DATA OBTAINED FROM PURSE-SEINE OBSERVERS CARRY OUT BY THE INSTITUTO ESPAÑOL DE OCEANOGRAFÍA FROM THE NATIONAL DATABASE PLAN BETWEEN 2003 AND 2006

by

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ABSTRACT

We present data about vessel activity obtained by observers on board purse-seiners operating in the Indian Ocean between 2003 and 2006. Observation days totalled 601 in over 17 campaigns. We outline catches and discards per species and type of association. In this period, 477 sets were performed, involving catches of 17184 t of tuna, of which 490 t were discarded (corresponding to 2.9% of the total catch, with 0.5% in sets over free schools and 1.9% of sets over objects). We compare data obtained from the fishery in the same period. Likewise, we present information about purse-seiner activity in relation to floating objects. Finally, we include bycatch data, such as the presence index per type of association, size distribution and turtle catch data.

KEYWORDS

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1. Introduction

2003 marked the beginning of an ongoing European programme of data collection by observers in line with a National Database Plan (PNBD), whose main aim was to obtain data about bycatch discards and catches in the Spanish tropical purse-seine fishery.

Thanks to these observer programmes, we have an abundance of information about all the sets performed while observers were stationed on board, the catch and discards per set type, school detection modes, the time required for each fishing operation, the systems observed and the types of objects, all of which would be impossible to obtain from other customary sources, such as fishing logs or sampling in port.

This document updates previous studies carried out by the Spanish Oceanographic Institute (IEO) in relation to the activity of the Spanish fleet, using observer data within the PNBB (Delgado de Molina *et al*, 2005).

2. Material and methods

The data included in this document correspond to those obtained for the PNDB by IEO observers embarked on Spanish-registered tuna purse-seiners from April 2003 to early March 2006.

Observers gathered information by following the methodology set down in the manual for observers on board tuna purse-seiners drawn up by the Spanish organisations IEO and AZTI (Institute of Fishing and Nutrition Technology), along with the French IRD (Research Institute for Development)(Delgado de Molina *et al*, 1997), after several modifications, largely regarding logging operations over floating objects (FADs).

The basic information presented focuses on data from the fishery, catch and effort, tuna discards, bycatches and follow-up of the objects used by the fleet.

The catches are presented according to species: yellowfin-YFT (*Thunnus albacares.* Bonnaterre, 1788); skipjack-SKJ (*Katsuwomus pelamis.* Linnaeus, 1758); bigeye-BET (*Thunnus obesus.* Lowe, 1839) and OTHERS, which includes other species caught that correspond to several species of frigate tuna-FRZ (*Auxis* sp), Kawakawa-KWA (*Euthynnus affinis.* Cantor, 1849*)* and Albacore-ALB (*Thunnus alalunga,* Bonnaterre 1788) and per type of association: over a free school (FS) or floating object (FO).

Tuna discards were estimated in a similar way per species: YFT, BET, SKJ, ALB, FRZ, KWA, OTR (un-identified) and by type of association: FS and FO.

We considered four groups of bycatch species for data regarding accompanying fauna: swordfish, other fish, elasmobranchii and turtles. For each species, we calculated a presence index in relation to the total number of sets performed over each type of association (FS and FO) and an estimate of catch weight (t) of swordfish, elasmobranchii and other fish, bearing in mind catches over 0.1 t for FS sets and over 0.5 g for FO, but without considering catches of whale shark-RTY (*Rhincodon typus.* Smith, 1828), since its considerable size made weight estimation difficult.

3. Results

During these observations, the following forms were logged: 601 route forms, 477 fishing forms, 1062 tuna sampling forms, 425 associated species sampling forms and 1203 operations with objects forms.

Figure 1 shows the departure dates and duration of the campaigns undertaken with observers. Attempts were made to ensure that trips took place throughout the entire period of study, in order to observe the time variations made by the fleet where the mode and fishing zones were concerned. This was not possible for the first trips, owing to logistic problems, since most trips took place in the second half of the year. Average campaign duration was 35 days.

Table 1 shows data—grouped by year—obtained by observers on board for the PNDB-IEO from 2003 to 2006. Details are provided about the number of campaigns observed, observation days, the number of positive and negative sets per type of association, and the catches and discards obtained for each fishing mode. To date, 17 campaigns have taken place, with 601 days at sea, during which 371 positive sets were performed, involving catches of 17184 t of tuna, of which 490 t were discarded.

Figure 2 presents the percentage of sets observed, per fishery type, and the results. 48% of the sets were performed over floating objects, while 52% correspond to sets over free schools. Around 40% of sets over free schools were null, compared with 1% of sets over floating objects.

