

SCIENTIFIC ESTIMATIONS OF BY-CATCH LANDED BY THE SPANISH SURFACE LONGLINE FLEET TARGETING SWORDFISH (*XIPHIAS GLADIUS*) IN THE ATLANTIC OCEAN: 2000 -2004 PERIOD

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SUMMARY

*This paper presents data on the by-catch species landed by the Spanish surface longline fleet targeting swordfish (*Xiphias gladius*) in the Atlantic Ocean and preliminary data of Mediterranean, between 2000 and 2004. The species assumed as by-catches amounted to 75.3% of the total landings in weight from the Atlantic areas, large pelagic sharks to 70.3%, tunas to 3.2, billfish to 1.1%, and other species to 0.6%. As far as by-catch species are concerned, large pelagic sharks were the most prevalent ones with an average of 93.2% of the catch in weight, whereas tunas amounted to 4.3%, billfish to 1.6% and other species to 0.9%. The three most prevalent species in the catch, *Xiphias gladius*, *Prionace glauca* and *Isurus oxyrinchus*, represented, on average, 92.8% of the total landings in weight during this period. *Prionace glauca* and *Isurus oxyrinchus* are the most prevalent species within the group of large pelagic sharks, reaching prevalences of 86.3% and 10.5%, respectively, which is very similar to levels observed in other oceans.*

RÉSUMÉ

*Ce document présente l'information sur les débarquements d'espèces accessoires réalisés par la flottille espagnole de palangre de surface qui capture de l'espadon (*Xiphias gladius*) dans l'océan Atlantique, ainsi que les données préliminaires de la Méditerranée, entre les années 2000 et 2004. L'ensemble des espèces considérées comme accessoires ont représenté, pendant cette période pour l'océan Atlantique, 75,3% du total des débarquements en poids (espèces cibles plus accessoires), les grands requins pélagiques 70,3%, les thonidés 3,2%, les istiophoridés 1,1% et les autres espèces 0,6%. Ne tenant compte que des espèces considérées comme accessoires dans l'Atlantique, les grands requins pélagiques ont été les espèces prédominantes avec 93,2% des captures en poids, les thonidés représentant 4,3%, les istiophoridés 1,6% et les autres espèces 0,9%. Les trois espèces dominantes dans les captures, le *Xiphias gladius*, le *Prionace glauca* et l'*Isurus oxyrinchus* ont représenté ensemble 92,8% des débarquements totaux réalisés pendant cette période dans l'océan Atlantique. Au sein du groupe des grands requins pélagiques, le *Prionace glauca* et l'*Isurus oxyrinchus* sont les espèces prédominantes dans l'Atlantique, avec des niveaux de 86,3% et 10,5% respectivement, niveaux très similaires à ceux observés dans d'autres océans.*

RESUMEN

*En este documento se presenta información sobre desembarcos de especies by-catch realizados por la flota española de palangre de superficie que captura pez espada (*Xiphias gladius*) en el océano Atlántico y datos preliminares del Mediterráneo, entre los años 2000 y 2004. El conjunto de especies consideradas como by-catch supusieron durante este periodo para el océano Atlántico el 75,3% del total de los desembarcos en peso (especie objetivo más by-catch), grandes tiburones pelágicos 70,3%, túnidos 3,2%, billfishes 1,1% y otras especies 0,6%. Considerando sólo las especies asumidas como by-catch en el Atlántico, los grandes tiburones pelágicos fueron las especies más prevalentes con el 93,2% de las capturas en peso, los túnidos el 4,3%, los billfish el 1,6% y otras especies el 0,9%. Las tres especies más prevalentes en las capturas, *Xiphias gladius*, *Prionace glauca* e *Isurus oxyrinchus* representaron en conjunto sobre el 92,8% de los desembarcos totales realizados en este periodo en el océano Atlántico. Dentro del grupo de los grandes tiburones pelágicos *Prionace glauca* e *Isurus oxyrinchus* son las especies más prevalentes en el Atlántico, con niveles del 86,3% y 10,5%, respectivamente, niveles muy similares a los observados en otros océanos.*

KEYWORDS

By-catch, Sharks, Surface longline, Statistics

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1 Introduction

The Spanish surface longline fleet has been historically targeting swordfish *Xiphias gladius* (SWO) in the Atlantic areas, although other species are also caught simultaneously, mostly large pelagic sharks and to a lesser extent, tunas, billfish, etc., as in other oceans (García-Cortés & Mejuto 2000, 2001, 2002, Mejuto *et al.* 2000, 2002a, 2002b, 2003).

