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## **AZTI Discard Sampling Programme in the Spanish Purse-Seiner fleet in the Western Indian Ocean (2003-2006)**

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### **ABSTRACT**

This document presents the results of the observed programme carried out by AZTI-Tecnalia in the tuna purse-seiner fleet operating in the Western Indian Ocean. A description of the sampling-programme is presented along with the information about retained and discarded tuna species. Information of associated species by-catch is also presented.

### **KEYWORDS**

Tropical tunas, discards, Indian Ocean, purse-seiner.

### **INTRODUCTION**

Since 2003 AZTI-Tecnalia carries out part of the Spanish tropical tunas sampling programme for the collection of data in the fisheries sector (PNDB) under the EU Data Collection Regulations (EC) No 1543/200, 1639/2001 and 1581/2004. One of the objectives of the sampling programme set up in this framework is to estimate the discards (modules E and H of the Regulation) of by-catch species in the EU fishery.

In particular, for the tropical tuna fishery in the Indian Ocean, the discards sampling is carried out by observers on board and the sampling programme provides information about the catch of commercial and non commercial species that are retained and discarded. The sampling programme is coordinated with the Spanish Institute of Oceanography (IEO) and with the French Institut de Recherche pour le Développement (IRD) and IFREMER.

This document shows the preliminary results of the AZTI discard sampling in the Spanish Purse-seiners in the Western Indian Ocean from 2003 to 2006.

### **MATERIAL AND METHODS**

The information presented in this document was collected between April 2003 and November 2006. The yearly sampling level between 2003 and 2006 is presented in Table 1. The information of the last 3 trips of 2006 was not included in the analysis. The sampling was carried out following the *ad hoc* common methodology set down by IEO and AZTI (Delgado de Molina *et al*,

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1997). The sampling programme covers the following data: route data; set and drifting Fish Aggregating Device (FAD) characteristics; retained catch, discard and by catch estimations; and length distributions by species. The set is the sampling unit and the raising factor.

Figure 1 shows the trips distribution during the sampling period. Due to logistic reasons, most of the trips were concentrated on the second half of the year and not distributed homogeneously along the year as planned. Figure 2 shows the date and duration of the trips. The average duration by trip was 32 days and the average number of total sets (positive and negative) was 24.

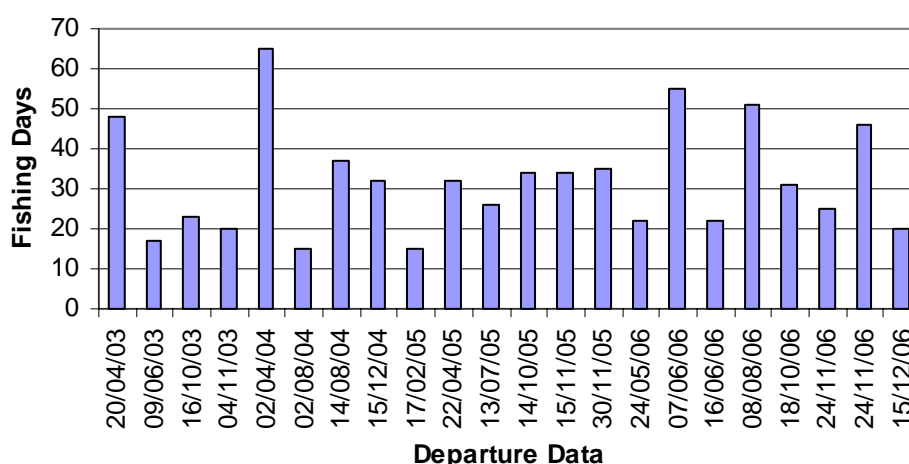
**Table 1.- AZTI discard sampling level in Western Indian Ocean (2003-2006).**

Project	Sampling Objective (trips)	Sampled trips	Fishing days	Total Sets***
PNDB 2003	6	4	108	98
PNDB 2004	6	4	149	92
PNDB 2005	7	6	176	164
PNDB 2006	7	8*	272**	181****
<b>Total</b>	<b>26</b>	<b>22</b>	<b>705</b>	<b>535</b>

\*only 5 trips used in the analysis, \*\*only 181 days in the analysis, \*\*\*positives and negatives, \*\*\*\*only 139 sets used in the analysis.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003					1	2				3	4	
2004				1				2	3			4
2005	1			2			3			4	5	6
2006					1	2	3	4		5	6	7

**Figure 1.- Annual trips distribution in the Indian Ocean. AZTI discards programme (2003-2006).** Striped areas: Trips overlap.



