8.12 SHK - SHARKS

The status of the stocks of blue shark (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*), resulting from the 2008 ICCAT assessment, and the stock of porbeagle (*Lamna nasus*), which was assessed jointly with ICES in 2009, are given in the 2010 SCRS Report. The information from the Ecological Risk Assessment (ERA) for nine species of pelagic elasmobranches carried out in 2008 is also included in the 2010 SCRS Report.

In 2011, a data preparatory meeting was held in response to the *Recommendation by ICCAT on Atlantic Shortfin Mako Sharks Caught in Association with ICCAT Fisheries* [Rec. 10-06] and to define the steps to follow in carrying out the ERA envisaged for 2012. The full report of the data preparatory meeting is included in SCRS/2011/017.

SHK-1. Biology

A great variety of shark species are found within the ICCAT Convention area, from coastal to oceanic species. Biological strategies of these sharks are very diverse and are adapted to the needs within their respective ecosystems where they occupy a very high position in the trophic chain as active predators. Therefore, generalization as regards to the biology of these very diverse species results in inevitable inaccuracies, as would occur for teleosts. To date, ICCAT has prioritized the biological study and assessment of the major sharks of the epipelagic system as these species are more susceptible of being caught as by-catch by oceanic fleets targeting tuna and tuna-like species. Among these shark species there are some of special prevalence and with an extensive geographical distribution within the oceanic-epipelagic ecosystem, such as the blue shark and shortfin mako shark, and others with less or even limited prevalence, such as porbeagle, hammerhead sharks, thresher sharks, white sharks, etc.

Blue shark and shortfin mako sharks show a wide geographic distribution, most often between 50ºN and 50ºS latitude. On the contrary, porbeagle show a distribution that is restricted to cold-temperate waters, preferably close to the continental shelf of both hemispheres where this species rarely overlaps with the fishing activity directed at tunas and tuna-like species. These three species have an ovoviviparous reproductive strategy, which increases the probability of survival of their young, with litters from only a few individuals in the case of shortfin mako and porbeagle, to abundant litters of about 40 pups in the case of blue shark. Their growth rates differ between sexes and among these three species. Females often reach first maturity at a large size. A characteristic of these species is usually their tendency to segregate temporally and spatially by size-sex, according to their respective processes of feeding, mating-reproduction, gestation and birth. Numerous aspects of the biology of these species are still poorly understood or completely unknown, particularly for some regions, which contributes to increased uncertainty in quantitative and qualitative assessments.

SHK-2. Fishery indicators

Earlier reviews of the shark database resulted in recommendations to improve data reporting on shark catches. Though global statistics on shark catches included in the database have improved, they are still insufficient to permit the Committee to provide quantitative advice on stock status with sufficient precision to guide fishery management toward optimal harvest levels. Reported and estimated catches for blue shark, shortfin mako and porbeagle are provided in **SHK-Table 1** and **Figures 1 to 4**.

A number of standardized CPUE data series for blue shark and shortfin mako were presented in 2008 as relative indices of abundance. The Committee placed emphasis on using the series that pertained to fisheries that operate in oceanic waters over wide areas. **SHK-Figure 5** presents the central tendency of the available series for the four stocks of these species.

Considering the quantitative and qualitative limitations of the information available to the Committee, the results presented in 2008, as those of the 2004 assessment (Anon. 2005c), are not conclusive. During the porbeagle assessment in 2009 (SCRS/2009/014), standardized CPUE data were presented for three of the four stocks (NE, NW and SW; **SHK-Figure 6)**. These series when referring to fisheries targeting porbeagle could fail to reflect the global abundance of the stock and where they refer to sharks caught as by-catch they could be highly variable. In 2010, only new information from Japan on the CPUE of shortfin mako and Porbeagle was presented. However, it was suggested that the recently developed method used for the stratification of the areas for the analysis of CPUE should be sent to the ICCAT Secretariat.

With regard to the species for which ERAs were conducted, the Committee understands that, in spite of existing uncertainties, results make it possible to identify those species that are more vulnerable to prioritize research and management measures **(SHK-Table 2)**. These ERAs are conditional on the biological variables used to estimate productivity as well as the susceptibility values for the different fleets.

SHK-3. State of the Stocks

Ecological risk assessments for 11 priority species of sharks (including *blue shark and shortfin mako*) caught in ICCAT fisheries demonstrated that most Atlantic pelagic sharks have exceptionally limited biological productivity and, as such, can be overfished even at very low levels of fishing mortality. Specifically, the analyses indicated that bigeye threshers, longfin makos, and shortfin makos have the highest vulnerability (and lowest biological productivity) of the shark species examined (with bigeye thresher being substantially less productive than the other species). All species considered in the ERA, particularly smooth hammerhead, longfin mako, bigeye thresher and crocodile sharks, are in need of improved biological data to evaluate their biological productivity more accurately and thus specific research projects should be supported to that end. **SHK-Table 2** provides a productivity ranking of the species considered. ERAs should be updated with improved information on the productivity and susceptibility of these species.

SHK-3.1 Blue shark

For both North and South Atlantic blue shark stocks, although the results are highly uncertain, biomass is believed to be above the biomass that would support MSY and current harvest levels below F_{MSY}. Results from all models used in the 2008 assessment (Anon. 2009c) were conditional on the assumptions made (*e.g.*, estimates of historical catches and effort, the relationship between catch rates and abundance, the initial state of the stock in the 1950s, and various life-history parameters), and a full evaluation of the sensitivity of results to these assumptions was not possible during the assessment. Nonetheless, as for the 2004 stock assessment (Anon. 2005c), the weight of available evidence does not support hypotheses that fishing has yet resulted in depletion to levels below the Convention objective (**SHK-Figure 7**).

SHK-3.2 Shortfin mako shark

Estimates of stock status for the North Atlantic shortfin mako obtained with the different modeling approaches applied in 2008 were much more variable than for blue shark. For the North Atlantic, most model outcomes indicated stock depletion to about 50% of biomass estimated for the 1950s. Some model outcomes indicated that the stock biomass was near or below the biomass that would support MSY with current harvest levels above F_{MSY}, whereas others estimated considerably lower levels of depletion and no overfishing (**SHK-Figure 7**). In light of the biological information that indicates the point at which B_{MSY} is reached with respect to the carrying capacity which occurs at levels higher than for blue sharks and many teleost stocks. There is a non-negligible probability that the North Atlantic shortfin mako stock could be below the biomass that could support MSY. A similar conclusion was reached by the Committee in 2004, and recent biological data show decreased productivity for this species. Only one modeling approach could be applied to the South Atlantic shortfin mako stock, which resulted in an estimate of unfished biomass which was biologically implausible, and thus the Committee can draw no conclusions about the status of the South stock.

SHK-3.3 Porbeagle shark

In 2009, the Committee attempted an assessment of the four porbeagle stocks in the Atlantic Ocean: Northwest, Northeast, Southwest and Southeast. In general, data for southern hemisphere porbeagle are too limited to provide a robust indication on the status of the stocks. For the Southwest, limited data indicate a decline in CPUE in the Uruguayan fleet, with models suggesting a potential decline in porbeagle abundance to levels below MSY and fishing mortality rates above those producing MSY (**SHK-Figure 8**). But catch and other data are generally too limited to allow definition of sustainable harvest levels. Catch reconstruction indicates that reported landings grossly underestimate actual landings. For the Southeast, information and data are too limited to assess their status. Available catch rate patterns suggest stability since the early 1990s, but this trend cannot be viewed in a longer term context and thus are not informative on current levels relative to B_{MSY}.

