# Updating the statistics reported for the EU-Spain purse seine fishing fleet in the Indian Ocean (period 1984-2019) and the effects of the COVID-19 pandemic on the port sampling activity in Victoria (Seychelles)

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## Abstract

*This document provides an update on the statistics reported for the Spanish purse seine fleet fisheries in the Indian Ocean for the period 1984 to 2019. Data include catch and effort statistics, as well as some fishery indicators by species and fishing mode. Information about the coverage of the sampling, together with maps and diagrams illustrating the spatial-temporal fishing patterns of this fleet are also provided.*

***Keywords:*** *Tropical tuna, purse seiner, EU-Spain, fishing mode, COVID-19, catch, sampling, size, FAD seeding*

## Background

In line with the work undertaken recently on the Spanish fleet (e.g., Soto & Fernández, 2016; Báez et al., 2017, 2018, 2020), the current paper provides an update on the reported statistics for the Spanish purse seine fleet fishing in the Indian Ocean in the period 1984 to 2019. Data include catch and effort statistics, as well as some fishery indicators by species and fishing mode. Information about the scheme and coverage of the sampling, together with maps and diagrams illustrating the spatial-temporal patterns followed by this fleet are also provided.

**Results**

*Carrying capacity*

Ending the third quarter of 2019 a new vessel has joined the Spanish freezer purse seiner fleet, increasing the whole carrying capacity of the fishery and reaching more than 24000 tonnes. Despite this, the total catch of the fleet during 2019 (172700 t) was lower than in 2018 (> 200 thousand t), but above the average catch of the previous ten years (approximately 137 thousand tons, by around 26% of total catch). This increase is mainly related to SKJ catches. Thus, 2018 and 2019 have been the years with the highest volume of catch of SKJ of the Spanish fleet.

*Catch data*

Since 2017, the Indian Ocean yellowfin tuna stock has been subject to an interim Rebuilding Plan (current IOTC Resolution 19/01). In 2018 the Spanish General Secretariat for Fisheries (SGP) adopted Individual Vessel Quotas which cannot be monitored using T3 processing (to see Báez et al., 20201 for major detail), as an average catch is estimated for every whole national EU fleet following this scientific methodology (Duparc et al., 2018). For the YFT, it was then decided to provide as official data the sales notes required to monitor the quota consumption by the Spanish purse seine vessels, which are in accordance with the TAC control and management per vessel. The T3 processing was used for the standardization of catches of the rest of the main target tuna species.

The nominal catch reported by the Spanish General Secretariat for Fisheries, per species and fishing mode, is shown in **Tables 1-3**. **Tables 4 and 5** display the Spanish purse seiners total catch by species in the FAO areas 57 and 51 respectively, for the period 1991-2019.

By species, in 2019, 119138 tonnes of SKJ, 42243 tonnes of YFT and 11303 tonnes of BET have been caught. Considering these three species, the most significant increase in the catches was in the case of the SKJ for the recent years. Thus the 5-year average SKJ catches in the 2013-2017 period was 10883 tons versus 133 thousand and 119 thousand tons for the years 2018 and 2019 respectively. Furthermore, if we take into account that during 2018 the maximum catch in SKJ was reached in the historical series, during 2019 the second highest catch of SKJ in the historical series was reached. In 2019 BET catches have dropped below the average of the last 5 years. The trend in YFT is a decrease in catches, which is due to the management rules imposed.

The number of FOB-associated school sets (FADs and logs) has increased steadily from the early period (1984–1990), with a 31.9% of the sets focused on associated schools, reaching by around 76% of the sets in recent years (2008–2017 period) A maximum peak was recorded in 2018 (96%) (Báez et al., 2020) and by around 83% in 2019. This arises from the unusual behaviour of the fishing fleet during 2018 year.

**Figure 1** shows in detail the total catches by species and effort in searching days, and **figures 2**, **3** and **4** show the catches by fishing mode and species. In the **figures 5 and 6** the distribution of the catches by species and fishing mode are detailed.

It seems to be a tendency to stabilization in the effort (searching days) for the two recent years and a slight decrease in the catches, less pronounced for catches on free schools.

*Fishing Effort*

The number of Spanish purse seiners by category of carrying capacity, total carrying capacity in tons and number of purse seiners and supply vessels associated to this fishery, period 1990 - 2019 is showed in the **Table 6.**

On the other hand, during 2019 the fishing effort measured in searching days (time spent on searching to perform setting with a maximum of 13 hours per day) was the lowest for the all historical series (**Table 7**), but the number of sets was higher than in previous years (4280 sets in average for the period 2009- 2018 vs. 5038 recorded during the 2019 year) (**Table 8**). Therefore, in a short space-time period the number of sets has increased. Searching time between sets has been shorter than in previous years.

The number of 1x1 degree squares explored by the purse seine Spanish fleet in the Indian Ocean, considering different minimum effort limits in the period 1991-2019 is showed in the **Table 9.**

**Figure 7** details the annual progress of some parameters commonly used to quantify the effort in the case of the EU-Spain tropical purse seiner fleet. The number of support vessels (data available since 1999), number of purse seiner vessels, fishing and searching days, carrying capacity and number of sets by fishing are illustrated. The **Figure 8** shows the number of supply vessels associated to the Spanish purse seiner fleet. The **Figure 9** shows the fishing and searching days, and carrying capacity. The **Figures 10-12** show the number of positives and nulls sets per fishing mode.

*Sampling in port*

In 2019, 137618 tuna fishes were sampled during the landing. The number of sampling units in wells was 538 (1091 wells in total). Taking into account that the number of landings performed by the EU-Spain purse seiner fleet was 161, the sampling effort covered by around 83% of the yearly unloading (133 trips).

The **Figure 13** shows the number of sampling in Spanish Purse seiners in Victoria port by month during 2019-2020. The number of tuna fishes sampled in Port Victoria during 2019 is registered in the **Table 10**.

*Size distribution*

The **Figure 14** shows the size distribution of the catches by main tropical tuna species and fishing mode, in 2019 and on average over 2014 - 2018 period.

*FADs deployed trend*

**Table 11** shows the trend in the number of man-made FADs deployed by the Spanish fleet, including supply vessels during the period 2017-2019. **Figure 15** shows the distribution of the man-made FADs deployed during the period 2017-2019.

**Discussion**

A trend of the fleet is observed to setting more towards the North. An unexpected effect of the COVID-19 pandemic has been the suppression of the sampling surveys in the port of Victoria between March and October 2020. For example, during 2019 and for the same period comprised between March and October, by around the 57% of the samplings were performed. This could imply some difficulties in 2020 standardization of the tropical tuna catches.

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**Table 1. Total catch** reported by Spanish purse seiners (on free-swimming schools and FOB-associated schools) by main species in the Indian Ocean, period 1984-2019. Key: YFT, yellowfin tuna; SKJ, skipjack tuna; BET, bigeye tuna; ALB, albacore; FOB, floating object

| TOTAL CATCH BY SPECIES (t) | | | | | |
|---|---|---|---|---|---|
| YEAR | YFT | SKJ | BET | ALB | TOTAL |
| **1984** | 11453 | 6393 | 759 | 197 | 18802 |
| **1985** | 18431 | 18643 | 1330 | 145 | 38549 |
| **1986** | 20030 | 19108 | 1845 | 0 | 40983 |
| **1987** | 26301 | 27936 | 4974 | 4 | 59215 |
| **1988** | 44948 | 39742 | 6810 | 65 | 91565 |
| **1989** | 41146 | 64003 | 5863 | 0 | 111012 |
| **1990** | 43728 | 47926 | 4867 | 145 | 96666 |
| **1991** | 44023 | 41790 | 6005 | 1066 | 92884 |
| **1992** | 37836 | 46694 | 3638 | 1461 | 89629 |
| **1993** | 47792 | 51272 | 5418 | 904 | 105386 |
| **1994** | 43128 | 61608 | 5924 | 1773 | 112433 |
| **1995** | 65143 | 69587 | 12233 | 561 | 147524 |
| **1996** | 59431 | 66276 | 11374 | 826 | 137907 |
| **1997** | 60977 | 62914 | 15897 | 1029 | 140817 |
| **1998** | 38565 | 58646 | 11245 | 269 | 108725 |
| **1999** | 51875 | 74285 | 16034 | 232 | 142426 |
| **2000** | 52070 | 77187 | 10769 | 410 | 140436 |
| **2001** | 47571 | 68346 | 7930 | 339 | 124186 |
| **2002** | 53205 | 91462 | 11096 | 217 | 155980 |
| **2003** | 78968 | 88035 | 8544 | 520 | 176067 |
| **2004** | 80810 | 64393 | 8634 | 76 | 153913 |
| **2005** | 77519 | 94312 | 10290 | 48 | 182169 |
| **2006** | 70924 | 118857 | 9952 | 438 | 200171 |
| **2007** | 37763 | 65006 | 9756 | 246 | 112771 |
| **2008** | 46051 | 65096 | 12490 | 299 | 123936 |
| **2009** | 33511 | 66570 | 11781 | 52 | 111914 |
| **2010** | 45209 | 75131 | 10022 | 130 | 130492 |
| **2011** | 52256 | 67247 | 10702 | 121 | 130326 |
| **2012** | 57745 | 42892 | 7589 | 378 | 108604 |
| **2013** | 68352 | 64632 | 13880 | 117 | 146981 |
| **2014** | 57892 | 66597 | 8988 | 188 | 133665 |
| **2015** | 52631 | 58283 | 9832 | 144 | 120890 |
| **2016** | 51489 | 75264 | 9371 | 22 | 136146 |
| **2017** | 54513 | 84432 | 12345 | 100 | 151390 |
| **2018** | 46992 | 132986 | 28167 | 0 | 208145 |
| **2019** | 42263 | 119138 | 11303 | 40 | 172744 |

