Stock Assessment Form
Demersal species

Reference year: 2019

Reporting year:2021

Striped red mullet (*Mullus surmuletus*) is one of the most important target species in the trawl fishery developed by around 30 vessels off Mallorca (Balearic Islands, GFCM-GSA05). A fraction of the small-scale fleet (~70 boats) also directs to this species during the second semester of the year, using both trammel nets and gillnets. During the last decade, the annual landings of this species have oscillated between 50 and 117 tons and 9 and 29 tons in the trawl and small-scale fishery, respectively. This stock has been assessed using data from both the trawl and the small-scale fishery on a time series covering 20years (2000-2019). The assessment has been carried out applying tuned virtual population analysis (Extended Survivor Analysis, XSA) and a statistical catch-at age (a4a) on the cohorts present during 200 2019 and a Y/R analysis based on the exploitation pattern resulting from the a4a model and population parameters for the period 2017-2019. These approaches were performed using monthly size composition of catches, official landings and the biological parameters estimated within the framework of the Data Collection Programme and from bibliography. All information was recomputed from a natural to an 'artificial' year, from 1st July to 30th June. Final year used corresponds to July 2019 to June 2020 and 2020 survey. The vector of natural mortality by age was calculated with PROBIOM. The software used was FLR in R.

Stock Assessment Form version 1.0 (January 2014)

Uploader: *Beatriz Guijarro/Marc Farré*

1 Basic Identification Data

Scientific name:	Common name:	ISCAAP Group:
Mullus surmutetus	Red mullet, surmullet, Striped red mullet	33
1st Geographical sub-area:	**2nd Geographical sub-area:**	**3rd Geographical sub-area:**
GSA05 – Balearic Islands		
4th Geographical sub-area:	**5th Geographical sub-area:**	**6th Geographical sub-area:**
1st Country	**2nd Country**	**3rd Country**
Spain		
4th Country	**5th Country**	**6th Country**
Stock assessment method: (direct, indirect, combined, none)		
Trawl survey, Indirect method (XSA, a4a and Y/R)		
Authors:		
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The ISSCAAP code is assigned according to the FAO 'International Standard Statistical Classification for Aquatic Animals and Plants' (ISSCAAP) which divides commercial species into 50 groups on the basis of their taxonomic, ecological and economic characteristics. This can be provided by the GFCM secretariat if needed. A list of groups can be found here:

http://www.fao.org/fishery/collection/asfis/en

Direct methods (you can choose more than one):

- Trawl survey

Indirect method (you can choose more than one):

- XSA
- A4A
- Y/R

2 Stock identification and biological information

2.1 Stock unit

GSA05 has been pointed as an individualized area for assessment and management purposes in the western Mediterranean (Quetglas *et al.*, 2012) due to its main specificities. These include: 1) Geomorphologically, the Balearic Islands (GSA05) are clearly separated from the Iberian Peninsula (GSA06) by depths between 800 and 2000 m, which would constitute a natural barrier to the interchange of adult stages of demersal resources; 2) Physical geographically-related characteristics, such as the lack of terrigenous inputs from rivers and submarine canyons in GSA05 compared to GSA06, give rise to differences in the structure and composition of the trawling grounds and hence in the benthic assemblages; 3) Owing to these physical differences, the faunistic assemblages exploited by trawl fisheries differ between GSA05 and GSA06, resulting in large differences in the relative importance of the main commercial species; 4) There are no important or general interactions between the demersal fishing fleets in the two areas, with only local cases of vessels targeting red shrimp in GSA05 but landing their catches in GSA06; 5) Trawl fishing exploitation in GSA05 is much lower than in GSA06; the density of trawlers around the Balearic Islands is one order of magnitude lower than in adjacent waters; and 6) Due to this lower fishing exploitation, the demersal resources and ecosystems in GSA05 are in a healthier state than in GSA06, which is reflected in the population structure of the main commercial species (populations from the Balearic Islands have larger modal sizes and lower percentages of small-sized individuals), and in the higher abundance and diversity of elasmobranches assemblages

2.2 Growth and maturity

Incorporate different tables if there are different maturity ogives (e.g. catch and survey). Also incorporate figures with the ogives if appropriate. Modify the table caption to identify the origin of the data (catches, survey). Incorporate names of spawning and nursery areas and maps if available.