The northeast Atlantic stock has the longest history of commercial exploitation. A lack of CPUE data for the peak of the fishery adds considerable uncertainty in identifying the current status relative to virgin biomass. Exploratory assessments indicate that current biomass is below B_{MSY} and that recent fishing mortality is near or above F_{MSY} (**SHK-Figure 9**). Recovery of this stock to B_{MSY} under no fishing mortality is estimated to take ca.

15-34 years. The current EU TAC of 436 t in effect for the northeast Atlantic may allow the stock to remain stable, at its current depleted biomass level, under most credible model scenarios. Catches close to the current TAC (e.g. 400 t) could allow rebuilding to B_{MSY} under some model scenarios, but with a high degree of uncertainty and on a time scale of 60 (40-124) years.

An update of the Canadian assessment of the northwest Atlantic porbeagle stock indicated that biomass is depleted to well below B_{MSY}, but recent fishing mortality is below F_{MSY} and recent biomass appears to be increasing. Additional modelling using a surplus production approach indicated a similar view of stock status, i.e., depletion to levels below B_{MSY} and current fishing mortality rates also below F_{MSY} (**SHK-Figure 10**). The Canadian assessment projected that with no fishing mortality, the stock could rebuild to B_{MSY} level in approximately 20-60 years, whereas surplus-production based projections indicated 20 years would suffice. Under the Canadian strategy of a 4% exploitation rate, the stock is expected to recover in 30 to 100+ years according to the Canadian projections.

SHK-4. Management Recommendations

Precautionary management measures should be considered for stocks where there is the greatest biological vulnerability and conservation concern, and for which there are very few data. Management measures should ideally be species-specific whenever possible.

For species of high concern (in terms of overfishing), and for which a high survivorship is expected in fishing gears after release, the Committee recommends that the Commission prohibit retention and landing of the species to minimize fishing mortality. The Committee recognizes that the difficulty in identifying look-alike species may complicate compliance with management measures adopted for those species

For all the species, but particularly for those which can be easily misidentified, it is essential that the Committee advances data collection and research on life history, together with the interactions with tuna fisheries, with the final objective of assessing the status of the stocks. Until such information is made available, the Commission should consider taking effective measures to reduce the fishing mortality of these stocks. These measures may include minimum or maximum size limits for landing (for protection of juveniles or the breeding stock, respectively); and any other technical mitigation measures such as gear modifications, time-area restrictions, or others, as appropriate. Such management actions should be combined with research activities, in order to provide information on their effectiveness.

The SCRS welcomed the conservation and management measures adopted by the Commission in the past two years regarding the species ranked as the most vulnerable in the last Ecological Risk Assessment and for which almost no data have been submitted (bigeye thresher, oceanic whitetip shark and hammerhead shark). At the same time, the SCRS expressed concern with the fact that no conservation and management measures have been adopted so far for the top ranked species in the ERA, the silky shark, *Carcharhinus falciformis*. Accordingly, the SCRS recommended that proper conservation and management measures, similar to those adopted for those species, be also adopted for the silky shark.

Both porbeagle stocks in the northwest and northeast Atlantic were estimated to be overfished, with the northeastern stock being more highly depleted. The main source of fishing mortality on these stocks is from directed porbeagle fisheries which are not under the Commission’s direct mandate. Those fisheries are managed mostly by ICCAT Contracting Parties through national legislation which includes quotas and other management measures.

The Committee also recommends that countries initiate research projects to investigate means to minimize by-catch and discard mortality of sharks, with a particular view to recommending to the Commission complementary measures to minimize porbeagle by-catch in fisheries for tuna and tuna-like species. For porbeagle sharks, the Committee recommends that the Commission work with countries catching porbeagle, particularly those with targeted fisheries, and relevant RFMOs to ensure recovery of North Atlantic porbeagle stocks and prevent overexploitation of South Atlantic stocks. In particular, porbeagle fishing mortality should be kept to levels in line with scientific advice and with catches not exceeding current level. New targeted porbeagle fisheries should be prevented, porbeagles retrieved alive should be released alive, and all catches should be reported. Management measures and data collection should be harmonized as much as possible among all relevant RFMOs dealing with these stocks, ICCAT should facilitate appropriate communication.

The Committee recommends that joint work with the ICES Working Group on Elasmobranch Fishes should be continued. In addition, stocks of mutual interest and areas of overlap, particularly species occurring in the Mediterranean Sea, should be discussed.

The Committee recommends that scientific observers be allowed to collect biological samples (vertebrae, tissues, reproductive tracts, stomachs) from species whose retention is prohibited by current regulations.

The Committee recommends that the CPCs explore methods to estimate catches of sharks in purse seine and artisanal fisheries.

NORTH ATLANTIC BLUE SHARK SUMMARY

2007 Yield		61,845 t[1]
Provisional Yield (2010)		37,238 t[2]
Relative Biomass:	B_{2007}/B_{MSY}	1.87-2.74[3]
	B_{2007}/B_0	0.67-0.93[4]
Relative Fishing Mortality:	F_{MSY}	0.15[5]
	F_{2007}/F_{MSY}	0.13-0.17[6]

[1] Estimated catch used in the 2008 assessments.
[2] Task I catch.
[3] Range obtained from the Bayesian Surplus Production (BSP) (low) and the Catch-Free Age Structured Production (CFASP) (high) models. Value from CFASP is SSB/SSB_{MSY}.
[4] Range obtained from BSP (high), CFASP and Age-Structured Production Model (ASPM) (low) models.
[5] From BSP and CFASP models (same value). CV is from CFASP model.
[6] Range obtained from BSP (high) and CFASP (low) models.

SOUTH ATLANTIC BLUE SHARK SUMMARY

2007 Yield		37,075 t[1]
Provisional Yield (2010)		27,729 t[2]
Relative Biomass:	B_{2007}/B_{MSY}	1.95-2.80[3]
	B_{2007}/B_0	0.86-0.98[4]
Relative Fishing Mortality:	F_{MSY}	0.15-0.20[5]
	F_{2007}/F_{MSY}	0.04-0.09[6]

[1] Estimated catch used in the 2008 assessments.
[2] Task I catch.
[3] Range obtained from BSP (low) and CFASP (high) models. Value from CFASP is $SSB/SSB_{MSY.}$
[4] Range obtained from BSP (high) and CFASP (low) models. Value from CFASP is SSB/SS_{B0}.
[5] Range obtained from BSP (low) and CFASP (high) models.
[6] Range obtained from BSP (low) and CFASP (high) models.

NORTH ATLANTIC SHORTFIN MAKO SUMMARY

2007 Yield		5,996 t[1]
Provisional Yield (2010)		4,016 t[2]
Relative Biomass:	B_{2007}/B_{MSY}	0.95-1.65[3]
	B_{2007}/B_0	0.47-0.73[4]
Relative Fishing Mortality:	F_{MSY}	0.007-0.05[5]
	F_{2007}/F_{MSY}	0.48-3.77[6]
Management measures in effect		[Rec. 04-10], [Rec. 07-06]

[1] Estimated catch used in the 2008 assessments.
[2] Task I catch.
[3] Range obtained from BSP (low) and CFASP (high) models. Value from CFASP is $SSB/SSB_{MSY.}$
[4] Range obtained from BSP (low), ASPM, and CFASP (high) models. Value from CFASP is SSB/SS_{B0}.
[5] Range obtained from BSP (low) and CFASP (high) models.
[6] Range obtained from BSP (high) and CFASP (low) models.

