

Check list and catch rate data by hook type and bait for Bycatch species caught by Spanish experimental longline cruises in the South-western Indian Ocean during 2005

by

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Abstract

In this paper, catch data are presented, in number of individuals and round weight (Kg), per a thousand hooks, from data obtained in the experimental cruises carried out by the Instituto Español de Oceanografía (IEO) in two surface Spanish longliners in international waters of South-western Indian Ocean between 25°S – 35°S and 30°E – 50°E.

This pilot action, which was followed continuously by scientific observers, was carried out in 2005 and several types of hooks and baits were experimentally used.

Although there is space-time stratification for sampling in the prospecting area, it has not been taken into consideration for this document. Joint analysis has been made of all the specimens sampled since activities began (539 sets with a total of 531916 hooks) for the entire area.

Total catch raised 1162t, from which 30t are considered true bycatch. The related species included in this group were 2.6% of total tons caught. Sharks and Rays, and Other Fishes are species which inclusion in ship holds depends on the fleet and has varied according to the trade.

Detailed information is presented about the catch of sea turtles, marine mammals and sea birds.

This document presents, in the same way, the total catch, in number and weight, for all and each one of the species or groups captured in this Pilot Action, indicating if they were included as commercial catch or as bycatch.

1. - Introduction

At the meeting of the Scientific Committee of the IOTC in November 2004, information was provided about the experimental campaign being carried out by the Instituto Español de Oceanografía (IEO) on two surface longliners in the waters of the South-western Indian Ocean.

These experimental fisheries use several types of hooks and bait, and scientific observers have been present on the two participating vessels from the onset (mid December 2004). At all the sets the observers take down data about catches (situation, time, species, hook, bait, etc) and about biological data (size, sex, individual weight, gonad weight, etc) of the various species caught.

At present, this experimental campaign has already finalized and the analysis of data obtained is being actually reviewed to get information from them and for the different Working Groups and Reunions of IOTC.

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The main objective of this paper is basically to provide information about bycatch species (accidental catches) caught during this Pilot Action (AP). The detailed analyses about the importance of incidental catches depending on the type of bait and hook will be later explored. This document is limited to present only the results obtained from data recorded about this matter.

Thus, the present document shows the results for the various species captured of bycatch and the catch ratios per type of hook and bait, in number of individuals and weight, from the data obtained by the observers during this AP.

2. - Material and Methods

The Pilot Action has been developed on board two surface longliners that have, as target species, the swordfish and tropical tunas. It has taken a year long (from mid December 2004 to mid December 2005) and the working area was placed in international waters between 25° S and 35° S and 30° E and 50° E (Figure 1).

Although there is space-time stratification for sampling in the prospecting area, it has not been taken into consideration for this document. Joint analysis has been made of all the specimens sampled during all this campaign for the entire area.

From the beginning and during the whole campaign, the same long line configuration has been used for both vessels. Basically, the long line has a fixed part, made up of 960 hooks of four different types, placed sequentially in 4 blocks of 240 hooks (60 of each type), each block baited alternately with two types of bait: mackerel and squid / like-squid species. The variable part of the long line (used occasionally when the sea state and duration of the manoeuvre permit) is made up of 60 or 120 hooks of one or two types, either the same as some hooks in the fixed part or with several varieties of fixed-part hooks, baited with either mackerel or squid / like-squid species. The squids and like-squids species used as bait were usually coloured with green dye.

Figures 2 and 3 show the types of hooks (A1: 16 J conventional metallic; A2: 16 J conventional blue; A3: 18 O metallic and A4: 18 O blue in the fixed part and A5: 18 J-O metallic) and baits (C1: mackerel and C2: squid / like-squid species) used. The different measurements of each hook are indicated.

For all sets and close to every hook, the long line was equipped with chemical and/or electric lights to attract fishes (Figure 4).

The long lines were lost at dusk (16:00 GMT – 19:00 Local time) and pulled in the following morning (03:00 GMT – 06:00 Local time), normally turning about at the final casting point.

Each long line was also equipped with one or two Micrel depth registers that recorded depth and temperature every minute.

