

ESTIMATION OF UNDERSIZE MEDITERRANEAN SWORDFISH (*XIPHIAS GLADIUS*) CATCHES BETWEEN 2008 – 2018 FOR THE LONGLINE MAIN FLEETS

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SUMMARY

Catches of undersize Mediterranean swordfish were estimated using the size samples (task2sz) from the longline gear for 2008 – 2018. ICCAT minimum size landing regulations for Med swordfish were implemented in 2014 (90 cm LJFL) and updated again in 2017 (100 cm LJFL). Prior research indicated that not all fleets have reported undersized catches/discards that can account for a significant percent of the swordfish caught by the longline operations, which is currently the main fishing gear in the Mediterranean Sea. Estimated discards since 2008 represent overall about 12% to 14% between 2008 and 2017 and increased to 24% in 2017/18 when the current minimum size was implemented.

RÉSUMÉ

Les captures d'espadon sous-taille en Méditerranée ont été estimées au moyen des échantillons de taille (task2sz) provenant de l'engin de pêche à la palangre pour la période 2008 - 2018. Les règlements de l'ICCAT concernant la taille minimale de débarquement de l'espadon de Méditerranée ont été mis en œuvre en 2014 (90 cm LJFL) et mis à jour à nouveau en 2017 (100 cm LJFL). Des recherches antérieures ont montré que les flottilles n'ont pas toutes déclaré de prises sous-taille/de rejets qui peuvent représenter un pourcentage important des espadons capturés à la palangre, qui est actuellement le principal engin de pêche en mer Méditerranée. Les rejets estimés depuis 2008 représentent globalement environ 12 à 14 % entre 2008 et 2017 et sont passés à 24 % en 2017-2018 lorsque la taille minimale actuelle a été mise en œuvre

RESUMEN

Se estimaron las capturas de peces espada del Mediterráneo de talla inferior a la regulada utilizando muestras de talla (tarea2sz) del palangre para 2008-2018. Las reglamentaciones sobre talla mínima de desembarque de ICCAT para el pez espada del Mediterráneo se implementaron en 2014 (90 cm LJFL) y se actualizaron en 2017 (100 cm LJFL). Investigaciones anteriores indican que no todas las flotas han declarado descartes/capturas de talla inferior a la regulada para un porcentaje significativo del pez espada capturado en operaciones de palangre, que es actualmente el principal arte pesquero que se utiliza en el Mediterráneo. Los descartes estimados desde 2008 representan en conjunto aproximadamente del 12 % al 14% entre 2008 y 2017 y aumentaron al 24 % en 2017/2018 cuando la talla mínima actual se implementó.

KEYWORDS

Swordfish, discards, longline, size samples

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1. Introduction

For Mediterranean swordfish regulations of minimum landing size (MLS) [Rec 13-04 and Rec 16-05] of 90 cm and 100 cm LJFL were implemented in 2014 and 2017, respectively for all fleets. It has been indicated that these regulations have resulted in the increase of discards of undersized swordfish and that not all fleets are reporting these discards. In 2019, a report based on scientific observer's data (SCRS/2019/135) indicated that a high percent of dead fish was discarded at sea, with the risk of not being reported. The study also showed that to complete the allocated catch quotas, the longline fleets needed to increase fishing effort and extend the fishing season, with economic impacts for the fleets and negative effects for the recovery plan of Mediterranean swordfish in general.

It has been requested to estimate the potential discards of undersize Mediterranean swordfish (Med-SWO) in particular for those fleets that account for the main part of the current catches, to be considered as alternative input for total removals for the upcoming stock assessment. In the previous assessment, a scenario with estimated discards of 0-age was done (Anon., 2017). In that case, discards were estimated *ad-hoc* by assuming that for every ton of catch, four 0-age fish were discarded (Tserpes et al., 2014).

This document presents an estimation of undersize Med-SWO discards using the size samples information provided by CPCs to the Secretariat.

2. Data and Methods

Since 2008 the Med-SWO catches are almost taken exclusively by longline fleets (**Figure 1**), and of these; 7 flag/LL fleets (EU.Italy, EU.Spain, Tunisia, EU.Greece, Morocco, Algeria, and Malta) account for over 95% of the total catches. Therefore, undersize discards were estimated only for these longline fleets. As indicated in SCRS/2019/135 some fleets do report undersize catches and discards, therefore the size sampling of these fleets was reviewed to assess for which fleets the undersized SWO should be estimated. **Figure 2** shows the size distribution of longline fleets that have provided size samples during the 2008-2018 period and for comparison the two minimum size regulations in effect in 2014 (90 MLS) and 2017 (100 MLS). As indicated, the longline fleets of EU.Spain, Malta, EU.Greece reported sizes of Med-SWO below the MLS through the period, suggesting that discards of undersize fish were included in the Task 1 NC. In contrast fleets like EU.Italy, Algeria and Morocco have not reported fish below the MLS since the 2010. Tunisia has not reported task 2sz in this period. Although there have been modifications in the longline fishing gear for swordfish in the Mediterranean, most of the fleets have experienced a transition from the traditional surface swordfish longline, to the so-called American style longline and the meso-pelagic longline since 2008. Although the proportion of each component likely is different in each country, it has been reported discards in both current main longline types of undersized swordfish (SCRS/2019/135). Thus, it is expected that the selectivity of the gear be similar for all fleets, and the size sample reported being similar when they operate with similar seasonality and over the same available fish resource.

Med-SWO size samples are available for longline fleets, **Figure 3** shows the comparison of the size distributions of the fleets EU.Spain + EU.Greece versus the EU.Italy fleet for 2008-2018. The plots show three periods: i) 2008-2013 when no ICCAT minimum size regulations were imposed, ii) 2014-2016 when the 90 cm LJFL minimum landing size (MLS) was active, and iii) 2017-2018 when the 100 cm LJFL minimum landing size (MLS) became implemented replacing the prior regulation. The plots in general indicate that the swordfish size catch of the Italian fleet is shifted towards larger size fish and this trend is also apparent when compared simultaneously (**Figure 4**). This could potentially be explained if the gear selectivity has been modified by the fleet with immediate response to avoid catching undersized fish in each period. However, there has not been reports of modifications by the fleet or gear modification that support this hypothesis. The alternative hypothesis is that the size sampling is not recording the undersized fish and the expected catch is not reported, something that national scientist have also indicated.