Table 2 compares data obtained by observers with those from fishing and sampling logs in port (Delgado de Molina *et al*, 2006), as well as the number of positive sets per type of association and catches per species. The lower area indicates observer data coverage for the entire fleet. As in other works (Sarralde *et al*, 2005), we observe that the coverage of the number of sets is much higher than the catch (approximately double). A reason for this discrepancy could be that the number of sets registered in the fishing logs on board, and from which many fishery statistics are obtained, is lower than the real number.

Table 3 shows the catches and catch rate per year, positive set, species and type of association, obtained by observers between 2003 and 2006. Yellowfin is the most caught species in sets over free schools, while skipjack is the dominant species in sets over floating objects. Catch rates per type of set, calculated in tonnes caught per set, are higher in the fishing mode over floating objects.

Figure 3 gives the composition per species (in %) of the catches obtained per type of school for all sets performed with observers during this period.

Table 4 presents the same data with catches discarded per year, species and type of association, as well as the importance of discards per species and set performed over each type of school. Most discards are produced in sets over floating objects and skipjack is the most discarded species, followed by small tuna (frigate tuna and Kawakawa), except in 2004, when a set was logged over a free school which involved discarding a considerable amount of frigate tuna. The annual proportions of discards varied between 0% and 2.6% for fishing over free schools and between 0.6% and 2.5% for catches over floating objects.

Figure 4 gives species' composition, in percentages, of the discards per type of association.

Table 5 shows the average duration, in minutes, of a set according to type of association and success. The process of hauling in the fishing gear is slower in sets over an object than in those over free schools. In all likelihood, this is due to the size of the fish entangled in the gear or the larger catches made with this type of set (Delgado de Molina *et al,* 1997).

Some observers used depth registers with which they measured the depth of the gear during fishing operations, following the same guidelines as those used in the Atlantic Ocean (Delgado de Molina *et al*, 2003). 103 depth observations were carried out, of which the minimum was 106 m and the maximum 189 m.

Table 6 presents the results obtained from analysing operations over floating objects in the Indian Ocean. A vessel generally visits an average of 38 objects per campaign, fishes over 14 and deposits an average of 18.

Figure 5 shows the number of operations undertaken according to the type of object. Practically all activities with objects involve rafts with buoys. Fishery with the support of a supply vessel was undertaken on very few occasions.

Table 7 presents the faunistic list of species per school type, as well as 1% of appearance. Most species mentioned are involved in both fishing modes. For fishery over free schools, the most frequent species are oceanic whitetip sharks (*Cacharhinus longimanus*. Poey 1861) and rainbow runner (*Elagatis bipinnulata*). Quoy & Gaimard, 1825), with an appearance of 4.7% in all the sets undertaken over free schools for both species. For fishing over floating objects, the most frequent bycatch species are found in the fish group. Rainbow runner and spotted oceanic triggerfish (*Canthidermis maculatus*. Bloch, 1786) are the species caught in most sets performed with this fishing mode: 72.5% and 74.3%, respectively. In the Selachii group, the silky shark (*Carcharhinus falciformis*. Müller & Henle, 1839) appears in 54.5% of sets over objects. The most frequent in the swordfish group is the striped marlin (*Tetrapturus audax*. Philippi, 1887), present in 7.7% of sets over objects.

Figure 6 gives the total catches in tonnes of the different groups of bycatch, except for turtles. In the Selachii group, the two associations with the whale shark have not been included, owing to their considerable size and the difficulty of calculating their weight. Both specimens involved were extracted live from the purse-seine. 51% of bycatches in weight correspond to Selachii, 42% to other fish and 7% to swordfish.

Figure 7 provides the percentage in weight (tonnes) of the various species of bycatch caught over free schools. Catches of species below 0.1 t have not been included.

The same procedure was followed in Figure 8 for bycatches associated with objects. Catches of species below 0.5 t have not been included.

Sampling was performed on all bycatch species. Figure 9 presents the composition of sizes to total length in intervals of 10 cm of the silky shark-CFA *(Carcharhinus falciformis)* and oceanic whitetip shark-CLO *(Carcharhinus longimanus).* Figure 10 gives the sex ratio, which is always very close to 50%. Figure 11 details the frequency of sizes of the black marlin-BLM *(Makaira indica.* Cuvier, 1832*)* in lower jaw furcal length (LJFL), and striped marlin-STM *(Tetrapturus audax).*

During observations, 14 turtles were caught in all, and always associated with a floating object. Table 8 lists the species of turtles. Figure 12 provides details of sex per turtle species where sex could be determined, 12 of which were returned live to the sea, while 2 died during the fishing operation.

No marine mammals were caught during these observations.

For a more accurate analysis and extrapolations of these data to the entire fishery, current space-time sampling strata should be considered (Pianet *et al*, 2000), and data from other observer programmes carried out in the Spanish and French purse-seine fleets can be incorporated to achieve suitable coverage. To this end, the results given in this study should be considered as preliminary.

