



Working Document to ICES WKCOLIAS2 2021

The Atlantic Chub Mackerel (*Scomber colias*) in the Canary Islands (Spain):

Fishery and Biological data Update

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1. Introduction

All the background information for the Atlantic chub mackerel *Scomber colias* (Gmelin, 1789) targeted by the artisanal purse-seine fishery in the Canary Islands was presented during the first ICES WKCOLIAS (Jurado-Ruzafa et al., 2020). In order to provide the most updated basis, the time series and the parameters estimations for the species in this area are here presented including data corresponding to 2019.

The 'Canary stock' status assessment is included in the framework of the Fishery Committee for the Eastern Central Atlantic (CECAF). However, until now, available data have not allowed carrying out reliable assessment due to the short time series available, considered consistent just since 2013. In this context, the aim of this document is to update for 2019 the existing data of fisheries and biology of the species collected data in the Data Collection Framework in the Canary Islands.

2. Material and Methods

All this information was already detailed in Jurado-Ruzafa et al. (2020), for fishery statistics and biological analyses.

3. Results

3.1 Fishery description

Fleets operating in the Canary Islands waters are composed by artisanal vessels, mainly targeting tuna, small pelagic fish and demersal species. Small pelagic are targeted by a relatively stable purse-seiners fleet, one of the monitored *métiers* in the region as part as the EU-Data Collection Framework. This is a mixed fishery, where vessels catch mainly four small pelagic species (*S. colias*, *Trachurus spp* Rafinesque, 1810, *Sardina pilchardus* (Walbaum, 1792) and *Sardinella spp* Valenciennes, 1847). Although the overall landings decreased in 2018 and 2019, the Atlantic chub mackerel was the most caught species during the whole period (40%), achieving the 60% in landings of the purse-seine fleet during the last year (Fig. 1).

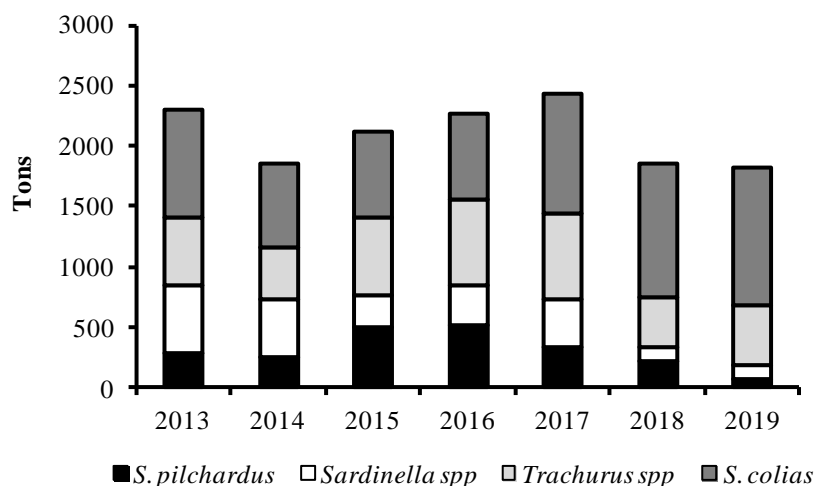


Figure 1. Annual landings of the main small pelagic fish by the artisanal purse-seiners in the Canary Islands

No regulation on maximum allowance catches is implemented for Atlantic chub mackerel, but legal minimum size is established at 20 cm of total length. In addition, it worth to notice that landing obligation regulation (Commission Delegated Regulation (EU) 1394/2014) includes a *survivability exemption* for artisanal purse-seine fisheries of the species in the region, which may release catches while the net is not fully taken on board.

The activity of the artisanal purse seine fleet in the Canary Islands is considered as one of the monitored *métiers* within the EU Data Collection Multiannual Programme (DC-MAP): purse seine targeting small pelagic fish (acronym: PS_SPF_10_0_0).