A similar analysis for the Algeria longline fleet (**Figure 5**) shows that when no minimum size restrictions were implemented, both the Spanish-Greece and Algerian fleets caught smaller size swordfish, more even in the Algerian size samples, albeit the low sampling. However, after 2014 when the 90 cm MLS was adopted, suddenly the size distribution shifter towards larger fish in this fleet. There is not size data from Algeria longline catches from 2017 or 2018. For the Morocco longline fleet (**Figure 6**) it shows that overall the size catches of this fleet are consistently larger than the Spain-Greece fleets. However, before the minimum size restrictions the Morocco fleet caught swordfish less than 100 LJFL cm, that were not present after the 2014 MLS restrictions were implemented (**Figure 7**). Finally, in the case of Tunisia there is not size data, then it was not possible to compare their size distribution.

3. Results and Discussion

Assuming that the longline gear for swordfish in the Mediterranean Sea has similar catchability, fishing operations and targets the same available stock, then it is expected that the size distribution of the catch shows similar distributions. Most of the size samples are from the Spanish longline fleets since 2008, and although the size distribution of catches has shown some shift towards larger fish since 2017, the size distribution was similar from 2008-2016 (**Figure 8**), indicating that up to 40% of size samples were of swordfish smaller or equal than 100 cm LJFL. Similar in the size distribution from the Greek longliners although in the last 2 years (2017-2018) show a rather important catches of fish ≤ 90 cm when the MLS in place is 100 cm LJFL.

Using the size frequency data, then is possible to infer that all longline fleets should have a similar size distribution, and the lack of smaller fish after the minimum size restrictions, reflects discards not size-sampled nor included in the landing reports. The approach then was to join the size samples for each of the time periods; i) 2008-2013, ii) 2014-2016 and iii) 2017-2018 of the Spanish and Greek longline fleets (SPAGRE) and considered this as the “base size distribution” for all longline fleets. These “base size distribution” is estimated from over 240 thousand size samples, covering the western and few from eastern Mediterranean, and from all quarters with most of the samples from the July – September quarter (**Figure 9**). The ‘base size distribution’ was then used to compared with the other longline fleets, that shown no sized fish less or equal than 115 cm LJFL; the Italy, Algerian, Morocco, Tunisia and Turkey longline fleets. Again these fleets, plus EU.Spain and EU.Greece account for over 96% of the total catches, thus it was not attempted to estimate discards for other gears or minor fleets.

Assuming that the size samples are representative of the total catch, it was estimated the corresponding weight distribution from the size distribution samples, by converting mid bin size to mid-weight using the current length-weight conversion factor for each size (5 cm bin mid-point). The weight distribution times the number of fish in each size bin then provides the weight of the sampled size swordfish. Once having a weight distribution of the catch for the “base size distribution” (SPAGRE) in each period, it was possible to estimate the ratio of weight of fish < 115 cm over the total weight (**Table 1**). The size of 115 cm was chosen because at this size most of the size frequency distributions of the Italian fleet and the SPAGRE cross (**Figure 3**).

Then, having the percent of reported catch < 115 cm by each fleet this was discounted from the expected percent of the catch < 115 cm of the “base distribution” SPAGRE, for each time period, this provided a percent of the non-reported weight for swordfish < 115 cm by fleet. Finally and again assuming that the size samples are representative of the total catch Task 1 NC reported, the estimated undersized longline catches were calculated for each year and fleet (**Figure 10**). **Table 2** shows the estimated total removals including the dead discards of undersize swordfish for the main longline fleets (**Figure 11**). Since 2008, the annual average of dead discards non reported is 1,368 t or about 12- 14% per year, with exception of 2017/18 when the minimum size restriction of 100 cm was implemented and for these years non-reported discards double to 23% on average.

References

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Table 1. Summary of the estimated proportion by weight (t) of the undersize swordfish for the main longline fleets for the three periods: 2008-2013 with no minimum size regulations (no MLS), 2014-2016 with 90 LJFL cm minimum size (90 cm), and 2017-2018 with 100 LJFL cm minimum size (100 cm). These estimates are from the size samples (task2sz) submitted by CPCs.

wgt sz t			< 115 cm LJFL					Not reported
MinSize	SPAGRE	FlagName	Yes	No	Total	Ratio Yes/No	% < 115	
100 cm	1	EU.Italy	307.388	516.253	823.642246			
			9	4	6	0.59542243	37.32%	
	0		5.36576	73.3776	78.7434466	0.07312523		30.51%
90 cm	1	EU.Italy	1	1352.45	1886.67090	0.39499419	6.81%	
			0	534.213	8	4	0.14179409	28.32%
	1		23.2026	163.636	186.839020	0.1242%	15.90%	
No MLS	1	EU.Italy	7	4	6	0.44399351	30.75%	
			0	915.132	2061.13	2976.27072	0.17267744	14.73%
	1		2	9	2	9		
wgt sz t			< 115 cm LJFL					Not reported
MinSize	SPAGRE	FlagName	Yes	No	Total	Ratio Yes/No	% < 115	
100 cm	1	Algerie	307.388	516.253	823.642246			
			9	4	6	0.59542243	37.32%	37.32%
	0			1352.45	1886.67090	0.39499419		
90 cm	1	Algerie	534.213	8	4	4	28.32%	
			0	0.14247	7.28555	7.42803084	0.01955551	1.92%
	1		915.132	2061.13	2976.27072	0.44399351	30.75%	
No MLS	1	Algerie	2	9	2	9		
			0	1.57107	16.0888	17.6599669	0.09764947	8.90%
	1		2	9	2	9		
wgt sz t			< 115 cm LJFL					Not reported
MinSize	SPAGRE	FlagName	Yes	No	Total	Ratio Yes/No	% < 115	
100 cm	1	Maroc	307.388	516.253	823.642246			
			9	4	6	0.59542243	37.32%	
	0		0.77778	33.1216	33.8994062	0.02348263		35.03%
90 cm	1	Maroc	3	2	9	5	2.29%	
			0		1352.45	1886.67090	0.39499419	
	1		534.213	8	4	0.02685425	28.32%	
No MLS	1	Maroc	0.99290	36.9737	37.9666597	0.0262%	25.70%	
			0	3	6	7	1	2.62%
	1		915.132	2061.13	2976.27072	0.44399351	30.75%	
No MLS	1	Maroc	2	9	2	9		
			0	2.02111	33.5269	35.5480786	0.06028321	5.69%
	1		3	7	3	3		
wgt sz t			< 115 cm LJFL					Not reported
MinSize	SPAGRE	FlagName	Yes	No	Total	Ratio Yes/No	% < 115	
100 cm	1		307.388	516.253	823.642246			
			9	4	6	0.59542243	37.32%	