**Table 2.** Total catch reported by Spanish purse seiners associated with **FOBs**, by species, in the Indian Ocean, 1984-2019. Key: YFT, yellowfin tuna; SKJ, skipjack tuna; BET, bigeye tuna; ALB, albacore.

| CATCH ON FOBs BY SPECIES (t) | | | | | |
|---|---|---|---|---|---|
| YEAR | YFT | SKJ | BET | ALB | TOTAL |
| **1984** | 2115 | 3142 | 281 | 0 | 5538 |
| **1985** | 5286 | 12465 | 686 | 0 | 18437 |
| **1986** | 5765 | 10187 | 1273 | 0 | 17225 |
| **1987** | 10644 | 14949 | 2766 | 0 | 28359 |
| **1988** | 13578 | 30148 | 3578 | 0 | 47304 |
| **1989** | 15995 | 37185 | 3820 | 0 | 57000 |
| **1990** | 11789 | 35320 | 2375 | 40 | 49524 |
| **1991** | 9900 | 33906 | 3748 | 55 | 47609 |
| **1992** | 13726 | 37055 | 3118 | 6 | 53905 |
| **1993** | 13932 | 36839 | 2753 | 0 | 53524 |
| **1994** | 12822 | 43072 | 4117 | 39 | 60050 |
| **1995** | 36328 | 56534 | 10280 | 29 | 103171 |
| **1996** | 25996 | 45944 | 9396 | 12 | 81348 |
| **1997** | 38170 | 54240 | 14654 | 63 | 107127 |
| **1998** | 22043 | 49422 | 8562 | 18 | 80045 |
| **1999** | 34689 | 63459 | 14301 | 1 | 112450 |
| **2000** | 32046 | 67961 | 8719 | 43 | 108769 |
| **2001** | 18860 | 56964 | 6404 | 4 | 82232 |
| **2002** | 24710 | 84063 | 9566 | 4 | 118343 |
| **2003** | 32808 | 73288 | 5590 | 2 | 111688 |
| **2004** | 20264 | 56556 | 7597 | 0 | 84417 |
| **2005** | 29367 | 76328 | 6775 | 15 | 112485 |
| **2006** | 37072 | 104022 | 6843 | 0 | 147937 |
| **2007** | 18861 | 54232 | 7569 | 1 | 80663 |
| **2008** | 17647 | 58032 | 8220 | 32 | 83931 |
| **2009** | 21623 | 62096 | 9692 | 14 | 93425 |
| **2010** | 34448 | 70458 | 8580 | 9 | 113495 |
| **2011** | 36854 | 63709 | 7822 | 0 | 108385 |
| **2012** | 32946 | 41298 | 4948 | 17 | 79209 |
| **2013** | 55758 | 61364 | 12431 | 17 | 129570 |
| **2014** | 43478 | 63454 | 7558 | 124 | 114614 |
| **2015** | 31948 | 55290 | 6694 | 66 | 93998 |
| **2016** | 38662 | 72972 | 8461 | 10 | 120105 |
| **2017** | 36584 | 83426 | 7926 | 10 | 127945 |
| **2018** | 45257 | 131447 | 26373 | 0 | 203077 |
| **2019** | 33547 | 104938 | 7731 | 3 | 146220 |

**Table 3.** Total catch reported by Spanish purse seiners on **free-swimming schools**, by species, in the Indian Ocean, 1984-2019. Key: YFT, yellowfin tuna; SKJ, skipjack tuna; BET, bigeye tuna; ALB, albacore.

| CATCH ON FREE SCHOOLS BY SPECIES (t) | | | | | |
|---|---|---|---|---|---|
| YEAR | YFT | SKJ | BET | ALB | TOTAL |
| **1984** | 9338 | 3251 | 478 | 197 | 13264 |
| **1985** | 13145 | 6178 | 644 | 145 | 20112 |
| **1986** | 14265 | 8921 | 572 | 0 | 23758 |
| **1987** | 15657 | 12987 | 2208 | 4 | 30856 |
| **1988** | 31370 | 9594 | 3232 | 65 | 44261 |
| **1989** | 25151 | 26818 | 2043 | 0 | 54012 |
| **1990** | 31939 | 12606 | 2492 | 105 | 47142 |
| **1991** | 34123 | 7883 | 2257 | 1011 | 45274 |
| **1992** | 24110 | 9638 | 520 | 1455 | 35723 |
| **1993** | 33860 | 14432 | 2664 | 904 | 51860 |
| **1994** | 30306 | 18536 | 1807 | 1734 | 52383 |
| **1995** | 28815 | 13054 | 1953 | 531 | 44353 |
| **1996** | 33435 | 20332 | 1977 | 814 | 56558 |
| **1997** | 22807 | 8673 | 1243 | 966 | 33689 |
| **1998** | 16522 | 9224 | 2683 | 250 | 28679 |
| **1999** | 17186 | 10826 | 1732 | 231 | 29975 |
| **2000** | 20024 | 9225 | 2050 | 367 | 31666 |
| **2001** | 28712 | 11382 | 1526 | 335 | 41955 |
| **2002** | 28494 | 7398 | 1530 | 212 | 37634 |
| **2003** | 46160 | 14746 | 2954 | 517 | 64377 |
| **2004** | 60546 | 7837 | 1036 | 76 | 69495 |
| **2005** | 48152 | 17984 | 3515 | 33 | 69684 |
| **2006** | 33852 | 14835 | 3109 | 438 | 52234 |
| **2007** | 18902 | 10774 | 2187 | 245 | 32108 |
| **2008** | 28405 | 7064 | 4271 | 267 | 40007 |
| **2009** | 11888 | 4475 | 2089 | 39 | 18491 |
| **2010** | 10761 | 4672 | 1442 | 121 | 16996 |
| **2011** | 15402 | 3538 | 2880 | 121 | 21941 |
| **2012** | 24728 | 1594 | 2641 | 361 | 29324 |
| **2013** | 12595 | 3268 | 1449 | 100 | 17412 |
| **2014** | 14414 | 3143 | 1430 | 65 | 19052 |
| **2015** | 20682 | 2994 | 3137 | 78 | 26891 |
| **2016** | 12827 | 2291 | 910 | 12 | 16040 |
| **2017** | 17929 | 1006 | 4419 | 90 | 23444 |
| **2018** | 1735 | 1539 | 1794 | 0 | 5059 |
| **2019** | 8716 | 14200 | 3572 | 37 | 26525 |

**Table 4.** Spanish purse seiners total catch by species in the **FAO area 57**, period 1991-2019.

| CATCH AND EFFORT PS DATA AREA: F57 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **YEAR** | **YFT** | **SKJ** | **BET** | **ALB** | **TOTAL** | **FISH. DAYS** | **#SETS+** |
| **1991** | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **1992** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1993** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1994** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1995** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1996** | 27 | 107 | 23 | 0 | 157 | 21 | 6 |
| **1997** | 123 | 147 | 35 | 0 | 305 | 33 | 14 |
| **1998** | 5736 | 4468 | 2716 | 6 | 12926 | 762 | 328 |
| **1999** | 59 | 149 | 40 | 0 | 248 | 33 | 11 |
| **2000** | 67 | 88 | 13 | 0 | 167 | 30 | 9 |
| **2001** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2002** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2003** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2004** | 1 | 4 | 1 | 0 | 5 | 1 | 1 |
| **2005** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2006** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2007** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2008** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2009** | 464 | 961 | 216 | 0 | 1641 | 47 | 51 |
| **2010** | 12 | 0 | 0 | 0 | 12 | 3 | 1 |
| **2011** | 15 | 62 | 16 | 0 | 94 | 1 | 3 |
| **2012** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2013** | 29 | 129 | 26 | 0 | 184 | 16 | 9 |
| **2014** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2015** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2016** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2017** | 118 | 364 | 119 | 21 | 522 | 14 | 17 |
| **2018** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2019** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 5.** Spanish purse seiners total catch by species in the **FAO area 51**, period 1991-2019.