Scientific observers had on board various types of scales and callipers to measure the weight and size of the specimens caught.

The observers on board tried to identify each species caught by the long line, however it was not always possible for all of them owing to different reasons (predated individuals, quick work, etc.). That is why in the list of species there are some codes for Orders, Families, Subfamilies and even for non-identified individuals belonging to different groups.

3. - Results

A total of 539 sets were made using 531916 hooks, and 28106 individuals of different species were caught, having 27865 of them all the information concerning to the origin of the catch (type of hook, bait, etc.). The fishing gear was mainly working at depths of between 40 and 90 m but, in some cases, the depth register indicated values lower (16 m) and higher (210 m) depths.

Total catch raised 1162t, from which 1076t are considered as commercial catches and in the 86t that last are included discards, bycatch and individuals predated by sharks, marine mammals or sea birds. So then, the 86t that were brought back to the sea are divided into: 15t discarded owing to predation, 40t nominal discards (commercial species not included in ships holds), 30t classified as bycatch and 1t of tuna that were opportunistically tagged. Bycatch were 2.6% of total catch in these experimental campaigns (Table 1). In this weight of bycatch, estimated of the 25 turtles and 3 marine mammals are included. If these weights are not taken into account, the bycatch would have supposed a 2.2% of total catch.

The following are the results, per groups of related species that took part of bycatch.

3.1. - Sensible species: sea turtles, marine mammals and sea birds

Table 2 shows the characteristics of the sets (date, latitude and longitude, type of bait and hook, and maximal depth of work) in which the sensible species were caught: sea turtles, marine mammals and sea birds.

Except for the three sea birds, that were found dead, the twenty five turtles and the three marine mammals caught were free alive and in good conditions to survive.

3.1.1. - Sea turtles

This Pilot Action was conducted to analyse the effects of using new kinds of circular hooks and different types of baits in the incidental catch of sea turtles.

Owing to the slight interaction observed, in the case of sea turtles, it has not been possible to extract definitive conclusions about these matters, although some interesting results are concluded:

- The number of turtles that interacted with the gear was 25 and all of them were free alive. That means 0.047 turtles per 1000 hooks and 0.046 individuals per set.
- Most of the turtles were caught owing to be tangled or hooked by the gear in their front tips. So 19 specimens (76%) were tangled, 4 (16%) directly bit the hook and there were 2 turtles (8%) which kind of caught is actually unknown.
- From 4 sea turtles that bit the hook, 3 were related to conventional hooks and 1 to a circular hook.
- Most of the turtles tangled were associated to that areas of the gear baited with squid/like-squid species.
- The predominant species was *Dermochelys coriacea* (DMM): 17 individuals in relation to 25 caught (68%). This species showed a high number of tangles in the long line, either for being more abundant or owing to the great size of their tips (15 specimens from 17 caught were tangled by the gear).
- The whole catch of sea turtles supposed a 0.089% of the total individuals caught.

3.1.2. - Marine mammals

Only three species of marine mammals took part of the catch during the AP: a dolphin, a sea bear and a pilot whale. All of them had a catch rate of 0.00186 individuals per set or 0.00188 individuals per 1000 hooks.

Marine mammals implied a 0.011% of the total specimens caught.

The three mammals were caught with circular hooks.

3.1.3. - Sea birds

It is remarkable that the three specimens of sea birds were hooked in a short period of time, only in two days (16 and 17 October) and in close areas (zone 5). The rest of the year there was a lack of interaction of the gear with sea birds.

The species were: 2 albatross and 1 petrel. In the case of the albatross, the catch ratio was 0.00371 individuals per set and 0.00375 individuals per 1000 hooks; while concerning to petrels, the catch ratio had values of 0.00186 specimens per set and 0.00188 specimens per 1000 hooks.

Altogether, the sea birds supposed a 0.0011% of the total individuals caught.

In this case, all of them bit directly the hook.