**Figure 2.- Fishing days by trip in the Indian Ocean. AZTI discards programme (2003-2006).**

## RESULTS

### Sampling level

The AZTI sampling level coverage in relation to the Spanish purse seiners in the Indian Ocean is described in Tables 1-5. The coverage of the fishing days sampled has increased year by year, increasing from 2.4 % in 2003 to 4.2 % in 2006 (Table 2).

The percentage of positive sets sampled in FADs increased from 2.5% in 2003 to 4.5 % in 2005; however, this level was 3.5 % in 2006 although it is expected to be higher when all the data is analysed. The sampling in free school sets has decreased from a 2.0 % of the fishery sets sampled to a 0.1% in 2006 (Table 3).

In

Table 4 the retained catch as well as tuna-like species discarded catch in the observed trips as well as in the Spanish purse-seiners are observed.

**Table 2.-** Fishery and observed fishing days.

Year	Fishing days		
	Observed*	Fishery	Percentage
2003	108	4,468	2.4%
2004	149	4,730	3.2%
2005	176	5,808	3.0%
2006	272	6,462	4.2%
<b>Total</b>	<b>705</b>	<b>21,468</b>	<b>3.3%</b>

\* travel days included.

**Table 3.-** Positives sets in the AZTI observed trips and in the fishery by fishing mode in the Indian Ocean (2003-2006). 2006: last 3 trips are not included in this table.

Year	Positive Sets						Total		
	FAD			Free schools			Observed	Fishery	%
Observed	Fishery	%	Observed	Fishery	%				
2003	49	1,822	2.7	22	1,104	2.0	71	2,926	2.4
2004	46	1,775	2.6	2	1,246	0.2	48	3,021	1.6
2005	118	2,620	4.5	5	1,608	0.3	123	4,228	2.9
2006	107	3,100	3.5	1	1,588	0.1	108	4,668	2.3
<b>Total</b>	<b>320</b>	<b>8,837</b>	<b>3.4</b>	<b>30</b>	<b>5,546</b>	<b>0.5</b>	<b>350</b>	<b>14,843</b>	<b>2.4</b>

**Table 4.-** Tuna retained catch and discards (t) in observed trips and fishery. 2006: last 3 trips are not included in this table.

Year		2003	2004	2005	2006*
YFT	Observed	556	1,360	2,422	1,806
	Fishery	78,968	80,810	77,520	70,924
	%	0.7%	1.7%	3.1%	2.5%
SKJ	Observed	924	500	2,122	2,093
	Fishery	88,035	64,393	94,312	118,857
	%	1.0%	0.8%	2.2%	1.8%
BET	Observed	166	100	440	105
	Fishery	8,544	8,634	10,290	9,952
	%	1.9%	1.2%	4.3%	1.1%
Total YFT+SKJ+BET	Observed		1960	4984	4004
	Fishery	1646	175,547	153,837	182,122
	%	0.9%	1.3%	2.7%	2.0%
All tuna Discards	Observed	97	14	54	67

\* provisional data

## **Tuna retained catch and discards**

### *Specific composition*

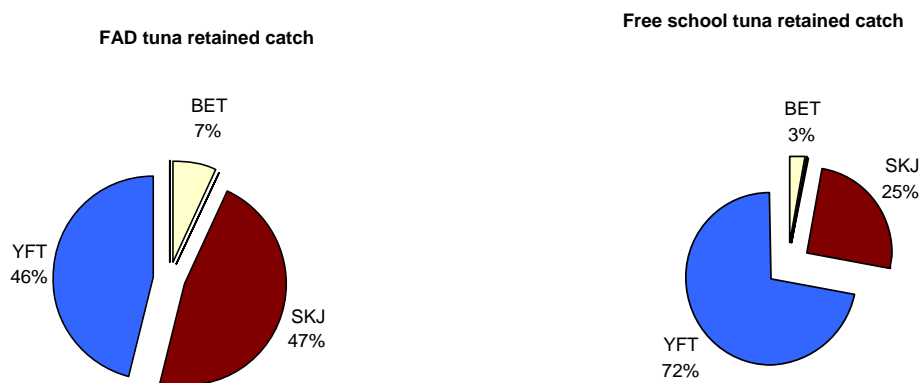
Figures 3 and 4 describe the specific composition of retained catch and discards. According to the results from observers in FAD sets the skipjack (*Katsuwonus pelamis*) made 47 % of the total catch in weight whereas yellowfin (*Thunnus albacares*) made up around 46 % of the total weight of the catch. The percentage of the skipjack and yellowfin in the observed free schools hauls was 72 % and 25 % of total weight, respectively. The latter results on free school sets are very similar to those observers from the whole Spanish purse-seiners fishery (Delgado de Molina *et al.*, 2007); where yellowfin comprised around 65% in the free school sets.