	0	EU.Malta	81.1013 6	269.861 5	350.962817 2	0.30052961 5	23.11%	14.21%	
90 cm	1		534.213	8	1352.45	0.39499419	28.32%		
	0	EU.Malta	308.974	435.421	744.395786	0.70959746	41.51%		
No MLS	1		915.132	2061.13	2976.27072	0.44399351	30.75%		
	0	EU.Malta	343.248	408.207	751.456065	0.84086594	45.68%		
wgt sz t			< 115 cm LJFL						
MinSiz e	SPAGR E	FlagNam e	Yes	No	Total	Ratio Yes/No	% < 115	Not reporte d	
100 cm	1		307.388 9	516.253 4	823.642246 6	0.59542243	37.32%		
	0	EU.Cypr us	1.20248 5	7.61098 5	8.81346960 8	0.15799335	13.64%	23.68%	
90 cm	1		534.213	8	1352.45	0.39499419	28.32%		
	0	EU.Cypr us	3.56815 4	18.6719 5	22.2401011 8	0.19109703 1	16.04%	12.27%	
No MLS	1		915.132	2061.13	2976.27072	0.44399351	30.75%		
	0	EU.Cypr us	11.6300 2	30.7719 9	42.4020060 5	0.37794170 9	27.43%	3.32%	
wgt sz t			< 115 cm LJFL						
MinSiz e	SPAGR E	FlagNam e	Yes	No	Total	Ratio Yes/No	% < 115	Not reporte d	
100 cm	1		307.388 9	516.253 4	823.642246 6	0.59542243	37.32%		
	0	Turkey		24.1732	2	24.1731952	0.00%	37.32%	
90 cm	1		534.213	8	1352.45	0.39499419	28.32%		
	0	Turkey		4.59281	8	4.59280959	0.00%	28.32%	
No MLS	1		915.132	2061.13	2976.27072	0.44399351	30.75%		
	0	Turkey	0.65756 3	9 3.3547	2 1	4.01226306	0.19601246 6	16.39%	14.36%

Table 2. Estimated total removals of SWO-Med by including the 2008-2018 dead discards of undersize.

YearC	Task1NC	Upd Disc Undersz	Task 1 UPD	% increase
1950	586		586	
1951	580		580	
1952	337		337	
1953	501		501	
1954	452		452	
1955	340		340	
1956	393		393	
1957	645		645	
1958	914		914	
1959	601		601	
1960	515		515	
1961	612		612	
1962	703		703	
1963	722		722	
1964	798		798	
1965	1,760		1,760	
1966	1,752		1,752	
1967	1,317		1,317	
1968	3,440		3,440	
1969	3,723		3,723	
1970	3,341		3,341	
1971	4,975		4,975	
1972	5,973		5,973	
1973	4,809		4,809	
1974	5,043		5,043	
1975	4,314		4,314	
1976	4,637		4,637	
1977	5,289		5,289	
1978	5,970		5,970	
1979	5,719		5,719	
1980	6,740		6,740	
1981	6,981		6,981	
1982	6,508		6,508	
1983	6,896		6,896	
1984	13,666		13,666	
1985	15,292		15,292	
1986	16,765		16,765	
1987	18,320		18,320	
1988	20,365		20,365	
1989	17,762		17,762	
1990	16,018		16,018	
1991	15,746		15,746	
1992	14,709		14,709	
1993	13,265		13,265	
1994	16,082		16,082	
1995	13,015		13,015	
1996	12,053		12,053	
1997	14,693		14,693	
1998	14,369		14,369	
1999	13,699		13,699	
2000	15,569		15,569	
2001	15,006		15,006	
2002	12,814		12,814	
2003	15,694		15,694	
2004	14,405		14,405	
2005	14,622		14,622	
2006	14,915		14,915	
2007	14,227		14,227	
2008	12,164	1,519	13,683	12%
2009	11,840	1,396	13,235	12%
2010	13,265	1,488	14,754	11%
2011	11,450	1,191	12,640	10%
2012	9,913	1,133	11,046	11%
2013	9,096	973	10,070	11%
2014	9,801	1,168	10,969	12%
2015	10,751	1,223	11,974	11%
2016	10,921	1,369	12,291	13%
2017	8,402	1,988	10,390	24%
2018	7,079	1,598	8,677	23%