3.2. - Another incidental species: Sharks, rays and other fishes

In this section, the catches of another species of fishes that were absent in the list of commercial species are shown. This is a criterion that may vary depending on the fleet and trade of the destiny port. It might also vary from a cruise to another as it has happened during this Pilot Action.

The list of species classified as bycatch is shown in Table 3, divided as sharks and rays on one hand and other fishes on the other. Their catch rates, per number of individuals and round weight (Kg), are indicated for each species.

In the case of sharks and rays, the highest catch rate corresponds to *Pteroplatytrygon violacea* (Bonaparte, 1832), with a value of 2.61 specimens per 1000 hooks. Taking into account that precise analyses are needed, this species is apparently caught with higher rates by conventional hooks baited with squid/like-squid species than by another configuration. As for weight, the highest catch rate (8.50 Kg/1000 hooks) corresponded to sharks belonging to Subfamily *Rhinopteridae* for circular hooks and very similar in which concerns to the type of bait. In general, except for the mentioned *Pteroplatytrygon violacea*, the catch rates of the rest of species included in this group do not reach the value of 0.5 specimens/100 hooks.

With regard to the group of related species named as other fishes, the highest catch rate is shown by *Alepisaurus ferox* (Lowe, 1833), 0.45 individuals/1000 hooks, that seems to be caught with similar rates by every kind of baits and hooks. However, if the catch rate per weight is analysed, the highest value is shown for individuals of species *Mola mola* (Linnaeus 1758), 1.88 individuals/1000 hooks, maybe because of their great weight per specimen. In general, except for *Alepisaurus ferox*, no other species of this group reach the catch rate of 0.1 individuals/1000 hooks.

Table 4 shows the list of species, per group, number of individuals and round weight (tons), indicating which of them has been included, total or partially, as commercial species.

Table 1. Total catch, in number of individuals and weight in tons (total) obtained in the present Pilot action. Commercial catch, discards, tagged tunas, bycatch and loose of fishes owing to predation are equally indicated with two components: predation of commercial species (commercial catch predated) and bycatch species equally predated (bycatch predated)

Groups	Commercial catch		Discards		Tagging		Bycatch		Predation				Total	
									Commercial catch predated		Bycatch predated			
	n	RND (t)	n	RND (t)	n	RND (t)	n	RND (t)	n	RND (t)	n	RND (t)	n	RND (t)
Sharks and rays	7771	469	1552	30,3	-	-	1705	21,4	8	0,4	3	0,12	11039	520,9
Billfishes and SWO	9210	451	363	4,9	-	-	-	-	251	9,9	-	-	9824	465,7
Tunas	2814	102	56	0,8	75	1	-	-	109	3,3	-	-	3054	106,9
Other fishes	3228	54	504	4,3	-	-	322	3,9	100	1,6	2	0,01	4156	63,9
Turtles	-	-	-	-	-	-	25	2,4	-	-	-	-	25	2,4
Mammals	-	-	-	-	-	-	3	2,1	-	-	-	-	3	2,1
Birds	-	-	-	-	-	-	3	No data	-	-	-	-	3	No data
Non-identified	-	-	-	-	-	-	2	0,11	-	-	-	-	2	0,11
Total	23023	1076	2475	40,3	75	1	2060	29,91	468	15,2	5	0,13	28106	1162,5

Table 2. ByCatch of sea turtles, mammals and birds during AP. It is indicated the date of match, latitude and longitude, area, bait and hook, and maximum depth read by sensors positioned in long line every set (at the head and before the middle of the line) depending on the type of catch.