3.2 Fleet composition

The Canary (artisanal) fleet is polyvalent and very adaptable to annual variations, and the purse-seine artisanal *métier* is yearly revised. One of the criteria used to characterize this *métier* is to include vessels whose small pelagic landings reach 60%. In 2019, it consisted of 30 vessels with a gross tonnage of 10 t, 78.7 hp of power and 11 m of length on average. The duration of each fishing trip is one day.

3.3. Fishing effort

Total catches and fishing effort recorded for the *métier* from 2013 to 2019 are presented in Table 1. An increase of the CPUE (in kg/fishing days with positive catch for *S. colias*) seems to be happening since 2016 (Fig. 2).

Table 1. Landings (in tons) of Atlantic chub mackerel and fishing effort (fishing days with positive catch for *S. colias*) of the artisanal purse seine fleet in the Canary Islands (2013-2019)

	2013	2014	2015	2016	2017	2018	2019	Average
Landings (t)	889	696	712	706	987	1105	1149	892
Fishing effort (days)*	2492	1460	1739	1627	1808	1669	1701	1785

* only fishing trips in which one of the species is landed, are considered as “positive” fishing effort for this species

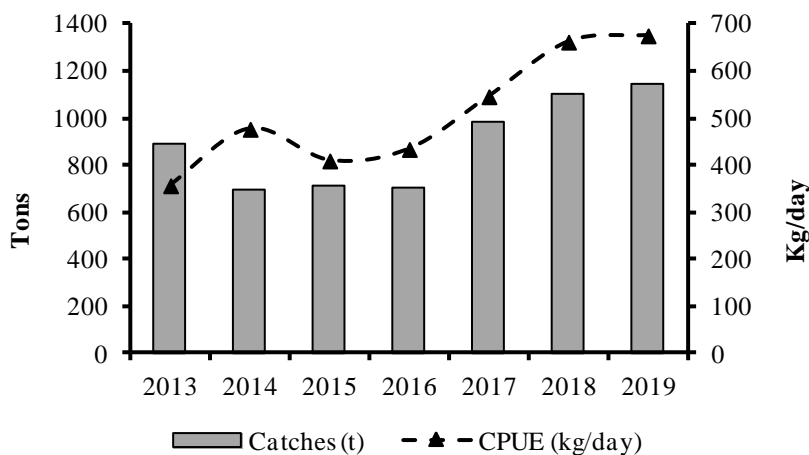


Figure 2. Total landings of *S. colias* and Catch per Unit Effort (CPUE; effort corresponding to days with positive catch in the species) in the Canary Islands from 2013 to 2019

3.5 Biological Data

3.5.1 Length-Weight relationships

Length samplings include stock-specific samplings at landing sites and from fish markets, as well as samplings on board. Comparing LWRs between sexes (from biological samplings), no significant differences were found ($p \geq 0.2$) and LWRs obtained for pooled sexes seems to be adequate for further analyses.

The number of measured specimens, ranges and mean total length (cm), parameters a and b of the LWRs and coefficients of determination (R^2) are presented in Table 2. The minimum R^2 achieved for the LWRs was obtained in the quarterly analyses (Q1 2015 (0.84)), but it is ≥ 0.95 , when considering whole years.

The b values estimated by year ranged from 3.315 (in 2015) to 3.554 (in 2018). Whether data is considered by quarter, b values ranged from 2.696 (Q 4 in 2014) to 3.719 (Q 1 in 2019) (Table 2). Most of the values of b were above 3. No seasonal trend was observed in the values of b .

Table 2. Length-weight relationships for the Atlantic chub mackerel analyzed from commercial landings in the Canary Islands, 2013-2019. TL: Total length (cm).