Table 2.2-1: Maximum size, size at first maturity and size at recruitment.

Somatic magnitude measured (LT, LC, etc)				**Units**	cm
Sex	**Fem**	**Mal**	**Combined**	**Reproduction season**	End of spring and summer
Maximum size observed			39	**Recruitment season**	End of summer, beginning of autumn
Size at first maturity			14.2	**Spawning area**	Continental Shelf
Recruitment size to the fishery			10	**Nursery area**	Continental Shelf

Table 2-2.2: M vector and proportion of matures by size or age (Combined)

Size/Age	Natural mortality	Proportion of matures
0	1.54	0.00
1	0.43	1.00
2	0.29	1.00
3	0.24	1.00
4	0.22	1.00
+5	0.21	1.00

Table 2-3: Growth and length weight model parameters

			Sex			
		Units	female	male	Combined	Years
Growth model	**L_∞**	cm			35	
	K				0.26	
	t_0				-0.5	
	Data source	Spanish DCF				
Length weight relationship	**a**				0.0124	
	b				3.0194	
	M (scalar)					
	sex ratio (% females/total)					

3 Fisheries information

3.1 Description of the fleet

In the Balearic Islands (GSA 5), commercial trawlers employ up to four different fishing tactics (Palmer *et al.* 2009), which are associated with the shallow and deep continental shelf, and the upper and middle continental slope (Guijarro and Massutí 2006; Ordines *et al.* 2006). Vessels mainly target striped red mullet (*Mullus sumuletus*) and European hake (*Merluccius merluccius*) on the shallow and deep shelf respectively. However, these two target species are caught along with a large variety of fish and cephalopod species. The Norway lobster (*Nephrops norvegicus*) and the red shrimp (*Aristeus antennatus*) are the main target species on the upper and middle slope respectively. The Norway lobster is caught at the same time as a large number of other fish and crustacean species, but the red shrimp fishery is the only Mediterranean fishery that could be considered mono-specific. The species assessed, the striped red mullet, is one of the most important target species in the trawl fishery working on the continental shelf off Mallorca (~30 vessels). A fraction of the small-scale fleet (~100 boats) also directs to this species during the second semester of the year (July-December), using both trammel nets and gillnets.

Table 3-1: Description of operational units exploiting the stock

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	ESP	05	E-Trawl (12-24 meters)	03- Trawls	33- Demersal inshore species	MUR
Operational Unit 2	ESP	05	C- Minor gear with engine (6-12 meters)	07- Gillnets and Entangling Nets	33- Demersal inshore species	MUR

Table 3.1-2: Catch, bycatch, discards and effort by operational unit in the reference year

Operational Units*	Fleet (n° of boats)*	Catch (T or kg of the species assessed)	Other species caught (names and weight)	Discards (species assessed)	Discards (other species caught)	Effort (units)
Trawl		65*	See comments	No (1)	Yes (1)	Fishing trips
Trammel net		17*	See comments	Yes (2)	Yes (2)	Fishing trips
Total		96*	See comments	No (1)	Yes (1)	Fishing trips

* Catch is the average landings, in tons, 2000-2019.

(1) Carbonell (1997).
(2) Since Mas *et al*. (2004), twelve species were discarded at least in one occasion, and the discarded fraction in this fishery was 1.4% in number. *M. surmuletus* were discarded in 19% of the fishing sets and made up the largest fraction of the discards (42.8% in number).