Group	SPECIES	DATE	Lat°	Lat'	Lon°	Lon'	Area	BAIT	HOOK	Depth_head (m)	Depth_end (m)	Type of catch
Sea Turtles	CCC	21/5/2005	30	29	46	23	7	C1	-	32	-	Tangled or hooked
		26/5/2005	29	59	47	2	3	C2	-	-	106	Tangled or hooked
	CMM	27/12/2004	29	59	40	0	2	C1	A4	36	-	Type of caught unknown ?
		15/1/2005	30	16	45	10	7	C1	A2	36	-	Bit the hook
	DCC	3/1/2005	31	23	34	55	4	C2	-	37	-	Tangled or hooked
		16/1/2005	29	35	42	40	2	C1	A4	-	-	Type of caught unknown ?
		13/2/2005	31	21	34	56	4	C2	-	37	70	Tangled or hooked
		14/2/2005	30	36	44	10	6	C2	A4	-	155	Bit the hook
		28/2/2005	29	35	45	1	3	C1	-	115	-	Tangled or hooked
		19/3/2005	29	58	38	39	1	C1	-	186	-	Tangled or hooked
		27/3/2005	31	0	34	42	4	C1	-	-	24	Tangled or hooked
		8/5/2005	29	18	40	31	2	C2	-	-	103	Tangled or hooked
		20/5/2005	27	58	38	33	1	C2	A2	125	-	Bit the hook
		25/7/2005	29	29	37	41	1	C2	-	-	56	Tangled or hooked
		3/8/2005	31	54	34	41	4	C2	-	43	-	Tangled or hooked
		29/8/2005	30	8	36	55	5	C1	-	29	41	Tangled or hooked
		4/9/2005	28	53	41	27	2	C2	-	32	-	Tangled or hooked
		10/10/2005	29	43	43	27	2	C2	-	44	91	Tangled or hooked
		13/10/2005	29	50	44	20	2	C1	-	27	41	Tangled or hooked
	23/10/2005	29	37	41	27	2	C2	-	128	46	Tangled or hooked	
27/10/2005	29	58	39	12	1	C2	-	28	31	Tangled or hooked		
LOL	13/7/2005	29	50	45	59	3	C2	-	-	26	Tangled or hooked	
TOE	8/3/2005	29	32	40	40	2	C2	-	36	-	Tangled or hooked	
	21/4/2005	32	50	35	5	5	C2	-	-	54	Tangled or hooked	
	11/9/2005	31	10	35	17	5	C1	A1	96	39	Bit the hook	
Sea Mammals	GME	10/5/2005	29	52	40	4	2	C1	A4	-	25	
	OTA	3/8/2005	31	54	34	41	4	C1	A3	43	-	
	SBR	11/10/2005	28	45	37	26	1	C2	A3	-	32	
Sea Birds	ALT	16/10/2005	30	3	37	13	5	C1	A2	27	-	
		17/10/2005	30	52	37	19	5	C1	A3	22	-	
	PET	16/10/2005	30	3	37	13	5	C2	A3	27	-	

Species code	Scientific name	Common name (Spanish)	Common name (English)	Species code	Scientific name	Common name (Spanish)	Common name (English)
CCC	<i>Caretta caretta</i>	Tortuga bobá / Caguama	Loggerhead turtle	GME	<i>Globicephala melas</i>	Calderón común	Pilot whale
CMM	<i>Chelonia mydas</i>	Tortuga verde	Green turtle	OTA	<i>Arctocephalus pusillus</i>	Oso marino de El Cabo	South African fur seal
DCC	<i>Dermochelys coriacea</i>	Tortuga laúd	Leatherback turtle	SBR	<i>Steno bredanensis</i>	Delfín de dientes rugosos	Rough toothed dolphin
LOL	<i>Lepidochelys olivacea</i>	Tortuga bastarda / Golfina	Olive ridley	ALT	<i>Diomedea chlororhynchus</i>	Albatros picamarillo	Yellow-nosed albatross
TOE	-----	Tortuga de placas no identificada	Turtle non-identified	PET	<i>Procellaria aequinoctialis</i>	Petrel de mentón blanco	White-chinned petrel

Table 3. Catch rate (Kg) and number of individuals / 1000 hooks FOR NON-COMERCIAL SPECIES from data collected in RAI-AP/2004 by observers on board Spanish longliners in waters of south western Indian Ocean during 2005