| CATCH AND EFFORT PS DATA AREA: F51 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **YEAR** | **YFT** | **SKJ** | **BET** | **ALB** | **TOTAL** | **FISH. DAYS** | **#SETS+** |
| **1991** | 44023 | 41790 | 6005 | 1066 | 92923 | 4324 | 2402 |
| **1992** | 37836 | 46694 | 3638 | 1461 | 89629 | 4296 | 2594 |
| **1993** | 47792 | 51272 | 5418 | 904 | 105385 | 4565 | 2693 |
| **1994** | 43128 | 61608 | 5924 | 1773 | 112433 | 4463 | 2814 |
| **1995** | 65143 | 69587 | 12233 | 561 | 147524 | 5221 | 3341 |
| **1996** | 59404 | 66169 | 11351 | 826 | 138977 | 5771 | 3818 |
| **1997** | 60855 | 62767 | 15862 | 1029 | 140720 | 6374 | 3886 |
| **1998** | 32829 | 54179 | 8529 | 262 | 95799 | 4882 | 3053 |
| **1999** | 51816 | 74137 | 15994 | 232 | 142179 | 5192 | 3208 |
| **2000** | 52004 | 77099 | 10756 | 410 | 140705 | 4496 | 3160 |
| **2001** | 47571 | 68346 | 7930 | 339 | 124389 | 4940 | 3105 |
| **2002** | 53205 | 91462 | 11096 | 217 | 156386 | 4570 | 3088 |
| **2003** | 78968 | 88035 | 8544 | 520 | 176200 | 4468 | 2926 |
| **2004** | 80809 | 64389 | 8633 | 76 | 154101 | 4729 | 3020 |
| **2005** | 77519 | 94312 | 10290 | 48 | 182562 | 5808 | 4228 |
| **2006** | 70924 | 118857 | 9952 | 438 | 200543 | 6462 | 4688 |
| **2007** | 37763 | 65006 | 9756 | 246 | 112848 | 5895 | 3647 |
| **2008** | 46051 | 65096 | 12490 | 299 | 124004 | 4792 | 3505 |
| **2009** | 33047 | 65609 | 11566 | 52 | 110311 | 3737 | 3296 |
| **2010** | 45197 | 75131 | 10022 | 130 | 130507 | 3822 | 3705 |
| **2011** | 52241 | 67184 | 10686 | 121 | 130255 | 3850 | 3747 |
| **2012** | 57745 | 42892 | 7589 | 378 | 108608 | 3991 | 3415 |
| **2013** | 68323 | 64503 | 13854 | 114 | 146798 | 4208 | 3776 |
| **2014** | 57892 | 66597 | 8988 | 188 | 133739 | 4185 | 3472 |
| **2015** | 52631 | 58283 | 9832 | 144 | 120890 | 4157 | 3584 |
| **2016** | 51489 | 75264 | 9371 | 22 | 136174 | 4261 | 4256 |
| **2017** | 54395 | 84068 | 12226 | 79 | 150769 | 3498 | 3650 |
| **2018** | 46992 | 132986 | 28167 | 0 | 208145 | 3627 | 4259 |
| **2019** | 42263 | 119139 | 11304 | 40 | 172746 | 3680 | 4424 |

**Table 6.** Number of Spanish purse seiners by category of carrying capacity, total carrying capacity in tons and number of purse seiners and **support vessels** associated to this fishery, period 1990 - 2019.

| | Capacity category class (t) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | 50-400 | 401-600 | 601-800 | 801-1200 | 1201-2000 | >2000 | #P.seiners | C.Cap. (t) | #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 | 6 |
| **2019** | 0 | 0 | 0 | 0 | 11 | 4 | 15 | 24061 | 6 |

**Table 7.** Nominal fishing effort in **fishing days** and **searching days** of the purse seine Spanish fleet, period 1990-2019

| YEAR | F.DAYS | S.DAYS |
|---|---|---|
| **1990** | 5006 | 4205 |
| **1991** | 4325 | 3544 |
| **1992** | 4296 | 3591 |
| **1993** | 4565 | 3842 |
| **1994** | 4463 | 3771 |
| **1995** | 5221 | 4470 |
| **1996** | 5793 | 4925 |
| **1997** | 6407 | 5584 |
| **1998** | 5644 | 4888 |
| **1999** | 5224 | 4496 |
| **2000** | 4526 | 3825 |
| **2001** | 4940 | 4214 |
| **2002** | 4570 | 3889 |
| **2003** | 4468 | 3671 |
| **2004** | 4730 | 3891 |
| **2005** | 5808 | 4619 |
| **2006** | 6462 | 5180 |
| **2007** | 5895 | 4916 |
| **2008** | 4792 | 3882 |
| **2009** | 3784 | 2992 |
| **2010** | 3825 | 2938 |
| **2011** | 3851 | 2944 |
| **2012** | 3991 | 3150 |
| **2013** | 4224 | 3326 |
| **2014** | 4185 | 3340 |
| **2015** | 4157 | 3287 |
| **2016** | 4261 | 3268 |
| **2017** | 3512 | 2618 |
| **2018** | 3627 | 2632 |
| **2019** | 3680 | 2616 |

**Table 8.** Total number of **sets**, positive sets and null sets. Same statistics by fishing mode.

| | ALL | | | FOB-ASSOCIATED SCHOOLS | | | FREE-SWIMMING SCHOOLS | | |
|---|---|---|---|---|---|---|---|---|---|
| **YEAR** | **Nº total SETS** | **Nº SETS +** | **Nº SETS -** | **Nº total SETS** | **Nº SETS +** | **Nº SETS -** | **Nº total 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 |
| **2019** | 5038 | 4424 | 614 | 4190 | 3932 | 258 | 848 | 492 | 356 |

**Table 9.** Number of **1x1 degree squares** explored by the purse seine Spanish fleet in the Indian ocean, period 1991-2019. The same, considering different minimum effort limits and number of squares with sets and with catch.

| NUMBER OF 1ºX1º SQUARE PROSPECTED BY THE SPANISH FLEET | | | | | |
|---|---|---|---|---|---|
| YEAR | N. CWP VISITED | N. CWP with SET | N. CWP with CATCH | N. CWP Eff >12hrs | N. CWP Eff >60hrs |
| **1990** | 395 | 319 | 199 | 301 | 286 |
| **1991** | 370 | 290 | 197 | 289 | 277 |
| **1992** | 419 | 347 | 223 | 338 | 324 |
| **1993** | 415 | 318 | 202 | 317 | 308 |
| **1994** | 479 | 380 | 218 | 359 | 348 |
| **1995** | 447 | 357 | 210 | 343 | 339 |
| **1996** | 574 | 459 | 280 | 446 | 437 |
| **1997** | 627 | 490 | 281 | 454 | 437 |
| **1998** | 742 | 547 | 263 | 525 | 512 |
| **1999** | 584 | 438 | 247 | 459 | 442 |
| **2000** | 585 | 428 | 223 | 450 | 430 |
| **2001** | 506 | 412 | 262 | 426 | 405 |
| **2002** | 534 | 448 | 430 | 436 | 259 |
| **2003** | 511 | 421 | 403 | 396 | 252 |
| **2004** | 492 | 376 | 359 | 368 | 221 |
| **2005** | 514 | 414 | 383 | 391 | 250 |
| **2006** | 563 | 473 | 464 | 449 | 275 |
| **2007** | 579 | 488 | 466 | 457 | 263 |
| **2008** | 577 | 504 | 483 | 476 | 276 |
| **2009** | 629 | 524 | 517 | 485 | 239 |
| **2010** | 531 | 480 | 464 | 411 | 232 |
| **2011** | 522 | 458 | 452 | 405 | 221 |
| **2012** | 500 | 416 | 405 | 398 | 224 |
| **2013** | 568 | 503 | 493 | 456 | 233 |
| **2014** | 460 | 390 | 382 | 352 | 200 |
| **2015** | 476 | 430 | 419 | 391 | 200 |
| **2016** | 554 | 532 | 524 | 450 | 263 |
| **2017** | 541 | 491 | 478 | 409 | 190 |
| **2018** | 544 | 518 | 510 | 479 | 232 |
| **2019** | 511 | 456 | 450 | 393 | 215 |