Year	Quarter	N	TL (mean \pm sd)	TL (min-max)	a	b	R^2
2013	1	607	19.8 \pm 2.55	17.3-28.7	0.0039	3.216	0.98
	2	155	29.6 \pm 1.76	25.6-33.9	0.0035	3.265	0.89
	3	160	28.2 \pm 4.17	21.7-38.1	0.0080	3.040	0.99
	4	256	27.5 \pm 2.74	19.9-34.6	0.0011	3.601	0.96
	Total	1178	23.9 \pm 5.10	17.3-38.1	0.0028	3.337	0.99
2014	1	235	25.6 \pm 3.19	21.2-38.3	0.0030	3.302	0.97
	2	332	24.6 \pm 2.79	19.1-36.1	0.0032	3.307	0.95
	3	238	25.3 \pm 3.74	17.4-33.7	0.0018	3.489	0.98
	4	287	21.5 \pm 1.08	19.2-25.4	0.0196	2.696	0.87
	Total	1092	24.2 \pm 3.26	17.4-38.3	0.0025	3.375	0.97
2015	1	269	21.7 \pm 1.55	18.5-27.2	0.0061	3.091	0.84
	2	194	27.1 \pm 3.05	20.3-35.0	0.0017	3.488	0.97
	3	243	25.4 \pm 2.19	17.9-32.6	0.0045	3.195	0.95
	4	347	23.1 \pm 2.15	15.0-29.2	0.0033	3.269	0.95
	Total	1053	24.0 \pm 2.97	15.0-35.0	0.0030	3.315	0.96
2016	1	278	23.8 \pm 3.28	19.0-34.8	0.0026	3.362	0.97
	2	246	25.3 \pm 1.62	21.2-30.2	0.0044	3.216	0.86
	3	214	24.9 \pm 4.86	15.1-37.5	0.0011	3.629	0.98
	4	217	24.1 \pm 2.24	14.5-30.5	0.0158	2.758	0.94
	Total	955	24.5 \pm 3.25	14.5-37.5	0.0018	3.475	0.95
2017	1	473	23.1 \pm 2.31	18.0-33.2	0.0108	2.884	0.94
	2	331	26.3 \pm 2.88	16.7-36.3	0.0049	3.160	0.95
	3	271	26.5 \pm 2.95	21.0-34.6	0.0028	3.346	0.96
	4	312	23.8 \pm 2.05	20.2-33.7	0.0036	3.242	0.94
	Total	1387	24.7 \pm 2.96	16.7-36.3	0.0028	3.329	0.95
2018	1	306	24.7 \pm 2.02	17.5-31.2	0.0054	3.113	0.93
	2	262	27.2 \pm 4.02	16.1-38.7	0.0025	3.392	0.98
	3	231	26.9 \pm 3.78	14.5-34.2	0.0012	3.610	0.98
	4	324	26.2 \pm 3.52	15.3-35.3	0.0013	3.557	0.97
	Total	1123	26.2 \pm 3.51	14.5-38.7	0.0014	3.554	0.96
2019	1	261	27.0 \pm 3.70	15.8-39.9	0.0007	3.719	0.95
	2	227	30.2 \pm 3.56	13.2-42.5	0.0019	3.411	0.96
	3	257	30.3 \pm 4.78	14.0-38.8	0.0010	3.589	0.94
	4	99	29.1 \pm 4.60	14.5-37.0	0.0027	3.312	0.94
	Total	844	29.1 \pm 4.37	13.2-42.5	0.0013	3.533	0.96
Overall total		7632	25.1 \pm 4.02	13.2-42.5	0.0029	3.317	0.97

3.5.2 Catch length frequencies

Based on the length sampling of landings from the artisanal purse-seine fleet, annual length frequency distributions (LFD) for the period 2013-2019 were obtained. Two clearly differentiated modes were registered only in 2013 and 2019 (Figs. 3 and 4).