SHARKS AND RAYS

Number of hooks		72160		67500		53696		74460		7200		275016		63785		64685		47850		74640		5940		256900		531916	
Type of bait and hook		CIA1		CIA2		CIA3		CIA4		CIA5		C1		C2A1		C2A2		C2A3		C2A4		C2A5		C2		Total catch	
Species	Scientific name	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)
DVI	<i>Pteroplatytrigon violacea</i>	2,25	6,34	2,12	5,95	1,43	4,00	1,18	3,24	2,08	5,93	1,76	4,94	5,03	14,90	4,73	13,19	2,86	8,27	1,53	4,51	3,87	12,73	3,51	10,16	2,61	7,46
FAL	Family <i>Alopiidae</i>	-	-	-	1,48	0,02	2,42	0,08	9,80	-	-	0,03	3,49	-	-	0,02	0,93	0,02	2,93	-	-	-	-	0,01	0,78	0,02	2,18
FDA	Family <i>Dasyatidae</i>	0,11	0,46	0,13	0,46	-	-	0,15	0,53	-	-	0,10	0,38	0,20	0,86	0,22	0,81	-	-	0,16	0,54	-	-	0,15	0,57	0,13	0,47
FSP	Family <i>Sphyrnidae</i>	0,07	5,71	0,03	2,07	0,02	1,86	0,07	8,19	-	-	0,05	4,59	0,02	0,47	0,02	1,31	-	-	0,01	2,68	-	-	0,01	1,23	0,03	2,96
MNT	Genus <i>Manta</i>	-	-	-	0,00	0,04	4,66	0,05	8,46	-	-	0,02	3,20	-	-	0,05	5,26	0,04	6,06	-	-	-	-	0,02	2,45	0,02	2,84
MCO	<i>Mobula tarapacana</i>	0,10	11,36	0,01	1,19	0,07	7,26	0,08	5,73	-	-	0,07	6,24	0,06	8,31	0,05	4,56	0,13	13,79	0,04	4,69	-	-	0,06	7,14	0,06	6,68
MOM	<i>Mobula mobular</i>	0,08	4,92	0,03	2,81	0,09	7,45	0,03	2,69	-	-	0,05	4,16	0,08	4,70	0,02	2,16	0,10	5,64	0,03	3,35	-	-	0,05	3,74	0,05	3,96
RAX	Ray non-identified	-	-	-	0,00	-	-	-	-	-	-	-	-	-	-	0,03	6,65	-	-	-	-	-	-	0,01	1,67	0,00	0,81
RDC	<i>Dasyatis centroura</i>	-	-	-	0,04	-	-	-	-	-	-	-	-	0,01	0,02	0,05	-	-	-	-	-	-	-	0,00	0,01	0,00	0,01
REX	Shark non-identified	0,01	1,11	-	-	-	-	-	-	-	-	-	0,29	-	-	-	-	-	-	-	-	-	-	-	-	0,00	0,15
RHI	Subfamily <i>Rhinopteriidae</i>	0,01	3,05	0,04	8,44	0,11	19,18	0,05	10,61	-	-	0,05	9,49	0,02	3,14	0,02	2,63	0,04	8,36	0,08	15,27	-	-	0,04	7,43	0,05	8,50
SLE	<i>Sphyrna lewini</i>	0,10	7,75	0,03	1,23	0,09	2,15	0,13	7,94	-	-	0,09	4,90	-	-	0,03	1,44	0,04	2,63	0,01	1,67	-	-	0,02	1,34	0,05	3,18

