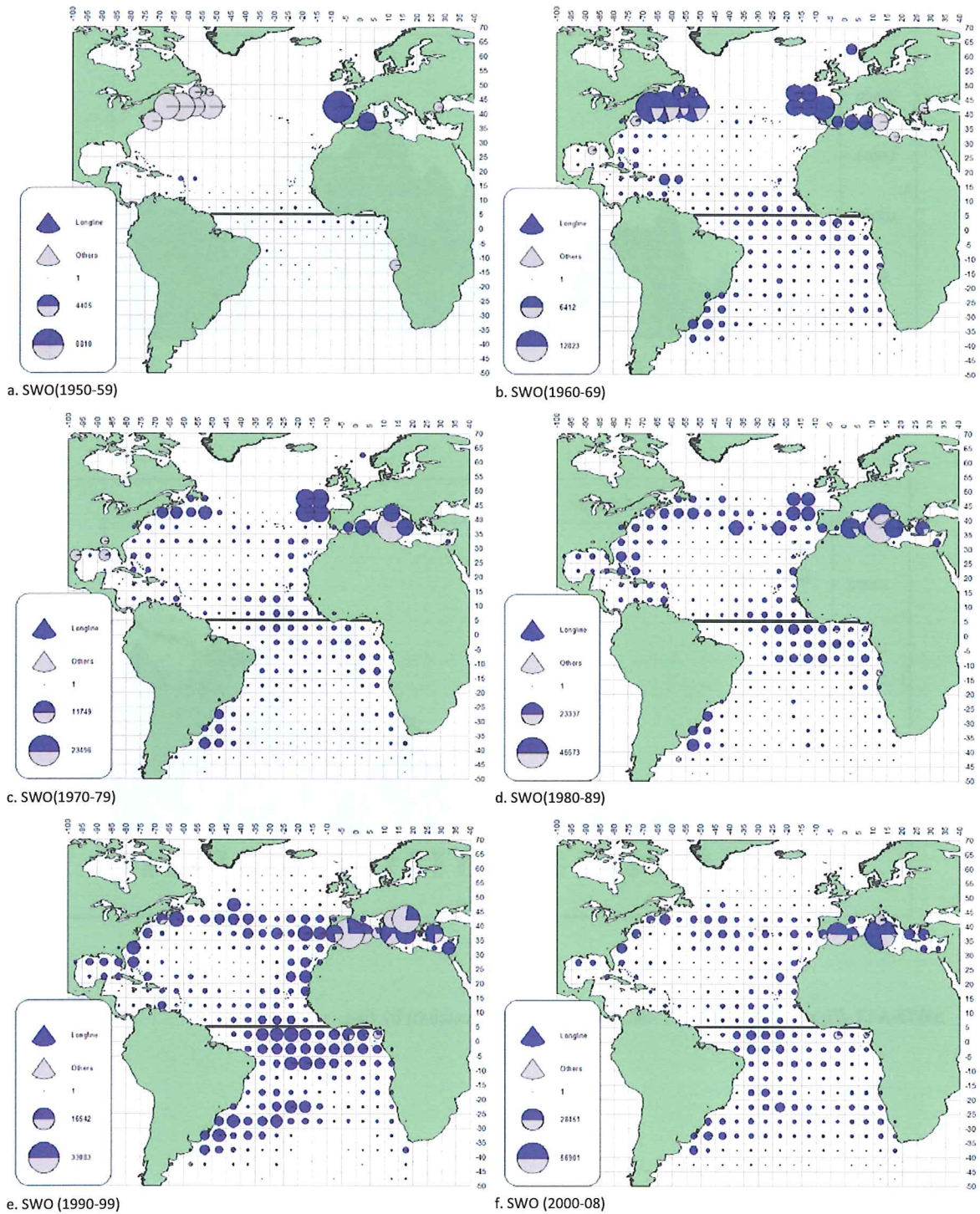
⁴ Provisional and preliminary, based on production model results that included catch data from 1970-2008.

⁵ As of September 29, 2010.

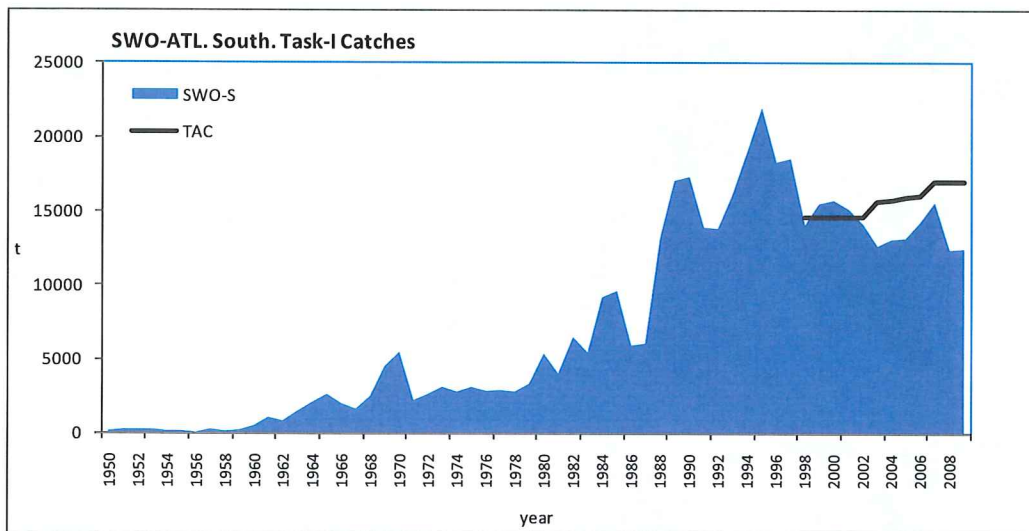
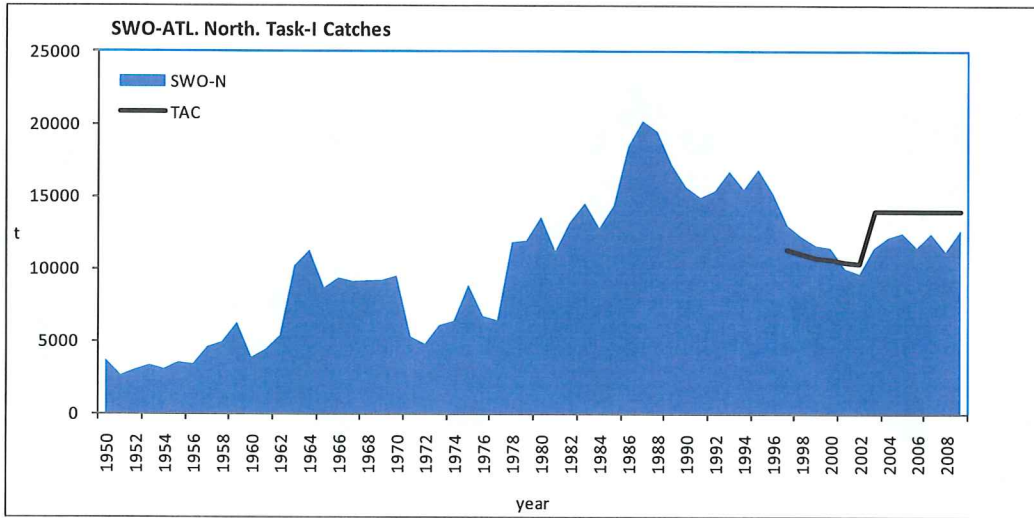
SWO-ATL-Table 1. Estimated catches (t) of Atlantic swordfish (*Xiphias gladius*) by gear and flag.