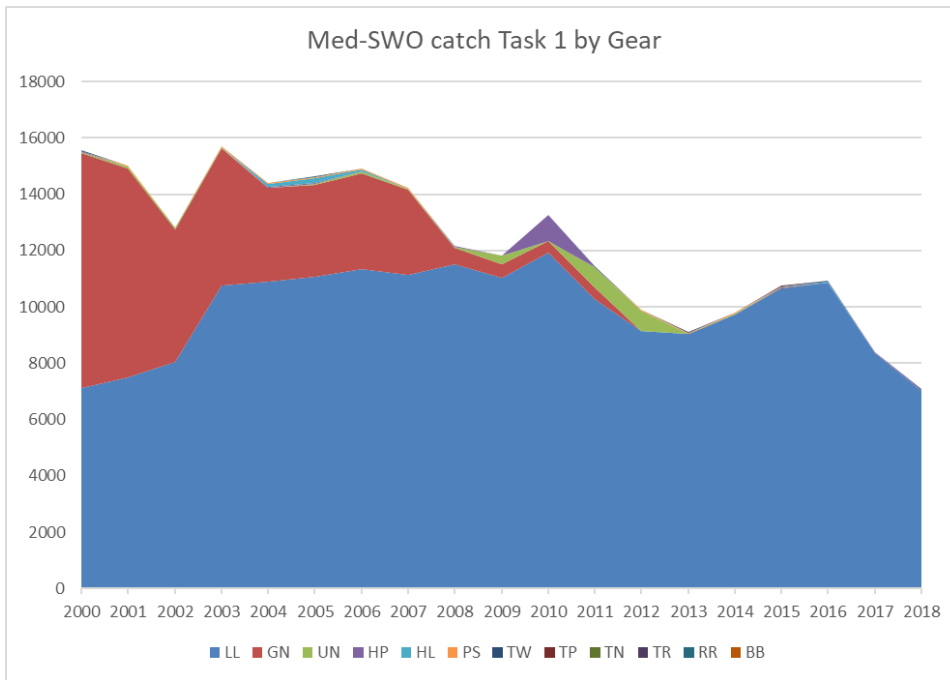


Figure 1. Total reported catch of Med-SWO (Task 1 NC) by main fishing gear type 2000 - 2018.

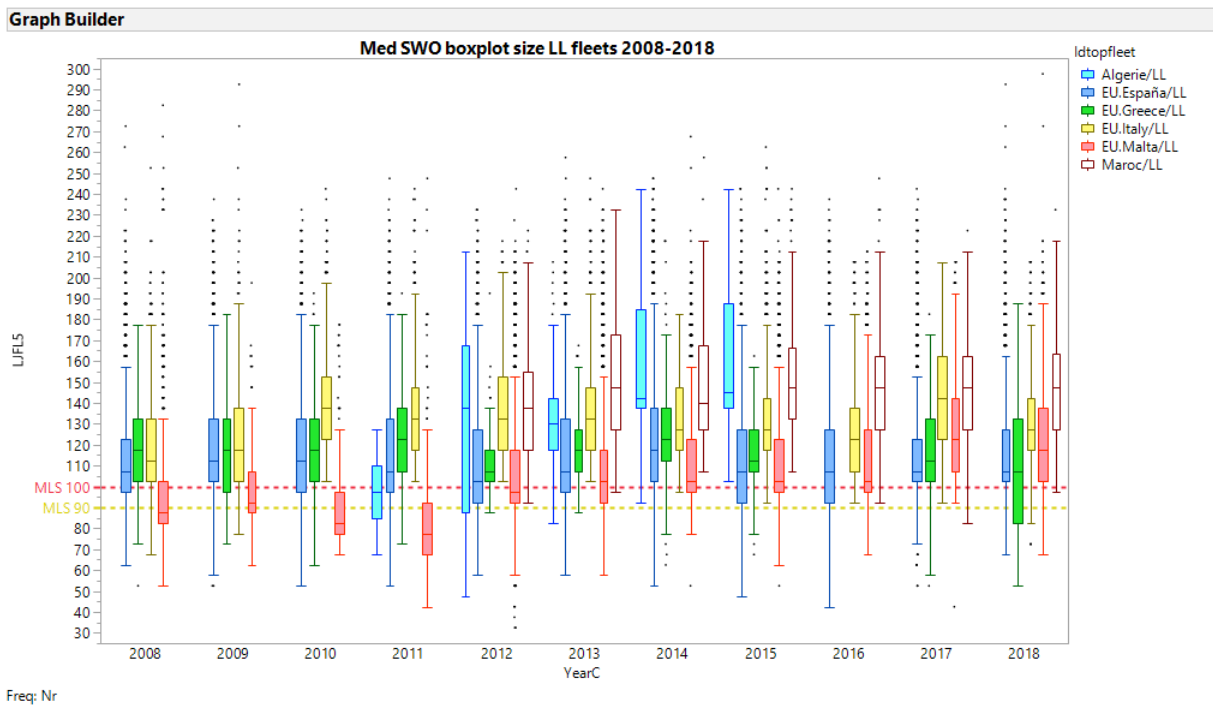


Figure 2. Med-SWO size distribution (LJFLS cm) for the main longline fleets that have provided task2_sz during the 2008 – 2018 period. The horizontal broken lines indicate the minimum landing size (MLS) regulations that were implemented in 2014 (MLS 90) and in 2017 (100 MLS).

