

PRELIMINARY SCIENTIFIC ESTIMATIONS OF BY-CATCHES LANDED BY THE SPANISH SURFACE LONGLINE FLEET TARGETING SWORDFISH (*XIPHIAS GLADIUS*) IN THE INDIAN OCEAN: YEARS 1993-2000

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ABSTRACT

*This paper presents preliminary scientific estimations on the landings of by-catches by species, carried out by the Spanish surface longline fleet targeting swordfish (*Xiphias gladius*) in the Indian Ocean. From the beginning of this activity in 1993 until the year 2000, the mean figures of by-catches landed by the Spanish fleet accounted for 54.7% of the total number of catches landed. Some of the by-catches landed that are worthy of note include the group of large pelagic sharks, representing a mean percentage of 88.3% of the total number of y-catches landed, followed by the tuna group (10.4%) and lastly, the billfish species (Fam. Istiophoridae: 1.2%).*

Key words: swordfish, Indian Ocean, bycatch, longline, statistics.

INTRODUCTION

The Spanish surface longline fleet began fishing in the Indian Ocean at the end of 1993 at which time 3 vessels set out to conduct a Prospecting Survey on the swordfish (*Xiphias gladius*) in the SE Indian Ocean (FAO51). This prospecting activity continued on through the first few months of 1994 with the addition of two other vessels. These vessels later left the Indian Ocean, where only sporadic trips were made by another vessel or by the other two vessels. Starting in 1998, there was an increase in the number of vessels which would alternate their fishery activity between the Indian and other oceans, with only 2 vessels operating on a permanent basis (García-Cortés & Mejuto, 2000). In the year 2000 another Prospecting Survey was carried out on the swordfish conducted by two longliners in areas of the SE Indian Ocean (FAO51, approx. 60°E) farther removed from the African continent. During that year a total of 6 Spanish longliners were fishing in the Indian Ocean in addition to alternating their activities with other oceans.

From the outset of its activity in the Indian Ocean, in addition to the target species *Xiphias gladius* (SWO), the Spanish surface longline fleet has been catching other species such as billfish, tuna and pelagic sharks, the latter being of great importance, both because of their abundance as well as their increasing economic worth (Mejuto & González-Garcés, 1984; Mejuto, 1985).

The gear used by Spanish surface longliners has been, from the beginning, the “traditional type” of longline gear with clips, even though the rest of the Spanish surface longline fleet operating in the Atlantic Ocean has, since late 1998, been replacing this fishing gear with the “American type” longline gear (Mejuto et al., 2001 (a), (b); Mejuto et al., in press (a).

Ever since the Spanish surface longline vessels started operating in the Pacific Ocean, the Spanish Institute of Oceanography began broadening its RIM (Information and Sampling Network) in order to be able to monitor more closely the activity of this part of the Spanish fleet. And, at the same time, the On-Board Observers Program was extended to the Indian Ocean to gather information *in situ* on the activities in areas-seasons where fishing is carried out only sporadically.

MATERIAL AND METHODS

The data used in this paper are based on information acquired through the RIM (Information and Sampling Network) of the Spanish Oceanography Institute, which include declarations on landings per trip, interviews with skippers at the port, in addition to scientific log-books filled out voluntarily by the fleet, as well as information provided by the Scientific Observers on board commercial vessels conducting Prospecting Surveys on swordfish and carrying out regular fishery activities.

The information compiled from records of commercial activity and from some of the voluntary log-books did not provide the required level of detail and included names with a mixture of species. When the identification of species by spatial strata

was not possible, we used the information provided by the scientific observers to get an idea of the classification by species.

The information collected was originally set down in formats of 5°x5 °-months and weighted accordingly by spatial-temporal strata, following the methodology recommended for the long-distance longline fleets (Miyake, 1990).

For descriptive purposes, the group of species of large pelagic sharks was grouped together under a generic label called SHK, comprised primarily of individuals from the family Carcharhinidae (mainly *Prionace glauca*: PGO), followed by the family Lamnidae (basically *Isurus oxyrinchus*: IOO), Sphyrnidae and lastly, by Alopiidae.