The amount of landed pelagic sharks has been increasing in the last decades for many fleets-gears in all oceans, although historical catches were probably high since the middle of the last century. This is due to their high relative abundance in number and biomass in most oceans and fishing areas, the disappearance or drastic reduction of discards of these species in many fleets which used to be numerous in the past (Mejuto & González-Garcés 1984, Mejuto 1985), the improvements in the conservation systems onboard in recent decades and the upward trend of the price of these species and its derivative products in international markets (Mejuto & García-Cortés 2004). Therefore, these species, which have been intensively caught for many decades, are now present in international markets of their bodies, fins and other derivatives. Recent changes have been observed in the Spanish fleet operating in the Atlantic Ocean, as the target of the fishing effort has been modified. As a result, the so-called bycatch, more precisely the blue shark *Prionace glauca*, has become a second target species for some sets, trips and areas, affecting to the fishing strategies and the CPUE indicators (Mejuto & de la Sem, 2000). Since the development of the oceanic longline in the middle of the past century, the elevated prevalence of blue shark is well known in the oceanic epipelagic layers of almost all oceans in the world. This species is mostly found at least between 55°N and 50°S and it has been caught historically with ancestral gears and more actively since off-shore fishing began. The prevalence of the blue shark over other species of elasmobranchs and teleosts is probably due to their advantageous reproductive strategy, provided with an elevated renewal rate and taking advantage of the mean value of around 37 embryos per litter, with even larger litter related to the larger female size (Castro & Mejuto 1995, Mejuto & García-Cortés 2005a). As a result, this species is much more prevalent than other large pelagic elasmobranchs and teleosts (Castro *et al.* 2000, ROSE & McLoughlin 2001).

The fishing gear used by the Spanish surface longline vessels from the beginning of their activity in the Atlantic until the end of the 1990' was the "traditional Spanish longline", equipped with plurifilament main line and clips. However since then, the monofilament "American style" -Florida style modified- (Ward & Elscot 2000) longline gear was introduced in most of the Spanish fleet operating in the Atlantic Ocean, with a mean of 1100-1500 hooks per set.

It is well known that in distant fleets all over the world it is not easy in some cases to correctly identify all the bycatch species, especially when they present a certain taxonomic difficulty and /or have a low price at the markets and/or have the same price per unit of weight and/or use the same local name. For this reason, we must be precautious when considering landing data related to low-prevalence or low-priced bycatch species. The same applies to fishing gears, other than longline targeting tuna, which could provide confusing or underestimated specific identifications in landings or logbooks.

The objective of this paper is to analyze and update the historical series of bycatch scientific data of the Spanish surface longline fishery operating in the Atlantic Ocean provided previously, which included information until year 1999 for pelagic sharks (Mejuto *et al.* 2002a) and until 2000 for other species (García-Cortés & Mejuto 2002, Mejuto *et al.* 2002b). Besides, the objective is to know, to the most specific taxonomic level possible, the bycatch associated to this fishery and to define the relative global prevalence among species, which might lead us to determine the consistency of the estimations over the years and might be useful to compare data from other fleet operating with similar fishing strategies.

2 Material and Methods

The information provided on this paper is based on declarations of landings per trip, interviews with skippers at the ports and information filled out voluntarily by the fleet, among other sources, obtained between 2000 and 2004, in addition to information provided by the scientific observers on board commercial vessels during regular fishing activities targeting swordfish and daily sampling in ports. Observations at sea were carried out on 12 longliners during 18 long trips with a coverage of 1069 sets.

For descriptive purposes, the species related to large pelagic sharks were classified into group SHK, which is made up mainly of specimens of family Carcharhinidae (fundamentally *Prionace glauca*: PGO), followed by the family Lamnidae (mainly *Isurus oxyrinchus*: IOO), Sphyrnidae and finally, Alopiidae. The group TUN includes different tuna species among which *Thunnus obesus* (BET), *Thunnus alalunga* (ALB) and *Thunnus albacares* (YFT) are the most important. The group of billfish was labelled as BIL and includes species from the family Istiophoridae. The

group OTH includes several species, which have not been identified in certain cases (generally with low commercial value) or which have been identified in terms of species but whose catch is very rare (**Table 1**).