NORTHWEST ATLANTIC PORBEAGLE SUMMARY

Current Yield (2008)		144.3 t[1]
Relative Biomass:	B_{2008}/B_{MSY}	0.43-0.65[2]
Relative Fishing Mortality:	F_{MSY}	0.025-0.075[3]
	F_{2008}/F_{MSY}	0.03-0.36[4]
Management measures in effect		TAC of 185, 11.3 t[5]

[1] Estimated catch allocated to the Northwest stock area.
[2] Range obtained from age-structured model (Canadian assessment; low) and BSP model (high). Value from Canadian assessment is in numbers; value from BSP in biomass. All values in parentheses are CVs.
[3] Range obtained from BSP model (low) and age-structured model (high).
[4] Range obtained from BSP model (low) and age-structured model (high).
[5] The TAC for the Canadian EEZ is 185 t (MSY catch is 250 t); the TAC for the USA is 11.3 t.

SOUTHWEST ATLANTIC PORBEAGLE SUMMARY

Current Yield (2008)		164.6 t[1]
Relative Biomass:	B_{2008}/B_{MSY}	0.36-0.78[2]
Relative Fishing Mortality:	F_{MSY}	0.025-0.033[3]
	F_{2008}/F_{MSY}	0.31-10.78[4]
Management measures in effect		None

[1] Estimated catch allocated to the southwest stock area.
[2] Range obtained from BSP (low and high) and CFASP models. Value from CFASP model (SSB/SSB_{MSY}) was 0.48 (0.20).
[3] Range obtained from BSP (low) and CFASP (high) models.
[4] Range obtained from BSP (low and high) and CFASP models. Value from CFASP model was 1.72 (0.51).

NORTHEAST ATLANTIC PORBEAGLE SUMMARY

Current Yield (2008)		287 t[1]
Relative Biomass:	B_{2008}/B_{MSY}	0.09-1.93[2]
Relative Fishing Mortality:	F_{MSY}	0.02-0.03[3]
	F_{2008}/F_{MSY}	0.04-3.45[4]
Management measures in effect		TAC of 436 t[5]
		Maximum landing length of 210 cm FL[5]

[1] Estimated catch allocated to the northeast stock area.
[2] Range obtained from BSP (high) and ASPM (low) models. Value from ASPM model is SSB/SSB_{MSY}. The value of 1.93 from the BSP corresponds to a biologically unrealistic scenario; all results from the other BSP scenarios ranged from 0.29 to 1.05.
[3] Range obtained from the BSP and ASPM models (low and high for both models).
[4] Range obtained from BSP (low) and ASPM (high) models. The value of 0.04 from the BSP corresponds to a biologically unrealistic scenario; all results from the BSP scenarios ranged from 0.70 to 1.26.
[5] In the European Union.

BSH-Table 1. Estimated catches (t) of blue shark (Prionace glauca) by area, gear and flag. (v02, 2011-09-30)

			1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
TOTAL			1482	1614	1835	1810	3028	4307	3643	9577	9562	9634	9560	37610	33809	35093	39101	34447	32735	35572	36304	43071	40351	47044	53900	58830	65183
	ATN		1482	1614	1835	1810	3028	4299	3536	9566	8084	8285	7258	29053	26510	25741	27965	21022	20037	22911	21740	22357	23215	26925	30722	35201	37238
	ATS		0	0	0	0	0	8	107	10	1472	1341	2301	8409	7238	9332	11091	13378	12682	12650	14438	20642	16957	20068	23097	23444	27729
	MED		0	0	0	0	0	0	0	0	6	8	2	148	61	20	44	47	17	10	125	72	178	51	82	185	216
Landings	ATN	Longline	0	0	0	0	1387	2257	1583	5734	5880	5871	5467	27618	25288	24405	26473	20013	18426	21936	20304	21033	22090	25966	30443	34434	36347
		Other surf.	1482	1088	1414	1330	900	1270	1768	2696	1632	1793	1086	1255	1030	1228	1355	904	1543	975	1372	1258	1080	905	150	664	727
	ATS	Longline	0	0	0	0	0	8	107	10	1472	1341	2294	8398	7231	9305	11091	13376	12678	12645	14339	20638	16898	19998	22708	23438	27716
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	6	4	27	0	1	4	6	99	3	59	10	375	6	14
	MED	Longline	0	0	0	0	0	0	0	0	6	8	2	148	61	20	44	47	17	10	44	72	83	49	81	18	50
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81	0	95	2	1	167	165
Discards	ATN	Longline	0	526	421	480	741	772	184	1136	572	621	602	180	170	104	137	105	68	0	63	66	45	53	129	102	163
		Other surf.	0	0	0	0	0	0	0	0	0	0	103	0	22	4	0	0	0	0	1	0	0	0	1	1	1
	ATS	Longline	0	0	0	0	0	0	0	0	0	0	7	5	4	1	0	0	0	0	0	0	0	60	14	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	
Landings	ATN	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	461
		Brasil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	
		Canada	320	147	968	978	680	774	1277	1702	1260	1494	528	831	612	547	624	581	836	346	965	1134	977	843	0	0	0
		Cape Verde	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.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	185	104	148	0	0	0	367	109	88	53
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	171	206	240	588	292	110	78	133
		EU.Denmark	0	0	0	2	2	1	1	0	1	2	3	1	1	0	2	1	13	5	1	0	0	0	0	0	0
		EU.España	0	0	0	0	0	0	0	0	0	0	0	24497	22504	21811	24112	17362	15666	15975	17314	15006	15464	17038	20788	24465	26094
		EU.France	50	67	91	79	130	187	276	322	350	266	278	213	163	399	395	207	221	57	106	120	99	167	119	84	122
		EU.Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	66	31	66	11	2	0	0	0	0	0	0	0
		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	1	
		EU.Portugal	0	0	0	0	1387	2257	1583	5726	4669	4722	4843	2630	2440	2227	2081	2110	2265	5643	2025	4027	4338	5283	6167	6252	8261
		EU.United Kingdom	0	0	0	0	1	0	0	0	0	12	0	0	1	0	12	9	6	4	6	5	3	6	6	96	8
		FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
		Japan	0	0	0	0	0	0	0	0	1203	1145	618	489	340	357	273	350	386	558	1035	1729	1434	1921	2531	2007	1793
		Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	254	892	613	1575	
		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	456	0	0	0	0	43	134	255	56
		Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	3	2	1	1	0	2	8	9
		U.S.A.	1112	874	355	271	87	308	215	680	29	23	283	211	255	217	291	39	0	0	7	2	2	1	8	4	8
		UK.Bermuda	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
		Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	26	10	18	7	71	74
	ATS	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	259	0	236	109	0	273
		Benin	0	0	0	0	0	0	0	0	0	0	0	6	4	27	0	0	0	0	0	0	0	0	0	0	
		Brasil	0	0	0	0	0	0	0	0	0	0	743	1103	0	179	1683	2173	1971	2166	1667	2523	2591	2258	1986	1274	1500
		China P.R.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	565	316	452	0	0	0	585	40	109	41
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	521	800	866	1805	2177	1843	1341	1594
		EU.España	0	0	0	0	0	0	0	0	0	0	0	5272	5574	7173	6951	7743	5368	6626	7366	6410	8724	8942	9615	13099	13953
		EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
		EU.Portugal	0	0	0	0	0	0	0	0	0	847	867	1336	876	1110	2134	2562	2324	1841	1863	3184	2751	4493	4866	5358	6338
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	239	0	0	14	
		Japan	0	0	0	0	0	0	0	0	1388	437	425	506	510	536	221	182	343	331	209	236	525	896	1789	981	1123
		Korea 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	222
		Namibia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2213	0	1906	6616	0	0	1829	207	2352
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	168	22	0	0	0	0	0	0	0	521	0	
		Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	**0**
		South Africa	0	0	0	0	0	0	0	0	0	0	0	0	23	21	0	83	63	232	128	154	90	82	126	119	125
		U.S.A.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	
		Uruguay	0	0	0	0	0	8	107	10	84	57	259	180	248	118	81	66	85	480	462	376	232	337	359	942	208
	MED	EU.Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	3	6	5	0	0	0	0	
		EU.España	0	0	0	0	0	0	0	0	0	0	0	146	59	20	31	6	3	3	4	8	61	3	2	7	48
		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	1
		EU.Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	1	95	46	75	175	165
		EU.Malta	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	2	2	2	1
		EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	2	0	5	41	14	3	0	56	22	0	0	0	2
		Japan	0	0	0	0	0	0	0	0	5	7	1	1	0	0	0	0	0	1	1	2	0	0	2	0	**0**
Discards	ATN	U.S.A.	0	526	421	480	741	772	184	1136	572	618	704	180	192	100	137	106	68	0	65	66	45	54	130	103	164
		UK.Bermuda	0	0	0	0	0	0	0	0	0	3	1	0	0	8	0	0	0	0	0	0	0	0	0	0	0
Discards	ATS	Brasil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	14	0	
		U.S.A.	0	0	0	0	0	0	0	0	0	0	7	5	4	1	0	0	0	0	0	0	0	0	0	0	