However, in the FAD sets the results are very different, being the skipjack percentage in the observed trips less than in the whole fishery (47% of the tuna weight against 70%) and higher for the yellowfin percentage (46% against 25%)

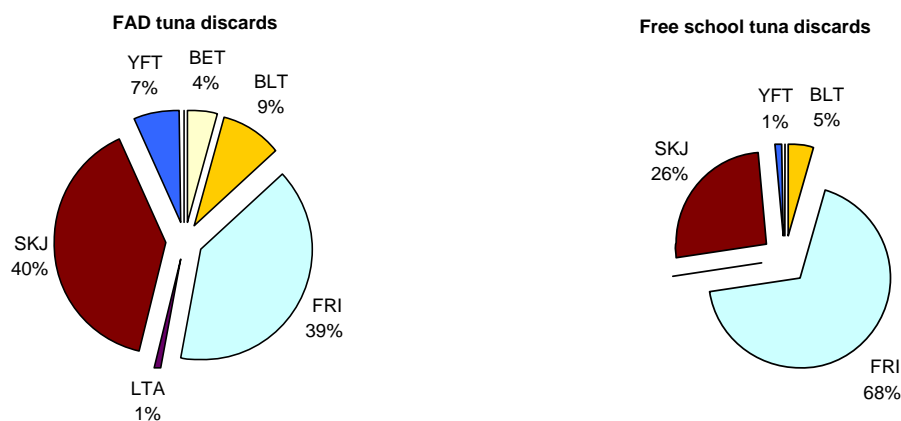
Delgado de Molina *et al.* (2007). By years, the percentage of the skipjack weight was between the 30% in 2004 and the 63% of 2003 in the observed trips.

The more abundant tuna species in the discards were (Figure 4) skipjack, and frigate tuna (*Auxis thazard*), 40 and 39% respectively in weight of the total discards in FADs sets and 26 and 68% in free school sets.

### Observers



**Figure 3.-** Specific composition of the retained catch in the observed trips, by fishing mode in the Spanish purse seiners in the Indian Ocean, annual average of 2003-2006 observers data. Specific composition made from 918 t (free school) and 11,705 t (FAD). BET: *Thunnus obesus*, SKJ: *Katsuwonus pelamis*, YFT: *Thunnus albacares*.



**Figure 4.-** Specific composition of the tuna discards in the observed trips, by fishing mode in the Spanish purse seiners in the Indian Ocean, annual average of 2003-2006 observers data. Specific composition made from 21 t (free school) and 210 t (FAD). ALB: *Thunnus alalunga*, BET: *Thunnus obesus*, BLT: *Auxis rochei*, FRI: *Auxis thazard*, LTA: *Euthynnus alleteratus*, SKJ: *Katsuwonus pelamis*, YFT: *Thunnus albacares*.

### Retained catch and discards estimations

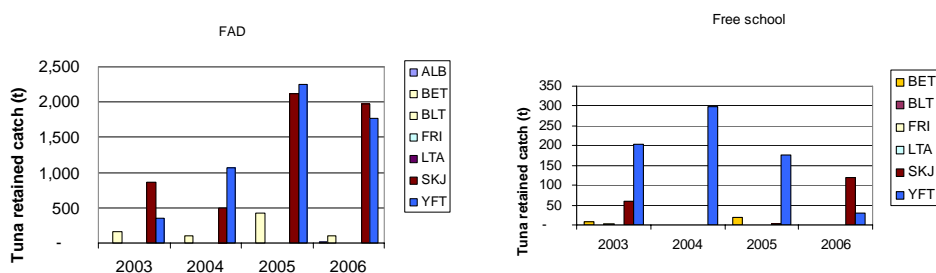
Table 6 and Figures 5 and 6 present different estimations of retained catch and discard from the observed data sets. Table 5 shows the retained and discard tuna catch in weight by the observed trips by type of set and year, while Figures 5 and 6 present this information by species.