The breakdown into species of the most prevalent bycatch landed, such as PGO and IOO, was mainly performed based on the information provided by the own fleet in their voluntary scientific reports and the sampling in ports, since their taxonomic identification is normally easy, reliable and usual. However, the identification at the level of other species belonging into some groups such SHK, BIL, OTH and TUN was fundamentally based on the information provided by on-board observers who have a limited spatial-temporal coverage and sampling in ports. Due to the wide geographic areas of Spanish vessels in the Atlantic ocean, it was not very reliable to achieve a satisfactory breakdown into species of the landings in certain cases. Consequently, the reported landings of combined species with low prevalence could be in some cases assigned or allocated to a single species. The data from year 2000 was carry over from previous papers (García-Cortés & Mejuto 2002, Mejuto *et al.* 2002b) where the prevalence composition among species had been taken from the 1999 data because its larger coverage and consistence. So, data from year 2000 should be reviewed in the near future to upgrade the time series.

The data were geographically compiled and set down in 5°x5° squares-month, raised by spatial-temporal strata according to the methodology described for distant longline fleets (MIYAKE 1990) and later combined into BIL areas. Data from the Mediterranean areas are also included in this paper, however these data from the most recent years are preliminary and incomplete and because of this they were not included in the final comparative analyses and descriptions.

The records that were originally based on dressed weight were converted, where necessary, to units of round weight (RW) by applying different conversion factors according to the species or group of species, depending on the manipulation process applied to the fish on board. Conversion factors were defined for different species and presentations: *Prionace glauca* (PGO): Round weight (RW)= Dressed weight (DW) * 2.4074. Others species of Carcharhinidae: Round weight (RW) = Dressed weight (DW) * 2. *Isurus oxyrinchus* (IOO): Round weight (RW) = Dressed weight (DW) * 1.4541. The other pelagic sharks (other SHK): Round weight (RW) = Dressed weight (DW) * 1.4. All species included in the group of billfish (BIL): Round weight (RW) = Dressed weight (DW) * 1.2. The conversion factors applied to each species within the group of tuna (TUN) were: Round weight (RW) = Gutted weight (GW) * 1.1 and Round weight (RW)= Dressed weight (DW) * 1.25.

3 Results and Discussion

The group including the three most prevalent species in the catch, which are also those of highest commercial interest for human consumption (SWO+PGO+IOO), represent 92.8% of the total landings in the Atlantic Ocean. This level is very similar to that observed in the regions of SE Pacific and the Indian where the rates are estimates to be around 91% and 90% , respectively (Mejuto & García-Cortés 2005b, García-Cortés & Mejuto *in press*). The group of species considered as bycatch of the swordfish (*Xiphias gladius*) surface longline fishery in the Atlantic Ocean accounted for 75.3 % of the total catch landed in weight between 2000 and 2004 (**Table 2**). This percentage is similar than those previously observed for the Atlantic Ocean (Castro *et al.* 2000, Mejuto *et al.* 2002a) and it was expected in view of some activities targeting PGO carried out in certain areas of the Atlantic.

Between 2000 and 2004 the bycatch was mainly large pelagic sharks (SHK), of which 28,692 t/yr were landed on average. This accounts for 70.3% in weight of the total catch landed for all the species combined. The average landing of the tuna group (TUN) was 1,293 t/yr, which accounted a mean value of 3.2% in weight of the total catch landed. The volume of billfish (BIL) amounted to 1.2% of the total landed catch, reaching 480 t/yr on average. Finally, the group of species with the lowest economic value (OTH) represented around 0.6% of the total yearly catch, with landings reaching 263 t /yr on average (**Figure 1**).

The volume of landings in weight per group of species in relation to the assumed as bycatch as a whole (excluding the swordfish) amounted to 93.4 % for the SHK group, 4.3% for the TUN group, 1.6% for the BIL group and 0.9% for the OTH group (**Table 3, Figure 2**). As expected, the amount of SHK was much more prevalent as compared to the other groups. Similar results were provided for the SHK group representing between 95% and 99% of the bycatch, depending on the year of observation (Castro *et al.* 2000, Mejuto *et al.* 2002a). **Table 4** shows the total landings in weight per species by ICCAT BIL areas for 2000-2004 period.

The bycatch analyzed during this period was made up fundamentally of PGO, with an average landing of 81.0%, followed by the IOO with 9.5%. The average figures for the other SHK were lower than 1.7%. As far as the species of the TUN group are concerned, BET and ALB must be pointed out, with 1.9% and 1.7% of the total landed bycatch, respectively, as well as YFT reaching 0.5%. The volume of landed species of the BIL group always remained below 1.2% of the total bycatch. It must be noted that the percentage in weight obtained in the OTH group by the species *Lepidocibium flavobrunneum* represented 0.7% of the total bycatch landed.