POR-Table 1. Estimated catches (t) of porbeagle (Lamna nasus) by area, gear and flag. (v02, 2011-09-30).

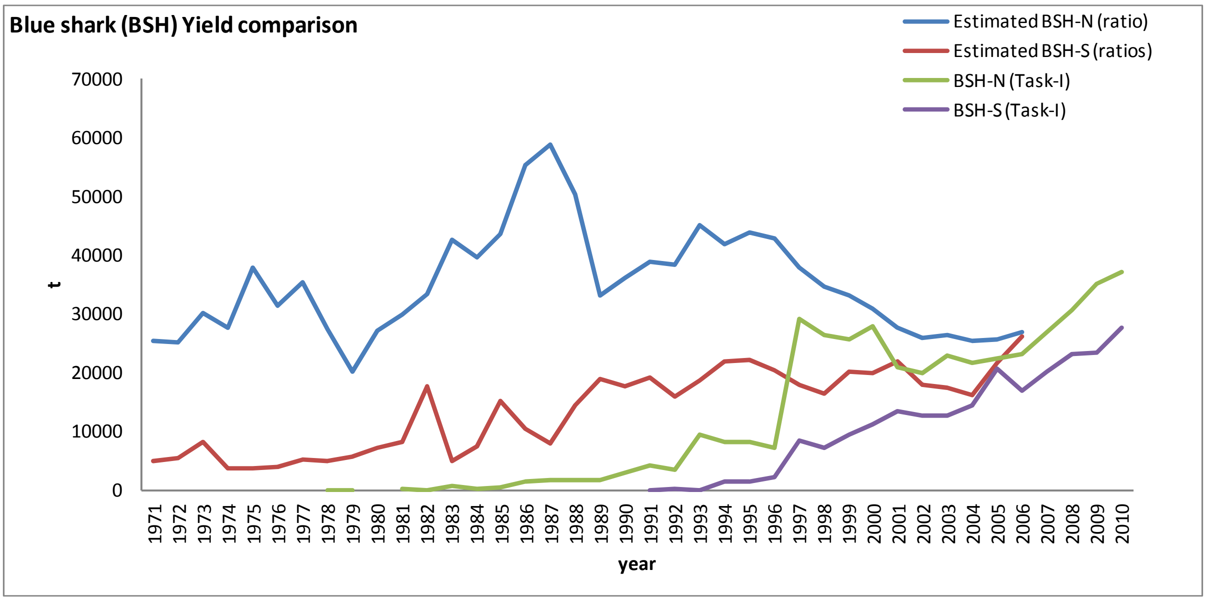
			1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
TOTAL			732	844	1025	1013	1309	1990	2603	1910	2729	2140	1560	1859	1469	1403	1469	999	848	648	745	571	507	515	600	475	134
	ATN		732	844	1024	1013	1309	1990	2603	1909	2726	2136	1556	1833	1451	1393	1457	998	838	604	725	539	470	502	513	412	120
	ATS		0	0	1	0	0	0	0	1	2	3	3	26	17	10	11	1	11	43	17	31	37	13	85	62	14
	MED		0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	3	2	1	0	2	1	1
Landings	ATN	All gears	732	844	1024	1013	1309	1990	2601	1909	2725	2136	1556	1833	1451	1393	1457	998	838	604	725	539	470	502	512	412	117
	ATS		0	0	1	0	0	0	0	1	2	3	3	26	16	9	11	1	11	43	17	31	37	13	85	62	14
	MED		0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	3	2	1	0	2	1	1
Discards	ATN		0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	ATS		0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	
Landings	ATN	Canada	24	59	83	73	78	329	813	919	1575	1353	1051	1334	1070	965	902	499	237	142	232	202	192	93	124	62	83
		EU.Denmark	114	56	33	33	46	85	80	91	93	86	72	69	85	107	73	76	42	0	0	0	0	0	0	0	0
		EU.España	26	30	69	42	26	47	15	21	52	19	41	25	25	18	13	24	54	27	11	14	34	8	41	77	
		EU.France	260	280	446	341	551	300	496	633	820	565	267	315	219	240	410	361	461	303	413	276	194	354	311	228	
		EU.Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	1	3	0	0	0	0	0	0	0	
		EU.Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	8	2	6	3	11	18	0	4	8	7	3	0
		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	
		EU.Portugal	0	3	3	2	2	1	0	0	0	0	0	0	0	0	7	4	10	101	50	14	6	0	3	17	7
		EU.Sweden	8	5	3	3	2	2	4	3	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
		EU.United Kingdom	6	3	3	15	9	0	0	0	0	0	0	0	1	6	8	12	10	0	0	24	11	26	15	11	0
		Faroe Islands	270	381	373	477	550	1189	1149	165	48	44	8	9	7	10	0	0	0	0	0	0	0	0	0	0	
		Iceland	0	0	0	0	0	0	1	3	4	6	5	3	4	2	2	3	2	1	1	0	1	0	1	0	1
		Japan	0	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	12	10	13	13
		Norway	24	25	11	25	43	32	41	24	24	26	28	17	27	32	22	11	14	19	0	8	27	0	0	0	12
		U.S.A.	0	1	0	2	2	5	1	50	106	35	78	56	13	3	1	1	1	0	1	0	0	0	1	1	1
	ATS	Benin	0	0	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	
		Chile	0	0	0	0	0	0	0	0	1	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	
		EU.España	0	0	0	0	0	0	0	0	0	0	0	2	2	2	7	1	2	9	4	0	3	5	4	13	
		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	
		EU.Poland	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	
		Falklands	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
		Guinea Ecuatorial	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	1	0	0	0	0	1	0	0	3	14	0	1	0	0	0	0	0	0	0	5	41	34	8
		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	
		Uruguay	0	0	0	0	0	0	0	0	0	3	0	5	13	2	4	0	8	34	8	28	34	3	40	14	6
	MED	EU.Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	2	0	0
		EU.Malta	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	1	0	0	0	1	0
Discards	ATN	U.S.A.	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	ATS	Uruguay	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	