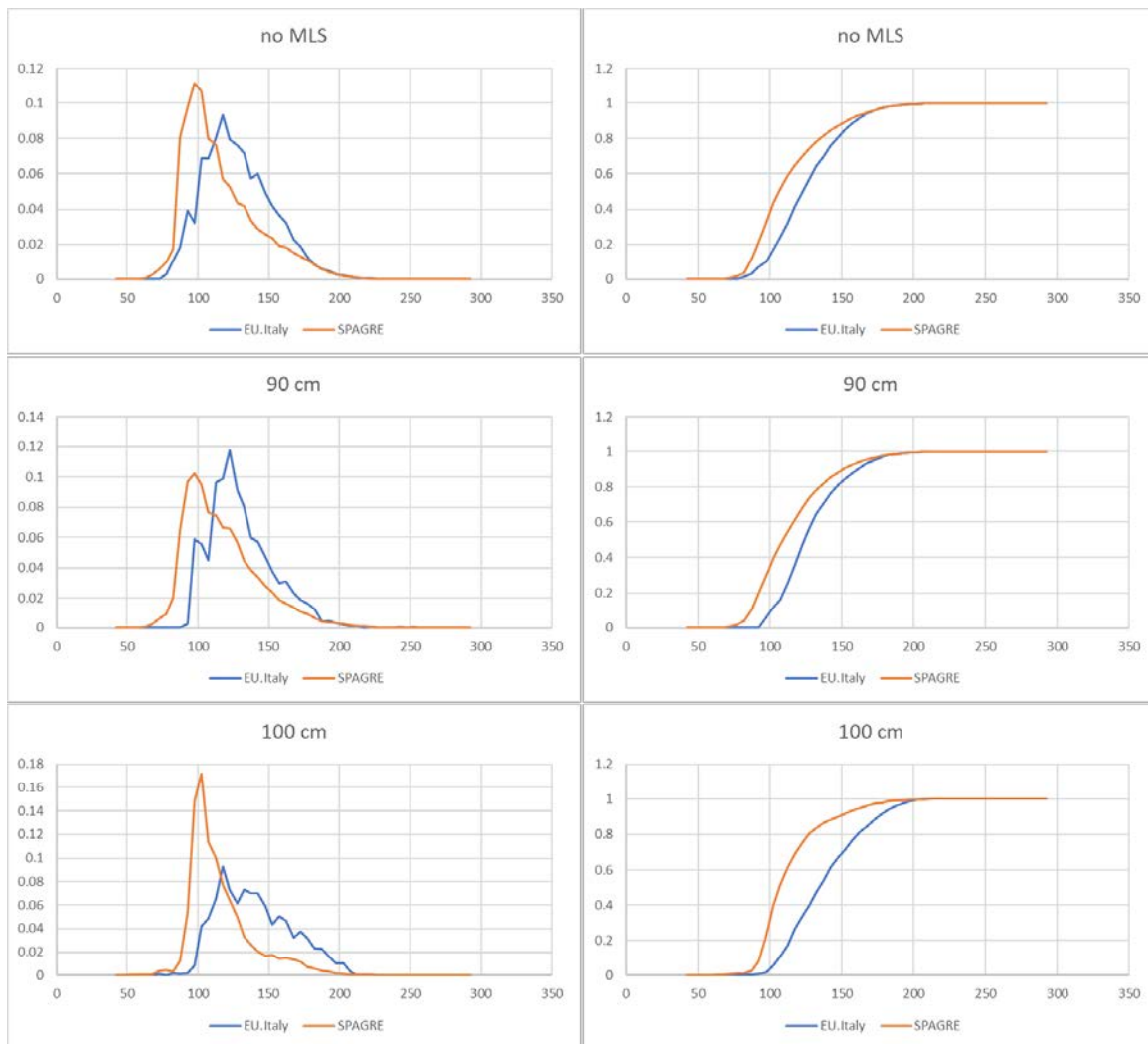


Figure 3. Comparison of the size frequency distributions (left column) and cumulative density size functions (right column) for the Med-SWO size samples from the Spanish and Greece longline fleets (SPAGRE) versus the Italian longline fleets (EU.Italy). The top row shows the comparison for the 2008-2013 period when no ICCAT minimum size landing regulations were imposed (no MLS), the middle row the period 2014-2016 when the 90 LJFL cm MLS were in effect (90 cm) and the bottom row the period 2017-2018 when the 100 LJFL cm MLS were implemented.

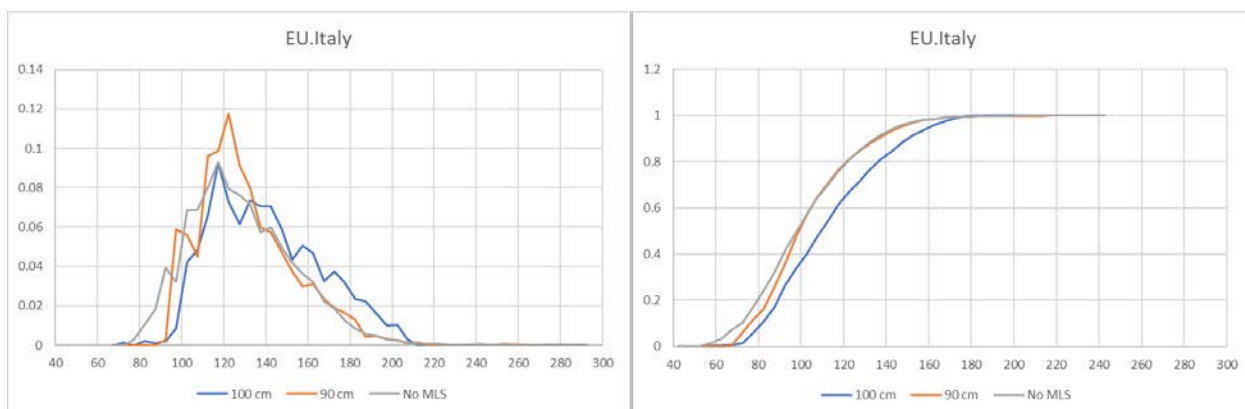


Figure 4. Italian longline fleet size distributions (size frequency distribution left, cumulative density right) for the 3 periods of no MLS (2008-2013), 90 cm minimum size restriction (2014-2016) and 100 cm minimum size restriction (2017-2018).