OTHER FISHES

Number of hooks		72160		67500		53696		74460		7200		275016		63785		64685		47850		74640		5940		256900		531916	
Type of bait and hook		CIA1		CIA2		CIA3		CIA4		CIA5		C1		C2A1		C2A2		C2A3		C2A4		C2A5		C2		Total catch	
Species	Scientific name	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)	n	RWT (Kg)
ALX	<i>Alepisaurus ferox</i>	0,40	1,79	0,40	1,47	0,48	1,51	0,47	1,83	-	-	0,43	1,62	0,53	1,76	0,51	1,75	0,52	1,84	0,39	1,59	-	-	0,47	1,68	0,45	1,65
ELP	<i>Elagatis bipinnulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,02	0,09	-	-	-	-	-	-	0,00	0,02	0,00	0,01
FGE	Family <i>Gempylidae</i>	0,01	0,02	-	-	-	-	0,04	0,08	-	-	0,01	0,03	0,02	0,05	0,03	0,05	0,02	0,01	-	-	-	-	0,02	0,03	0,02	0,03
FMO	Family <i>Molidae</i>	-	-	-	-	-	-	0,04	2,35	-	-	0,01	0,64	-	-	0,02	0,46	0,04	2,72	0,03	1,47	-	-	0,02	1,05	0,02	0,84
FSC	Family <i>Scombridae</i>	-	-	-	-	-	-	-	-	-	-	-	-	0,02	0,86	-	-	-	-	-	-	-	-	0,00	0,21	0,00	0,10
GES	<i>Gempylus serpens</i>	0,12	0,24	0,13	0,28	0,09	0,15	0,03	0,15	0,14	0,14	0,09	0,20	0,05	0,08	0,05	0,07	-	-	-	-	0,17	0,17	0,03	0,04	0,06	0,13
LLA	<i>Lagocephalus lagocephalus</i>	-	-	-	0,04	-	-	0,01	0,03	-	-	0,01	0,02	-	-	-	-	0,02	0,03	-	-	0,17	0,17	0,01	0,01	0,01	0,01
MAL	<i>Masturus lanceolatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	0,05	4,70	0,02	1,24	0,02	1,46	0,03	3,48	-	-	0,03	2,76	0,01	1,33
MMO	<i>Mola mola</i>	0,01	6,93	-	-	-	-	0,01	1,07	-	-	0,01	2,11	0,03	2,19	0,03	2,78	0,02	0,84	0,01	0,80	-	-	0,02	1,63	0,02	1,88
MOR	<i>Mola ramsayi</i>	-	-	-	-	-	-	0,01	1,34	-	-	0,00	0,36	0,03	3,45	0,03	4,48	-	-	-	-	-	-	0,02	1,99	0,01	1,15
NAD	<i>Naucrates ductor</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,01	0,01	-	-	0,00	0,00	0,00	0,00
YTC	<i>Seriola lalandi</i>	-	-	-	0,40	-	-	-	-	-	-	0,00	0,10	-	-	0,02	0,07	-	-	-	-	-	-	0,00	0,02	0,00	0,06

Table 4. List of species of total catch, per number of individuals (n) and round weight (RWT) in tons, indicating if it takes part of commercial catch (Com)