Other species caught

Trawl
Spicara smaris, Mullus barbatus, Pagellus acarne, Pagellus erythrinus, Trachurus mediterraneus, Scyliorhinus canicula, *Serranus cabrilla, Trachinus draco, Scorpaena notata, Trigloporus lastoviza, Scorpaena scrofa, Octopus vulgaris, Eledone moschata, Sepia officinalis, Loligo vulgaris.*

Trammel net (Mas *et al.*, 2004): *Diplodus annularis, Spicara maena, Diplodus vulgaris, Serranus scriba.*

3.2 Historical trends

Historical catches showed a general decreasing trend, with some puntual peaks in 2001, 2006, 2010, and 2016 (Fig. 3.2-1). Catches has increased after minimum values in 2015.

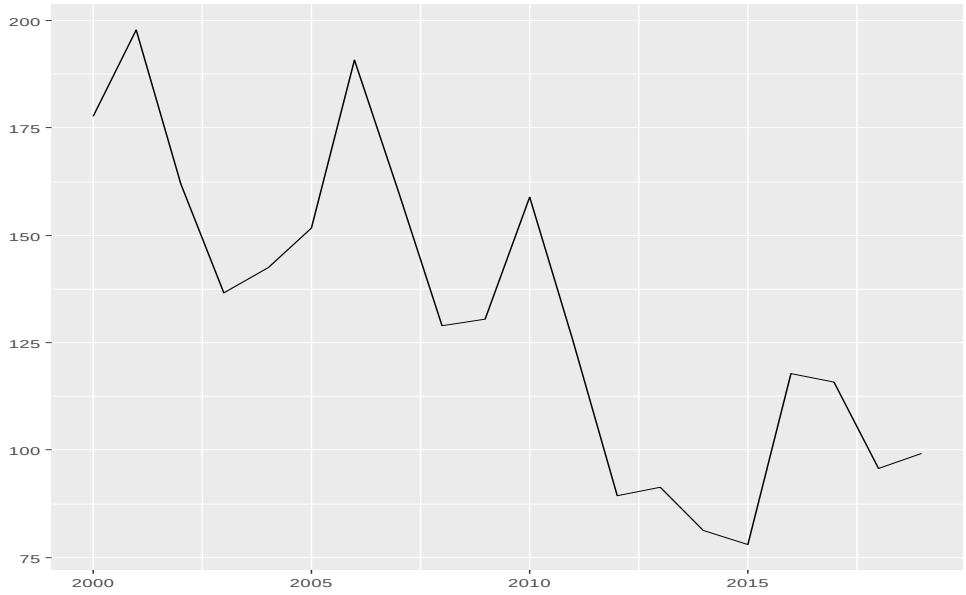

Fig. 3.2-1. *M. surmuletus* GSA05: Annual landings of bottom trawl fleet from 1992 to 2019.

Age structures were dominated by individuals from 1 and 2 ages (Fig. 3.2-2).