	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
TOTAL	23969	24380	26266	32685	34305	32976	28826	29207	32868	34459	38803	33511	31567	26251	27123	27180	25139	23758	24075	25252	25643	25718	27997	23551	25103
ATN	14383	18486	20236	19513	17250	15672	14934	15394	16738	15501	16872	15222	13025	12223	11622	11453	10011	9654	11442	12175	12480	11473	12444	11188	12655
ATS	9586	5894	6030	13172	17055	17304	13893	13813	16130	18958	21930	18289	18542	14027	15502	15728	15128	14104	12633	13077	13162	14245	15553	12363	12448
Landings ATN	14240	18269	20022	18927	15348	14026	14208	14288	15641	14309	15764	13808	12181	10778	10449	9642	8425	8664	9997	11406	11527	10840	11617	10473	11724
Other surf.	143	217	214	586	1902	1646	511	723	689	484	582	826	393	961	643	672	685	374	822	449	620	409	546	471	780
ATS	8863	4951	5446	12404	16398	16705	13287	13176	15547	17387	20806	17799	18239	13748	14823	15448	14302	13576	11712	12485	12915	13723	14890	11623	12062
Other surf.	723	943	584	768	657	599	606	637	583	1571	1124	489	282	269	672	278	825	527	920	591	248	522	572	734	386
Landings ATN	0	0	0	0	0	0	0	0	0	0	0	0	26	12	9	4	1	6	8	5	7	10	8	8	9
Other surf.	0	0	0	0	0	0	0	0	0	0	0	1	21	10	6	1	0	0	0	0	1	0	0	0	6
Other surf.	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
Other surf.	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 ATN	0	0	0	0	0	0	0	0	0	0	0	33	16	16	12	13	19	10	21	25	44	39	27	39	20
Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Brasil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112
Canada	585	1059	954	898	1247	911	1026	1547	2234	1676	1610	739	1089	1115	1119	968	1079	959	1285	1203	1558	1404	1348	1334	1300
China P.R.	0	0	0	0	0	0	0	0	73	86	104	132	40	337	304	22	102	90	316	56	108	72	85	92	92
Chinese Taipei	152	157	52	23	17	270	577	441	127	507	489	521	509	286	285	347	299	310	257	30	140	172	103	82	89
Cuba	162	636	910	832	87	47	23	27	16	50	86	7	7	7	7	7	0	0	3	3	2	2	0	0	0
Côte D'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
EU.Denmark	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.España	7441	9719	11135	9799	6648	6386	6633	6672	6598	6185	6953	5547	5140	4079	3996	4595	3968	3957	4586	5376	5521	5448	5564	4366	4949
EU.France	4	4	0	0	0	75	75	75	95	46	84	97	164	110	104	122	0	74	169	102	178	92	46	14	15
EU.Ireland	0	0	0	0	0	0	0	0	7	0	15	15	132	81	35	17	5	12	1	3	2	2	0	0	1
EU.Netherlands	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.Poland	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.Portugal	22	468	994	617	300	475	773	542	1961	1599	1617	1703	903	773	777	732	735	766	1032	1320	900	949	778	747	898
EU.United Kingdom	0	0	0	0	0	0	0	0	2	3	1	5	11	0	2	1	0	0	0	0	0	0	0	0	2
FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	3	36	48	0	82	48
Faroe Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0
Grenada	0	0	0	0	56	5	1	2	3	13	0	4	15	15	42	84	0	54	88	73	56	30	26	43	0
Iceland	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	921	807	413	621	1572	1051	992	1064	1126	933	1043	1494	1218	1391	1089	161	0	0	0	0	575	705	656	889	935
Korea Rep.	160	68	60	30	320	51	3	3	19	16	16	19	15	0	0	0	0	0	0	0	0	51	65	175	157
Liberia	24	16	30	19	35	3	0	7	14	26	28	28	28	28	28	0	0	0	0	0	0	0	0	0	0
Libya	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
Maroc	137	181	197	196	222	91	110	69	39	36	79	462	267	191	119	114	523	223	329	335	334	341	237	430	724
Mexico	0	0	0	0	0	0	0	0	6	14	0	22	14	28	24	37	27	34	32	44	41	31	35	34	32
NEI (ETRO)	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
NEI (MED)	0	14	3	131	190	185	43	35	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Norway	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
Panama	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
Philippines	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
Rumania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	44	5	0	8	0	22	28
Russian Federation	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
Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108	108	0	180	138
Seychelles	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
Sierra Leone	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
St. Vincent and Grenadines	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
Sta. Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0
Trinidad and Tobago	6	45	151	42	79	66	71	562	11	180	150	158	110	130	138	41	75	92	78	83	91	19	29	48	30
U.S.A.	4705	5210	5247	6171	6411	5519	4310	3852	3783	3366	4026	3559	2987	3058	2908	2863	2217	2384	2513	2380	2160	1873	2463	2387	2697
U.S.S.R.	13	18	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UK.Bermuda	0	0	0	0	0	0	0	0	0	0	1	1	5	5	3	3	2	0	0	1	1	0	3	4	3
UK.British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	7	0	0	0