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SARRALDE R., J. Ariz, A. Delgado de Molina, P. Pallarés[1] y J.C. Santana. Actividad de los observadores en la flota atunera española de cerco en el océano atlántico desde 2001 al 2005. SCRS/2005/099

Observer data	2003	2004	2005	2006	TOTAL
n trips	4	5	6	2	17
n fishing days	102	234	216	49	601
n positive sets Free school	12	21	69	47	149
n negative sets Free school	10	26	52	12	100
n positive sets on FADs	51	102	61	8	222
n negative sets on FADs	1	1	3	1	6
Free school Total catch (t)	745	1236	2604	1237	5822
FADs Total catch	2921	4554	3178	219	10872
Free school discards (t)	1	54	2	14	72
FADs discards (t)	114	258	38	8	418

Table 1 - Catch by fishing mode and fishing effort observed by year

Year	2003		2004		2005		2006	
	Fishery	Observers	Fishery	Observers	Fishery	Observers	Fishery	Observers
Fishing days	4468	102	4730	234	5808	216		49
n sets Free school *	1869	22	2363	47	3047	121		59
n sets on FADs *	1932	52	1884	103	2768	64		9
Species								
YFT (t)	78968	1637	80810	2168	77519	3233		1197
SKJ (t)	88035	1916	64393	3055	94312	2280		144
BET (t)	8544	114	8634	527	10290	252		114
OTHERS (t)	653	0	269	41	441	17		2
Discards (t)		115		313		40		22
TOTAL (t)**	176200	3781	154106	6103	182562	5823		1478

* positive and null sets

** discards included

Coverage observers %				Total
year	2003	2004	2005	2003-2005
fishing days	2.3	4.9	3.7	3.6
sets	4.0	8.0	6.7	6.2
catches	2.1	4.0	3.2	3.1

Table 2 - Fishery and Observer data by year and coverage of observer activities

	2003		2004		2005		2006		TOTAL	
Observer data	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs
Catches (t)										
YFT	607	1030	1205	964	2287	947	1107	91	5205	3031
SKJ	136	1780	31	3024	201	2079	42	102	409	6984
BET	2	112	1	526	107	145	87	27	197	809
OTHERS	0	0	0	41	9	8	2	0	11	49
DISCARDS	1	114	54	258	2	38	14	8	72	418
TOTAL	746	3035	1290	4812	2607	3216	1251	227	5894	11290

	2003		2004		2005		2006		TOTAL	
	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs
Yield (t/ positive set)										
YFT	50.6	20.2	57.4	9.4	33.1	15.5	23.5	11.3	34.9	13.7
SKJ	11.3	34.9	1.5	29.6	2.9	34.1	0.9	12.8	2.7	31.5
BET	0.2	2.2	0.0	5.2	1.6	2.4	1.8	3.3	1.3	3.6
OTHERS	0.0	0.0	0.0	0.4	0.1	0.1	0.0	0.0	0.1	0.2
DISCARDS	0.1	2.2	2.6	2.5	0.0	0.6	0.3	1.0	0.5	1.9
TOTAL	62.2	59.5	61.5	47.2	37.8	52.7	26.6	28.4	39.6	50.9

Table 3 - Catches and catch rate (catch/positive set) by species and total

	2003		2004		2005		2006		TOTAL	
Observer data	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs
Discards (t)										
YFT	0.4	35.1	3.6	11.4	0.1	3.2	0.0	1.4	4	51
SKJ	0.4	57.5	0.1	141.0	1.1	8.9	0.0	1.4	2	209
BET	0.0	0.0	0.0	12.0	0.0	0.9	0.0	0.6	0	13
Frigate tuna	0.4	21.1	50.5	93.5	1.3	25.0	3.5	4.5	55.7	144.1
KAW	0	0	0	0.5	0	0	10.5	0	11	1
TOTAL	1.2	113.7	54.1	257.9	2.5	37.9	3.5	7.9	61	417

	2003		2004		2005		2006		TOTAL	
	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs	Free sch.	FADs
Yield (t/ positive set)										
YFT	0.0	0.7	0.2	0.1	0.0	0.1	0.0	0.2	0.0	0.2
SKJ	0.0	1.1	0.0	1.4	0.0	0.1	0.0	0.2	0.0	0.9
BET	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1
Frigate tuna	0.0	0.4	2.4	0.9	0.0	0.4	0.1	0.6	0.4	0.6
KAW	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0
TOTAL	0.1	2.2	2.6	2.5	0.0	0.6	0.3	1.0	0.4	1.9

Table 4 - Discards and discard rate (discards/positive sets) by species and total during observer cruises

	Free school	FADs
duration negative set (min.)	117	194
duration positive set (min.)	155	182
mean depth	147	156
Maximum depth	189	184
Minimum depth	106	124

Table 5 - Duration of sets and net depth.

FADs	Days	Visited	Deployed	Fished
Total	599	645	315	233
Trip average	35.2	37.9	18.5	13.7
Day average		1.0	0.5	0.4
minimum and maximum by day		0-2.4	0-1.8	0.1-0.8

Table 6 - Operations with objects: visited, deployed and fished.