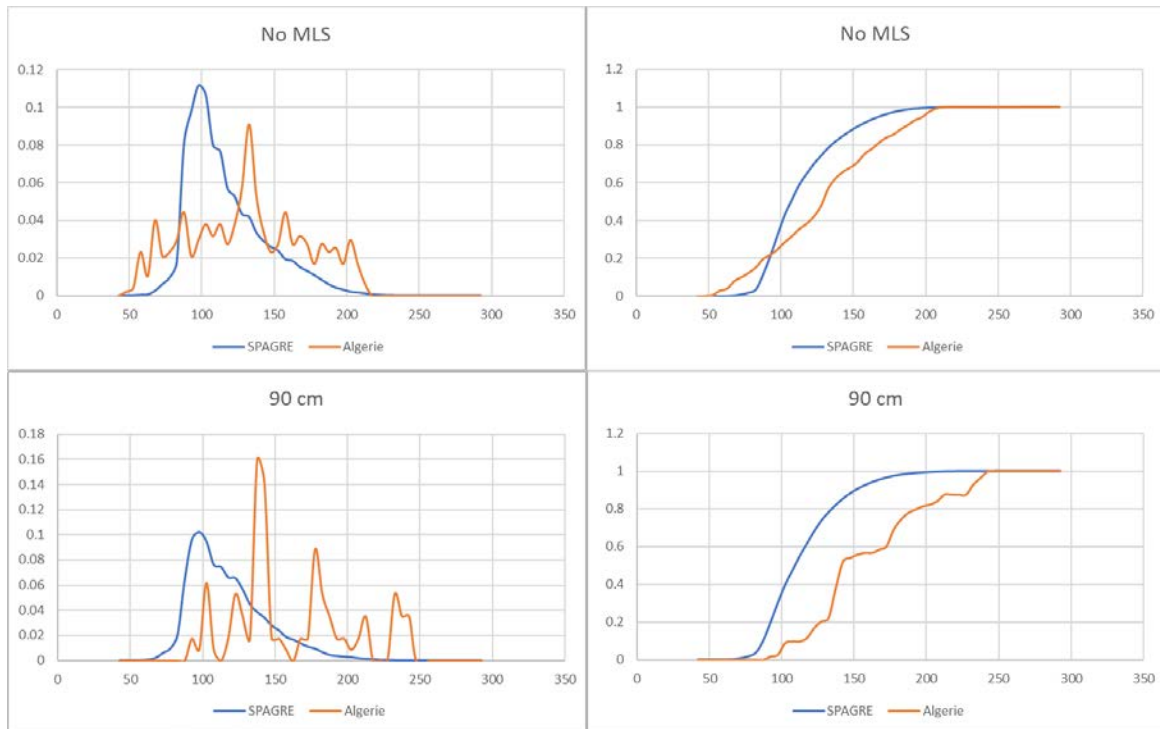


Figure 5. Comparison of the size frequency distributions (left column) and cumulative density size functions (right column) for the Med-SWO size samples from the Spanish and Greece longline fleets (SPAGRE) versus the Algeria longline fleets (Algerie). The top row shows the comparison for the 2008-2013 period when no ICCAT minimum size landing regulations were imposed (no MLS) and the bottom row the period 2014-2016 when the 90 LJFL cm MLS were in effect (90 cm). No size data is available from Algeria longline fleets for the 2017-2018 period