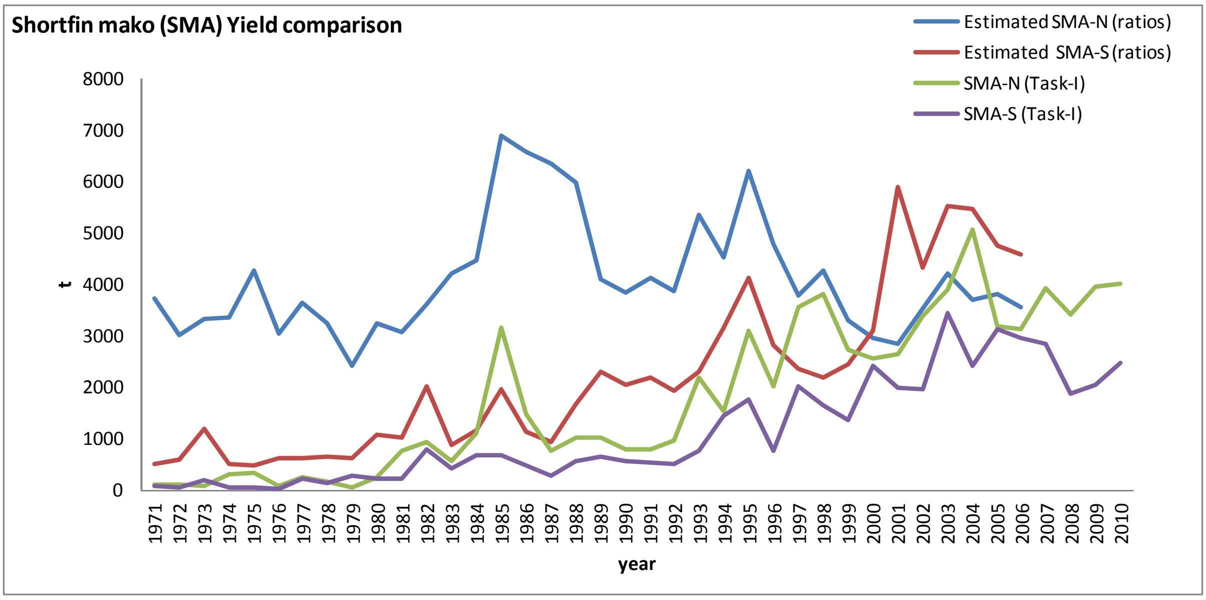
SMA-Table 1. Estimated catches (t) of Shortfin mako (Isurus oxyrinchus) by area, gear and flag. (v02, Oct 1 2011 2:15PM).

			1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
TOTAL			1951	1028	1562	1648	1349	1326	1446	2966	2972	4870	2778	5570	5477	4097	4994	4654	5361	7324	7487	6336	6073	6753	5284	5987	6500
	ATN		1481	766	1014	1011	785	797	953	2193	1526	3109	2019	3545	3816	2738	2568	2651	3395	3895	5063	3190	3113	3917	3403	3947	4016
	ATS		471	262	548	637	564	529	493	773	1446	1761	759	2019	1652	1355	2422	1996	1964	3426	2423	3130	2951	2834	1880	2039	2482
	MED		0	0	0	0	0	0	0	0	0	0	0	6	8	5	4	7	2	2	2	17	10	2	1	1	2
Landings	ATN	Longline	184	295	214	321	497	573	660	1499	1173	1633	1770	3369	3648	2645	2254	2424	3129	3792	4755	3172	3105	3901	3367	3552	3548
		Other surf.	1297	462	795	681	278	213	254	670	331	1447	248	177	168	91	313	227	266	104	308	18	8	10	27	375	459
	ATS	Longline	471	262	548	637	564	519	480	763	1426	1748	744	1997	1642	1345	2413	1979	1949	3395	2347	3116	2907	2792	1798	2032	2482
		Other surf.	0	0	0	0	0	9	13	10	20	13	15	23	10	10	9	18	15	31	76	14	43	30	82	7	1
	MED	Longline	0	0	0	0	0	0	0	0	0	0	0	6	8	5	4	7	2	2	2	17	10	2	1	1	2
		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	
Discards	ATN	Longline	0	9	5	9	10	11	38	24	21	29	1	0	0	0	0	0	0	0	0	0	0	7	9	20	9
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0
	ATS	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	
Landings	ATN	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	28
		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	
		Canada	0	0	0	0	0	0	0	0	0	111	67	110	69	70	78	69	78	73	80	91	71	72	43	53	41
		China P.R.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81	16	19	29
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	84	57	19	30	25	23	12	15
		EU.España	0	0	0	0	0	0	0	0	0	0	0	2416	2199	2051	1566	1684	2047	2068	3404	1751	1918	1816	1895	2216	2091
		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	15	2
		EU.Portugal	0	0	0	0	193	314	220	796	649	657	691	354	307	327	318	378	415	1249	473	1109	951	1540	1033	1169	1432
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	2	1	1	1	0	0	0	1	15	0
		FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	4
		Japan	120	218	113	207	221	157	318	425	214	592	790	258	892	120	138	105	438	267	572	0	0	82	131	98	117
		Mexico	0	0	0	0	0	0	0	0	0	10	0	0	0	0	10	16	0	10	6	9	5	8	6	7	8
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	49	33	39	
		Philippines	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	
		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	17	21	
		St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	3	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	0	0	0	0	0	0	0	0	0
		Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	3	1	2	1	1	1	1	1
		U.S.A.	1361	540	896	795	360	315	376	948	642	1710	469	407	347	159	454	395	415	142	411	187	130	216	188	202	217
		UK.Bermuda	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
		Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	20	6	11	2	35	22
	ATS	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	0	17	2	0	32
		Brasil	0	0	0	0	0	0	0	0	0	0	83	190	0	27	219	409	226	283	238	426	210	145	203	99	128
		China P.R.	0	0	0	0	0	0	0	34	45	23	27	19	74	126	305	22	208	260	0	0	0	77	6	24	32
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	626	121	128	138	211	124	123	146
		Côte D'Ivoire	0	0	0	0	0	9	13	10	20	13	15	23	10	10	9	15	15	30	15	14	16	25	0	5	7
		EU.España	0	0	0	0	0	0	0	0	0	0	0	1356	1141	861	1200	1235	811	1158	703	584	664	654	628	939	1192
		EU.Portugal	0	0	0	0	0	0	0	0	0	92	94	165	116	119	388	140	56	625	13	242	493	375	321	502	336
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	11	
		Japan	428	234	525	618	538	506	460	701	1369	1617	514	244	267	151	264	56	133	118	398	0	0	72	115	108	107
		Korea 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	29
		Namibia	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	459	0	509	1415	1243	1002	295	23	307
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	24	1	0	0	0	0	0	0	0	10	0	
		Philippines	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	
		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	
		South Africa	0	0	0	0	0	0	0	0	0	0	0	0	19	13	0	79	19	138	126	125	99	208	136	100	144
		U.S.A.	0	0	0	0	0	0	0	0	0	0	0	2	1	0	2	0	0	0	0	0	0	0	0	0	
		Uruguay	43	28	23	19	26	13	20	28	12	17	26	20	23	21	35	40	38	188	249	146	68	36	41	106	23
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52	12	13	1	0	0	
	MED	EU.Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
		EU.España	0	0	0	0	0	0	0	0	0	0	0	6	7	5	3	2	2	2	2	2	4	1	0	0	1
		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	
		EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	5	0	0	0	15	5	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	0	0	
Discards	ATN	Mexico	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		U.S.A.	0	9	5	9	10	11	38	24	21	28	1	0	0	0	0	0	0	0	0	0	0	7	10	20	9
		UK.Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	
	ATS	Brasil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	