Associated fauna	% Free school	% FADs
BILLFISHES		
Familia Istiophoridae	1.3	9.0
Istiophorus platypterus	2.7	0.5
Makaira indica	2.7	9.5
Tetrapturus angustirostris	1.3	0.9
Tetrapturus audax	0.0	7.7
Xiphias gladius	0.0	0.5
OTHER FISHES		
Ablennesse hians	0.0	6.8
Abudefduf vaigiensis	0.7	0.0
Acanthocybium solandri	2.0	46.8
Aluterus monoceros	0.0	20.3
Aluterus scriptus	1.3	2.3
Canthidermis maculatus	2.0	74.3
Carangoides orthogrammus	0.0	3.2
Carangoides orthogrammus	0.0	1.8
Caranx crysos	0.0	0.5
Caranx sexfasciatus	0.0	2.7
Coryphaena equiselis	0.0	0.9
Coryphaena hippurus	3.4	73.0
Decapterus macarellus	0.0	37.8
Diodon hystrix	0.7	1.4
Elagatis bipinnulata	4.7	75.2
Familia Balistidae	0.0	2.3
Familia Belonidae	0.7	1.8
Familia Bramidae	0.7	0.5
Familia Carangidae	0.7	4.5
Familia Coryphaenidae	0.7	0.5
Familia Diodontidae	0.7	0.0
Familia Echeneidae	0.7	0.5
Familia Ephippidae	0.0	0.5
Familia Exocoetidae	4.0	0.0
Familia Fistularidae	0.7	0.0
Familia Molidae	0.7	0.0
Familia Pomacentridae	0.0	0.5
Familia Tetraodontidae	0.0	0.5
Kyphosus cinerascens	0.0	18.0
Kyphosus sectator	0.7	10.8
Kyphosus sp.	0.0	0.9

Kyphosus vaigiensis	0.0	12.2
Lagocephalus lagocephalus	2.0	0.0
Lobotes surinamensis	0.7	43.2
Naucrates ductor	2.0	1.8
Otros peces sin identificar	4.0	0.0
Platax sp.	0.0	2.7
Platax teira	0.0	1.4
Remora australis	0.0	0.5
Remora remora	1.3	1.8
Remorina albescens	0.0	0.5
Ruvettus pretiosus	0.0	3.6
Seriola rivoliana	0.0	12.2
Sphyraena barracuda	1.3	14.4
Tylosurus crocodilus	0.0	0.5
Uraspis helvola	0.0	11.7
Uraspis secunda	0.7	32.9
Uraspis sp.	0.0	10.4
Zanclus cornutus	0.7	0.0
SHARKS		
Carcharhinus falciformis	4.0	54.5
Carcharhinus longimanus	4.7	15.3
Familia Carcharhinidae	0.7	0.0
Familia Dasyatidae	2.7	0.9
Familia Sphyrnidae	0.0	0.5
Isurus oxyrinchus	0.0	0.5
Manta birostris	1.3	0.9
Mobula mobular	6.7	0.0
Mobula sp	0.7	0.0
Mobula tarapacana	0.0	0.9
Prionace glauca	0.7	0.0
Pteroplatytrygon violacea	2.7	3.6
Rhincodon typus	0.7	0.5
Sphyrna lewini	0.7	0.0
TURTLES		
Caretta caretta	0.0	0.9
Chelonia mydas	0.0	2.3
Eretmochelys imbricata	0.0	1.8
Lepidochelis kempii	0.0	0.5
Lepidochelis olivacea	0.0	0.5

Table 7 - List of fauna and presence rate distinguishing between object and free school.

TURTLES	FADs
Caretta caretta	3
Chelonia mydas	5
Eretmochelys imbricata	4
Lepidochelis kempii	1
Lepidochelis olivacea	1
Total	14

