FREE SCHOOL FISHERY TRENDS FOR SPANISH TROPICAL PURSE SEINERS IN THE INDIAN OCEAN

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Abstract

This document provides an update of the statistics of the Spanish purse seine fleet fishing in the Indian Ocean for the period 1990 to 2018, focusing on setting on tuna free schools. Catch and effort statistics, as well as some fishery indicators by species and fishing mode, are included in the analysis. In recent years, there has been a substantial change in the set ratio trends by type of school. This period is coinciding with the establishment of yellowfin tuna stock recovery plan with the aim to reduce their catches by 15% compared to the 2014 level . Thus, in the previous years, there was a ratio around of five sets on log schools for each set on free school. During the last year, this ratio has changed, reaching 25 sets on log schools for each set on free school. This operational change in the behavior of the fleet is an inflection point in the trends from time series.

Introduction

Considering that the yellowfin tuna stock was determined to be overfished and subject to overfishing, and according to the recommendations of the 18th Scientific Committee held in Bali, Indonesia (2015), the catches of yellowfin tuna (*Thunnus albacares*, YFT) have to be reduced by 20% of the 2014 levels to recover the stocks to levels above the interim target reference points with 50% probability by 2024. This recommendations were adopted in the IOTC`s Resolution 16/01 (superseded by Resolution 17/01, and then by Resolution 18/01) "On an interim plan for rebuilding the Indian ocean yellowfin tuna stock in the IOTC area of competence". Thus, the Spanish purse seiners have to reduce the YFT catches on 15% under the catches of 2014. Due to this management issues the Spanish authority closed of fishing activity on 5th November of 2017 up to the end of the 2017 year. During 2017, the YFT catches setting on free school was very similar to average to the previous years. However, during the past year there was a significant and intentional reduction setting on free school.

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In line with the works undertaken recently on the Spanish fleet (e.g., Soto & Fernández, 2016; Báez et al., 2017, 2018), the current paper provides an update on the statistics of the Spanish purse seine fleet fishing in the Indian Ocean for the period 1990 to 2018 setting on free schools. Catch and effort statistics, as well as some fishery indicators by species and fishing mode, are included in the analysis.

Material and methods

The current monitoring of the Spanish purse seine landings has been made remotely by outsourcing the sampling activities to the Seychelles Fishing Authority (SFA). It is generally acknowledged that species composition records in logbooks are frequently biased due to misidentification (Fonteneau, 1976). Consequently, routine processing corrections (based on a specific sampling design and multispecies size-frequency samples, collected during the landing operation), have been performed since 1980 (Pallarés and Hallier, 1997; Pianet et al., 2000). Thus, data from the Spanish purse seine vessels are collected at port in the Indian Ocean, and are shared with those from IRD (*Institut de Recherche pour le Développement*) and SFA for the adjustment of the nominal catches using the T3 software.

Currently, the collection and management of raw data for the Indian Ocean PS fisheries is based on the AVDTH ('*Acquisition et Validation des Données de Pêche au Thon Tropical*') software that was developed by IRD in the mid-1990s (Lechauve, 1999). AVDTH is a standalone application which connects to an MS Access database. The datasets are composed by (i) daily fishing activities and catches as recorded in logbooks, (ii) landing reports recorded on a trip basis at unloading or transshipment of the principal market tunas by commercial category, and (iii) the size-frequency histograms collected at unloading.

The collection of logbooks and landing reports is done in collaboration with the fishing companies and it typically covers *c.* 95 % of the fishing trips and activities. The current system of statistics started in the early 1980s, and the same methodology and protocols are followed by Spain, France and Seychelles. Sampling operations are carried out during the unloading of the purse seiners at fishing ports to estimate both size and species composition of the catch.

As explained above, to avoid the systematic bias in the logbook species composition, it is necessary to correct the catch estimates of the logbooks, as well as to

provide estimates on the size distribution, by using the samples taken from all the purse seine fleets combined.

Results

In 2018, the catch composition for the main target species on free schools was: 2163 t of yellowfin (YFT), 1548 t of skipjack (SKJ), and 571 t of bigeye (BET). The total catch in 2018 was 4292 t, 82 % lower than last year and 79% lower than the average previous 5 years (**Table 1**). **Figure 1** shows the total catches by species and the effort in number of free school sets. In the **figures 2 and 3** the distribution of the catches by species and $1^0 \times 1^0$ squares for 2018 compared to the previous years and the average over the 2012 – 2016 period is presented.