**Table 10**. Number of tuna fishes sampled in Victoria port during 2019 by month and species.

| Month | Tuna species | Number of fishes counted | Number of fishes measured |
|---|---|---|---|
| January | *Thunnus albacares* | 3070 | 3070 |
| January | *Auxis thazard* | 446 | 446 |
| January | *Katsuwonus pelamis* | 9103 | 2200 |
| January | *Thunnus obesus* | 728 | 728 |
| February | *Thunnus albacares* | 7427 | 7427 |
| February | *Auxis thazard* | 830 | 830 |
| February | *Katsuwonus pelamis* | 22455 | 5800 |
| February | *Thunnus obesus* | 1678 | 1678 |
| February | *Euthynnus affinis* | 34 | 34 |
| March | *Thunnus albacares* | 4116 | 4116 |
| March | *Auxis thazard* | 495 | 495 |
| March | *Katsuwonus pelamis* | 14692 | 3700 |
| March | *Thunnus obesus* | 1219 | 1219 |
| March | *Euthynnus affinis* | 1 | 1 |
| April | *Thunnus albacares* | 2038 | 2038 |
| April | *Auxis thazard* | 121 | 121 |
| April | *Katsuwonus pelamis* | 12067 | 2700 |
| April | *Thunnus obesus* | 371 | 371 |
| April | *Euthynnus affinis* | 1 | 1 |
| May | *Thunnus albacares* | 3894 | 3894 |
| May | *Auxis thazard* | 168 | 168 |
| May | *Katsuwonus pelamis* | 19037 | 4100 |
| May | *Thunnus obesus* | 329 | 329 |
| June | *Thunnus albacares* | 4565 | 4565 |
| June | *Auxis thazard* | 675 | 675 |
| June | *Katsuwonus pelamis* | 13656 | 3500 |
| June | *Thunnus obesus* | 177 | 177 |
| June | *Euthynnus affinis* | 122 | 122 |
| July | *Thunnus albacares* | 6244 | 6244 |
| July | *Auxis thazard* | 128 | 128 |
| July | *Thunnus alalunga* | 8 | 8 |
| July | *Katsuwonus pelamis* | 5928 | 1800 |
| July | *Thunnus obesus* | 674 | 674 |
| July | *Euthynnus affinis* | 43 | 43 |
| August | *Thunnus albacares* | 6981 | 6981 |
| August | *Auxis thazard* | 591 | 591 |
| August | *Katsuwonus pelamis* | 25841 | 6600 |
| August | *Thunnus obesus* | 1682 | 1682 |
| September | *Thunnus albacares* | 5807 | 5807 |
| September | *Auxis thazard* | 1127 | 1127 |
| September | *Katsuwonus pelamis* | 24651 | 6150 |
| September | *Thunnus obesus* | 1006 | 1006 |
| October | *Thunnus albacares* | 6266 | 6266 |
| October | *Auxis thazard* | 619 | 619 |
| October | *Katsuwonus pelamis* | 19884 | 5100 |
| October | *Thunnus obesus* | 940 | 940 |
| November | *Thunnus albacares* | 7556 | 7556 |
| November | *Auxis thazard* | 1112 | 1112 |
| November | *Katsuwonus pelamis* | 30115 | 7500 |
| November | *Thunnus obesus* | 668 | 668 |
| November | *Euthynnus affinis* | 2 | 2 |
| December | *Thunnus albacares* | 8256 | 8256 |
| December | *Auxis thazard* | 302 | 302 |
| December | *Katsuwonus pelamis* | 25540 | 4550 |
| December | *Thunnus obesus* | 1401 | 1401 |
| | **TOTAL** | **306887** | **137618** |

**Table 11** Trend in the number of man-made FADs deployed by the Spanish fleet, including supply vessels. Key: PS, Purse seiners; SV, Supply vessel.

| Year | TOTAL FADs deployed | PS_FADs deployed | SV_FADs deployed | Total Vessels | Number PS | Number SV |
|---|---|---|---|---|---|---|
| 2017 | 12688 | 6526 | 6162 | 24 | 14 | 10 |
| 2018 | 10177 | 5976 | 4201 | 20 | 14 | 6 |
| 2019 | 8364 | 5033 | 3331 | 21 | 15 | 6 |