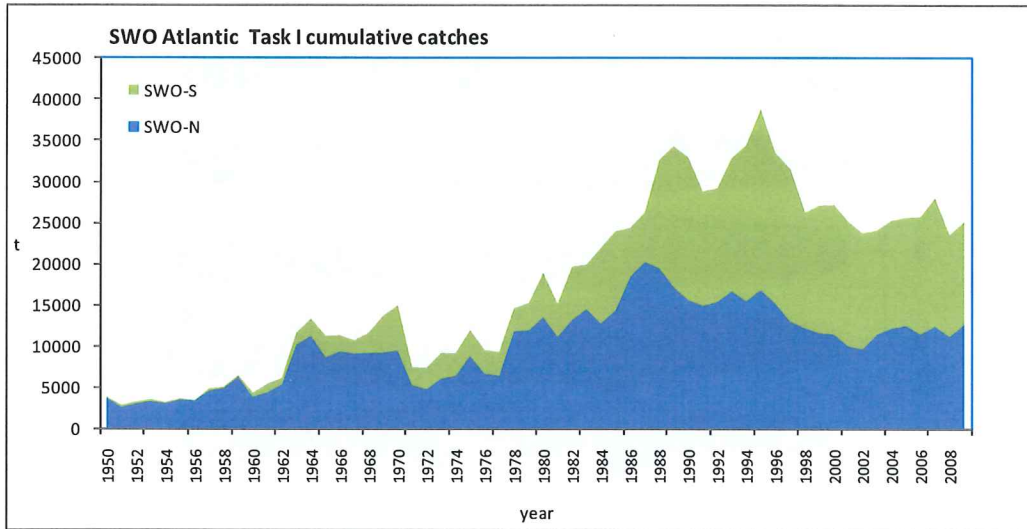
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
UK, Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Venezuela	51	84	86	2	4	9	75	103	73	69	54	85	20	37	30	44	21	34	45	53	55	22	30	11	13
ATS	228	815	84	84	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Angola	361	351	198	175	230	88	88	14	24	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Argentina	0	0	0	0	0	0	0	0	0	0	1	0	0	0	17	8	0	0	0	0	0	0	0	120	32
Belize	90	39	13	19	26	28	28	26	28	25	24	24	10	0	3	0	0	0	0	0	0	0	0	0	0
Benin	562	753	947	1162	1168	1312	2609	2013	1571	1975	1892	4100	3847	4721	4579	4082	2910	2920	2998	3785	4430	4153	3407	3386	3386
Brasil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
Cambodia	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
China P.R.	280	216	338	798	610	900	1453	1686	846	2829	2876	2873	2562	1147	1168	1303	1149	1164	1254	745	744	377	671	727	612
Chinese Taipei	1301	95	173	159	830	448	209	246	192	452	778	60	60	0	0	0	0	0	0	0	0	0	0	0	0
Cuba	10	10	10	12	7	8	18	13	14	20	19	26	18	25	26	20	19	19	43	29	31	39	17	159	100
Côte D'Ivoire	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: Bulgaria	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: Lithuania	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: España	0	66	0	4393	7725	6166	5760	5651	6974	7937	11290	9622	8461	5832	5758	6388	5789	5741	4527	5483	5402	5300	5283	4073	5183
EU: Portugal	0	0	0	0	0	0	0	1	0	0	380	389	441	384	381	392	393	380	354	345	493	440	428	271	367
EU: United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Gabon	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
Ghana	25	13	123	235	156	146	73	69	121	51	103	140	44	106	121	117	531	372	734	343	55	32	65	177	132
Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Honduras	0	0	0	0	0	0	0	3	0	0	6	4	5	2	8	0	0	0	0	0	0	0	0	0	0
Japan	4613	2913	2620	4453	4019	6708	4459	2870	5256	4699	3619	2197	1494	1186	775	790	685	833	924	686	480	1090	2155	1600	1491
Korea Rep.	917	369	666	1012	776	50	147	147	198	164	164	7	18	7	5	10	0	2	24	70	36	94	176	223	10
Mixed flags (FR+ES)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
NEI (ETRO)	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
Namibia	0	0	0	0	0	0	0	0	0	22	0	0	0	0	730	469	751	504	191	549	832	1118	1038	518	25
Nigeria	0	0	0	0	0	0	0	3	0	0	9	0	0	0	105	0	0	0	0	0	0	0	0	0	0
Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	29	105	0	0	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	8	1	1	4	58	41	49
S. Tomé e Príncipe	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
Seychelles	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
South Africa	8	5	5	4	0	0	5	9	4	1	4	1	1	240	143	328	547	649	293	295	199	186	207	142	170
St. Vincent and Grenadines	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
Togo	6	32	1	0	2	3	5	5	8	14	14	64	0	0	0	0	0	0	0	9	10	2	0	0	0
U.S.A.	0	0	0	0	0	0	0	0	0	0	0	171	396	160	179	142	43	200	21	15	0	0	0	0	0
U.S.S.R.	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UK: Sta Helena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	4	0	0	0	0	0	0	0
Uruguay	1125	537	699	427	414	302	156	210	260	165	499	644	760	889	650	713	789	768	850	1105	843	620	464	370	501
Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	26	6	3
Discards ATN	0	0	0	0	0	0	0	0	0	0	0	0	5	52	35	50	26	33	79	45	106	38	61	39	9
Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	598	567	319	263	0	0	0	0	0	0
Mexico	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
U.S.A.	0	0	0	0	0	0	215	383	408	708	526	588	446	433	494	490	308	263	282	275	227	185	220	205	142
ATS	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
Brasil	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
U.S.A.	0	0	0	0	0	0	0	0	0	0	0	1	21	10	6	1	0	0	0	1	0	0	0	0	0