A total of 14 Spanish purse seiners operated in the IOTC area during 2018. The Spanish fleet was composed of 10 vessels of carrying capacity (CC) 201-2000 t and 4 vessel of CC >2000 t. The total capacity in 2018 was lower than in 2016 (**Table 2**).

Table 3 shows the total number of sets and the number of sets by fishing mode.

Mean weight by species by fishing mode is presented in **figures 4, 5 and 6**. The mean weight on logs is normally lower than the mean weight on free school catches.

Figure 7 shows the ratio between the number of sets on log schools per number of sets on free schools. Thus in the previous years there was a ratio of around five sets on log schools for each set on free schools. But during the last year this ratio has changed to reach 25 sets on log schools for each set on free schools. However, the yield per set (number of tons per free school set) was similar to previous years, thus during 2018 we estimated in 25 t of tropical tuna per free school set, versus 24.4 tons of tropical tuna per set in average for the period 2017-2013.

Conclusions

1. During 2018 there was a significant increase in sets on log schools.
2. Tropical tuna catches per set showed a similar trend.
3. The fishing capacity of the Spanish purse seine fleet during the 2018 was the same to the previous years.
4. The year 2018 represents an outlier within Spanish time series for the catch ratios by type of school.

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Table 1. Spanish purse seiners catch on free schools by species in the Indian Ocean, 1990-2018.

CATCH ON FREE SCHOOL BY SPECIES					
YEAR	YFT	SKJ	BET	ALB	TOTAL
1990	31939	12606	2492	105	47142
1991	34123	7883	2257	1011	45289
1992	24110	9638	520	1455	35724
1993	33860	14432	2664	904	51861
1994	30306	18536	1807	1734	52383
1995	28815	13054	1953	531	44353
1996	33435	20332	1977	814	57786
1997	22807	8673	1243	966	33898
1998	16522	9224	2683	250	28679
1999	17186	10826	1732	231	29976
2000	20024	9225	2050	367	31753
2001	28712	11382	1526	335	41974
2002	28494	7398	1530	212	37668
2003	46160	14746	2954	517	64403
2004	60546	7837	1036	76	69496
2005	48152	17984	3515	33	69729
2006	33852	14835	3109	438	52271
2007	18902	10774	2187	245	32138
2008	28405	7064	4271	267	40017
2009	11888	4475	2089	39	18490
2010	10761	4672	1442	121	16995
2011	15402	3538	2880	121	21940
2012	24728	1594	2641	361	29394
2013	12595	3268	1449	100	17412
2014	14414	3143	1430	65	19074
2015	20682	2994	3137	78	26891
2016	12827	2291	910	12	16040
2017	17929	1006	4419	90	23444
2018	2163	1548	571	0	4292

Table 2. Number of Spanish Purse seiners by category, carrying capacity in tons and number of supplies vessels used in association with Spanish boat 1990 - 2018.

Class	50-400	401-600	601-800	801-1200	1201-2000	>2000	total	C.Cap.	Supp
1990	-	-	3	8	9	0	20	17908	-
1991	0	0	3	6	8	0	17	16568	-
1992	0	0	1	6	11	0	18	16711	-
1993	0	0	1	6	11	1	19	18953	-
1994	0	0	2	4	11	1	18	18779	-
1995	0	0	2	5	11	1	19	20908	-
1996	0	0	2	6	13	1	22	24090	-
1997	0	0	2	6	14	1	23	26128	-
1998	0	0	2	6	12	0	20	21243	-
1999	0	0	2	6	12	0	20	20260	6
2000	0	0	1	7	9	0	17	19473	7
2001	0	0	1	7	9	0	17	20479	5
2002	0	0	1	6	10	1	18	20490	8
2003	0	0	1	6	9	2	18	21007	8
2004	0	0	1	4	10	5	20	23832	15
2005	0	0	1	4	10	5	20	29052	13
2006	0	0	1	5	11	5	22	31224	13
2007	0	0	1	4	11	5	21	29438	13
2008	0	0	0	3	10	4	17	24212	11
2009	0	0	0	2	9	4	15	20805	11
2010	0	0	0	1	8	4	13	20677	6
2011	0	0	0	1	8	4	13	20458	7
2012	0	0	0	1	9	4	14	21657	6
2013	0	0	0	1	9	4	14	22056	4
2014	0	0	0	2	9	4	15	20761	7
2015	0	0	0	1	11	5	17	23251	10
2016	0	0	0	0	10	4	14	23507	11
2017	0	0	0	0	10	4	14	22811	10
2018	0	0	0	0	10	4	14	22811	10

Table 3. Total number of sets, positive sets and null sets. Same statistics by fishing mode.