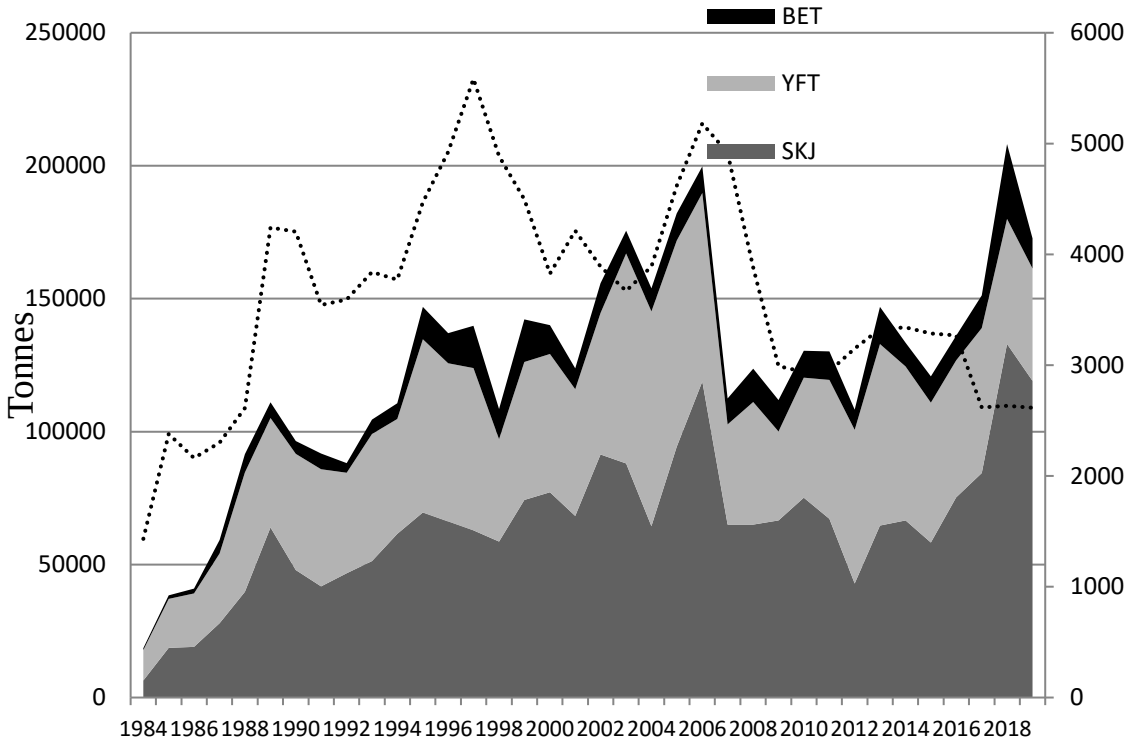



**Figure 1**. Catch by species and effort in searching days of the purse seine Spanish fleet.

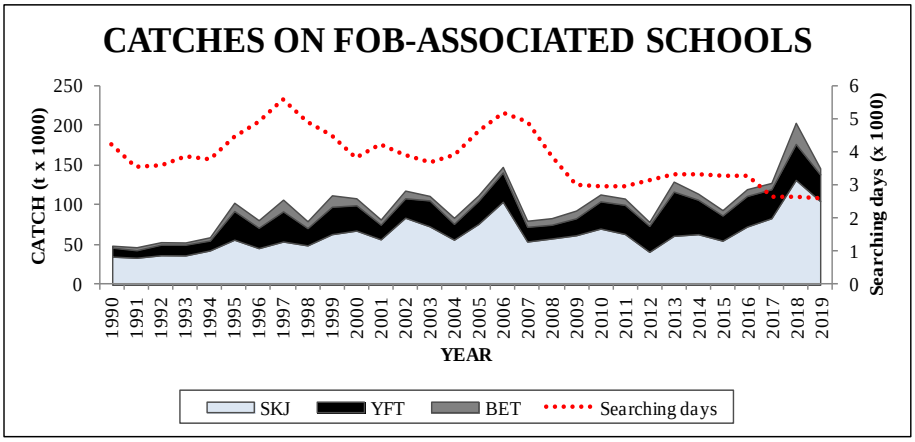



**Figure 2**. Catch by species on floating objects and effort in searching days of the purse seine Spanish fleet.

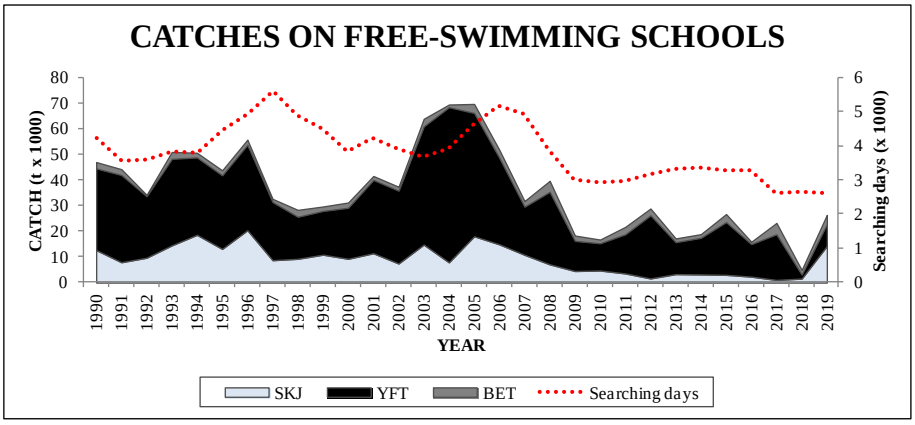



**Figure 3**. Catch by species on free schools and effort in searching days of the purse seine Spanish fleet.

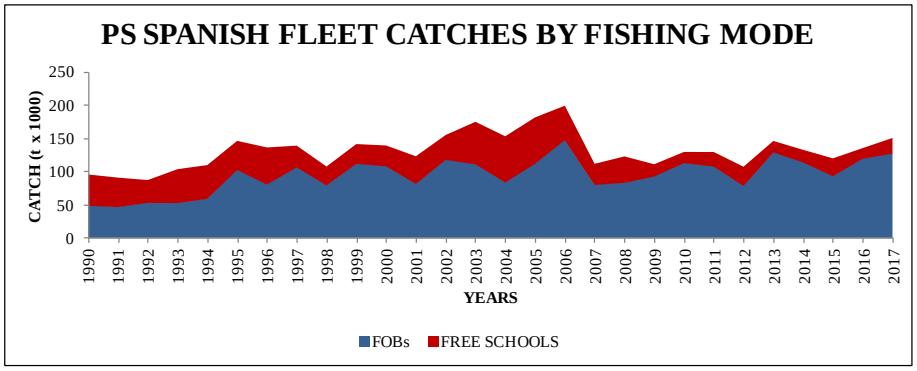



**Figure 4**. Catch by fishing mode (floating object and free school) of the purse seine Spanish fleet.

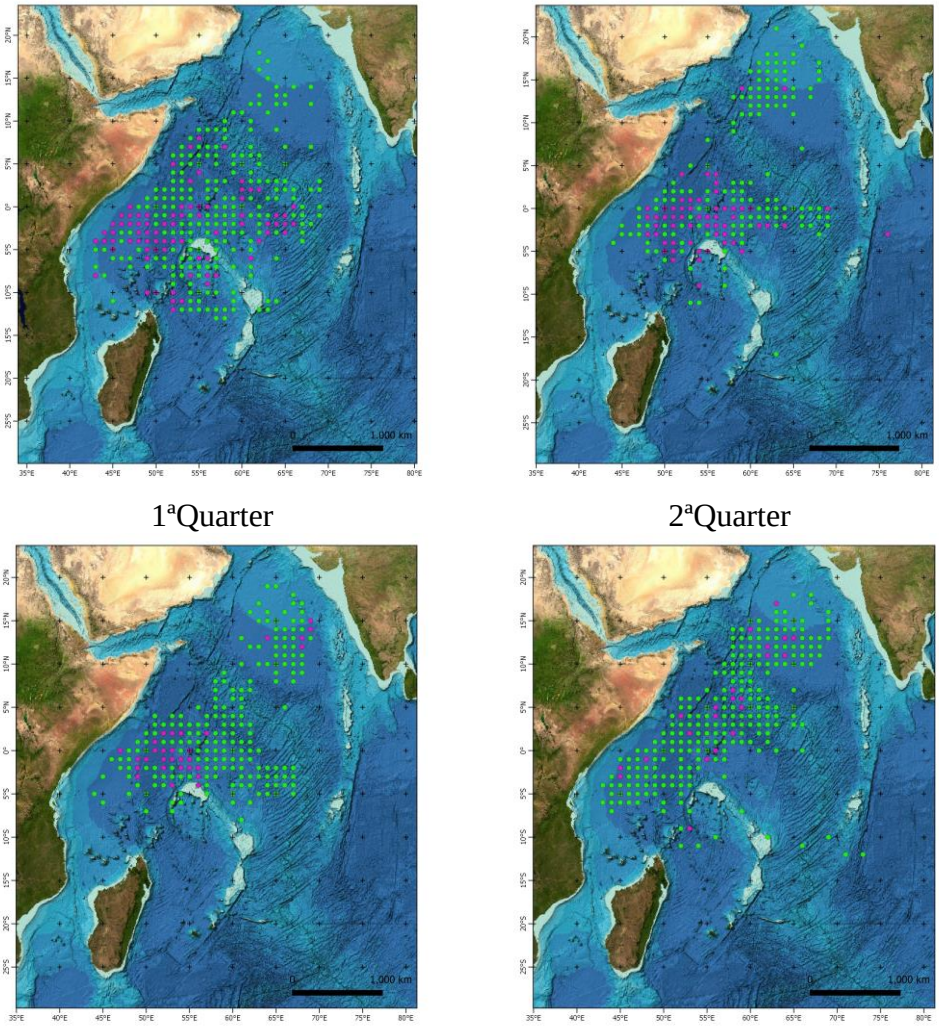
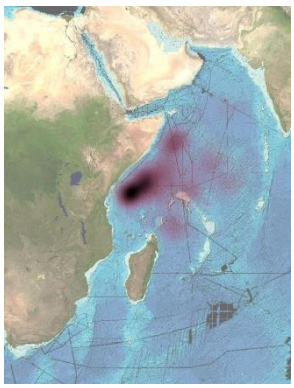
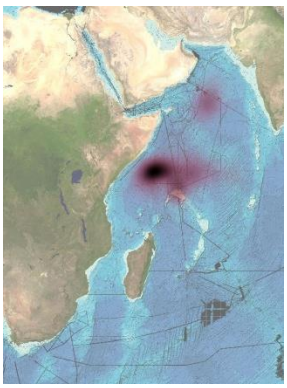
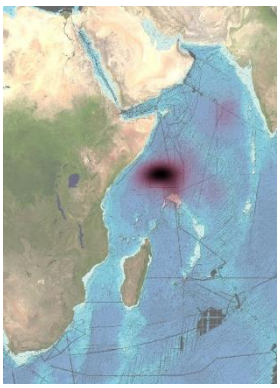
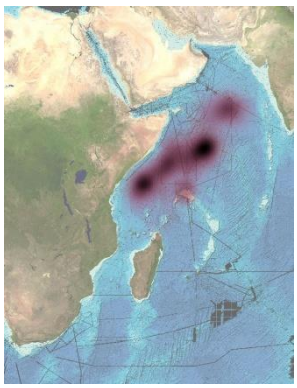


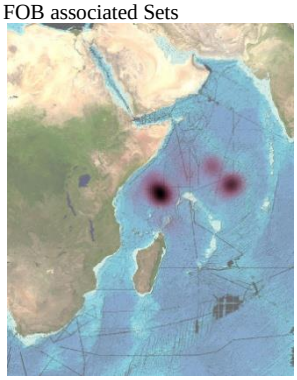

**Figure 5**. Distribution of the effort (fishing days) of the purse seine Spanish fleet in 2019 per quarter and fishing mode. Key: Green, FOB-associated sets; Pink, Free-swimming school sets.