Within the SHK group, the PGO species accounted most of the average catches (86.8%), followed by IOO (10.1%). These rates or prevalence among both species are almost mimetic to those observed for the Spanish surface longliners in other oceans. The prevalence of PGO is clearly predominant and remarkably higher as compared to the group of other bycatch species and, of course, into the SHK group. Within the TUN group, the species BET and ALB represented 43.1% and 40.2%, respectively. In the BIL group, 71.6% was identified as *Istiophorus platypterus*, 13.1% as *Tetrapturus albidus* and 10.7% as *Makaira nigricans*. However, the very high prevalence of the sail fish could be overestimated. The sail fish can be easier identify by the skippers that other BIL species and specifically recorded. This praxis could become in larger catch estimation after the raising and substitution procedures. Within the group of OTH, the 76.1% was represented by the species *Lepidocibium flavobrunneum*, very frequent in all oceans observed.

The prevalences observed among species for the 2000-2004 period are generally similar to those previously reported for the Spanish fleet in the Atlantic Ocean (Mejuto *et al* 2002a, 2002b, García-Cortés & Mejuto 2002). In some cases, the prevalence among species is almost mimetic to those found in other oceans.

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Table 1. List of species codes and their scientific names.

CODE	SCIENT. NAME
ACO	<i>Acantocibium solandri</i>
ALB	<i>Thunnus alalunga</i>
ALO	<i>Alopias spp.</i>
ASO	<i>Alopias superciliosus</i>
AVO	<i>Alopias vulpinus</i>
BET	<i>Thunnus obesus</i>
BFT	<i>Thunnus thynnus</i>
BIL	<i>Billfishes</i>
BKO	<i>Gasterochisma melampus</i>
BLM	<i>Makaira indica</i>
BLZ	<i>Makaira mazara</i>
BRO	<i>Brama spp.</i>
BUM	<i>Makaira nigricans</i>
CAO	<i>Carcharhinus spp.</i>
CBO	<i>Carcharhinus limbatus</i>
CFO	<i>Carcharhinus falciformis</i>
CGO	<i>Carcharhinus galapagensis</i>
CHO	<i>Coriphaena hipurus</i>
CLO	<i>Carcharhinus longimanus</i>
COO	<i>Carcharhinus obscurus</i>
CSO	<i>Carcharhinus signatus</i>
GCO	<i>Galeocerdo cuvier</i>
GGO	<i>Galeorhinus galeus</i>
IOO	<i>Isurus oxyrinchus</i>
IPO	<i>Isurus paucus</i>
LFO	<i>Lepidocibium flavobrunneum</i>
LGO	<i>Lampris guttatus</i>
LNO	<i>Lamna nasus</i>
LTA	<i>Euthynnus alletteratus</i>
MLS	<i>Tetrapturus audax</i>
MSP	<i>Tetrapturus belone</i>
OTH	<i>Other species</i>
PGO	<i>Prionace glauca</i>
PKO	<i>Pseudocarcharias kamoharai</i>
RPO	<i>Rubetus pretiosus</i>
SAO	<i>Istiophorus albicans</i>
SBO	<i>Sphyrna spp.</i>
SDO	<i>Seriola dumerili</i>
SHP	<i>Tetrapturus angustirostris</i>
SHK	<i>Sharks</i>
SKJ	<i>Katsuwonus pelamis</i>
SLO	<i>Sphyrna lewini</i>
SPF	<i>Tetrapturus pfluegeri</i>
SPO	<i>Sphyrna spp.</i>
SZO	<i>Sphyrna zygaena</i>
TLO	<i>Taractichthys longipinnis</i>
TUN	<i>Tuna spp.</i>
WHM	<i>Tetrapturus albidus</i>
YFT	<i>Thunnus albacares</i>

Table 2. Scientific estimation of landings (tons of round weight –RW-) of the target species (*Xiphias gladius*) vs. combined by-catch species, done by the Spanish surface longline fishery in the Atlantic Ocean during the 2000-2004 period.

YEAR	2000	2001	2002	2003	2004
SWO	10968,8	9755,9	9694,8	9111,6	10856,5
ByC	36709,6	30825,2	27401,6	28793,2	29914,2
TOTAL	47678,4	40581,1	37096,4	37904,8	40770,7
% ByC	77,0	76,0	73,9	76,0	73,4

Table 3. Scientific estimation of by-catch landings (kg of round weight –RW-) by group, done by the Spanish surface longline fishery in the Atlantic Ocean during the 2000-2004 period.