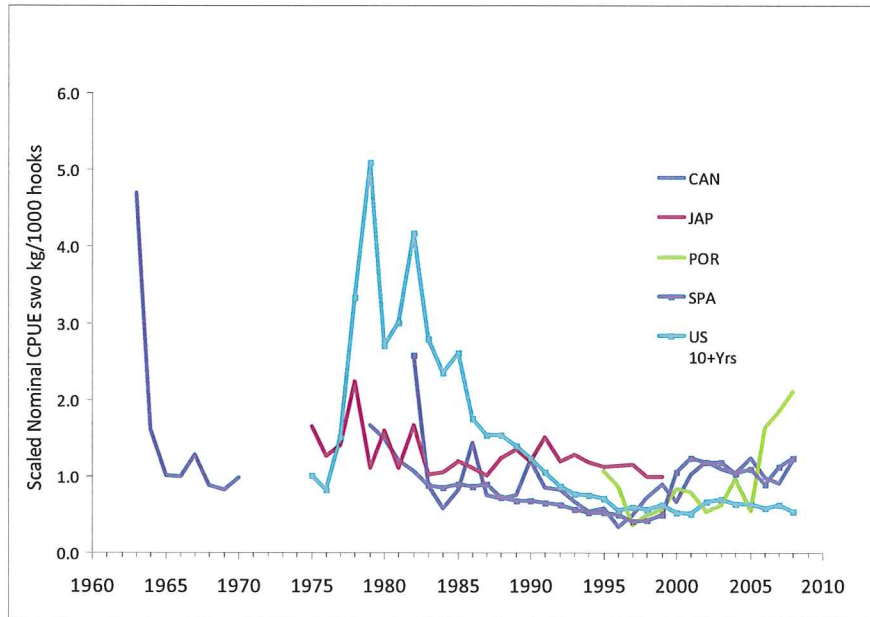
SWO-ATL-Figure 1. Geographic distribution of swordfish cumulative catch (t) by gear, in the Convention area, shown on a decadal scale. The more contemporary period (2000 to 2008) is shown on the bottom right.



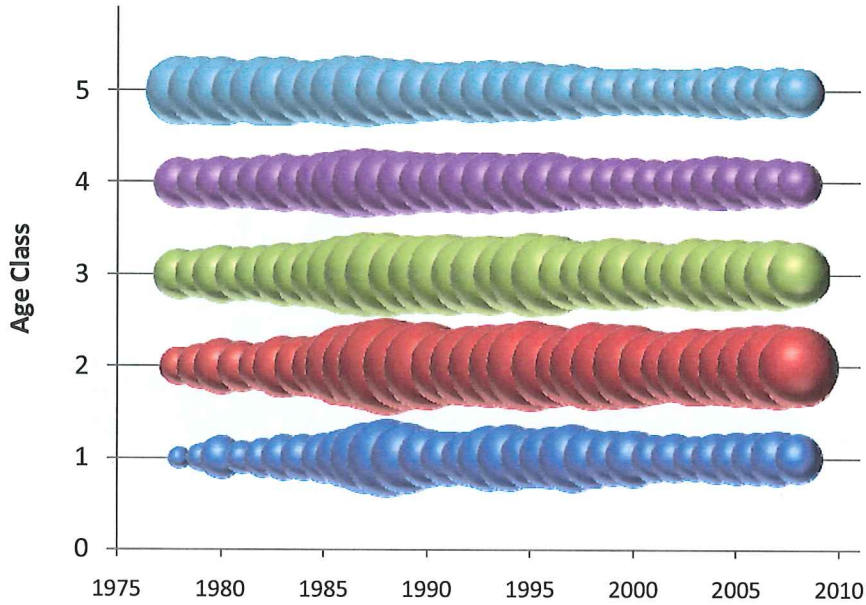
SWO-ATL-Figure 2. North and South Atlantic swordfish catch (t) by flag.



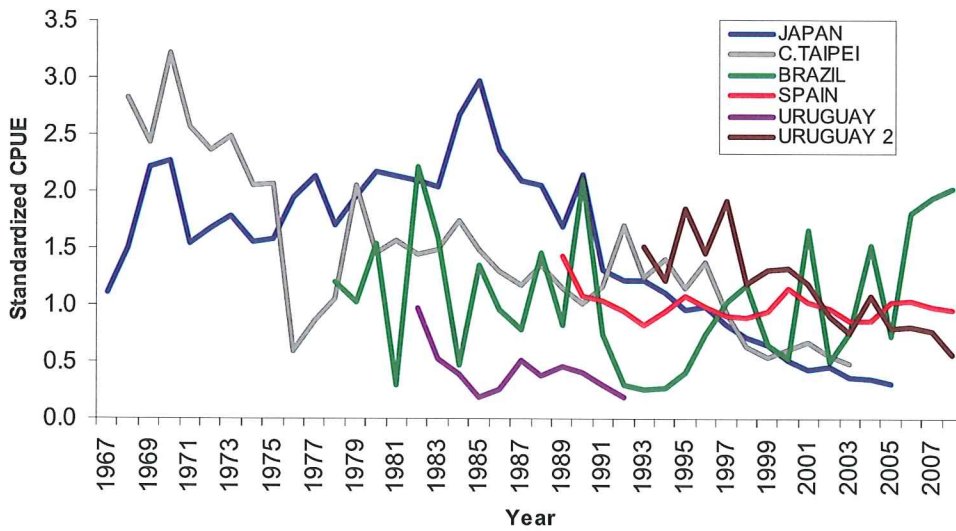
SWO-ATL-Figure 3. Swordfish reported catches (t) for North and South Atlantic, for the period 1950-2009 and the corresponding TAC.