The TUN group includes a collection of tuna species commonly made up of catches of the following species: *Thunnus obesus* (BET), *Thunnus alalunga* (ALB), *Thunnus albacares* (YFT) and, to a lesser extent, *Acanthocybium solandri* (ACO). The group of billfish was labeled as BIL and includes species from the Family Istiophoridae. The OTH collection groups together several species, which, on some occasions, have not been identified (generally of very little commercial value) or identified at the species level, but caught very sporadically.

The original weight records were transformed, where necessary, to units of round weight (RW) applying different conversion factors depending on the species or group of species and on the processing and manipulation of the fishes on board.

Prionace glauca (PGO) Round weight (RW) = Gutted weight (GW) * 1.1938

Round weight (RW) = Dressed weight (DW) * 2.4074

Isurus oxyrinchus (IOO) Round weight (RW) = Gutted weight (GW) * 1.151

Round weight (RW) = Dressed weight (DW) * 1.4541

And the rest of the pelagic sharks (OthSHK):

Round weight (RW) = Gutted weight (GW) * 1.15

Round weight (RW) = Dressed weight (DW) * 1.4

The following factor was applied to each of the species included in the billfish group (BIL):

Round weight (RW) = Dressed weight (DW) * 1.2

The conversion factors applied to each of the species included in the tuna group (TUN) were:

Round weight (RW) = Gutted weight (GW) * 1.1

Round weight (RW) = Dressed weight (DW) * 1.3

RESULTS AND DISCUSSION

The landings of species considered to be by-catches of the swordfish (*Xiphias gladius*) fishery in the Indian Ocean ranged from 36 to 4771 tons from 1993 to 2000, which accounts for a

landing percentage of between 15% and 80% of the total landings (Table 1).

The most important part of the by-catch is made up of the large pelagic sharks (SHK), whose mean percentage in landed weight in relation to the landed weight of the total by-catch was 88.3%, for the period under study, with a mean estimated landing of 1552 tons/year. The second group of species in terms of importance of by-catch landings for this period was the tuna group (TUN) with a mean percentage of 10.4% and a mean estimated landing of around 79 tons/year, followed by the billfish group (BIL) which had a mean percentage of 1.2% representing a mean estimated landing of approximately 8 tons/year. Lastly, was the OTH group, which presented a negligible landed average.

Tables 2 and 3 show the scientific estimations in round weight of the by-catch landings carried out from 1993 until the year 2000 broken down into species.

For the entire period analyzed, we can see that the SHK by-catch landed consisted essentially of PGO, with a mean landed percentage of 75.3% in relation to the total number of by-catches. The rest of the SHK group accounted for the following mean values: *Isurus* spp. (15.2%), *Carcharhinus* spp. (2.86%), *Sphyrna* spp. (0.5%) with the remaining shark landings being so small that the percentage was negligible. It is interesting to note that the species that was landed in the greatest quantity in the SHK group was PGO, representing 80.6% of this group, followed by IOO (14.1%).

As far as the TUN species landed are concerned, YFT stands out as accounting for 15.4% of the total landed by-catch, while BET and ALB represented around 12.8%. Landings of ACO were negligible.

The percentage of species landed pertaining to the BIL group accounted for 1.2% of the total by-catch, with the most important species being *Istiophorus platypterus*, *Makaira mazara* and *Makaira nigricans*, each representing approximately 1.3% of the total by-catch.

These landing percentages resulting from the by-catches were similar to those reported in other oceans (Mejuto & García-Cortés, 2001; Mejuto et al., in press (b)(c); García-Cortés & Mejuto, in press.)

In order to draw up graphs, the landings were classified into groups of species associated with this fishery by time periods, summarizing the information for years 1993-95, 1996-98 and 1999-2000 (Fig. 1). Please note that the last period shown includes information for only 2 years as compared to the other two periods which encompass 3 years each.

In the last two years examined, there was an increase in the landing levels in weight for the overall by-catch as compared to previous years. This may be due to an improvement in the statistical processing of the data, or perhaps to the increase in the amount of fish retained pertaining to one of the groups -the large pelagic sharks (SHK) for instance, possibly caused by

favorable changes in attitude towards pelagic sharks and their by-products on the international market.

In view of the fact that the breakdown by species is based on biased information from the fleet and/or on data provided by scientific observers covering a narrow spatial-temporal range (around 3 % for the period under study), it is quite likely that there may be considerable errors in the redistribution of the by-catch landings by species.