Year	Area	BIL	OTH	SHK	TUN	Tot. ByC
2000	North Atl.	147093	161714	26291763	418820	27019390
	South Atl.	264120	11983	8504222	909927	9690252
	<i>Tot ATL.</i>	<i>411213</i>	<i>173697</i>	<i>34795984</i>	<i>1328747</i>	<i>36709641</i>
	%	1,1	0,5	94,8	3,6	100
2001	North Atl.	165595	205078	19692747	410178	20473559
	South Atl.	245691	61263	9345519	699209	10351682
	<i>Tot ATL.</i>	<i>411286</i>	<i>266341</i>	<i>29038267</i>	<i>1109387</i>	<i>30825242</i>
	%	1,3	0,9	94,2	3,6	100
2002	North Atl.	177234	157203	18404006	423036	19161479
	South Atl.	525876	130188	6393637	1190414	8240115
	<i>Tot ATL.</i>	<i>703110</i>	<i>287391</i>	<i>24797643</i>	<i>1613450</i>	<i>27401594</i>
	%	2,6	1,0	90,5	5,9	100
2003	North Atl.	122026	150729	18557488	569426	19399669
	South Atl.	310364	73353	7976479	1033296	9393492
	<i>Tot ATL.</i>	<i>432390</i>	<i>224082</i>	<i>26533967</i>	<i>1602722</i>	<i>28793161</i>
	%	1,5	0,8	92,2	5,6	100
2004	North Atl.	183243	232811	20116947	421314	20954315
	South Atl.	261357	129905	8179541	389084	8959887
	<i>Tot ATL.</i>	<i>444600</i>	<i>362716</i>	<i>28296487,4</i>	<i>810398</i>	<i>29914201</i>
	%	1,5	1,2	94,6	2,7	100
Ave. %		1,6	0,9	93,2	4,3	100

Table 4. Scientific estimation of landings by species (kg of round weight –RW-) of the considered by-catch in the Spanish surface longline fishery by areas BIL, during 2000-2001 period.

Group	Year Species	2000	2000	2000	2000	2000	2001	2001	2001	2001	2001
		BIL94A	BIL94B	BIL95	BIL96	BIL97	BIL94A	BIL94B	BIL95	BIL96	BIL97
BIL	BLM	0	0	0	0	0	0	0	0	0	0
BIL	BLZ	0	0	0	0	0	0	0	0	0	0
BIL	BUM	17125	7478		77907	37565	3478	4290	0	11508	5874
BIL	MLS	0	0	0	0	0	1026	0	0	0	0
BIL	MSP	0	0	2266			0	0	1119	0	0
BIL	SAO	0	456		14397	7862	55908	64248	0	160998	49259
BIL	SHP	0	0	0	0	0	1430	0	0	0	0
BIL	SPF	2876	2629		46847	11340	2238	0	0	6326	5643
BIL	WHM	44459	72069	1438	60799	7405	10421	22554	85	6082	0
OTH	BRO		1078	5644	0	0	0	569	2891		
OTH	CHO	764	2391	6908	0	0	348	4119	15279	1184	0
OTH	LFO	60972	68494	0	2491	3564	88731	81539		20941	8966
OTH	LGO	96	930	0	0	0	302	2052	122		
OTH	GGO	0	0	0	0	0		39			
OTH	OTH	9918	13304	2921	1969	3917	6577	15248	917	16178	12924
OTH	RPO	427	1508	0	40	2	1035	729		0	
OTH	SBO	1403	419	0	0	0	1827	1628		800	233
OTH	SDO	0	0	221	0	0		154	297	22	
OTH	TLO	0	0	0	0	0	0	163	0	0	0
SHK	ALO	15975	22590	0	3740	6112	12348	57118		2553	0
SHK	ASO	6729	16416	0	0	0	26633	35351			0
SHK	AVO	2380	3086	4605	0	0	3410	16564	4467		560
SHK	CAO	44182	94675	0	42885	68705	19590	95243		34400	139773
SHK	CBO	0	0	0	0	0	0	27			
SHK	CFO	0	0	0	940	61	0	780		98	
SHK	CGO	0	0	0	0	0	0	0	0	0	0
SHK	CLO	0	24	0	1473	1040	129	3685		1166	1739
SHK	COO	0	0	0	0	0	0	0	0	0	0
SHK	CSO	0	0	0	0	0		25			
SHK	GCO	7664	533	0	191	0	3915	777		73	
SHK	IOO	784524	781063	2914	267729	932520	636721	1047749	1839	460589	774027
SHK	IPO	12332	3674	0	2570	1158	22173	15884		5183	8015
SHK	LNO	4737	8420	0	6938	0	2588	21522			505
SHK	PGO	14775957	9335960	30943	2756419	4194285	9403709	7958025	5606	3447996	4294588
SHK	PKO	0	0	0	0	0	22	23		0	0
SHK	SLO	0	0	0	0	0	74			131	
SHK	SPO	57353	311878	381	50146	163704	55128	248726		75901	93163
SHK	SZO	234	1376	0	843	2763	985	3784		2459	2600
TUN	ACO	115496	98293	1537	232042	49522	9465	0	0	11349	5175
TUN	ALB	41877	69852	0	455722	30307	106230	86215	3488	455037	90468
TUN	BET	0	3327	22444	0	0	59759	89733	48	55947	6545
TUN	BFT	0	3327	22444	0	0	0	3800	36508	0	0
TUN	BKO	0	0	0	0	0	0	0	0	1895	0
TUN	LTA	0	0	0	0	0	0	0	321	0	0
TUN	SKJ	45514	14192	77	775	654	0	4836	0	5838	5175
TUN	YFT	22714	7556	0	125264	15641	38893	11247	0	56234	5547