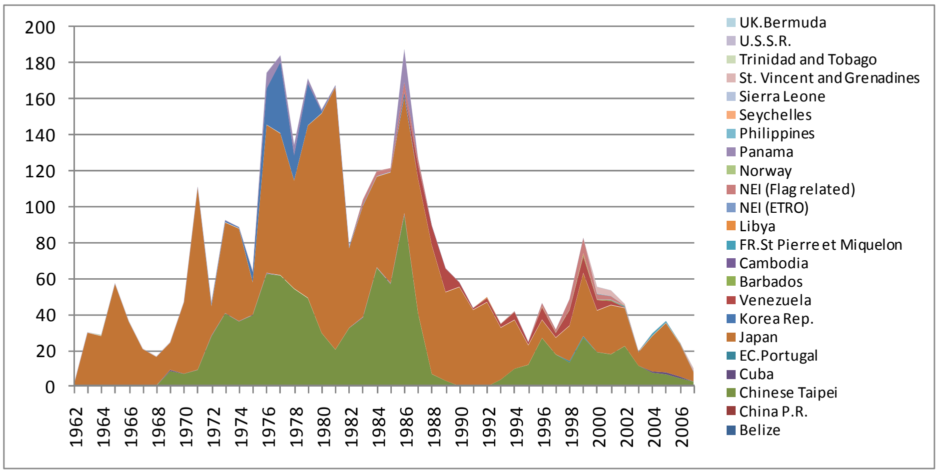
SHK-Table 2. Productivity values ranked from lowest to highest.

Species	*Productivity (r)*	*Productivity rank*
BTH (*Alopias superciliosus*)	0.010	1
SMA (*Isurus oxyrinchus*)	0.014	2
LMA (*Isurus paucus*)	0.014	3
POR (*Lamna nasus*)	0.053	4
FAL (*Carcharhinus falciformis*)	0.076	6
OCS (*Carcharhinus longimanus*)	0.087	7
SPL (*Sphyrna lewini*)	0.090	8
SPZ (*Sphyrna zygaena*)	0.124	9
ALV (*Alopias vulpinus*)	0.141	10
PST (*Pteroplatytrygon violacea*)	0.169	11
BSH (*Prionace glauca*)	0.301	12
CRO (*Pseudocarcharias kamoharai*)	-	-

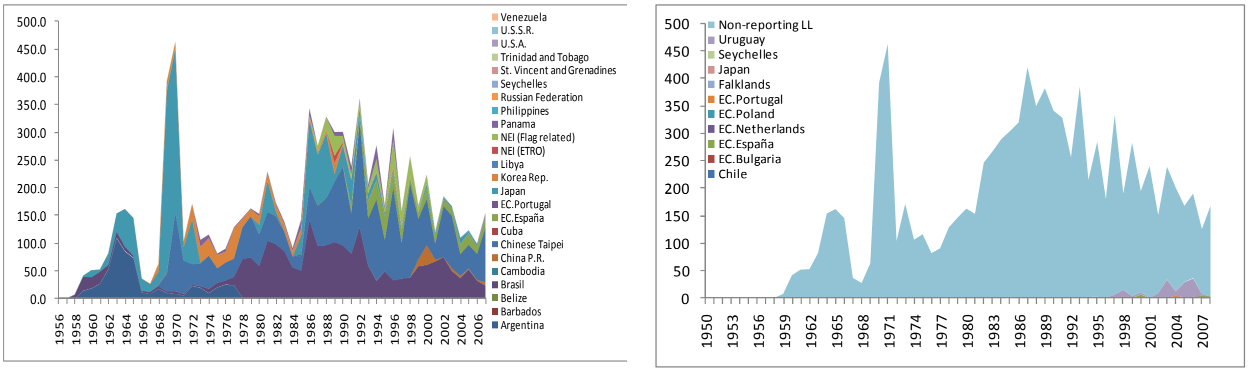




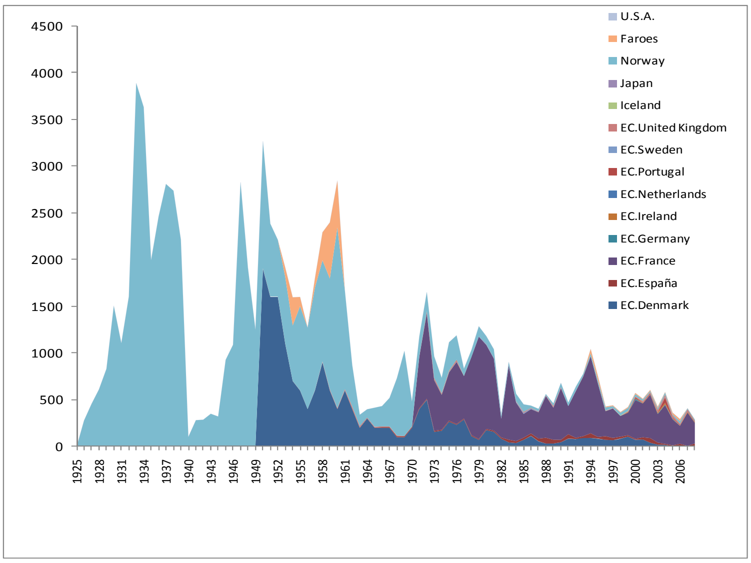
SHK-Figure 1. Blue shark (BSH) and shortfin mako (SMA) catches reported to ICCAT (Task-I) and estimated by the Committee.



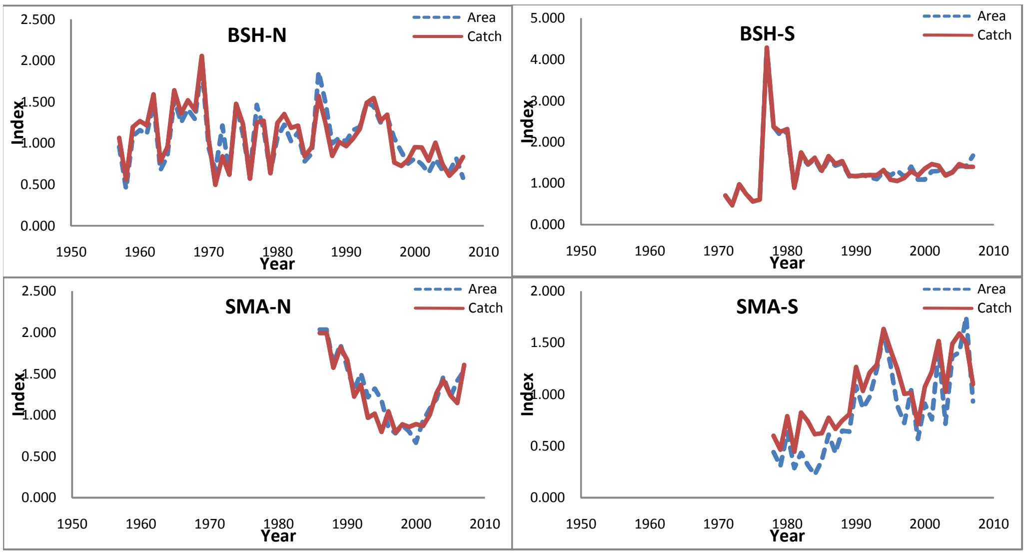
SHK-Figure 2. Potential catch of porbeagle by non-reporting longline fleets using catch ratios for the NW stock. Limited observations across the time-series result in an unquantified uncertainty in the estimates.