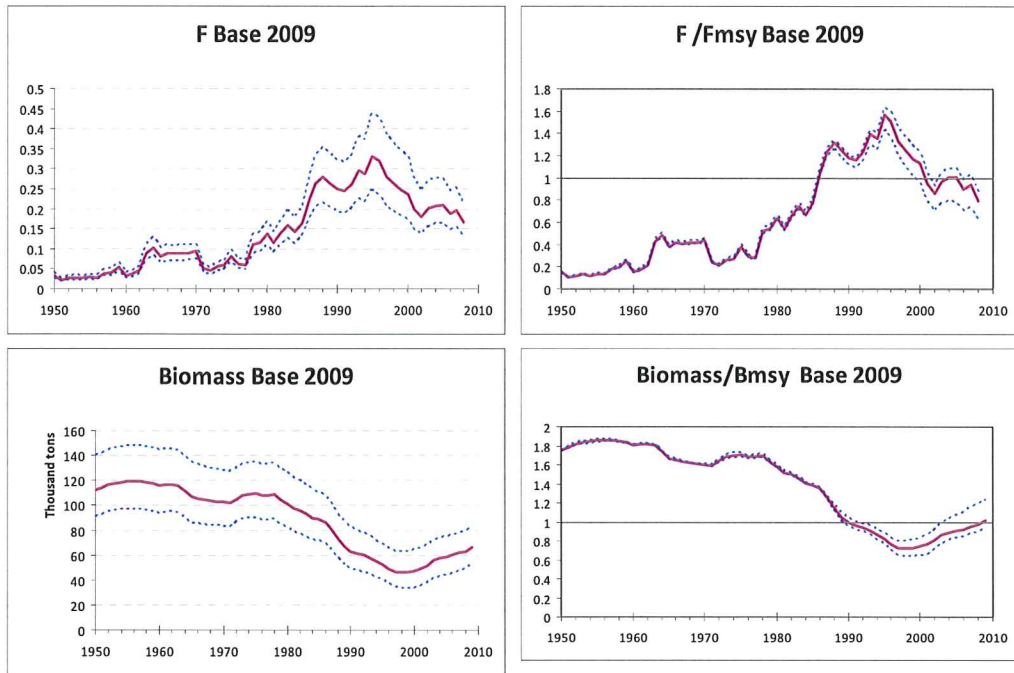
SWO-ATL-Figure 4. North Atlantic swordfish scaled nominal catch rate series used as input in the combined index of the base production model.



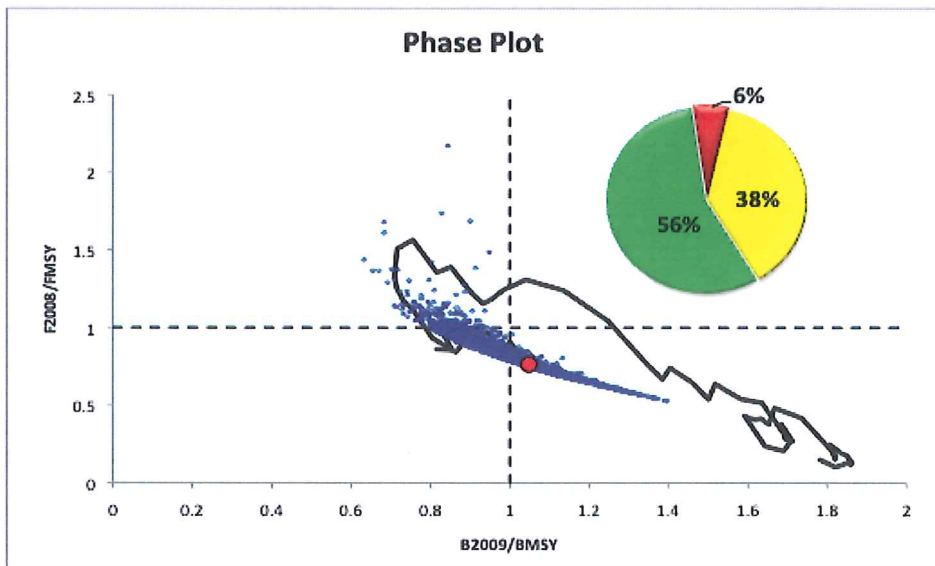
SWO-ATL-Figure 5. North Atlantic swordfish, catch at age (numbers) converted from catch at size. The area of the filled circle shows the proportional catch at age. Note: Age 5 is a plus group.



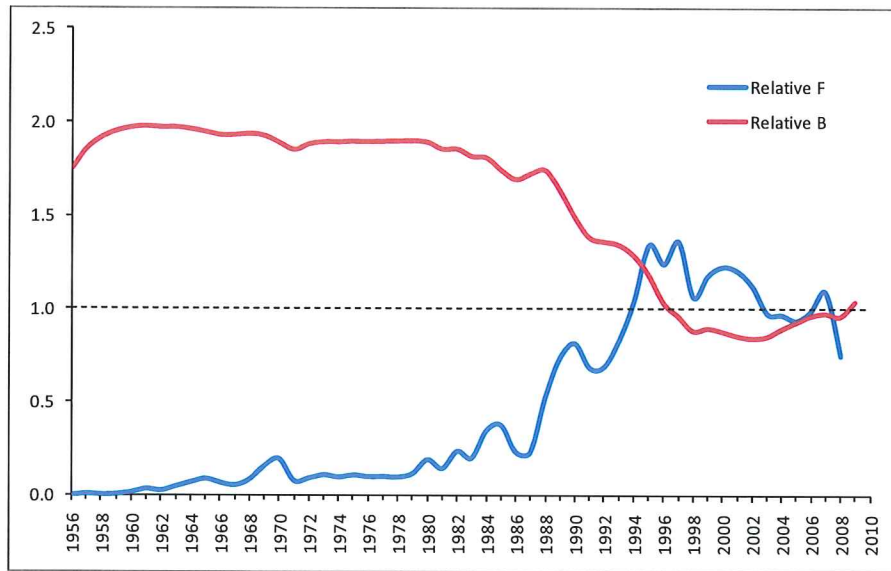
SWO-ATL-Figure 6. South Atlantic swordfish, standardized CPUE series for the production model (ASPIC) for characterizing the status of southern Atlantic swordfish (Scaled relative to mean of overlap). The series for Uruguay was treated as two series.