Table 4 (cont.). Scientific estimation of landings by species (kg of round weight –RW-) of the considered by-catch in the Spanish surface longline fishery by areas BIL, during 2002-2003 period.

Group	Year Species	2002 BIL94A	2002 BIL94B	2002 BIL95	2002 BIL96	2002 BIL97	2003 BIL94A	2003 BIL94B	2003 BIL95	2003 BIL96	2003 BIL97
BIL	BLM	0	0	0	0	0	2776	0	0	0	0
BIL	BLZ	0	0	0	0	0	0	0	0	0	5362
BIL	BUM	55	1229	0	2283	24845	4113	1538	0	6233	0
BIL	MLS	0	0	0	0	0	0	0	0	0	2340
BIL	MSP	0	0	1811	0	0	0	36	90	0	0
BIL	SAO	75031	96371	153	374124	113126	29520	60724	0	166935	122645
BIL	SHP	0	0	0	0	0	0	0	0	1606	0
BIL	SPF	87	444	0	4742	5275	4514	0	0	2073	0
BIL	WHM	0	4018	302	0	1481	7258	11548	0	1775	1395
OTH	BRO	0	49	1347	0	0	5	220	228	0	0
OTH	CHO	573	1827	884	1577	844	2908	3401	533	1228	914
OTH	LFO	59587	71149	0	45204	29488	73982	62204	78	27383	31879
OTH	LGO	150	1477	0	0	0	442	1565	40	0	0
OTH	GGO	0	16	0	0	0	0	0	0	0	0
OTH	OTH	6917	7577	175	36237	11735	2195	245	718	7326	190
OTH	RPO	812	477	0	214	0	916	386	0	364	46
OTH	SBO	5172	1404	0	3957	915	1838	405	0	2140	1880
OTH	SDO	0	0	130	0	0	0	0	0	0	0
OTH	TLO	0	16	0	0	0	0	17	0	0	0
SHK	ALO	1509	1518	0	593	0	2879	1133	0	139	2544
SHK	ASO	4520	38004	0	0	0	4154	17505	37	0	0
SHK	AVO	1740	9123	2305	0	0	5094	7459	204	0	0
SHK	CAO	13700	75745	0	17030	27932	21600	86391	0	16037	61484
SHK	CBO	0	0	0	0	11510	0	0	0	0	0
SHK	CFO	0	0	0	151	29768	52	0	0	0	0
SHK	CGO	0	3959	0	0	0	0	0	0	0	0
SHK	CLO	0	95	0	201	300	143	0	0	972	0
SHK	COO	0	0	0	0	2256	0	0	0	0	0
SHK	CSO	0	0	0	0	9117	0	0	0	0	0
SHK	GCO	2217	1331	0	41	218	2475	210	0	126	146
SHK	IOO	1010415	1036440	1666	381032	429480	1267511	800085	532	560657	597571
SHK	IPO	29122	23508	0	6946	4933	27767	24251	0	3708	6154
SHK	LNO	5158	49196	0	1127	1344	2075	24444	0	152	8587
SHK	PGO	8507098	7158810	3116	2140048	3228034	10269285	5705256	654	2874869	3751240
SHK	PKO	0	0	0	0	0	0	0	0	0	0
SHK	SLO	0	0	0	0	232	45	21	0	0	0
SHK	SPO	65750	363299	0	50763	40423	55668	231423	0	29318	62776
SHK	SZO	600	1149	0	29	10129	562	0	0	0	0
TUN	ACO	0	0	0	0	0	97	21	0	0	0
TUN	ALB	125212	110958	1892	768910	60224	3040	9282	454	99587	83833
TUN	BET	48135	87460	0	148433	35025	163631	263657	0	502763	295703
TUN	BFT	0	400	20856	0	0	923	319	5615	0	0
TUN	BKO	0	0	0	0	0	0	0	0	0	0
TUN	LTA	0	0	1070	0	0	0	0	272	0	0
TUN	SKJ	0	1738	8	0	22377	11	0	0	4926	0
TUN	YFT	22701	26432	0	139883	15561	37935	90510	0	6922	39562