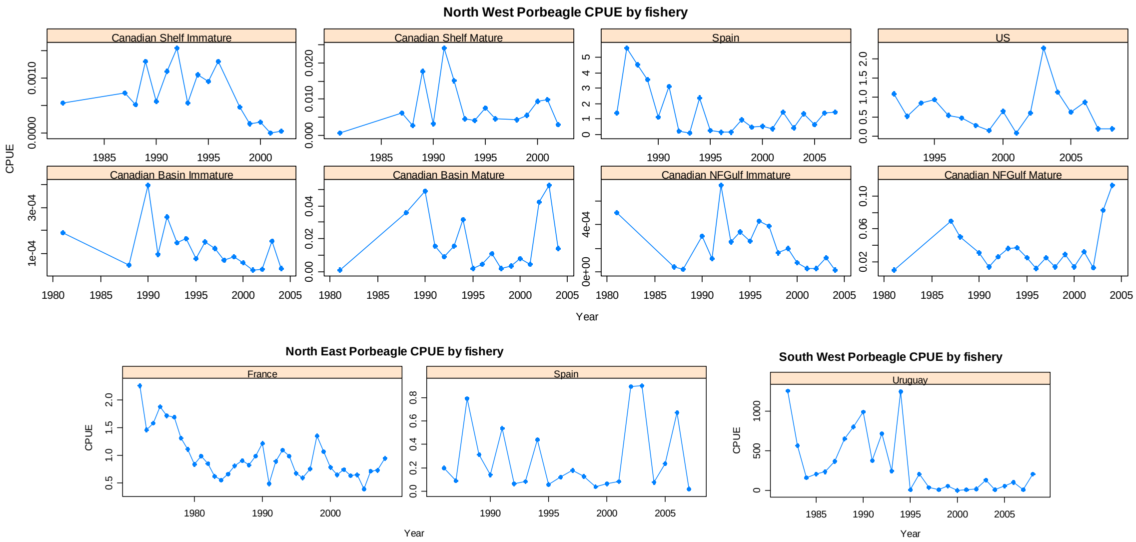
SHK Figure 3. Left plate: Estimated catch of porbeagle by non-reporting longline fleets using catch ratios for the SW stock. Very limited observations across the time-series result in a high but unquantified uncertainty in the estimates. Right plate: Comparison of estimates for non-reporting longline fleets with reported catch levels held in the Task I data set for the SW stock area.



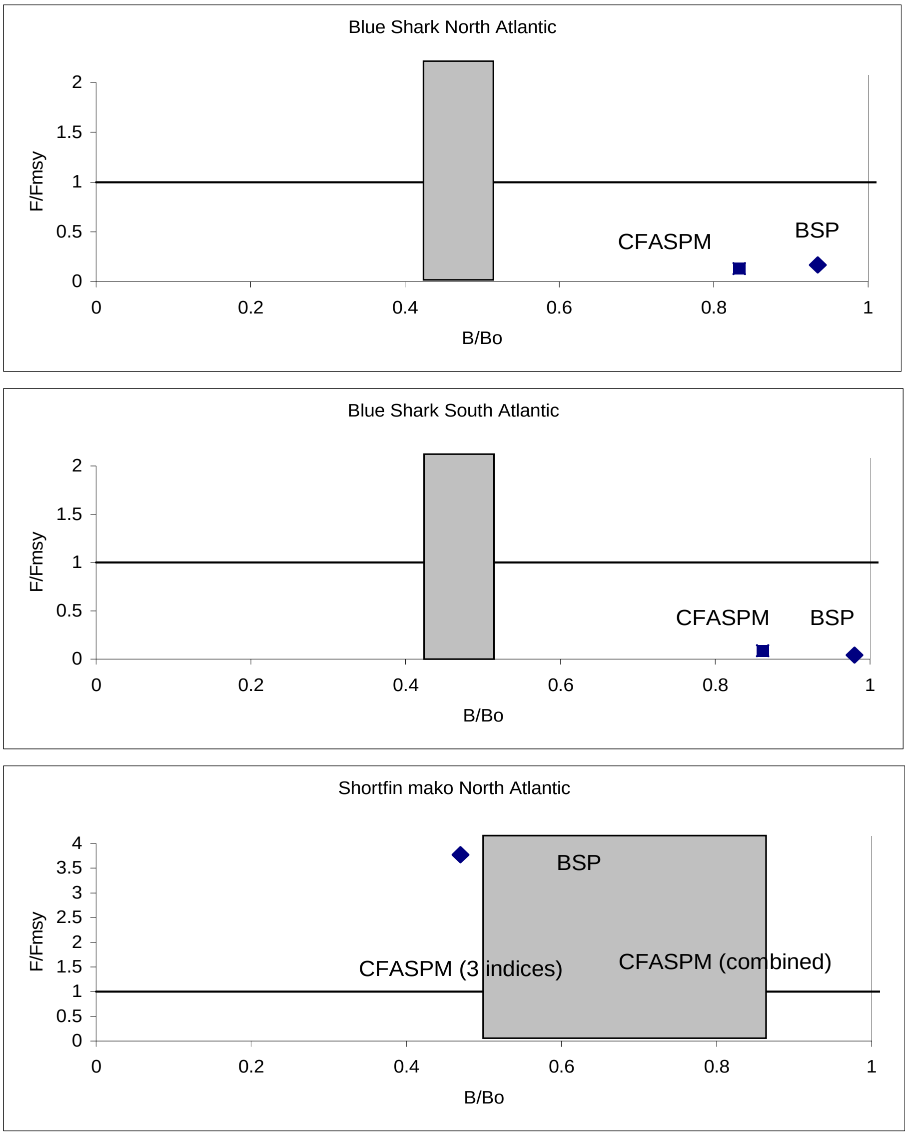
SHK Figure 4. Catch by flag of porbeagle sharks from the northeastern Atlantic used in the assessment. While these catches are considered the best available,, they are believed to underestimate the pelagic longline catches for this species.