Moreover, some of the information obtained with details of by-catches classified by species comes from experimental prospecting surveys conducted in new fishing grounds, using very different harvesting criteria than those employed by the commercial fleet.

Taking into account the relative importance (prevalence) of a number of by-catch species in this fishery, the increasing economic importance of some of these species on the international market, in addition to the well-known precedents from other oceans, in all probability, the fishing strategy of this fleet may be considered to be more complex than that of a simple fishery directed at a single target species.

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Table 1. Scientific estimations in Kg of round weight (RW), of landings of the total number of species considered to be by-catches of the Spanish surface longline fishery and landings of the target species (*Xiphias gladius*) from 1993-2000.

YEAR	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL BY-CATCH	36411	506486	40472	51013	no inf.	1343373	3749854	4771144
TOTAL SWO	206814	693937	18552	29337	507802	1424628	2012982	982885

Table 2. Scientific estimations in Kg of round weight (RW), of landings of pelagic sharks by species and other species considered to be by-catches of the Spanish surface longline fishery for the 1993-2000 period.

By-catch landings. Kg (RW). Indian Ocean (1993-2000)

	Species	1993	1994	1995	1996	1997	1998	1999	2000
SHK	<i>Alopias superciliosus</i>	0	308	0	0	no inf.	0	0	0
SHK	<i>Carcharhinus</i> spp.	7088	165165	4120	6170	no inf.	0	57521	14313
SHK	<i>Carcharhinus falciformis</i>	0	0	0	0	no inf.	10689	13968	0
SHK	<i>Carcharhinus longimanus</i>	0	0	0	0	no inf.	11629	31777	62
SHK	<i>Galeocerdo cuvieri</i>	0	1417	0	0	no inf.	221	0	0
SHK	<i>Isurus oxyrinchus</i>	10182	80899	3374	6356	no inf.	320625	543911	324264
SHK	<i>Isurus paucus</i>	1721	2672	0	0	no inf.	858	30423	5102
SHK	<i>Lamna nasus</i>	0	0	0	0	no inf.	0	4542	0
SHK	<i>Prionace glauca</i>	0	179315	30645	36327	no inf.	908999	2879468	4147219
SHK	<i>Sphyrna</i> spp.	733	11786	854	1358	no inf.	1085	893	0
SHK	<i>Sphyrna zygaena</i>	0	0	0	0	no inf.	15932	11431	0
	<i>Coriphaena hipurus</i>	0	0	0	0	no inf.	0	65	25
	Gempillidae	0	0	0	0	no inf.	0	12	0
	OTH	0	1448	0	0	no inf.	0	0	0
	Barracuda	0	0	0	0	no inf.	0	71	0
	Total SHK	19724	441562	38993	50211	no inf.	1270038	3573934	4490960

Table 3. Scientific estimations in Kg of round weight (RW), of landings of billfish and tuna by-catches by species carried out by the Spanish surface longline fishery for the 1993-2000 periods.

BIL & TUN . Landings, Kg (RW). Indian Ocean (1993-2000)

	Species	1993	1994	1995	1996	1997	1998	1999	2000
BIL	<i>Makaira mazara</i>	0	0	0	0	no inf.	0	16172	1440
BIL	<i>Makaira nigricans</i>	0	14321	1296	372	no inf.	0	602	54
BIL	<i>Tetrapturus audax</i>	0	0	0	0	no inf.	0	814	73
BIL	<i>Istiophorus platypterus</i>	0	2208	0	0	no inf.	8517	7427	661
BIL	<i>Tetrapturus angustirostris</i>	0	0	0	0	no inf.	0	1951	174
BIL	<i>Tetrapturus pfluegeri</i>	0	0	0	0	no inf.	1822	0	0
	Total BIL	0	16529	1296	372	no inf.	10339	26966	2401
TUN	<i>Acanthocybium solandri</i>	0	0	0	0	no inf.	0	3974	0
TUN	<i>Thunnus alalunga</i>	0	0	0	0	no inf.	5130	42589	122291
TUN	<i>Thunnus obesus</i>	6791	25693	100	235	no inf.	34517	58502	47065
TUN	<i>Thunnus albacares</i>	9896	21254	83	195	no inf.	23350	43740	108403
	Total TUN	16687	46947	183	430	no inf.	62996	148806	277758