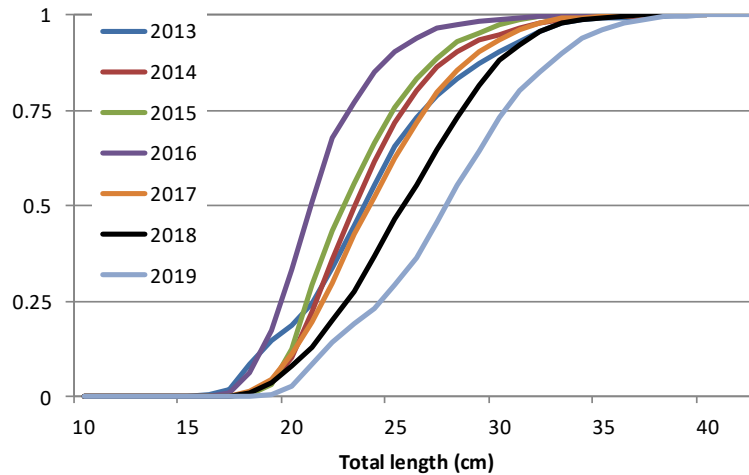


Figure 3. Length cumulative frequencies for the *S. colias* analyzed in the Canary Islands between 2013 and 2019.

Due to the differences observed among interannual quarters, LFD were not averaged or accumulated in this basis. However, separated quarterly (and total) LFD accumulated are presented jointly to the annual LFD in Figure 4. On one hand, quarterly cumulated length frequencies indicated smaller sizes during autumn or winter, depending on the year. On the other hand, when comparing years, the greatest difference occurred between sampled fish in 2016 and 2019.

Since the start of the monitoring, a general trend to larger chub mackerels in landings seems to be noticed. In fact, main modes have moved from 20-22 cm to 27-28 cm in 2019. It should be highlighted that the widest length range has been found during the last year of the period, including the smallest and the largest sampled individuals so far.