	ALL			FADs			FREE SCHOOL		
YEAR	Nº SETS	Nº SETS +	Nº SETS -	Nº SETS	Nº SETS +	Nº SETS -	Nº SETS	Nº SETS +	Nº SETS -
1990	4131	2876	1255	1612	1461	151	2519	1415	1104
1991	3291	2402	889	1409	1311	98	1882	1091	791
1992	3422	2594	828	1435	1377	58	1987	1217	770
1993	3756	2693	1063	1425	1372	53	2331	1321	1010
1994	3974	2814	1160	1413	1328	85	2561	1486	1075
1995	4197	3341	856	2287	2151	136	1910	1190	720
1996	4929	3824	1105	2166	2102	64	2763	1722	1041
1997	4592	3900	692	3004	2892	112	1588	1008	580
1998	4339	3381	958	2651	2512	139	1688	869	819
1999	4040	3219	821	2363	2267	96	1677	952	725
2000	3856	3169	687	2331	2236	95	1525	933	592
2001	4050	3105	945	2088	2004	84	1962	1101	861
2002	3681	3088	593	2331	2239	92	1350	849	501
2003	3801	2926	875	1932	1822	110	1869	1104	765
2004	4247	3021	1226	1884	1775	109	2363	1246	1117
2005	5815	4228	1587	2768	2620	148	3047	1608	1439
2006	6244	4688	1556	3333	3100	233	2911	1588	1323
2007	4940	3647	1293	2955	2624	331	1985	1023	962
2008	4495	3505	990	2564	2369	195	1931	1136	795
2009	3824	3347	477	2940	2773	167	884	574	310
2010	4309	3706	603	3442	3219	223	867	487	380
2011	4393	3750	643	3402	3196	206	991	554	437
2012	4135	3415	720	2855	2643	212	1280	772	508
2013	4253	3785	468	3626	3419	207	627	366	261
2014	4040	3472	568	3271	3045	226	769	427	342
2015	4235	3584	651	3109	2932	177	1126	652	474
2016	4809	4256	553	3991	3844	147	818	412	406
2017	4246	3667	579	3354	3197	157	892	470	422
2018	4558	4259	299	4387	4163	224	171	96	75