Table 4 (cont.). Scientific estimation of landings by species (kg of round weight –RW) of the considered by-catch in the Spanish surface longline fishery by areas BIL, during the year 2004.

Group	Year Species	2004		2004		2004	
		BIL94A	BIL94B	BIL95	BIL96	BIL96	BIL97
BIL	BLM	0	0	0	0	0	0
BIL	BLZ	0	0	0	0	0	0
BIL	BUM	4531	22507	0	23640	0	0
BIL	MLS	0	0	0	0	0	0
BIL	MSP	0	0	0	0	0	0
BIL	SAO	56566	80233	10	124597	68125	0
BIL	SHP	0	0	0	0	0	0
BIL	SPF	0	0	0	0	0	0
BIL	WHM	8116	11289	20	44994	0	0
OTH	BRO	10	557	400	1579	15	0
OTH	CHO	2330	2281	2964	3359	0	0
OTH	LFO	86810	114436	0	62328	0	0
OTH	LGO	395	1909	0	520	10	0
OTH	GGO	0	20	14	0	0	0
OTH	OTH	10494	6886	34	36656	19481	0
OTH	RPO	541	889	0	3237	0	0
OTH	SBO	3290	1963	0	1903	817	0
OTH	SDO	0	0	25	0	0	0
OTH	TLO	0	0	0	0	0	0
SHK	ALO	1009	6469	0	74	0	0
SHK	ASO	1083	37399	0	0	0	0
SHK	AVO	1699	15564	534	0	0	0
SHK	CAO	30839	92616	0	22372	26614	0
SHK	CBO	0	0	0	0	0	0
SHK	CFO	0	4287	0	0	0	0
SHK	CGO	0	0	0	0	0	0
SHK	CLO	0	0	0	0	0	0
SHK	COO	0	0	0	0	0	0
SHK	CSO	0	142	0	0	0	0
SHK	GCO	4557	102	0	200	58	0
SHK	IOO	1316370	771278	537	440876	261826	0
SHK	IPO	19312	28020	0	1690	2210	0
SHK	LNO	5108	5958	0	273	3443	0
SHK	PGO	11223267	6090626	1359	4282706	3083599	0
SHK	PKO	0	0	0	0	0	0
SHK	SLO	0	2153	0	270	0	0
SHK	SPO	82993	363522	13	18464	34866	0
SHK	SZO	115	12459	0	0	0	0
TUN	ACO	220417	33074	0	4557	0	0
TUN	ALB	3026	6874	39	69973	11494	0
TUN	BET	0	149366	0	169076	98070	0
TUN	BFT	0	3911	4351	0	0	0
TUN	BKO	0	0	0	0	0	0
TUN	LTA	0	0	226	0	0	0
TUN	SKJ	18	0	4	0	4161	0
TUN	YFT	966	3662	0	18656	13096	0