Table 8 - Number of turtles captured by species.
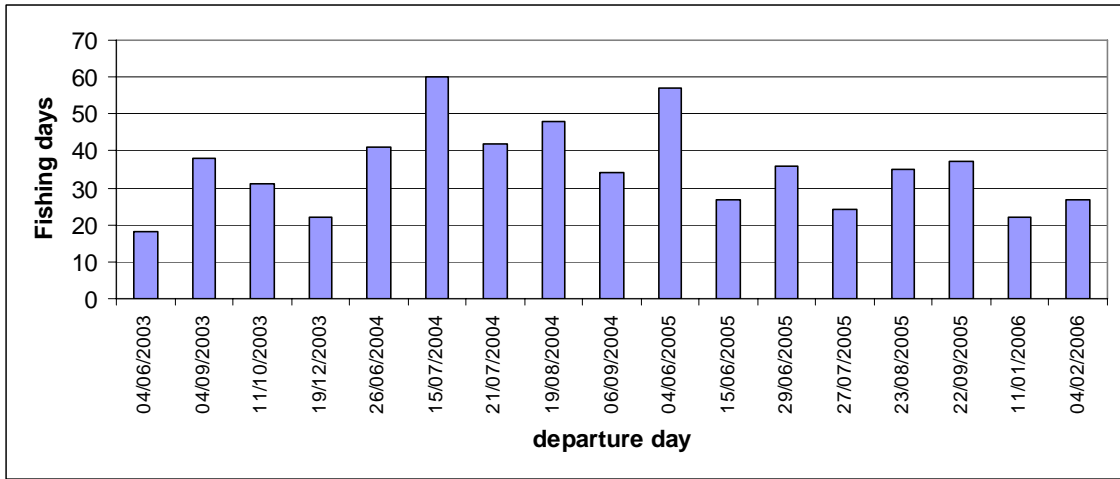
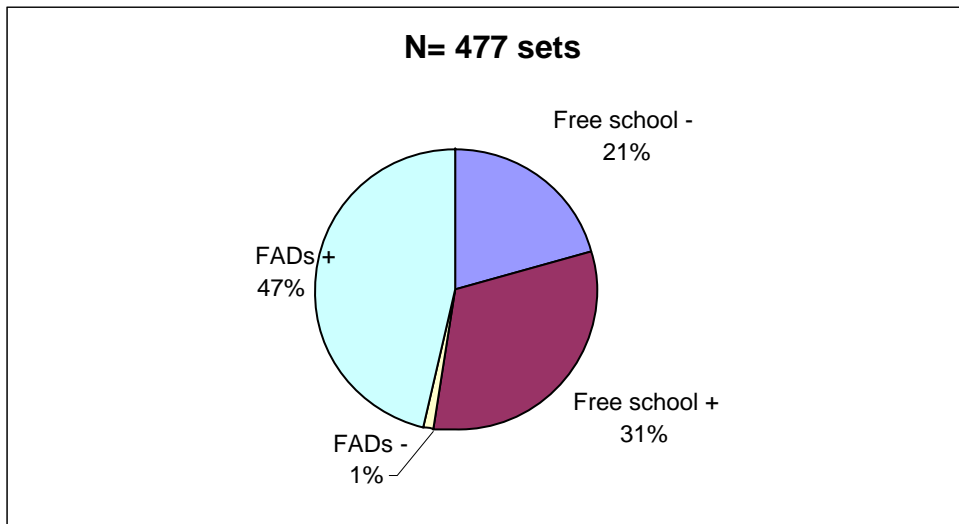Figure 1 - Fishing days and departure day of the PNDB observer trips.

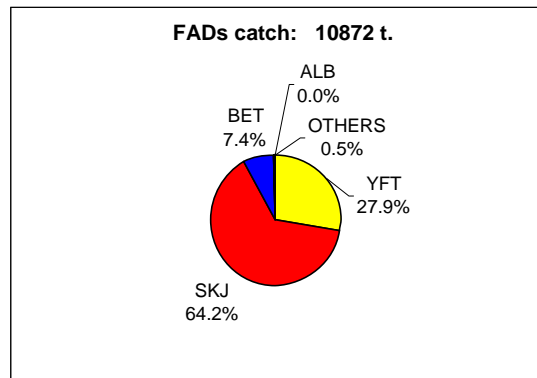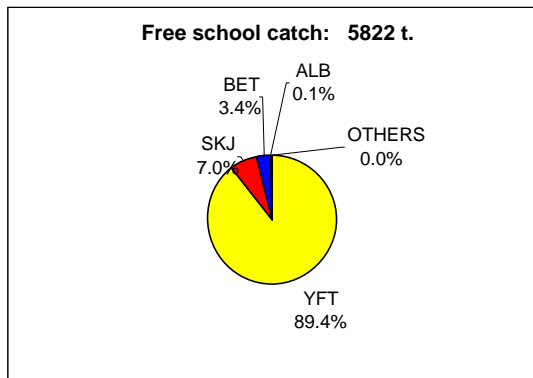Figure 2 - Association rate and success of the sets.

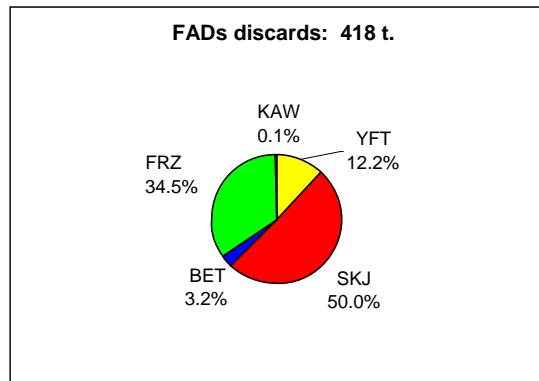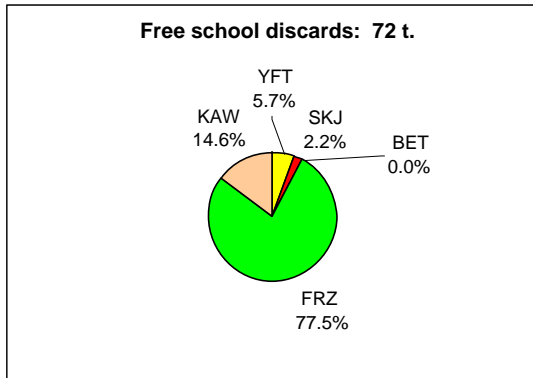Figure 3 - Catch composition by species and fishing mode.