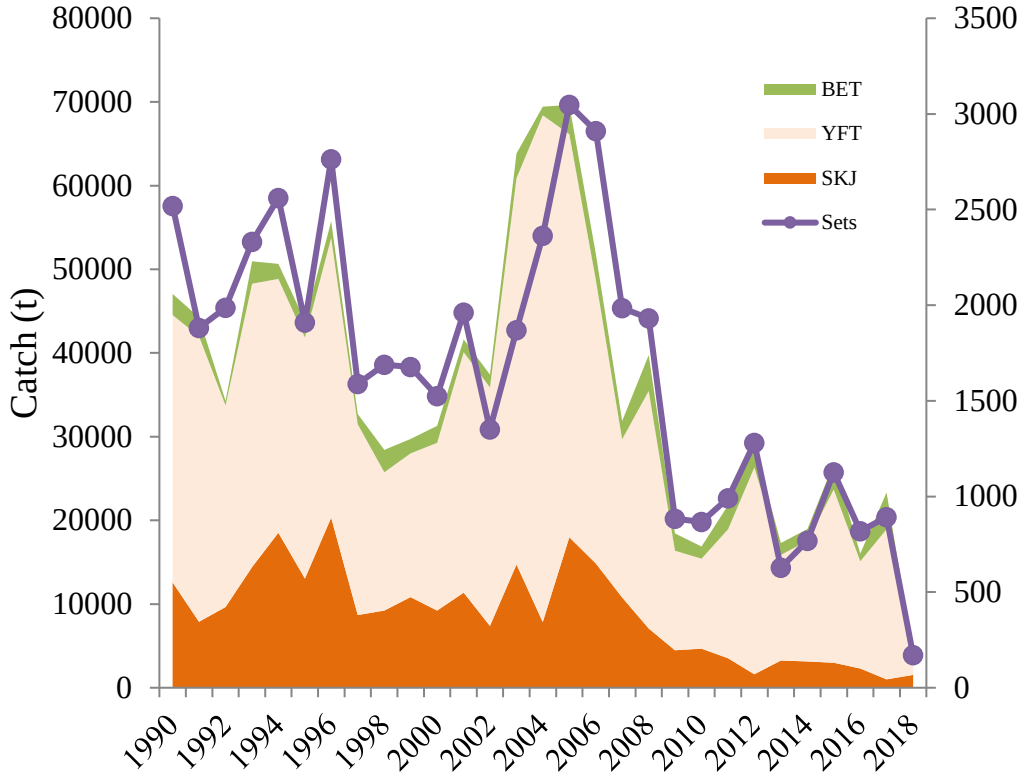

Figure 1. Total catches by species and the effort in number of free school sets.

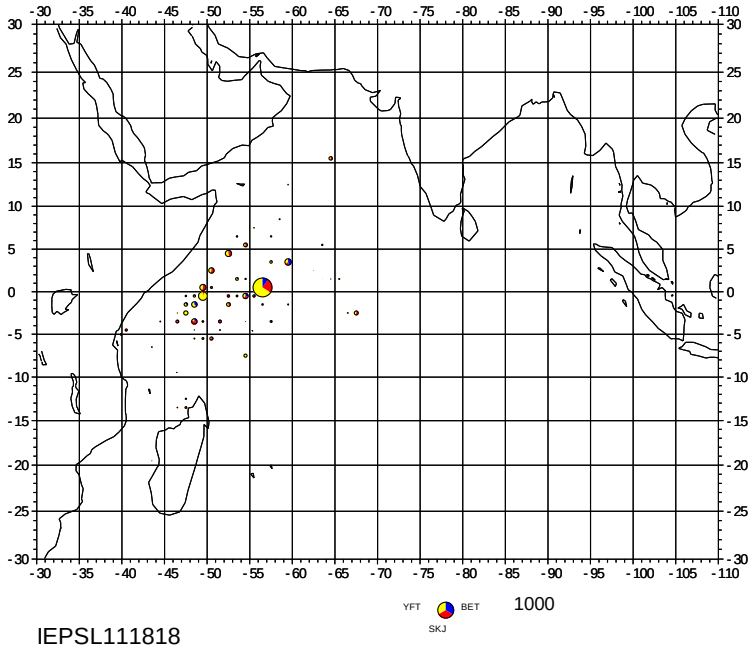

Figure 2. Distribution of the catches by species of de PS Spanish fleet, on free schools in 2018.

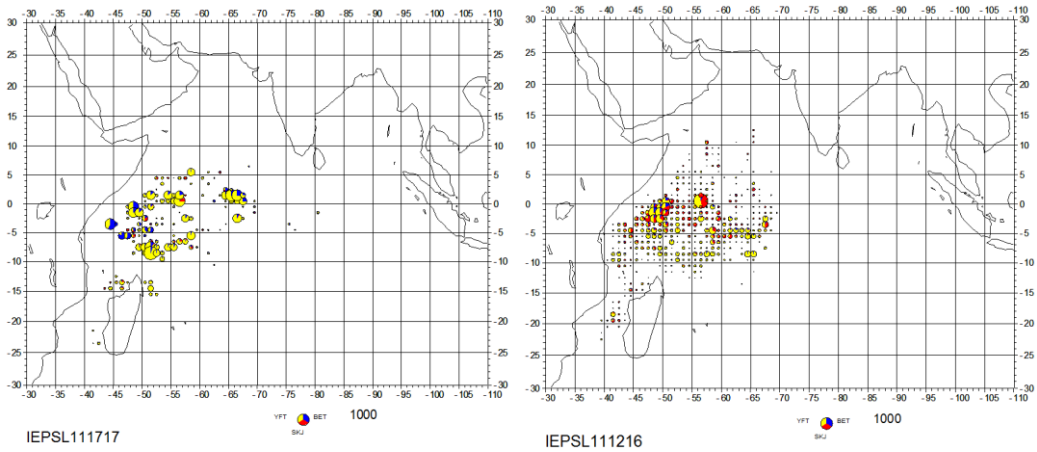

Figure 3. Distribution of the catches by species of de PS Spanish fleet, on free schools in 2017 (left) and on average over the 2012-2016 period (right).