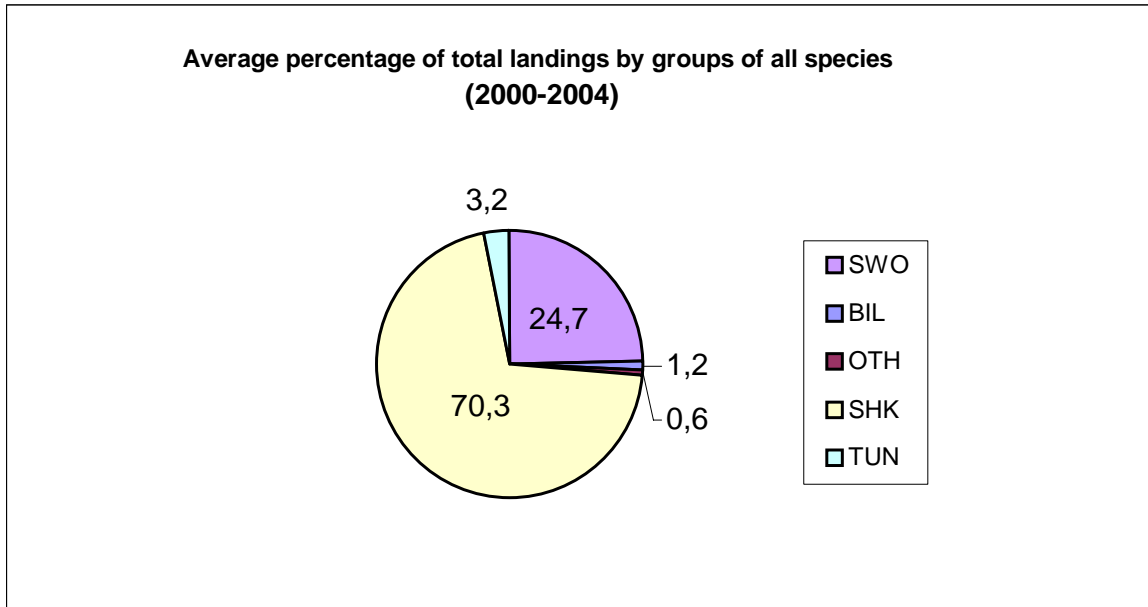


Figure 1. Scientific estimation of the percentage of the total landings (relative prevalence) by group (target and by-catch species) in the Spanish surface longline fishery in the Atlantic ocean, during 2000-2004 period.

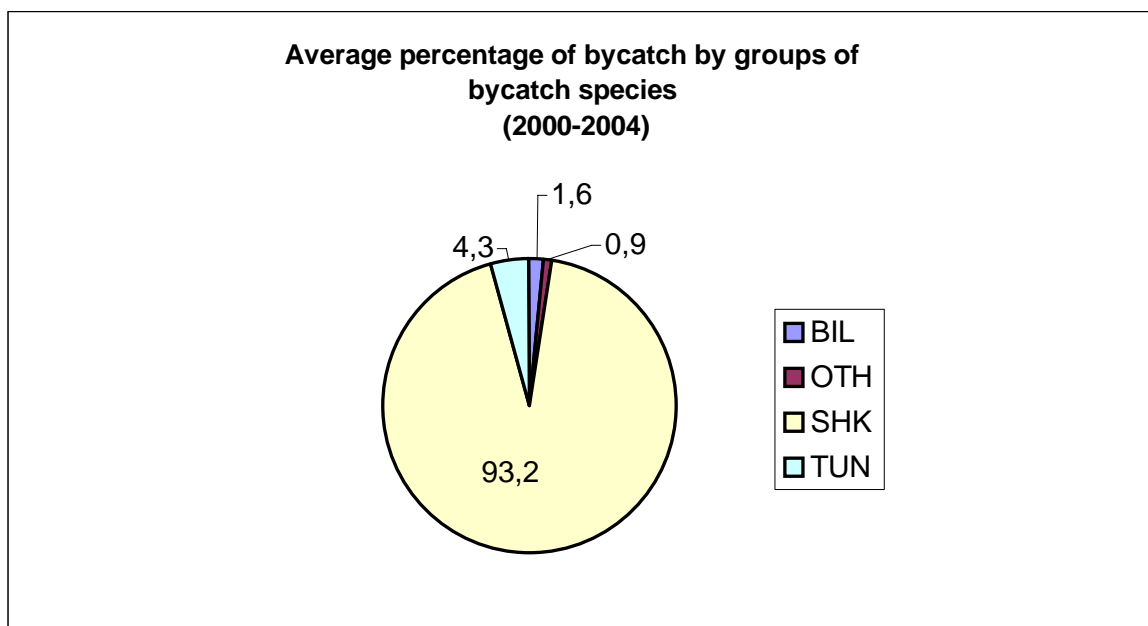


Figure 2. Scientific estimation of the percentage of landings by group within the by-catch species in the Spanish surface longline fishery in the Atlantic Ocean, during 2000-2004 period.