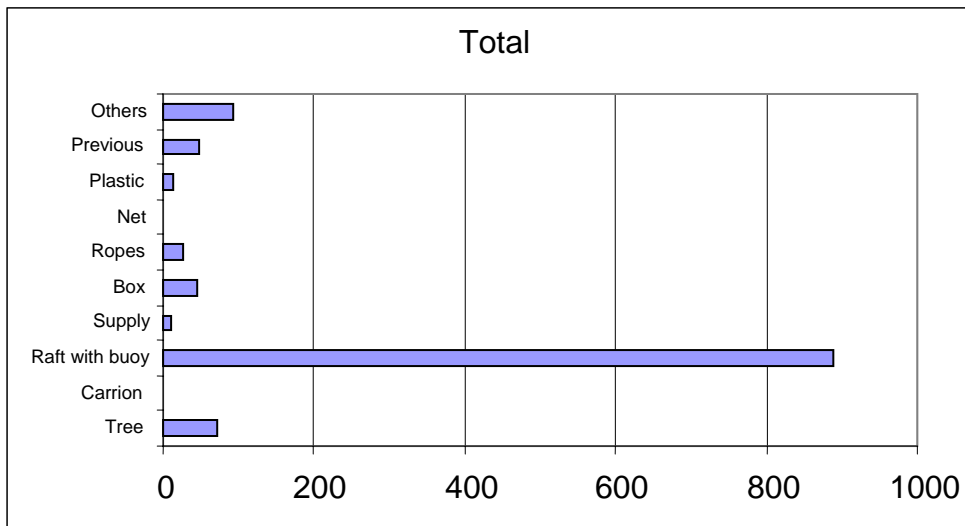Figure 4 - Discard composition by species and fishing mode.

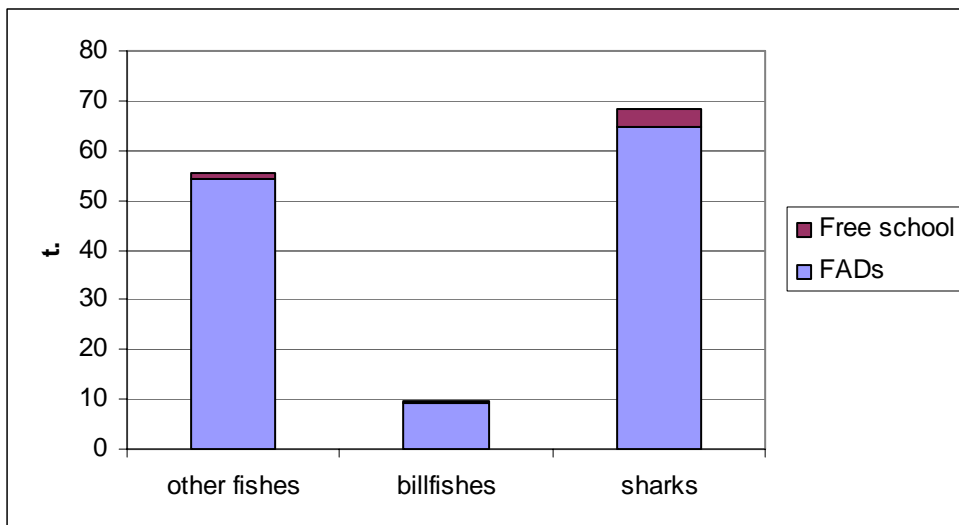Figure 5 - Number of FAD operations according to object type.