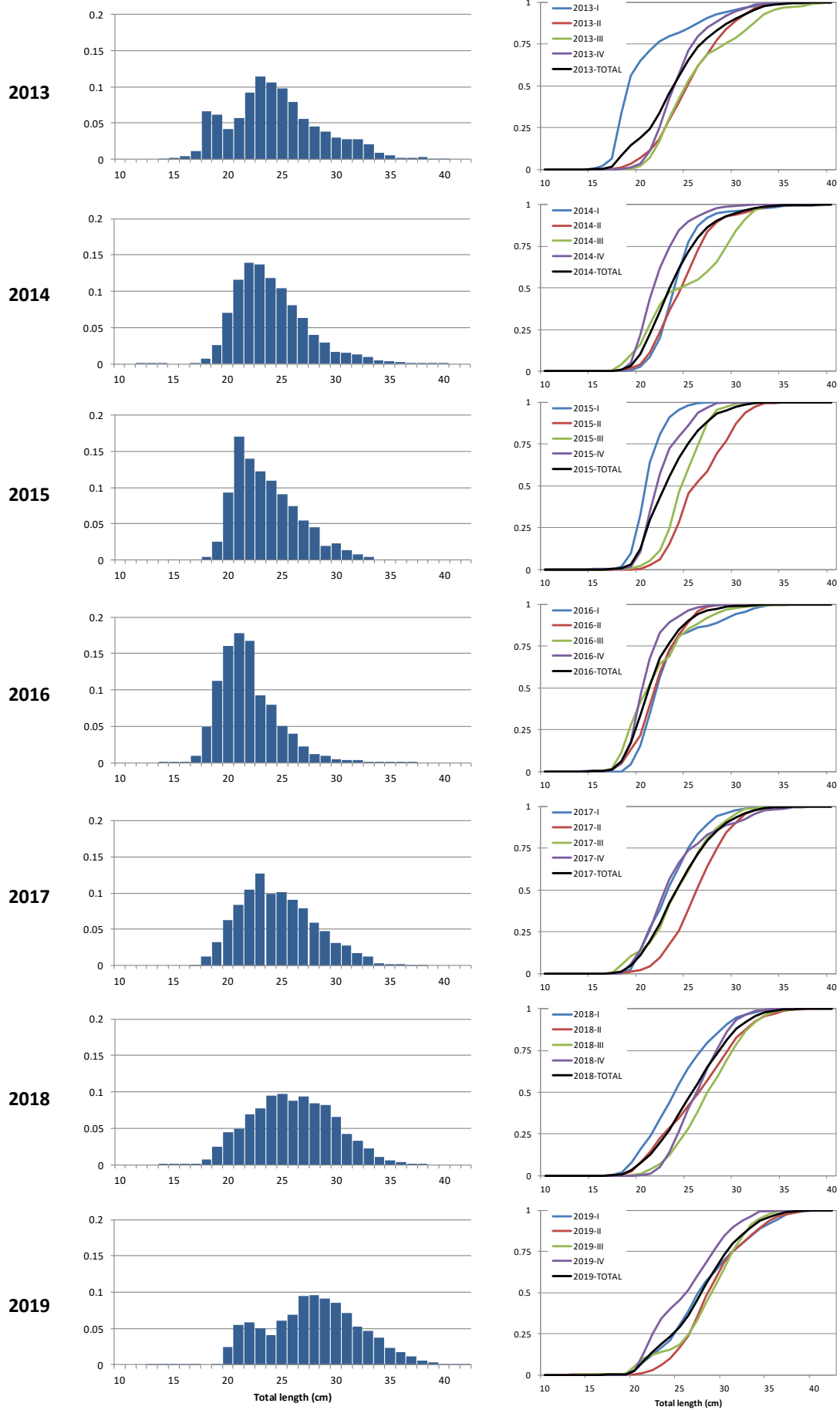


Figure 4. Catch length frequency distributions by year (left), quarterly accumulated (right). The last one on the bottom is presented for interannual comparison.

3.5.3 Sex ratio

The overall sex ratio resulted balanced for the whole period (1:1, $p=0.20$), and also considering each year separately ($p>0.2$, except in 2013 with $p=0.035$). When considering sex proportion by length class (Fig. 5), sex ratio resulted balanced from 20 cm to 30 cm both included ($p>0.2$).

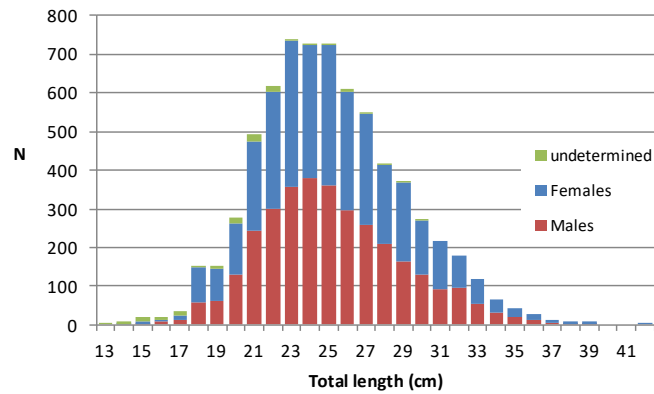


Figure 5. Length distribution of *S. colias*, from the biological samplings (2013-2019)

3.5.4 Spawning season and Length at First Maturity

Higher proportions of active stages (>50%) occurred from December to March for both sexes (Fig. 6), and GSI analysis also revealed an increase of the spawning activity from December to March (Fig. 7). In both cases, activity peaks in January-February. Accordingly, the spawning period for *S. colias* in the Canary waters seems to be between December and March.