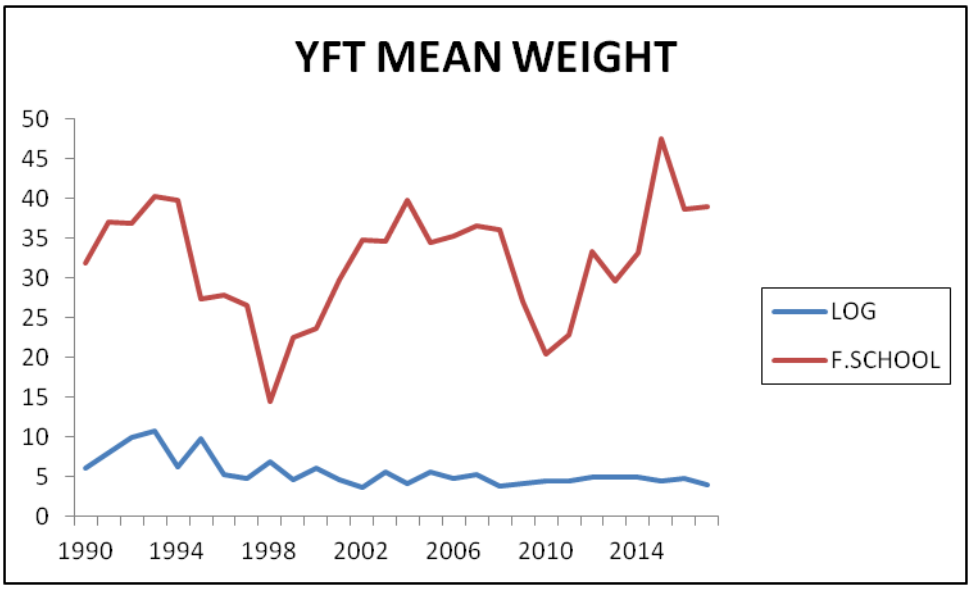

Figure 4. Yellowfin mean weight by fishing mode (log and free school) for the period 1990-2017.

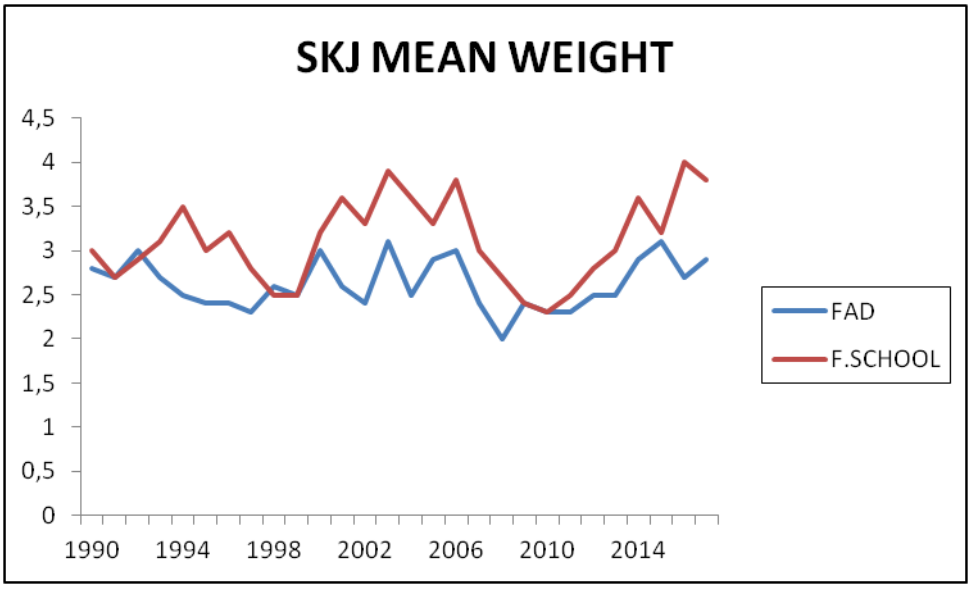

Figure 5. Skipjack mean weight by fishing mode (log and free school) for the period 1990-2017.