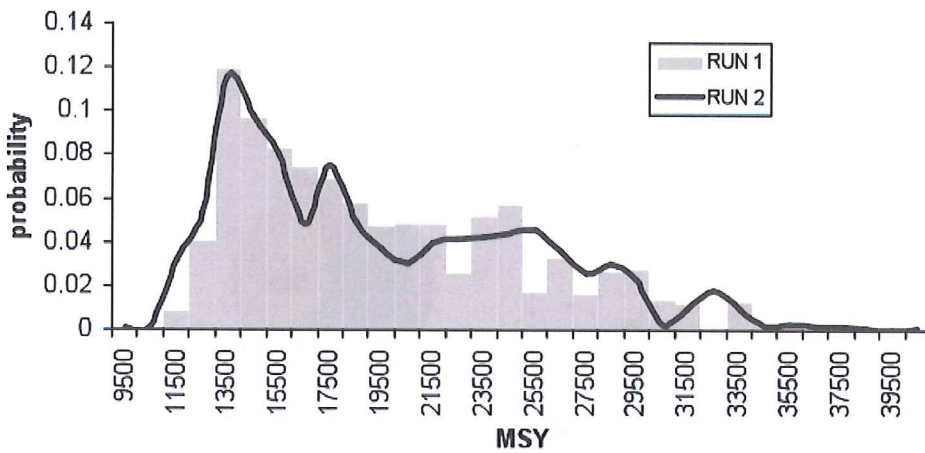
SWO-ATL-Figure 7. North Atlantic swordfish, biomass, fishing mortality and relative ratio trends for the base production model. The solid lines represent point estimates and broken lines represent estimated 80% bias corrected confidence intervals.



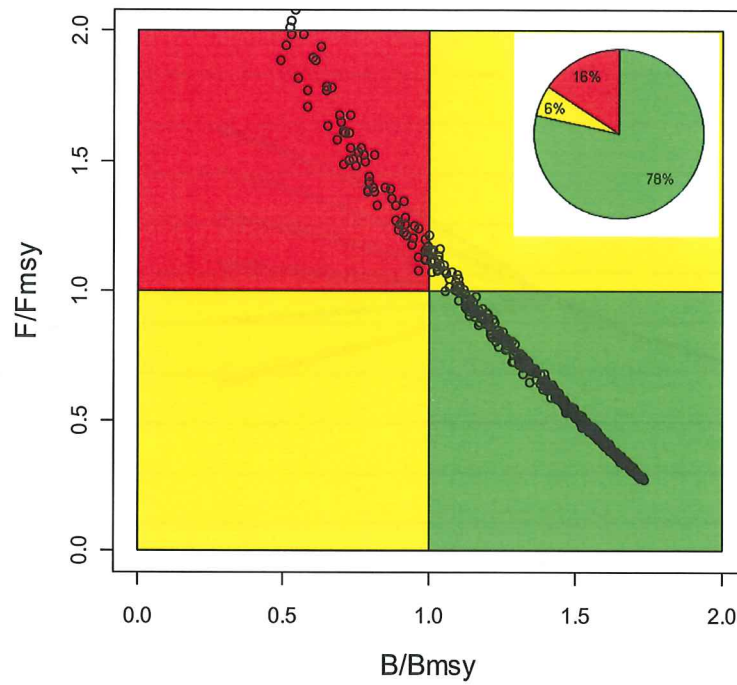
SWO-ATL-Figure 8. Summary figure of the current northern Atlantic swordfish stock status which includes different representation of the bootstraps results of the base ASPIC model: percentage, phase-plots (marked dot corresponds to the deterministic result) and stock status trajectories for the period 1950-2008. The x-axis represents relative biomass, and the y-axis relative exploitation rate.



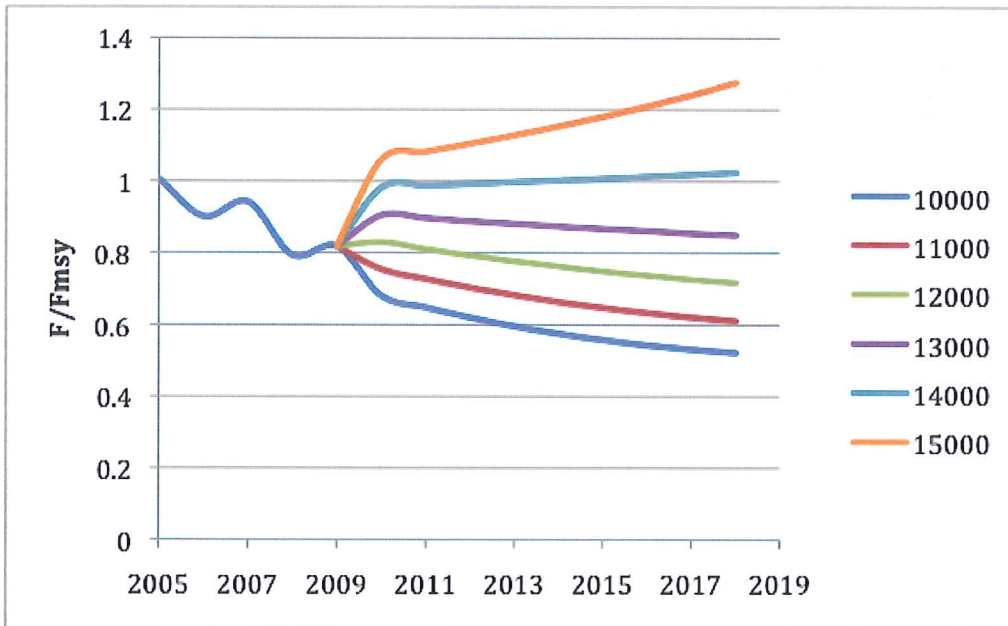
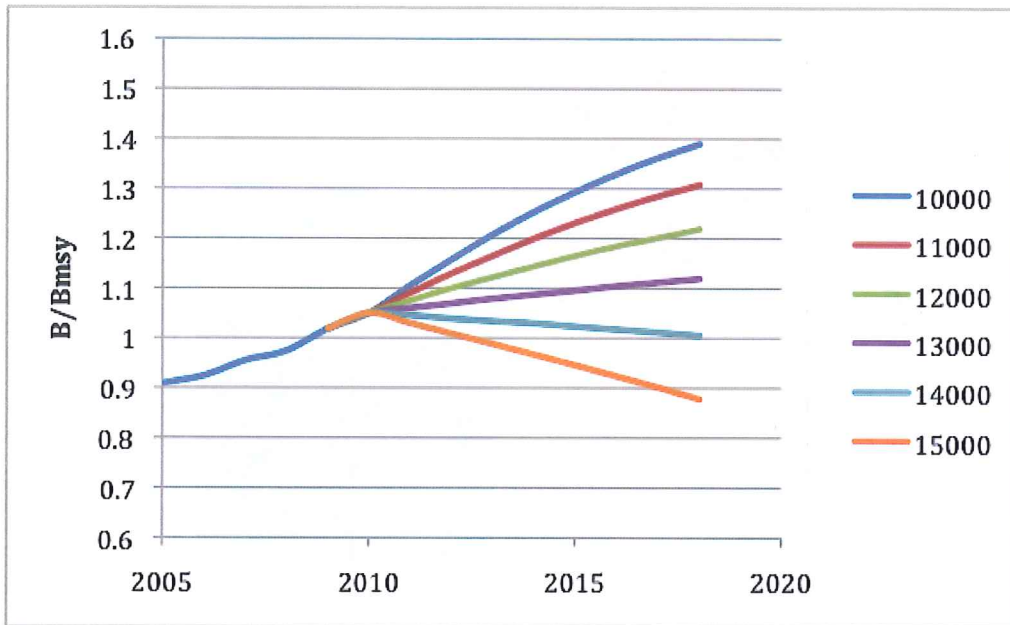
SWO-ATL Figure 9. South Atlantic, relative biomass (B/B_{MSY}) and relative fishing mortality (F/F_{MSY}) trajectories estimated by the base case production model.