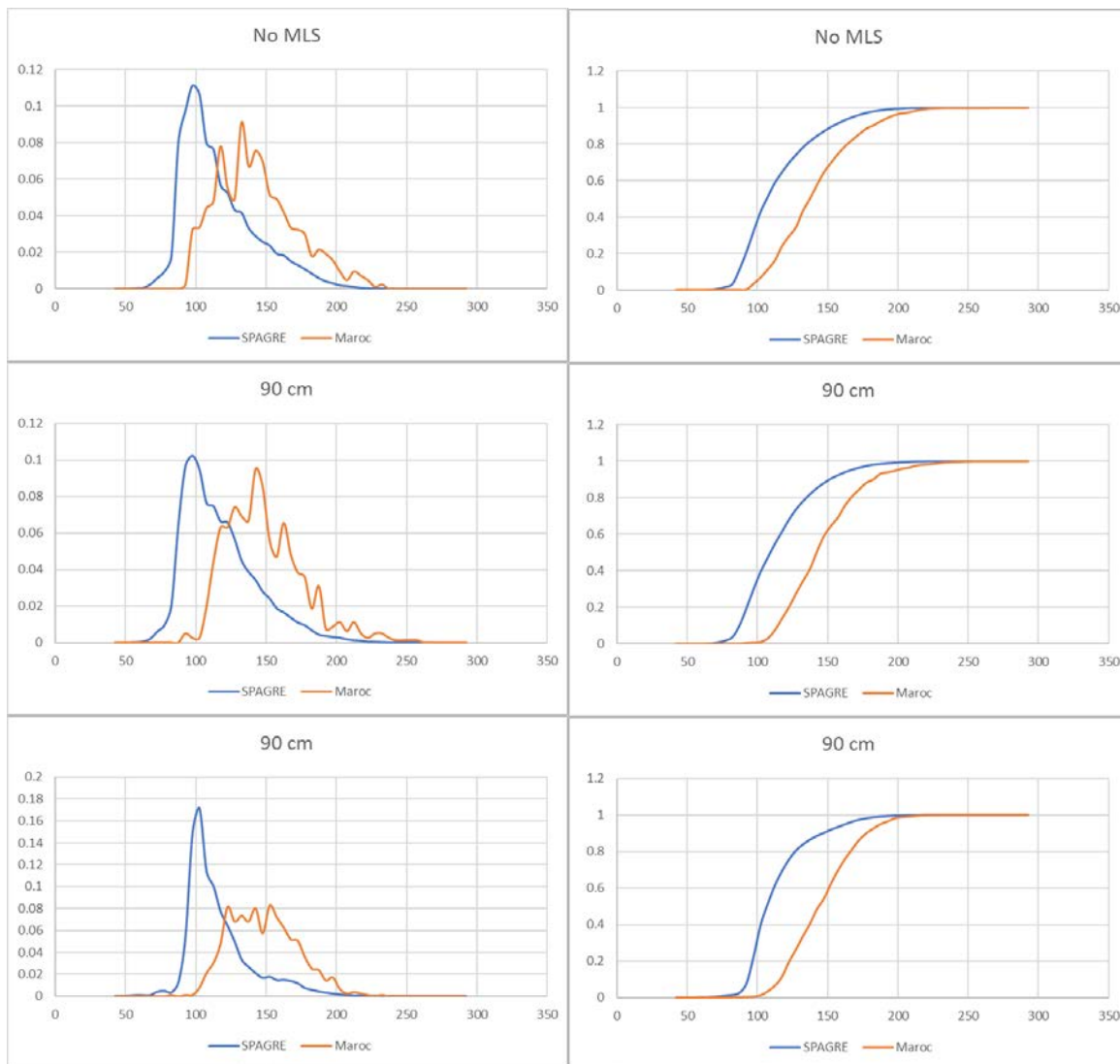


Figure 6. Comparison of the size frequency distributions (left column) and cumulative density size functions (right column) for the Med-SWO size samples from the Spanish and Greece longline fleets (SPAGRE) versus the Morocco longline fleets (Maroc). The top row shows the comparison for the 2008-2013 period when no ICCAT minimum size landing regulations were imposed (no MLS), the middle row the period 2014-2016 when the 90 LJFL cm MLS were in effect (90 cm) and the bottom row the period 2017-2018 when the 100 LJFL cm MLS were implemented.

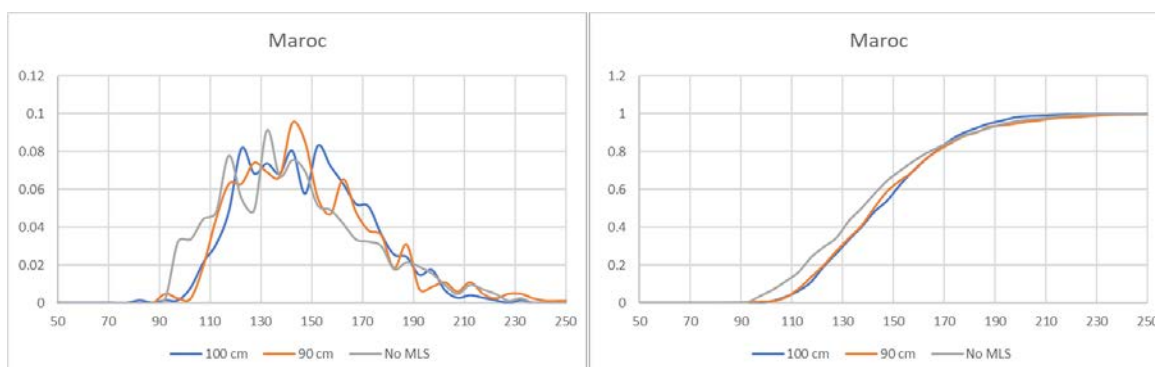


Figure 7. Morocco longline fleet size distributions (size frequency distribution left, cumulative density right) for the 3 periods of no MLS (2008-2013), 90 cm minimum size restriction (2014-2016) and 100 cm minimum size restriction (2017-2018)

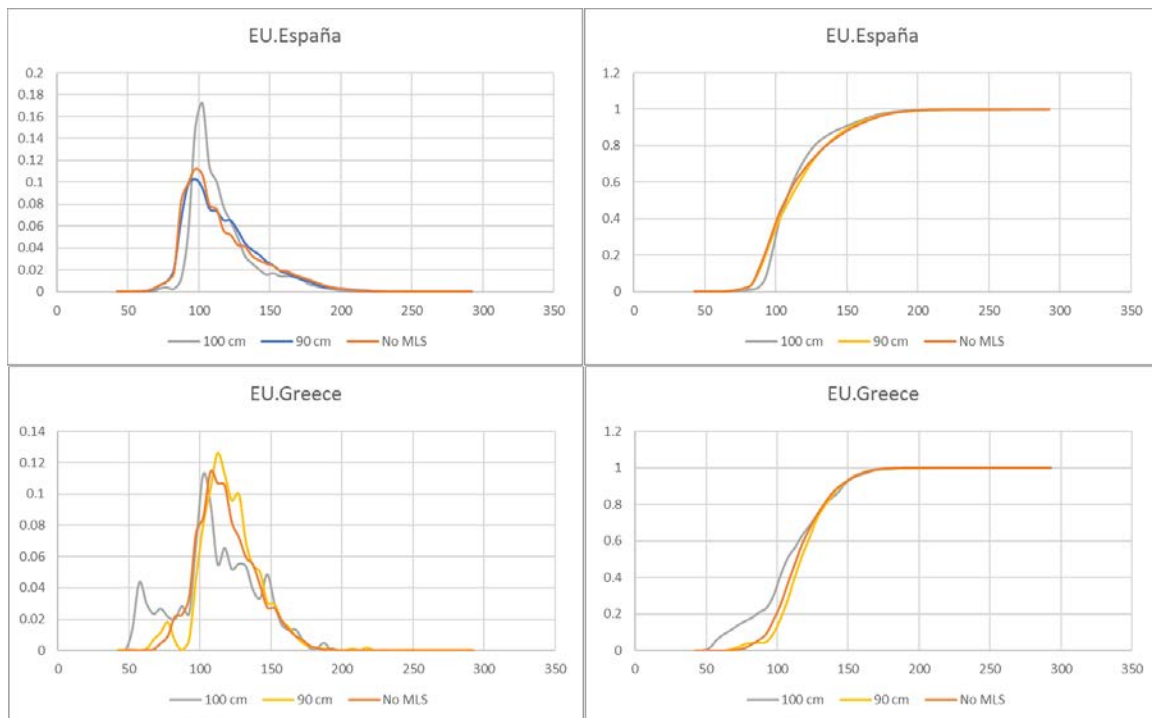


Figure 8. Spanish (top row) and Greek (bottom row) longline fleet size distributions (size frequency distribution left, cumulative density right) for the 3 periods of no MLS (2008-2013), 90 cm minimum size restriction (2014-2016) and 100 cm minimum size restriction (2017-2018).