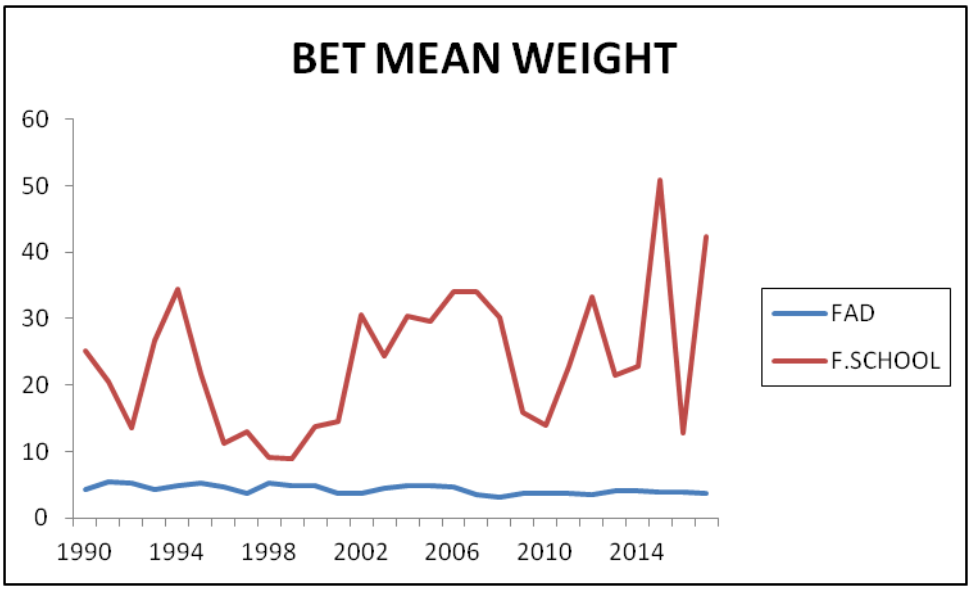

Figure 6. Bigeye mean weight by fishing mode (log and free school) for the period 1990-2017.

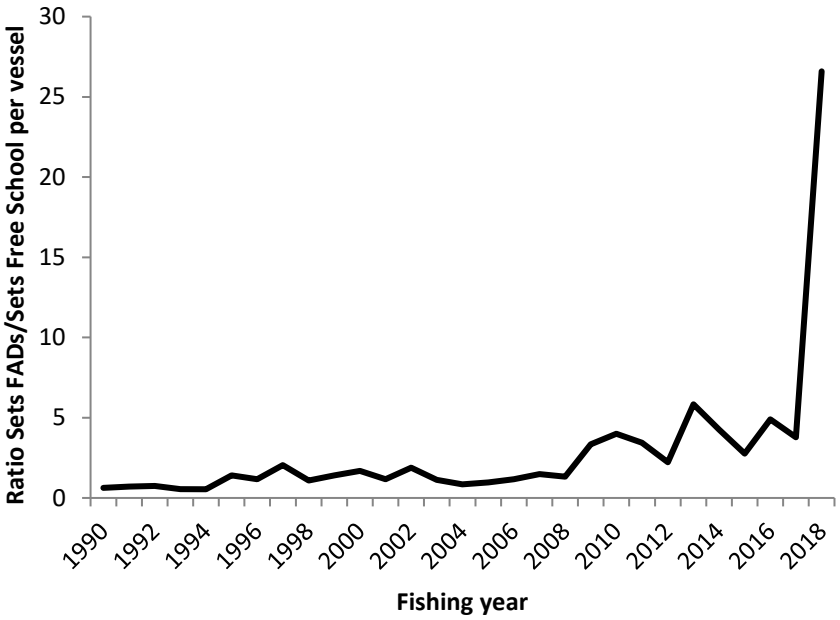

Figure 7. Trend in the fishing system used by Spanish fleet per fishing year. We plotted the ratio between the number of sets on FADs per vessel per year by the number of sets on Free schools per vessel per year. In recent years, there has been a significant increase in the proportion of FADs sets.