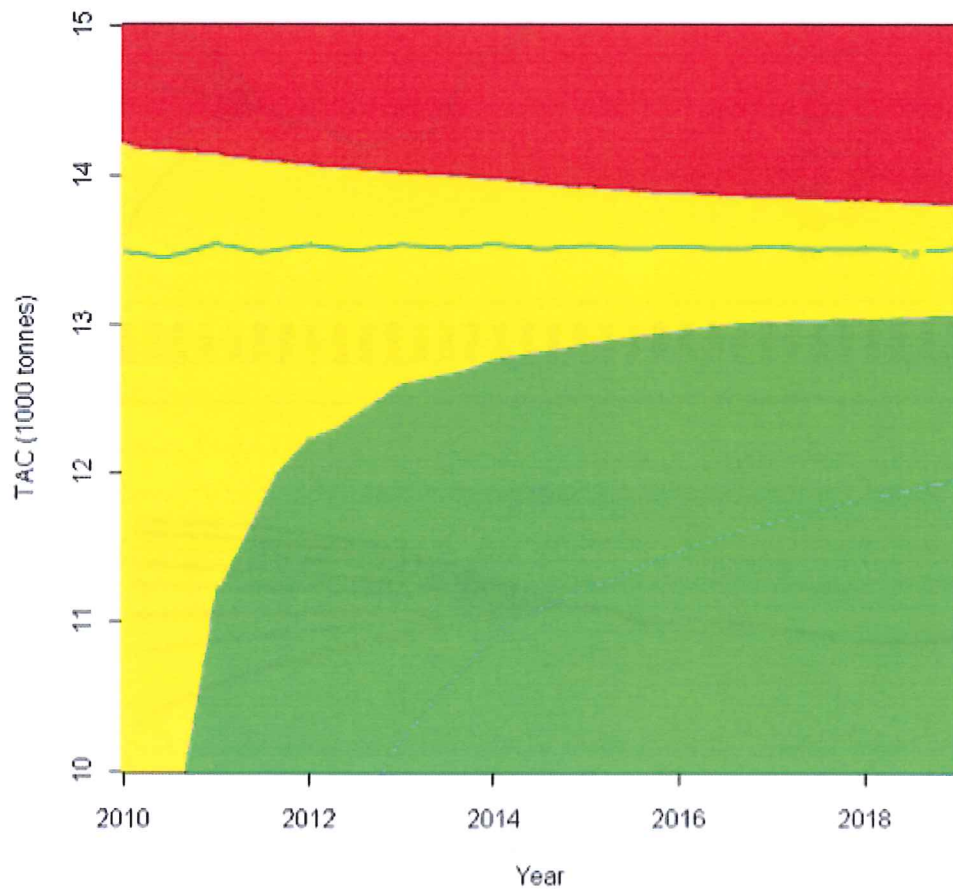
SWO-ATL-Figure 10. Posterior probability density estimates of MSY for South Atlantic swordfish from the catch-only model fitted to catch data from 1950 to 2009. Run 1 and 2 refer to two scenarios with different assumptions for the intrinsic rate of population increase.