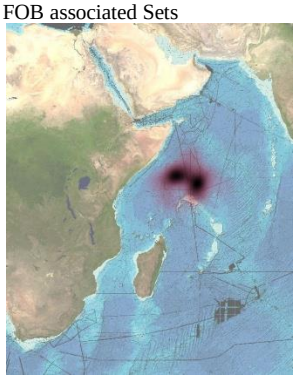

Skipjack tuna catches 1ªQuarter FOB associated Sets

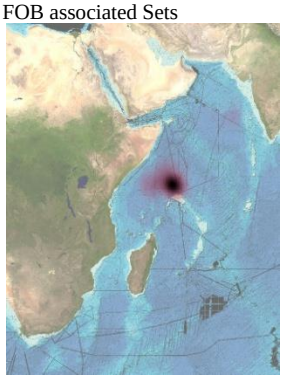

Skipjack tuna catches 2ªQuarter FOB associated Sets

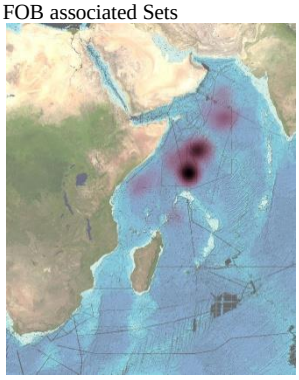

Skipjack tuna catches 3ªQuarter FOB associated Sets

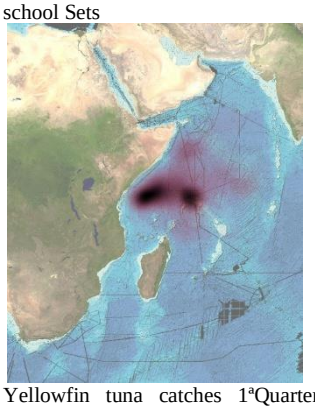

Skipjack tuna catches 4ªQuarter FOB associated Sets

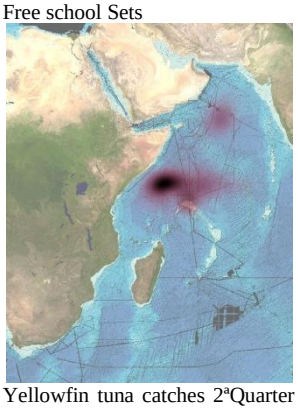

Skipjack tuna catches 1ªQuarter Free school Sets

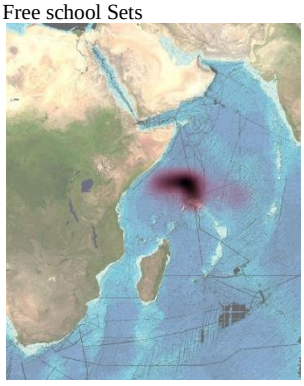

Skipjack tuna catches 2ªQuarter Free school Sets

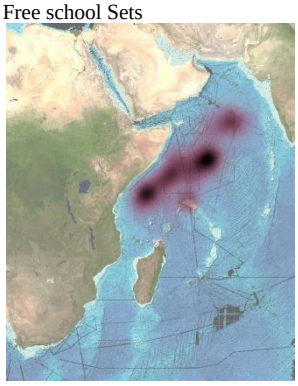

Skipjack tuna catches 3ªQuarter Free school Sets

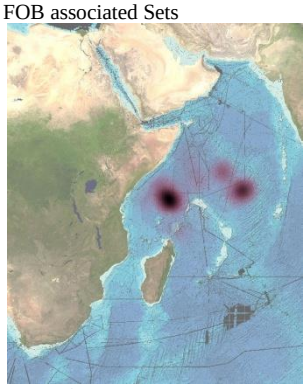

Skipjack tuna catches 4ªQuarter Free school Sets

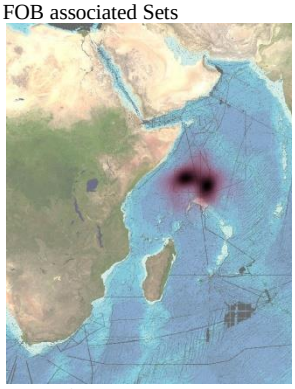

Yellowfin tuna catches 1ªQuarter FOB associated Sets

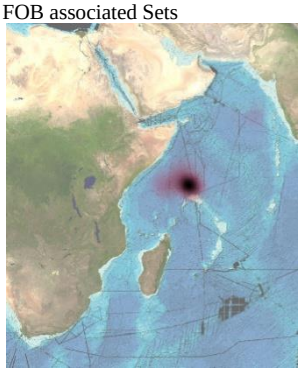

Yellowfin tuna catches 2ªQuarter FOB associated Sets

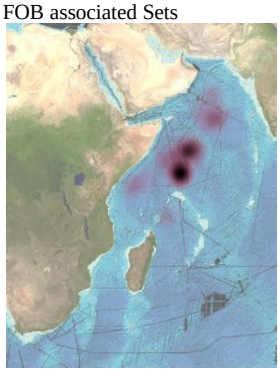

Yellowfin tuna catches 3ªQuarter FOB associated Sets

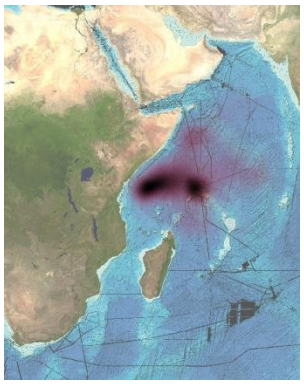

Yellowfin tuna catches 4ªQuarter FOB associated Sets


Yellowfin tuna catches 1ªQuarter Free school Sets

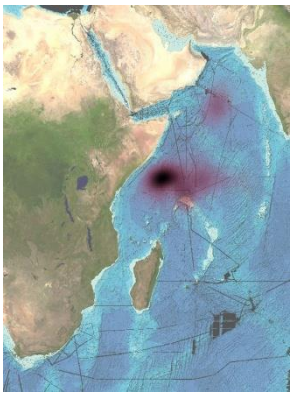

Yellowfin tuna catches 2ªQuarter Free school Sets


Yellowfin tuna catches 3ªQuarter Free school Sets

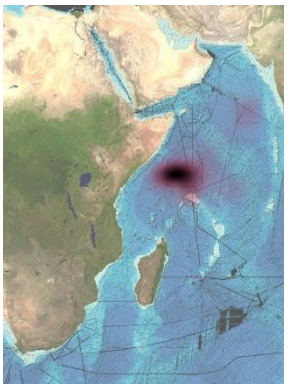

Yellowfin tuna catches 4ªQuarter Free school Sets



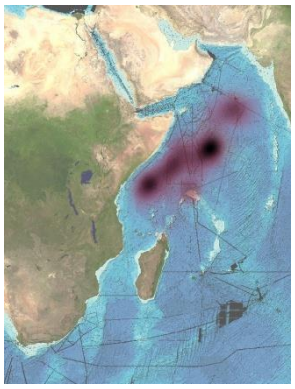
BFT catches 1ªQuarter FOB associated Sets



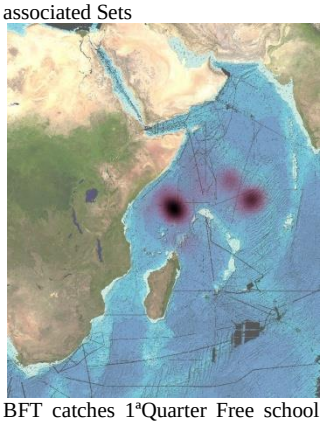
BFT catches 2ªQuarter FOB associated Sets



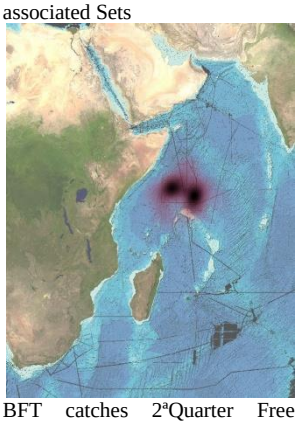
BFTcatches 3ªQuarter FOB associated Sets



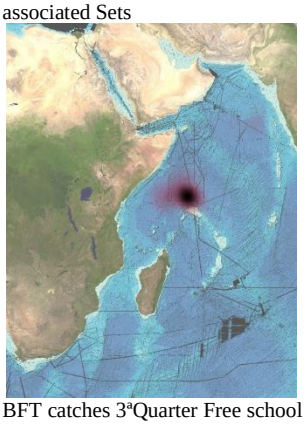
BFT catches 4ªQuarter FOB associated Sets



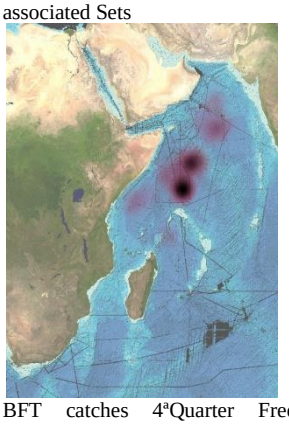
BFT catches 1ªQuarter Free school Sets



BFT catches 2ªQuarter Free school Sets



BFT catches 3ªQuarter Free school Sets



BFT catches 4ªQuarter Free school Sets

**Figure 6**. Distribution of the catches by species of de PS Spanish fleet in 2019 per quarter, species and fishing mode.

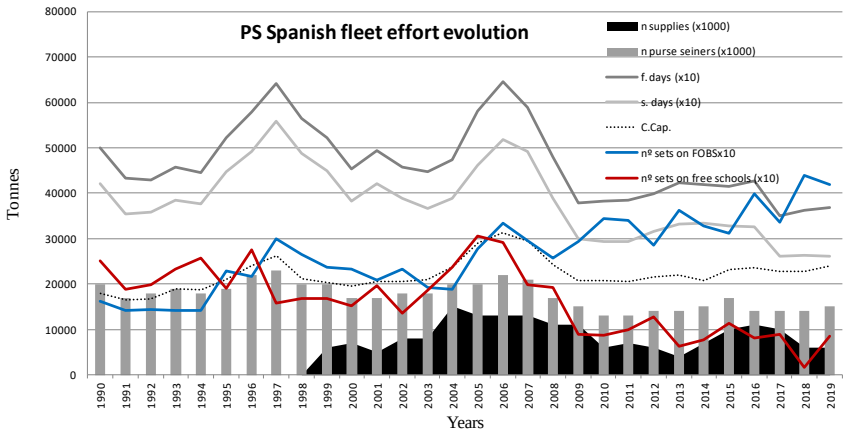



**Figure 7**. Yearly track of some parameters to quantify the Spanish purse seiners fishery effort: number of support vessels since 1999 (n supplies x1000), number of purse seiner vessels (n purse seiners x1000), fishing and searching days, carrying capacity (C.Cap) and number of sets by fishing mode (Floating objects and free schools).