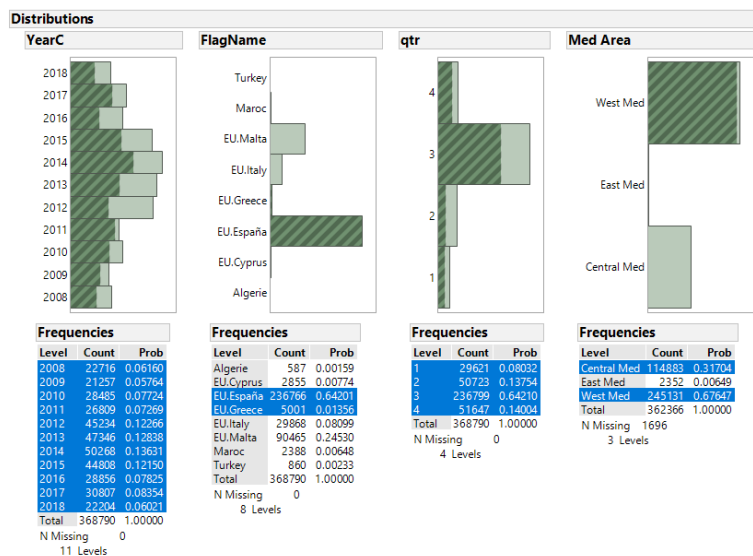


Figure 9. Med-SWO size samples available for 2008-2018 by year, longline fleet, quarter and area within the Mediterranean task 2sz database. Shade bars indicate the size samples from the Spanish and Greek longline fleets.

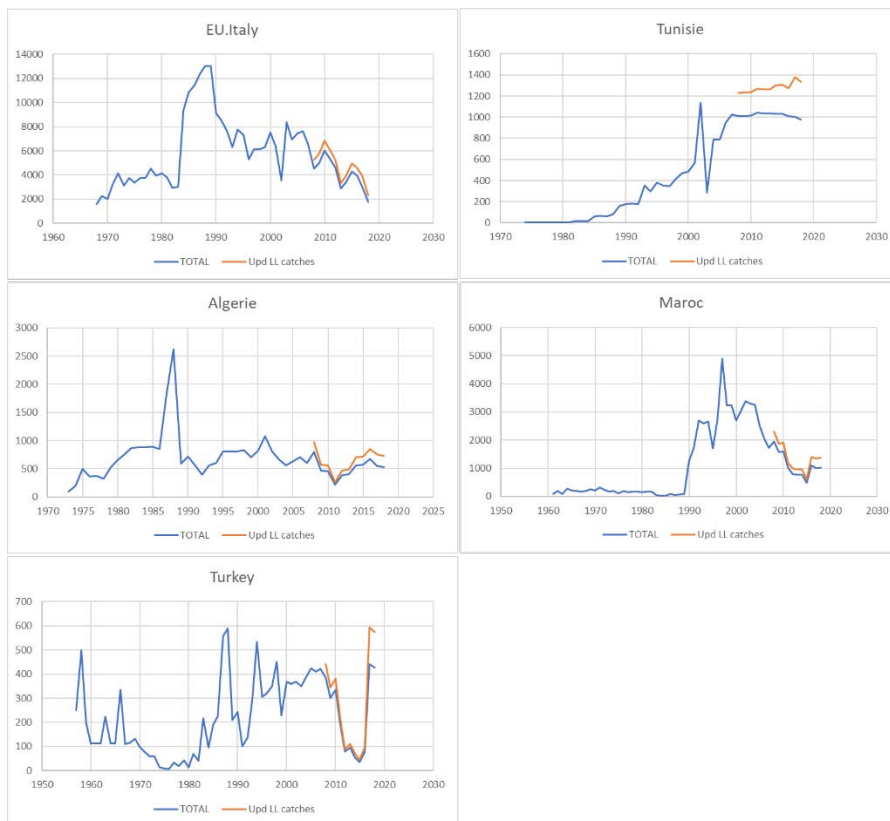


Figure 10. Estimated longline discards of undersize Mediterranean swordfish for the main longline fleets 2008-2018.

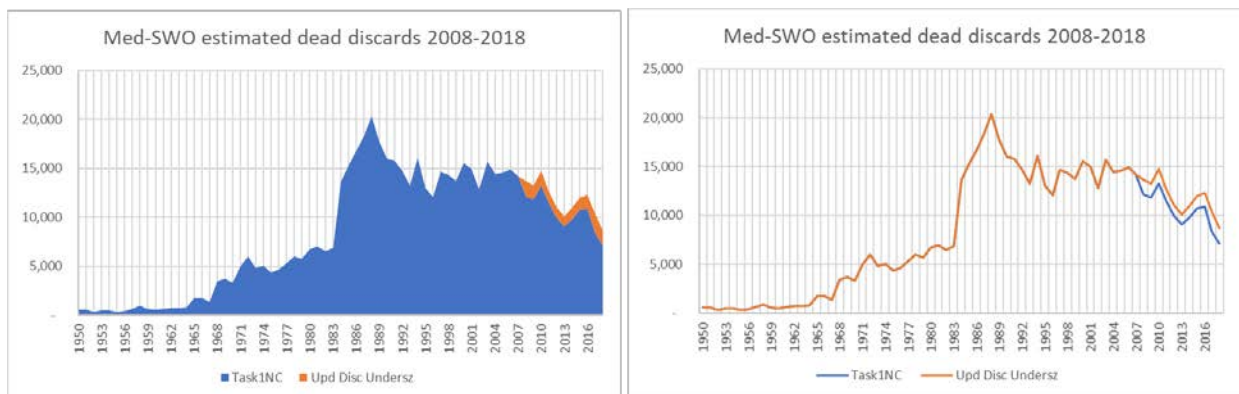


Figure 11. Estimated total removals for the Mediterranean swordfish stock by including the dead discards from the main longline fleets for the 2008-2018 period.