As the specific composition figure showed (Figure 36), there was a big difference between the catch of skipjack and yellowfin and the other tuna species in FADs sets whereas the main catch in free schools was made up by yellowfin (Figure 6).

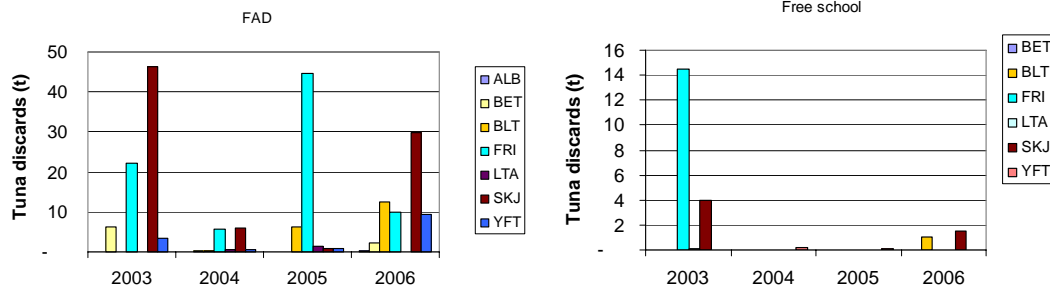
Figure 7 shows discard by species in observed sets. In accordance with these data, discard ratios were calculated as discard weight divided by retained plus discard weight (Figure 77). The discard ratios showed that the target species of this fishery and the albacore showed a very low ratio (0-3%) both in FAD and free school sets; whereas other tuna-like species (frigate tunas, *Auxis rochei* and *Auxis thazard*, and bonito, *Euthynnus alleteratus*) showed high ratios (88-100%) in both types of sets.

**Table 5.-** Retained and discarded tuna catch by weight (t) in the observed trips. 2006 3 last trips are not included in this table.

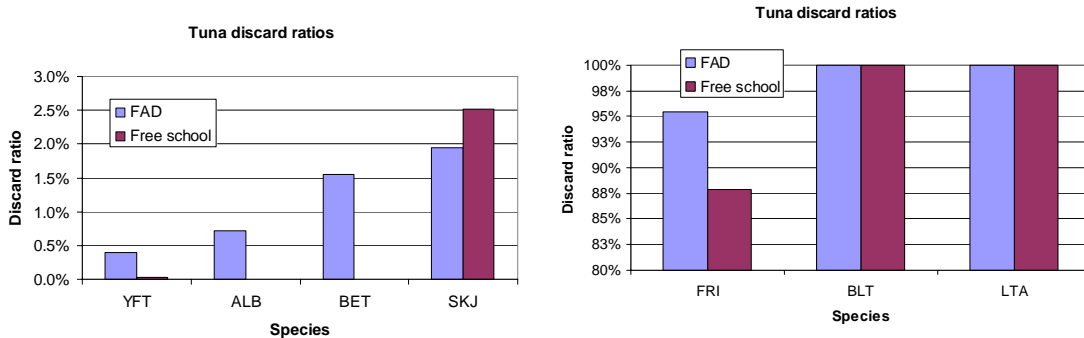
Year	FAD		Free school	
	Retained catch (t)	Discards (t)	Retained catch (t)	Discards (t)
2003	1,383	78	271	19
2004	1,663	13	298	0.2
2005	4,784	54	199	0.1
2006	3,875	64	150	2
<b>Total</b>	<b>11,705</b>	<b>210</b>	<b>918</b>	<b>21</b>



**Figure 5.-** Retained tuna catch in the sampled trips by fishing mode. The sampling effort is different each year (see Tables 1 and 2). ALB: *Thunnus alalunga*, BET: *Thunnus obesus*, BLT: *Auxis rochei*, FRI: *Auxis thazard*, LTA: *Euthynnus alleteratus*, SKJ: *Katsuwonus pelamis*, YFT: *Thunnus albacares*.