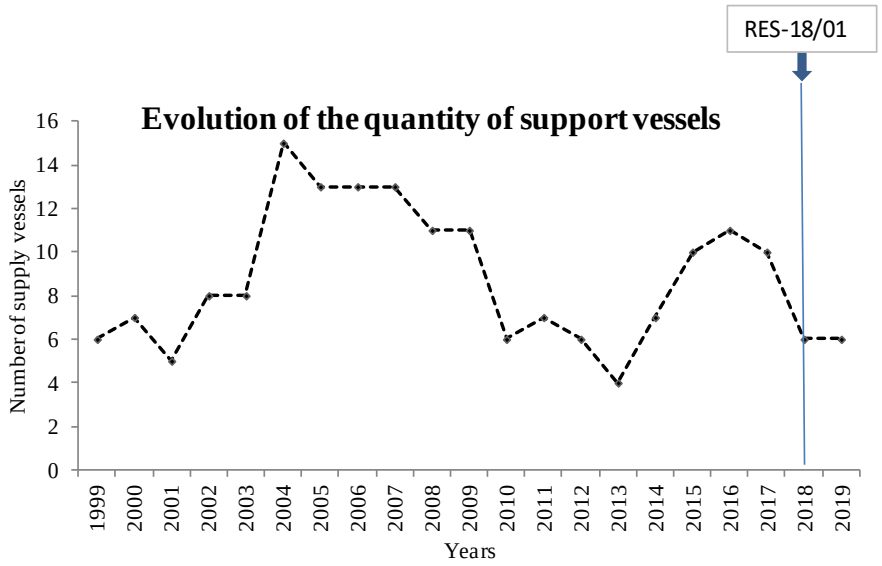



**Figure 8**. Number of supply vessels associated to the Spanish purse seiner fleet

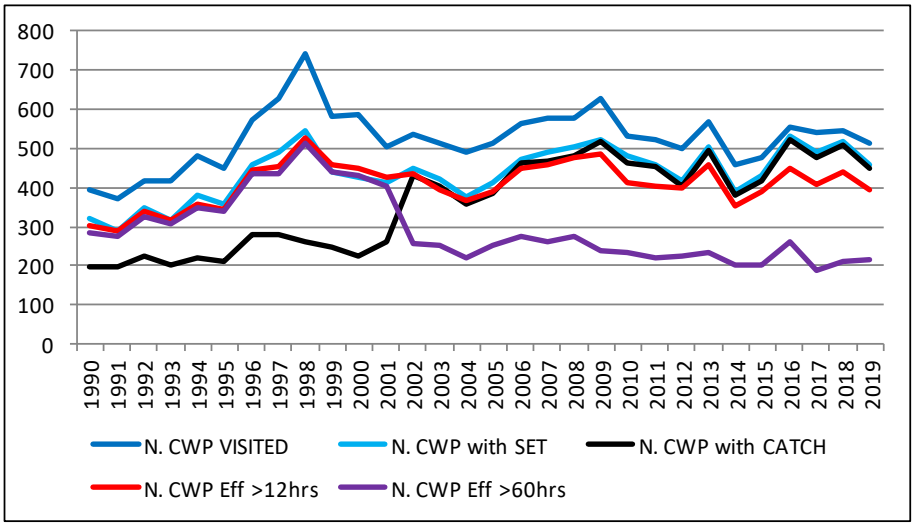



**Figure 9.** Spatial extent of EU-Spain purse seiner fishery showing the annual number of one degree squares visited with different efforts.