Group	SPECIES	n	RWT (t)	Com	Group	SPECIES	n	RWT (t)	Com
Sharks and rays		11039	521,0		Other fishes		4156	63,9	
<i>Alopias superciliosus</i>	ASU	15	1,4	√*	<i>Alepisaurus ferrox</i>	ALX	246	0,9	
<i>Carcharhinus falciformis</i>	CFA	616	11,0	√*	Family <i>Bramidae</i>	BRA	28	0,1	√
<i>Carcharhinus longimanus</i>	CLO	255	11,9	√*	<i>Coryphaena equiselis</i>	COE	69	0,7	√
<i>Carcharhinus obscurus</i>	DUS	9	1,0	√	<i>Coryphaena hippurus</i>	COH	784	7,9	√
<i>Pteroplatytrygon violacea</i>	DVI	1402	4,0		<i>Elagatis bipinnulata</i>	ELP	1	0,01	
Family <i>Alopiidae</i>	FAL	10	1,2		Family <i>Coryphaenidae</i>	FCO	10	0,1	√
Family <i>Carcharhinidae</i>	FCA	16	1,0		Family <i>Gempylidae</i>	FGE	8	0,01	
Family <i>Dasyatidae</i>	FDA	67	0,3	√	Family <i>Molidae</i>	FMO	8	0,4	
Family <i>Lamnidae</i>	FLA	1	0,1		Family <i>Scombridae</i>	FSC	1	0,1	
Family <i>Sphyrnidae</i>	FSP	16	1,6	√*	<i>Gempylus serpens</i>	GES	33	0,1	
<i>Galeocerdo cuvieri</i>	GCU	11	0,7		<i>Lampris guttatus</i>	LAG	18	0,6	√
<i>Isurus oxyrinchus</i>	IOX	1181	65,6	√	<i>Lepidocybium flavobrunneum</i>	LEC	2135	39,6	√*
<i>Isurus paucus</i>	LMA	2	0,2	√	<i>Lagocephalus lagocephalus</i>	LLA	4	0,01	
Genus <i>Manta</i>	MNT	11	1,5	√	<i>Masturus lanceolatus</i>	MAL	7	0,7	
<i>Modula taparacana</i>	MCO	34	3,6		<i>Mola mola</i>	MMO	8	1,0	
<i>Modula mobular</i>	MOM	28	2,1		<i>Mola ramsayi</i>	MOR	5	0,6	
<i>Prionace glauca</i>	PGL	6656	396,0		<i>Naucrates doctor</i>	NAD	1	0,0005	
<i>Lamna nasus</i>	POR	1	0,05	√	Order <i>Perciformes</i>	OPE	16	0,2	√
<i>Pseudocarcharias kamoharui</i>	PSK	534	2,4	√*	<i>Ruvettus pretiosus</i>	RUP	557	7,5	√*
Non-identified ray	RAX	3	0,5	√	<i>Sphyrna barracuda</i>	SPB	33	0,3	√*
<i>Dasyatis centroura</i>	RDC	2	0,01		<i>Cubiceps capensis</i>	UBP	9	0,1	√*
Non-identified shark	REX	1	0,1		<i>Acanthocybium solandri</i>	WAH	173	3,0	√*
Subfamily <i>Rhinopteridae</i>	RHI	24	4,5		<i>Seriola lalandi</i>	YTC	2	0,03	√
<i>Sphyrna lewini</i>	SLE	29	1,7		Turtles		25	2,4	
<i>Sphyrna zygaena</i>	SZY	115	8,7	√*	<i>Caretta caretta</i>	CCC	2	0,1	
Billfishes and Swordfish		9824	465,7		<i>Chelonia mydas</i>	CMM	2	0,1	
<i>Makaira indica</i>	BLM	30	3,5	√	<i>Dermochelys coriacea</i>	DCC	17	2,0	
<i>Makaira sp</i>	BMM	38	3,6	√	<i>Lepidochelys olivacea</i>	LOL	1	0,03	
Family <i>Istiophoridae</i>	FIS	8	0,5	√	Non-identified turtle	TOE	3	0,2	
<i>Istiophorus platypterus</i>	SAP	129	3,8	√	Mammals		3	2,1	
<i>Tetrapturus agustirostris</i>	SHS	168	2,8	√	<i>Globicephala melas</i>	GME	1	2,0	
<i>Tetrapturus audax</i>	STM	13	0,6	√*	<i>Arctocephalus pusillus</i>	OTA	1	No data	
<i>Xiphias gladius</i>	SWO	9438	450,9	√	<i>Steno bredanensis</i>	SBR	1	0,1	
Tunas		3054	106,9		Birds		3	No data	
Non-identified tuna	999	2	0,2	√	<i>Diomedea chlororhynchus</i>	ALT	2	No data	
<i>Thunnus alalunga</i>	ALB	188	3,6	√	<i>Procellaria aequinoctialis</i>	PET	1	No data	
<i>Thunnus obesus</i>	BET	2004	58,7	√	Non-identified		2	0,1	
<i>Katsuwonus pelamis</i>	SKJ	18	0,2	√*	Non-identified species	000	1	0,1	
<i>Thunnus albacares</i>	YFT	842	44,3	√	Non-identified Squid	POT	1	0,01	
					Total		28106	1162,5	

(*) These species were partially commercialized depending on trade, size, etc.