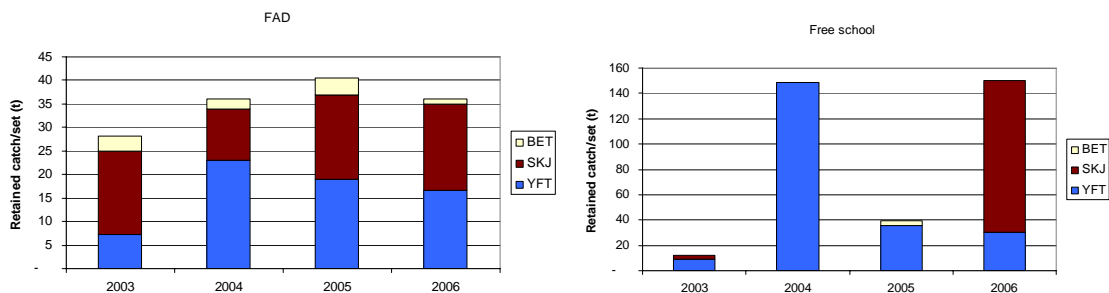


**Figure 6.-** Tuna discards in the sampled trips by fishing mode. The sampling effort is different each year (see Tables 1 and 2). ALB: *Thunnus alalunga*, BET: *Thunnus obesus*, BLT: *Auxis rochei*, FRI: *Auxis thazard*, LTA: *Euthynnus alleteratus*, SKJ: *Katsuwonus pelamis*, YFT: *Thunnus albacares*.

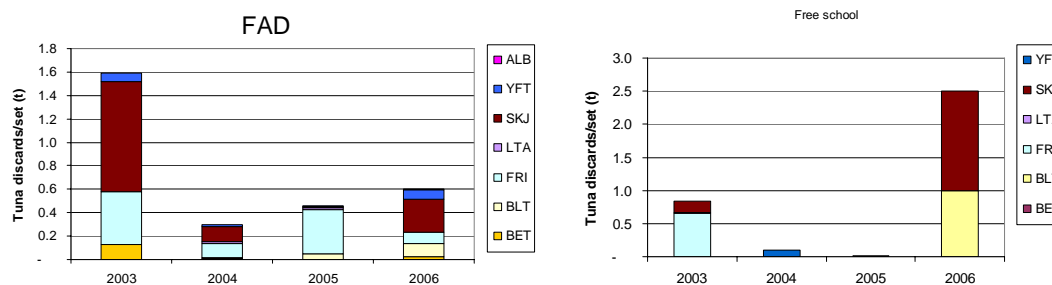


**Figure 7.-** Tuna discard ratios (=discard/(discard+retained catch)). ALB: *Thunnus alalunga*, BET: *Thunnus obesus*, BLT: *Auxis rochei*, FRI: *Auxis thazard*, LTA: *Euthynnus alleteratus*, SKJ: *Katsuwonus pelamis*, YFT: *Thunnus albacares*.

Data by species and sets (Figure 88) shows that retained catches is up to 160 t/set in free school sets and up to 45 t/set in FAD sets. Discards (Figure 99) are also higher in free school sets (up to 2.5 t/set against 1.6 t/sets in FAD sets), being skipjack and frigate tuna the main species in FAD sets and skipjack and frigate tuna in free school sets. However, this observation will be influenced by the total catch observed in each of the tow sampled.



**Figure 8.-** Retained catch by set (t) of the 3 main species in the Indian Ocean in the observed trips by type of fishing. ALB: *Thunnus alalunga*, BET: *Thunnus obesus*, BLT: *Auxis rochei*, FRI: *Auxis thazard*, LTA: *Euthynnus alleteratus*, SKJ: *Katsuwonus pelamis*, YFT: *Thunnus albacares*.



**Figure 9.-** Tuna discards by set (t) in the observed trips by type of fishing. ALB: *Thunnus alalunga*, BET: *Thunnus obesus*, BLT: *Auxis rochei*, FRI: *Auxis thazard*, LTA: *Euthynnus alleteratus*, SKJ: *Katsuwonus pelamis*, YFT: *Thunnus albacares*.

As expected by the sampling coverage, the coefficients of variation (CV) estimated of the discards estimations are higher in free school than in FAD sets, on average of 88% and 56% respectively. By species, the smaller CVs appear to be related to skipjack discards in FADs (on average 40%) and the higher for bonito and skipjack discards in free school (on average of 99%).