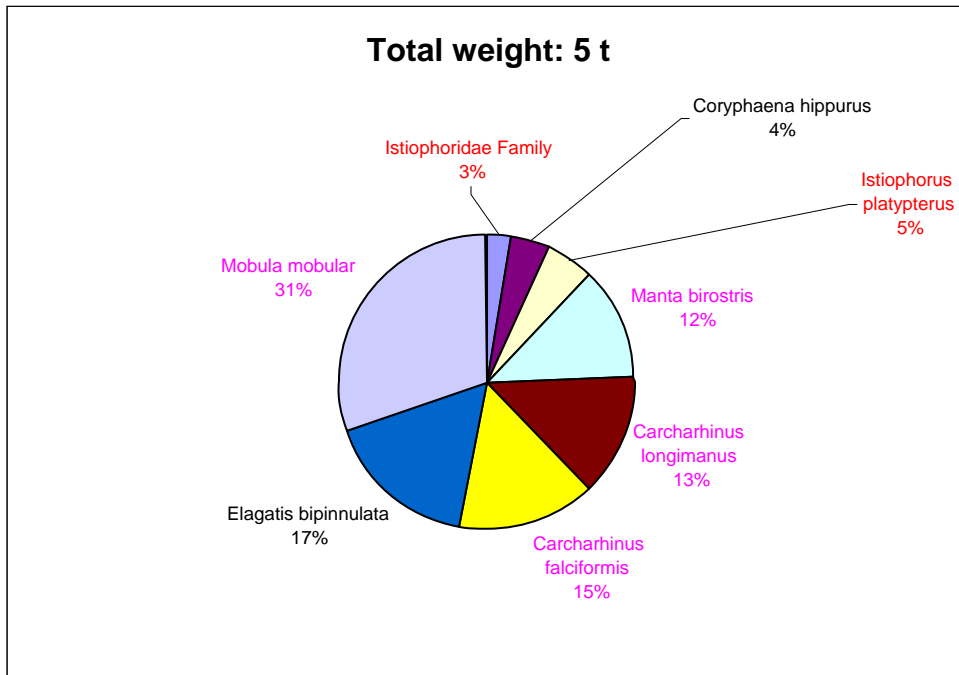Figure 6 - Catch of different groups of accessory fauna in tonnes by fishing mode.

Total weight: 5 t

- Coryphaena hippurus 4%
- Istiophoridae Family 3%
- Istiophorus platypterus 5%
- Mobula mobular 31%
- Manta birostris 12%
- Carcharhinus longimanus 13%
- Elagatis bipinnulata 17%
- Carcharhinus falciformis 15%

Figure 7 - Weight ratio of main species caught over free school

Total weight: 126 t

- Uraspis secunda 2.3%
- Lobotes surinamensis 1.0%
- Uraspis helvola 2.5%
- Sphyraena barracuda 0.4%
- Istiophoridae Family 0.9%
- Manta birostris 0.5%
- Tetrapturus audax 3.%
- Kyphosus cinerascens 0.4%
- Makaira indica 3.2%
- Canthidermis maculatus 4.5%
- Carcharhinus falciformis 34.7%
- Acanthocybium solandri 5.2%
- Elagatis bipinnulata 11.8%
- Carcharhinus longimanus 15.6%
- Coryphaena hippurus 13.8%

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Figure 8 - Weight ratio of main species caught over objects
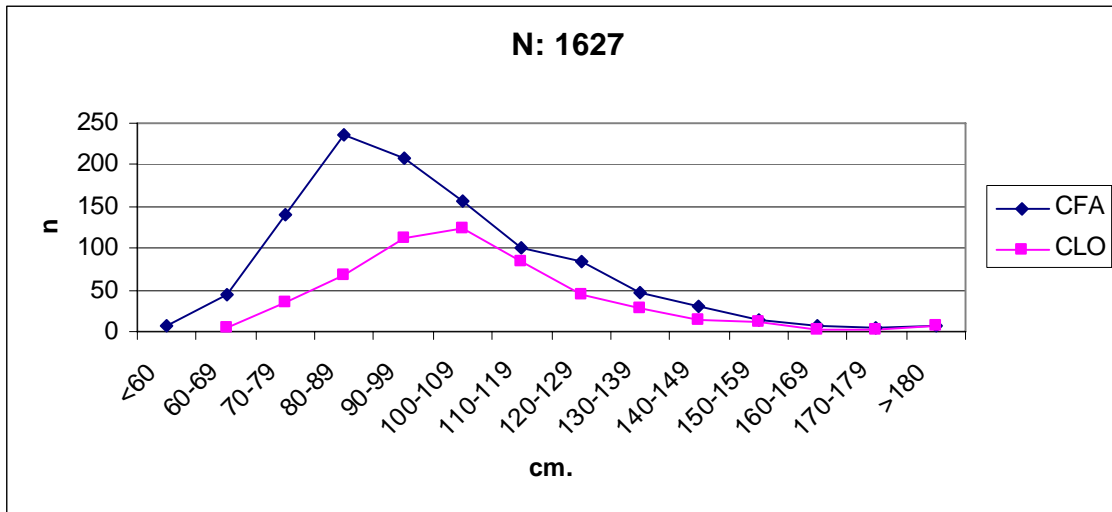
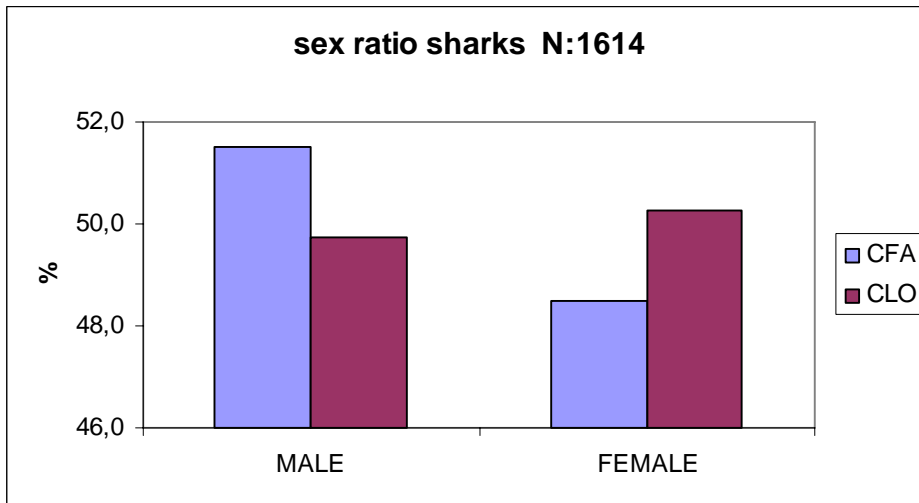Figure 9 - Length frequency of main sharks caught.