Figure 1 Area where the AP 08-2004 was carried out

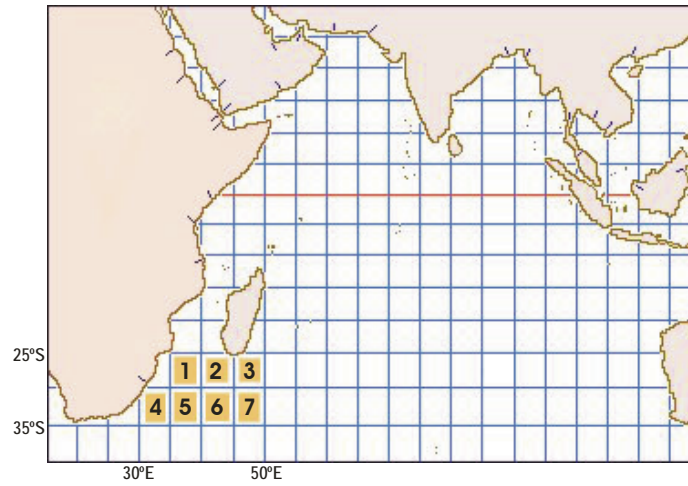
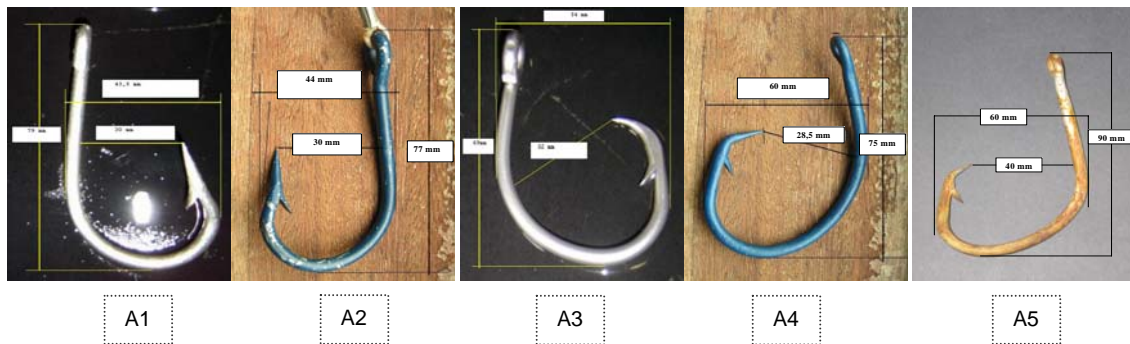


Figure 2. Main characteristics of the hooks used in AP-08/2004



A1. Hook 16 J conventional metallic; **A2.** Hook 16 J convencional blue; **A3.** Hook 18 O circular metallic; **A4.** Hook 18 O circular blue; **A5.** Hook 18 J-O

Type of hook	16 J conventional (A1 y A2)	18 O circular (A3 y A4)	18 J-O (A5)
Total length	77 mm	75 mm	90 mm
Opening	30 mm	28,5 mm	40 mm
Diameter	44 mm	60 mm	60 mm



Figure 3. Baits used in the long line. Squid and like-squid species are coloured usually in green, although other colours have been used

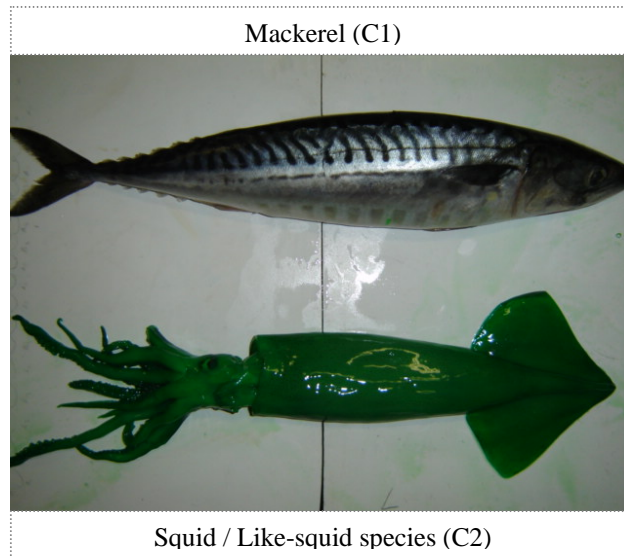


Figure 4. Chemical and electric lights used close to the hooks