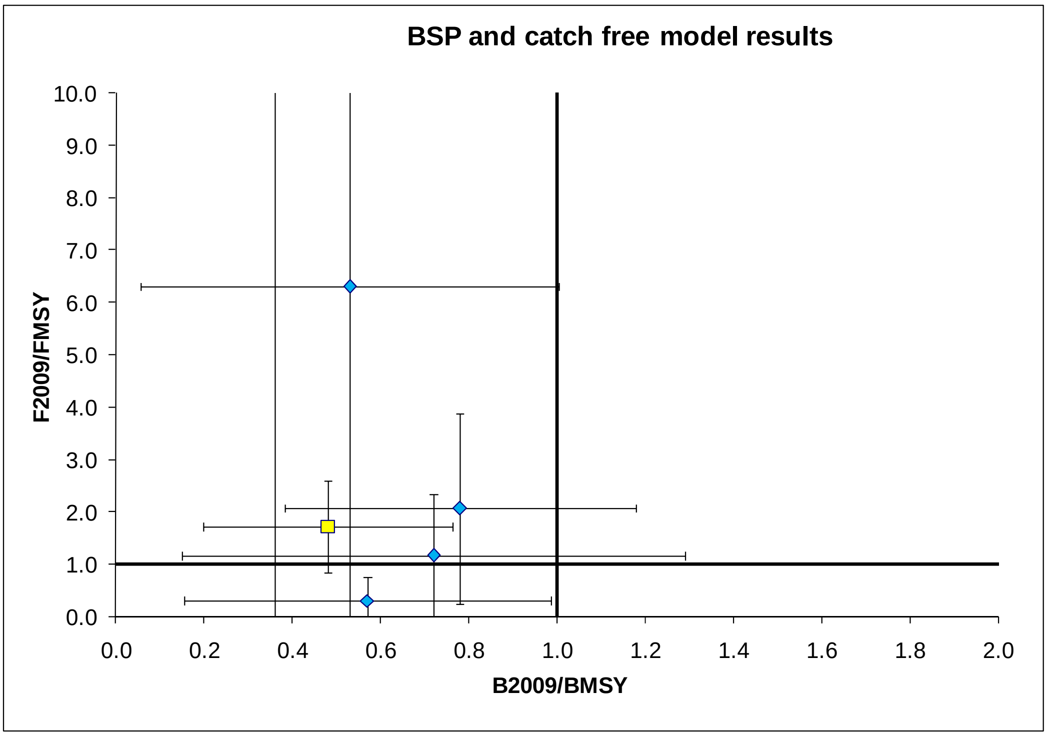
SHK-Figure 5. Average trends in the CPUE series used in the assessments of blue shark (BSH) and shortfin mako (SMA). The averages were calculated by weighting the available series either by their relative catch or by the relative spatial coverage of the respective fisheries.



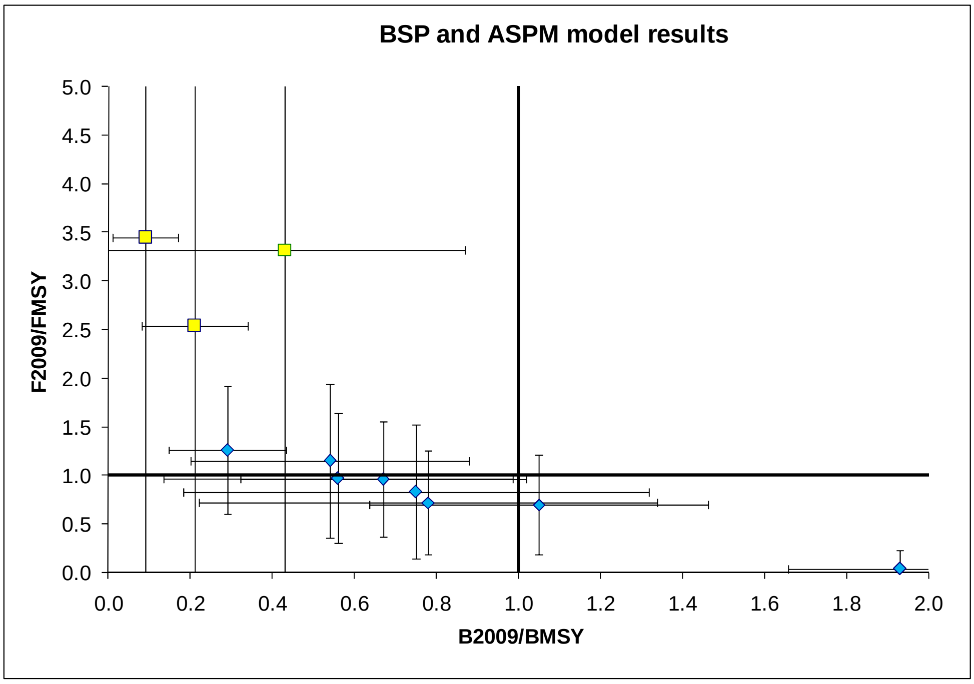
SHK-Figure 6. CPUE series for the porbeagle NW stock (upper figures), NE stock (lower left figures) and SW stock (lower right figure).



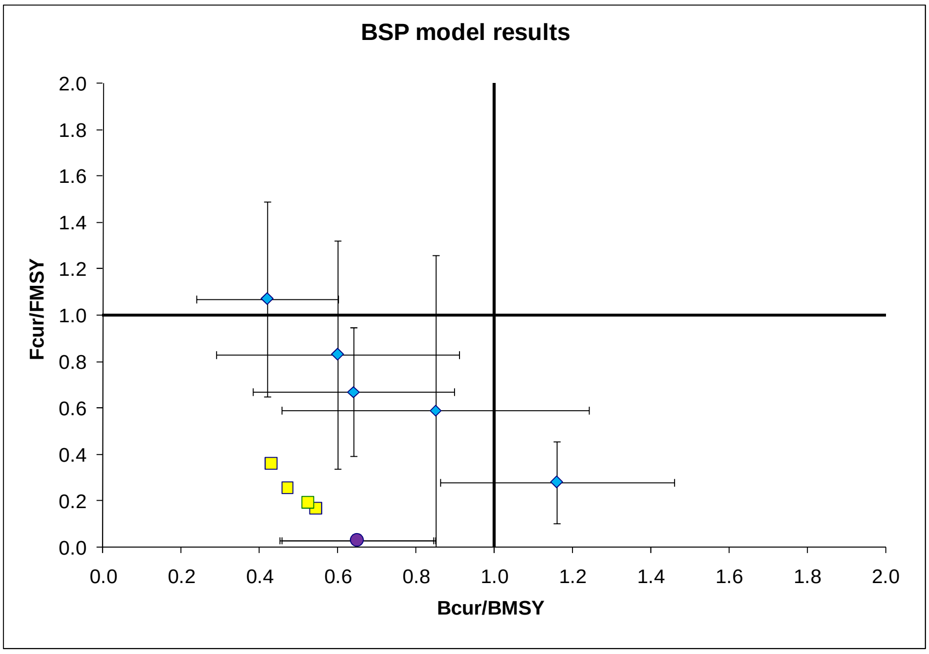
SHK-Figure 7. Phase plots summarizing base scenario outputs for the current stock status of blue shark (BSH) and shortfin mako (SMA). BSP=Bayesian surplus production model; CFASPM=catch-free, age-structured production model. The shaded box represents the area at which the biomass at MSY is estimated to be reached. Any points inside or to the left of the box indicate the stock is overfished (with respect to biomass). Any points above the horizontal line indicate overfishing (with respect to F) is occurring.



SHK-Figure 8. Phase plot for the southwest Atlantic porbeagle, showing status in 2009 from both the BSP model runs (diamonds) and the catch free age structured production model (square) results. Error bars are plus and minus one standard deviation.



SHK-Figure 9. Phase plot showing current status of northeast Atlantic porbeagle for the BSP model (diamonds) and the ASPM model (squares). Error bars are plus and minus one standard deviation.



SHK-Figure 10. Phase plot showing the northwest Atlantic porbeagle expected value of B/B_{MSY} and F/F_{MSY} in the current year, which is either 2005 (diamonds) or 2009 (circles), as well as approximate values from Campana *et al.* (2010) (squares). B/B_{MSY} was approximated from Campana *et al.* (2010) as N2009/N1961 times 2. Error bars are plus and minus one standard deviation.