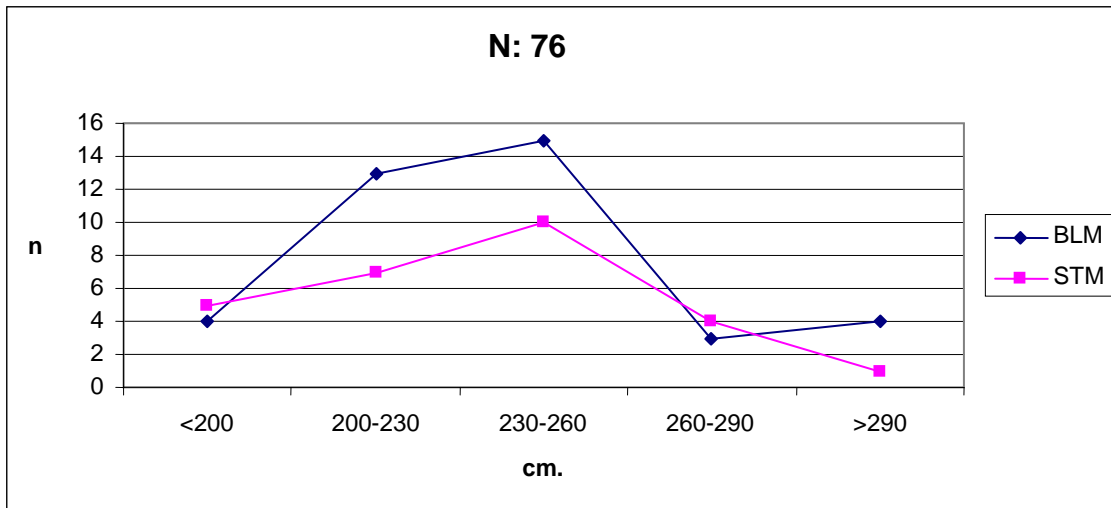Figure 10 - Sex ratio of main sharks caught.
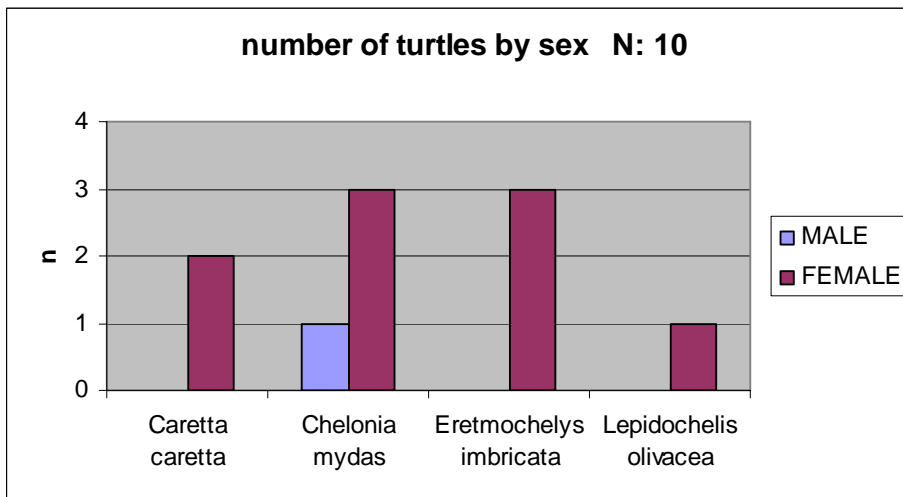
Figure 11 - Length frequency of main billfishes caught.

Figure 12 - Number of turtle catches by sex