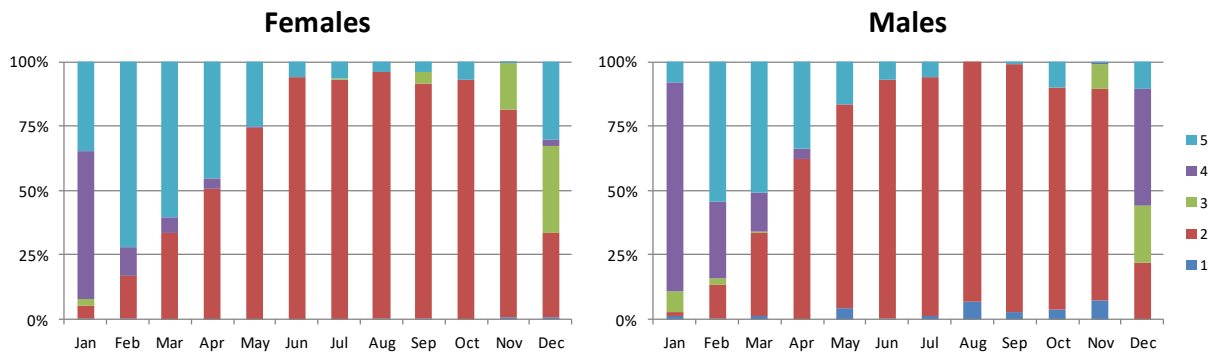


Figure 6. Monthly proportions of maturity stages by sex (2013-2019)

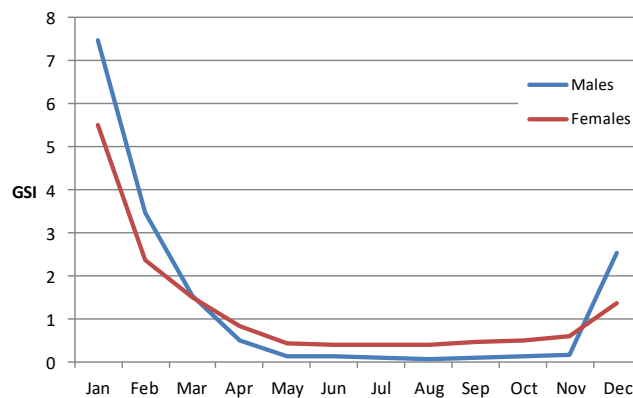


Figure 7. Monthly averaged GSI by sex (2013-2019)

When comparing the overall GSI for *S. colias* with the monthly evolution of the condition factor (*Kn*) (Fig. 8), it is possible to distinguish the somatic growth period (March-August) from the pre-spawning period (September-December).

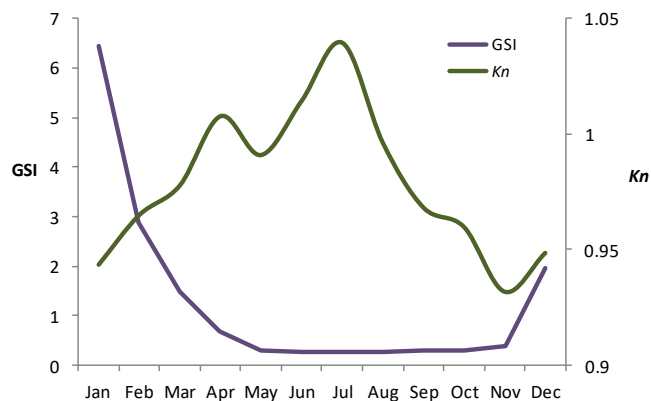


Figure 8. Monthly averaged GSI and *Kn* of *S. colias* (sexes pooled, time period: 2013-2019)

Table 3 presents the proportion of mature individuals by length class for undetermined, females and males during the spawning period. The fitted ogives to the Gompertz model (Fig. 9) gave very good results based on the coefficient of determination, both for males and females. These values and the estimated parameters for the function are presented in Table 4. Based on those results, length at first maturity resulted around 19 cm considering both sexes.