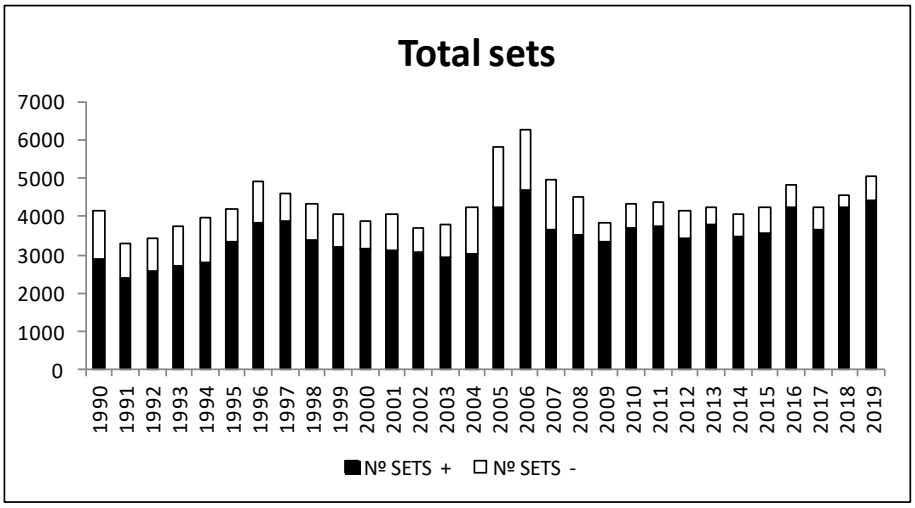



**Figure 10**. Number of positives and nulls sets.

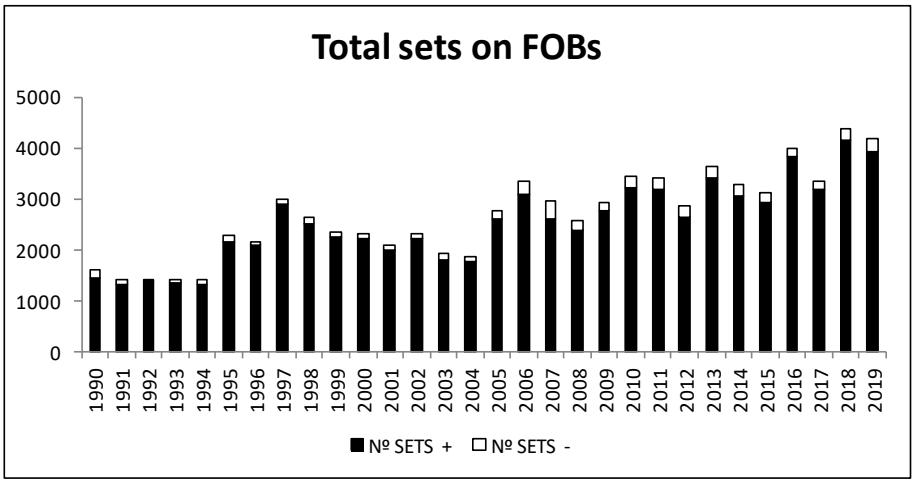



**Figure 11**. Number of positives and nulls sets on floating objects.

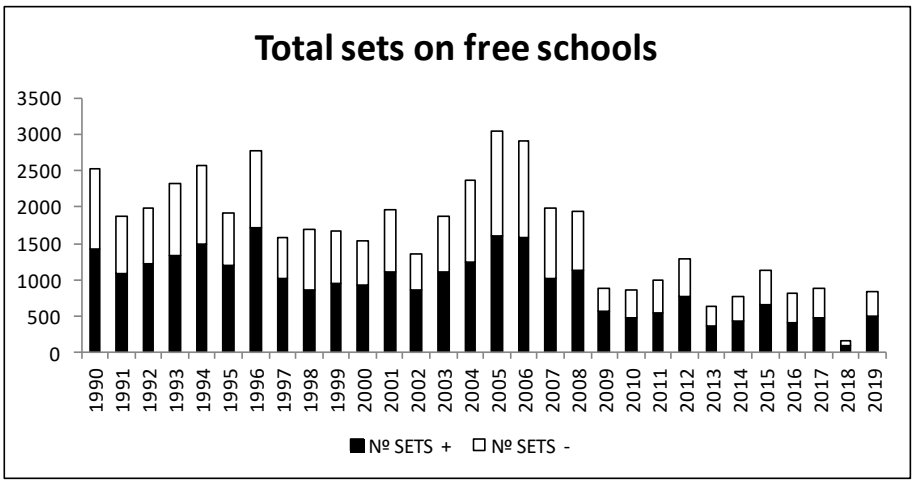



**Figure 12**. Number of positive and nulls sets on free schools.

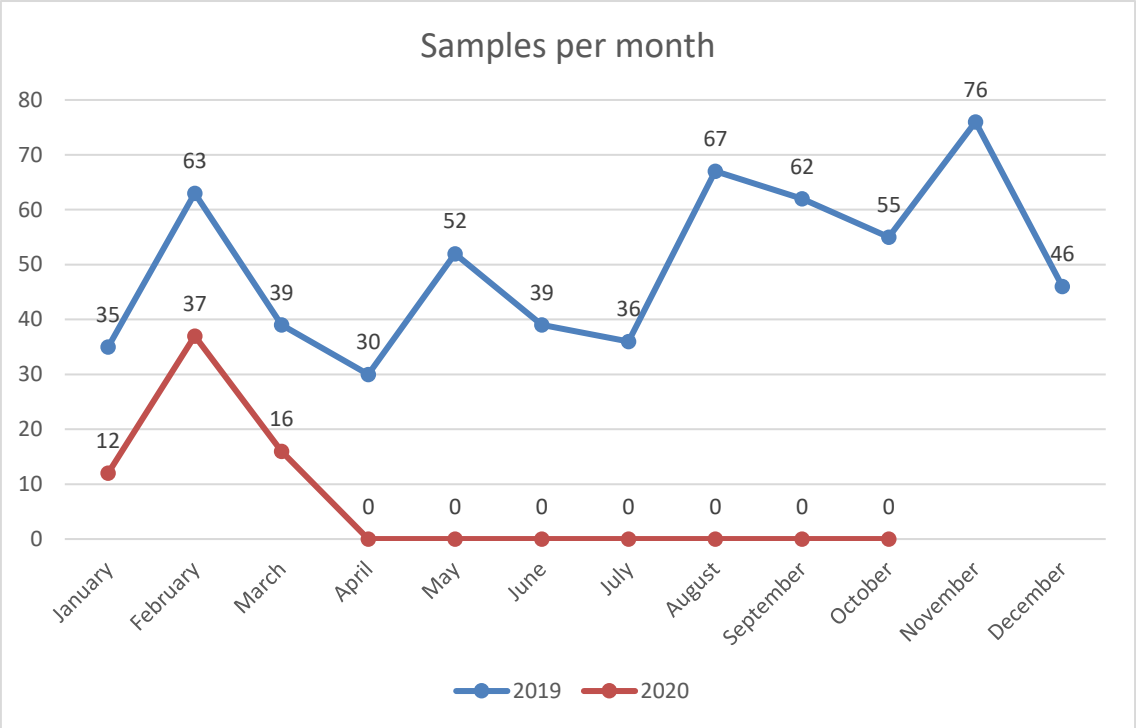



**Figure 13**. Number of samples during Spanish Purse seiners unloading in Victoria port by month during 2019-2020.

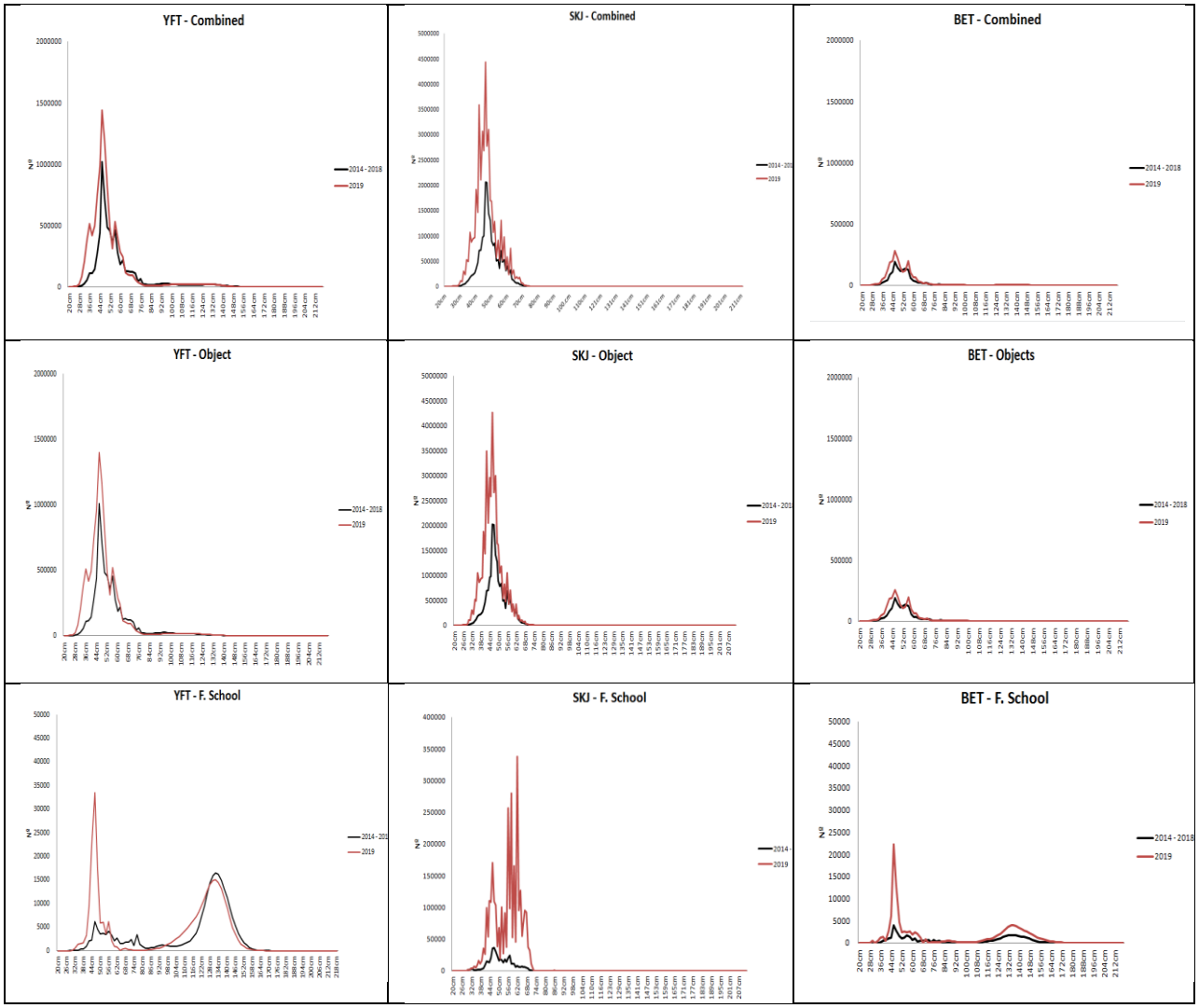
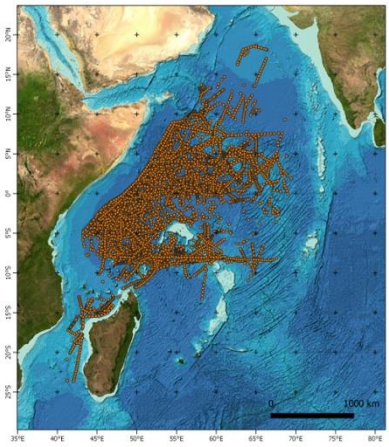
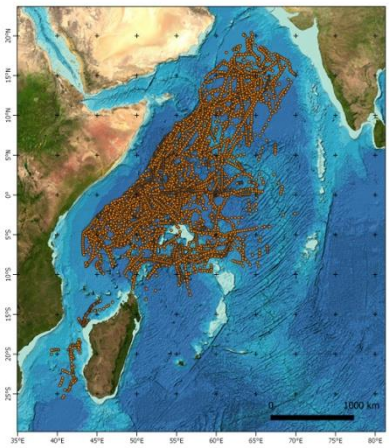



**Figure 14**. Size distribution of the catches by species (YFT, left; SKJ, middle; BET, right), by fishing mode (combined, top; Objects, middle; Free schools, bottom), in 2019 and on average over 2014 - 2018 period.

Deployed 2017



Deployed 2018



Deployed 2019

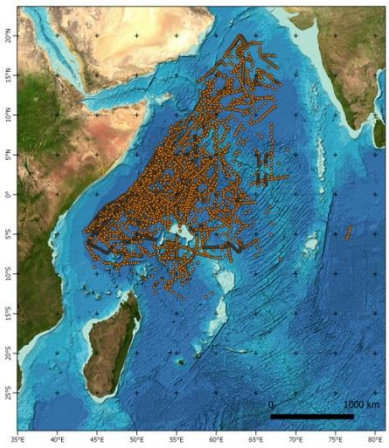


**Figure 15**. Map distribution of the man-made FADs deployed during the period 2017-2019.