### **Associated by-catch species**

Table 7 shows the percentage of set in which a by-catch species was present in FAD schools. The free school data was not analysed due to the low coverage. This analysis should be taken as preliminary as the data of associated species are been revised actually. 34 associated species were observed in log sets. *Elegatis bipinnulata*, *Coryphaena hippurus*, *Carcharhinus falciformis*, and *Istiophoridae* were the most frequent species, with a presence of 15.61%, 12.42%, 16.88% and 6.06% in the FAD sets, respectively.

**Table 7.- Associated fauna and presence rate in object and free school sets.**

Especie	% FAD
<b>BILLFISHES</b>	
<i>Makaira indica</i>	1.27
<i>Xiphias gladius</i>	0.96
<i>Tetrapturus audax</i>	0.64
<i>Familia Istiophoridae</i>	5.10
<i>Istiophorus platypterus</i>	0.96
<b>SHARKS &amp; RAYS</b>	
<i>Carcharhinus falciformis</i>	16.88
<i>Carcharhinus longimanus</i>	3.50
<i>Familia carcharhinidae</i>	2.55
<i>Familia Dasyatidae</i>	0.32
<i>Manta birostris</i>	0.32
<i>Mobula mobula</i>	0.32
<i>Orden Carcharhniforme</i>	0.96
<i>Rhiodon typus</i>	1.27
<b>TURTLES</b>	
<i>Eretmochelys imbricata</i>	0.96
<i>Lepidochelis olivacea</i>	1.91
Unidentified turtle	0.32
<b>CETACEAN</b>	
<i>Balaenoptera physalu.</i>	0.32
<b>OTHER FISHES</b>	

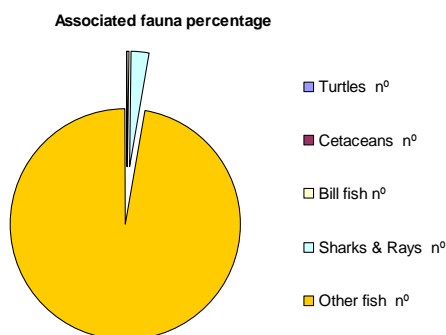


<i>Abalistes stellatus</i>	1.27
<i>Acanthocybium solandri</i>	4.14
<i>Aluterus monoceros</i>	0.96
<i>Canthidermis maculatus</i>	4.78
<i>Caranx crycos</i>	2.87
<i>Coryphaena hippurus</i>	12.42
<i>Elegatis bipinnulata</i>	15.61
<i>Familia balistidae</i>	7.01
<i>Familia Belonidae</i>	0.32
<i>Familia Diodontidae</i>	0.96
<i>Familia Sphyraenidae</i>	0.32
<i>Kyphosus sectator</i>	0.32
<i>Lobotes surinamensis</i>	2.23
<i>Masturus lanceolatus</i>	0.32
<i>Remora remora</i>	0.32
<i>Sphyraena barracuda</i>	2.55
<i>Uraspis secunda</i>	0.96

Figure 10 provides the distribution of the different bycatch groups, turtles, billfishes, cetaceans, sharks and other fishes. “Other fish” group made up more than 95% of the total associated fauna catches. *Canthidermis maculatus* together with some other *ballistidae*, *Elegatis bipinnulata* and *Coryphaena hippurus* comprised the main part of this fish group, both in number and in weight (Figures 11 & 12).

Figures 13 and 14 show the total length distributions of the most captured sharks (*Carcharinus falciformis*) and billfishes (*Istiophoridae*).

11 turtles were captured during the 4 year period, 7 *Lepidochelis olivacea*, 3 *Eretmochelys imbricata* and 1 unidentified turtle.