Table 3. Individuals analyzed (*N*) and proportion of sexually matures (*p_i*) by length class (*L_i*) for undetermined, females and males of Atlantic chub mackerel during spawning season (December to March)

<i>L_i</i> (cm)	Undetermined	Females		Males	
	<i>N</i>	<i>N</i>	<i>p_i</i>	<i>N</i>	<i>p_i</i>
14	1	1	0		
15	1	3	0.11		
16	2	3	0.28	2	
17	5	8	0.34	8	0.23
18	3	72	0.53	45	0.40
19	2	62	0.57	40	0.51
20		81	0.64	59	0.69
21	2	103	0.70	125	0.78
22	1	157	0.75	137	0.77
23		177	0.78	153	0.81
24		126	0.82	155	0.86
25		115	0.86	110	0.91
26		76	0.88	93	0.93
27		79	0.90	53	0.93
28		38	0.92	35	0.95
29		18	0.91	25	0.98
30		10	0.95	13	0.95
31		5	0.97	7	0.95
32		13	1.00	6	0.95
33		10	1.00	6	1.00
34		8	1.00	8	1
35		5	1.00	6	1
36		3	1	1	1
37			1		1
38			1	1	1
39		1	1	1	1
Total	17	1174	-	1089	-

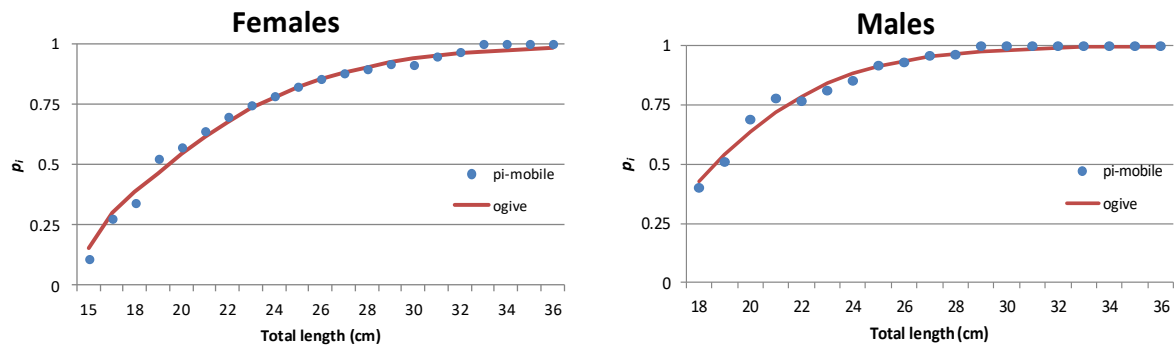


Figure 9. Maturity ogives for females and males of *S. colias* in the Canary Islands (spawning period December-March, for the period 2013-2019), fitting the mature fraction to the Gompertz function. p_i : proportion of mature individuals by length

Table 4. Estimated parameters c and d , and coefficient of determination (R^2) for the Gompertz model, Length at First Maturity (LFM), and the number of specimens analyzed during the spawning period (December to March, 2013-2018)

	c	d	R^2	LFM (cm)	N
Females	53.3	-0.223	0.99	19.44	1174
Males	241.02	-0.311	0.97	18.79	1089

4. Discussion and conclusions

Any noticeable change was observed for the *S. colias* analyzed during 2019, respect the results in Jurado-Ruzafa et al. (2020).

4.1 Fisheries

Since 2013, among the purse-seine landings in the Canary Islands, the Atlantic chub mackerel is the only targeted species which has increased.

Regarding the length frequencies, juveniles (absent in landings) seem protected by the minimum legal size, established at 20 cm in the Canary Islands. In addition, the smallest and the largest individuals analyzed so far were found in 2019, and a clear trend to larger Atlantic chub mackerels has been observed based on landing samplings.

4.2 Biological aspects

The slight increase in the LFM (from 18.5 to 19 cm) is closer to the previous results for the species in the area by Lorenzo (1992), around 20 cm. It could be explained for the commented trend to largest sizes in landings, what obviously influences on the data analysis and results.

Bibliography

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