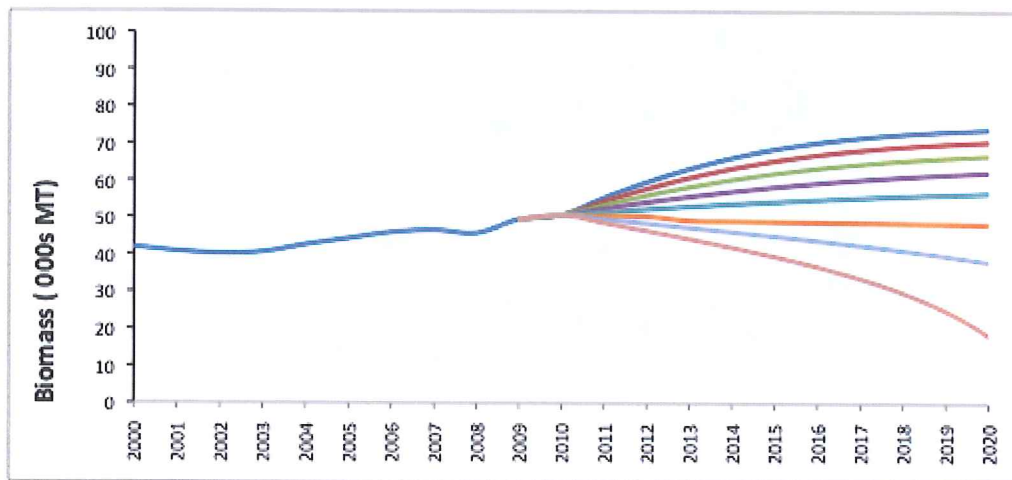
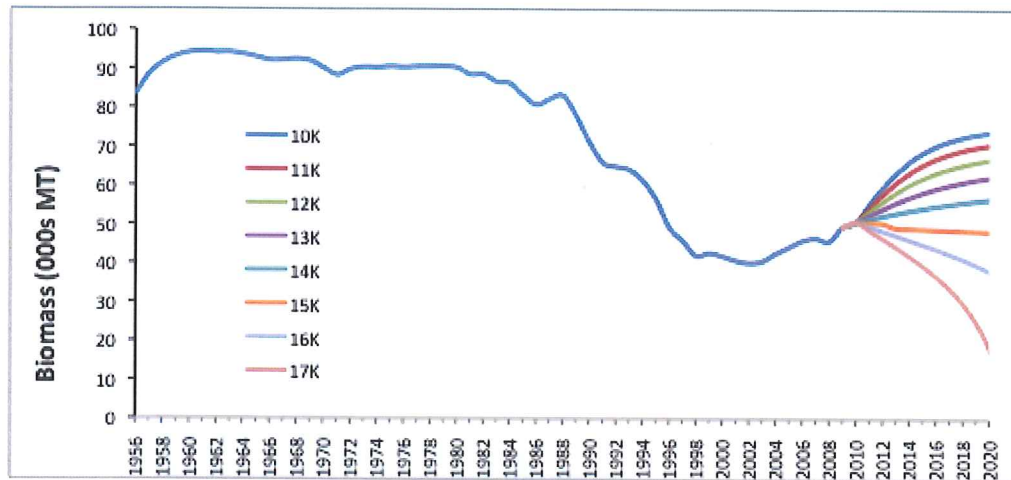
SWO-ATL-Figure 11. Summary figure of the current southern Atlantic swordfish stock status which includes the level of uncertainty on the knowledge of the state of the stock. Conditioned only on the catches, the model estimated a probability of 0.78 that the stock is not overfished and it is not undergoing overfishing.



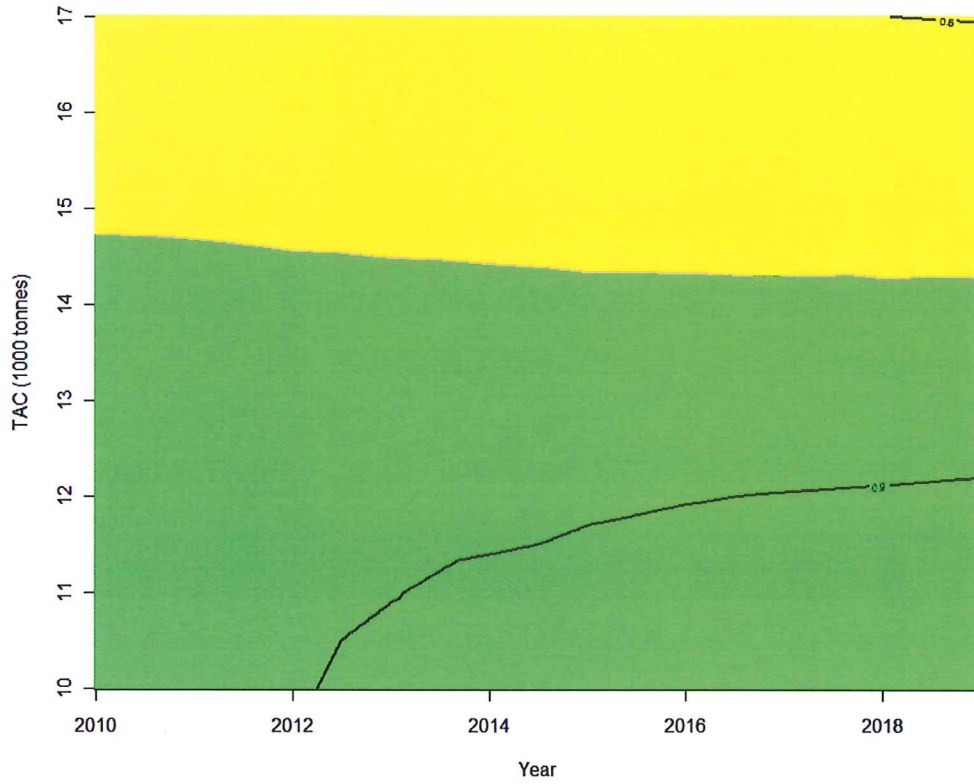
SWO-ATL-Figure 12. Projections of median relative North Atlantic swordfish stock biomass and F from the base ASPIC model under different constant catch scenarios (10\15 thousand tons) North Atlantic swordfish stock.



SWO-ATL-Figure 13. North Atlantic swordfish, probability contours of $B \geq B_{MSY}$ and $F \leq F_{MSY}$ for the constant catch scenarios indicated over time. Red areas represent probabilities less than 50%, yellow from 50-75%, and green above 75%. The 90th, 75th, 60th, and 50th probability contours are also depicted.



SWO-ATL-Figure 14. South Atlantic, projected biomass levels under various catch scenarios. The bottom panel provides the details of the projections over a reduced time interval.



SWO-ATL-Figure 15. South Atlantic swordfish, probability contours of $B > B_{MSY}$ and $F < F_{MSY}$ (from the catch only model, both runs combined) for the constant catch scenarios indicated over time. Yellow areas represent probabilities from 50-75%, and green above 75%. The 90th, 75th, probability contours are also depicted. No probabilities were below 50%.