**Figure 10.-** Distribution of main associated fauna groups in numbers caught over objects in the Indian Ocean .

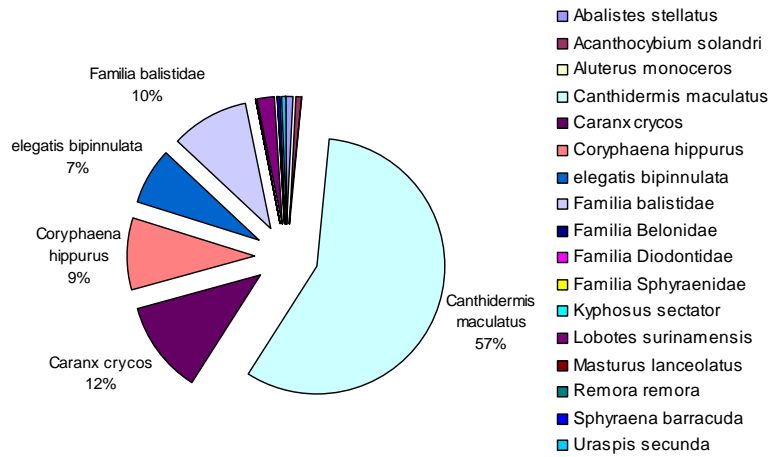


Figure 11.- Distribution of other fish in numbers caught over objects in the Indian Ocean.

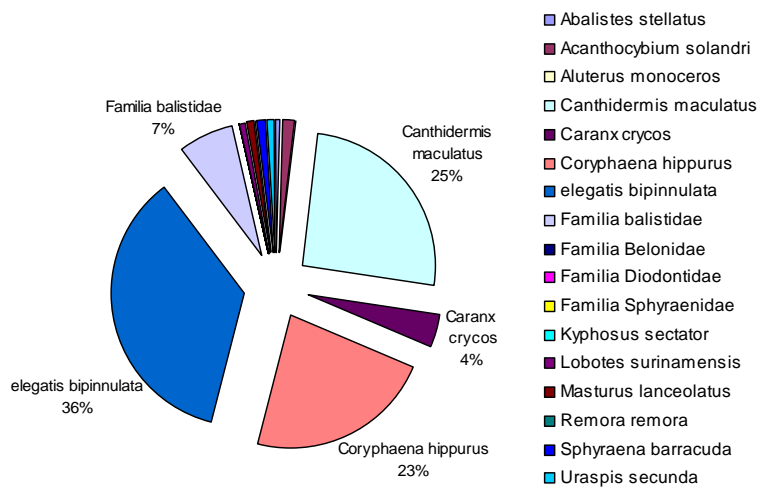


Figure 12.- Weight ratio of other fish caught over objects in the Indian Ocean

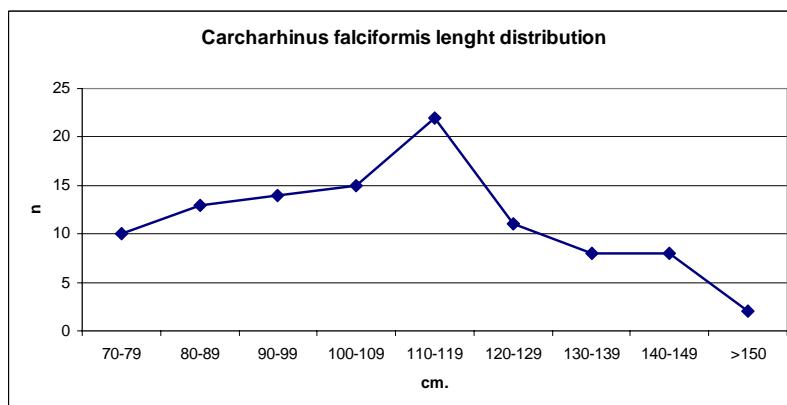
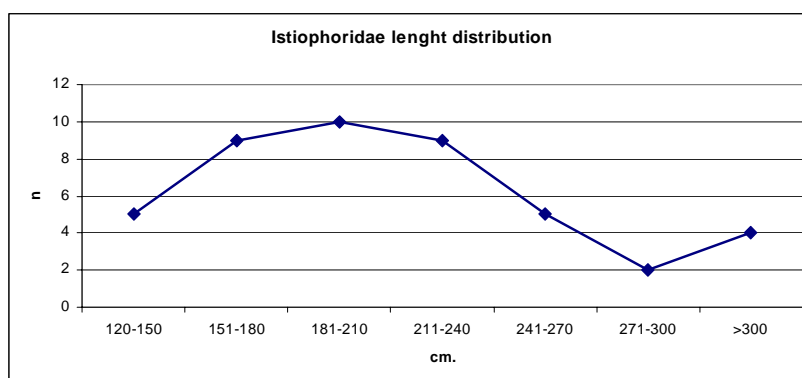


Figure 13.- Length frequency of main shark (*Carcharhinus falciformis*) caught over objects.



**Figure 14.-** Length frequency of main billfishes (*F. Istiophoridae*) caught over objects.

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