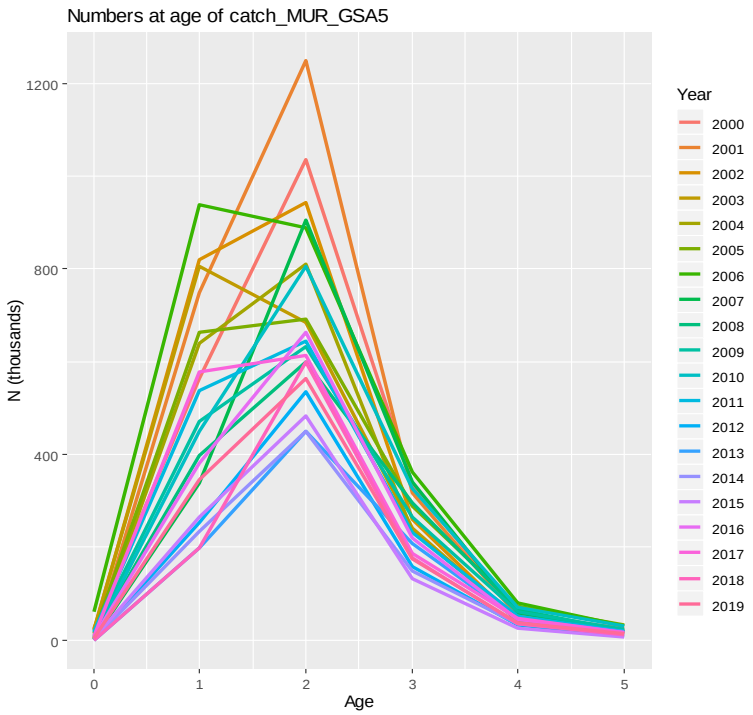

Figure 3.2.-2: Age composition from *M. surmuletus* caught by the bottom trawl fishery.

3.3 Management regulations

Trawl

- Fishing license: fully observed

- Engine power limited to 316 KW or 500 CV: not observed

- Mesh size in the cod-end (before Jun 1st 2010: 40 mm diamond; from Jun 1st 2010: 40 mm square or 50 mm diamond -by derogation-): fully observed

- Fishing forbidden upper 50 m depth: not fully observed

- Time at sea (12 hours per day and 5 days per week): fully observed

- MCRS: 11 cm TL

- Weekly temporal bans (winter, for some years)

- Fishing reduction (number of days)

- Spatial-temporal closures (2020)

Trammel net

- Fishing license: fully observed

- Fishing season (July to December): No regulated

- Maximum length of nets (2000 m/fisherman and 5000 m/boat): not fully observed

- Minimum mesh size (50 mm): fully observed

- Limitation to 6 fishing days per week: fully observed

- Time at sea (from sunrise to sunset): not fully observed
- Fishing forbidden deeper than 50 m depth: fully observed

3.4 Reference points

Table 3.3-1: List of reference points and empirical reference values previously agreed (if any)

Indicator	Limit Reference point/empirical reference value	Value	Target Reference point/empirical reference value	Value	Comments
B					
SSB					
F			$F_{0.1(2019)}$	0.14	
Y					
CPUE					
Index of Biomass at sea					

4 Fisheries independent information

4.1 BALAR-MEDITS bottom trawl surveys

4.1.1 Brief description of the direct method used

From 2001, the Spanish Institute of Oceanography has performed annual bottom trawl surveys following the same methodology and sampling gear described in the MEDITS protocol (BALAR surveys, Massutí and Reñones, 2005). Since 2007, this survey has been included in the MEDITS program (Bertrand *et al.*, 2002). Mean stratified abundances and biomasses by km^2 has been computed using the methodology described by Grosslein and Laurec (1982), with the following formula:

- Mean catch by stratum: $$\overline{Y}_{st} = \frac{1}{N_h} * \sum Y_h$$
- Variance by stratum: $$S^2(\overline{Y}_{st}) = \frac{1}{N_{h-1}} * \sum (Y_h - \overline{Y}_{st})^2$$
- Mean total catch: $$Y_t = \frac{1}{A} * \sum (\overline{Y}_{st} * A_h)$$
- Total variance: $$S^2(\overline{Y}_t) = \frac{1}{A^2} * \sum \frac{S^2(\overline{Y}_{st}) * A_h^{\,2}}{N_h}$$
- SE (standard error): $$SE = \sqrt{S^2(\overline{Y}_{st})}$$

Nh: number of hauls in each sub-stratum; Yh: mean catch by haul in each sub-stratum; A: total stratum area; Ah: sub-estratum area; $S^2(\overline{Y}_{st})$ variance in each sub-stratum.

Direct methods: trawl based abundance indices

Table 4.1-1: Trawl survey basic information

Survey	MEDITS_05_2019	**Trawler/RV**	RV "Miguel Oliver"
Sampling season	End Spring (June)		
Sampling design	MEDITS Handbook V.8 (2016)		
Sampler (gear used)	G.O.C. 73		
Cod –end mesh size as opening in mm	20 mm		
Investigated depth range (m)	50-750 m		

Map of hauls positions

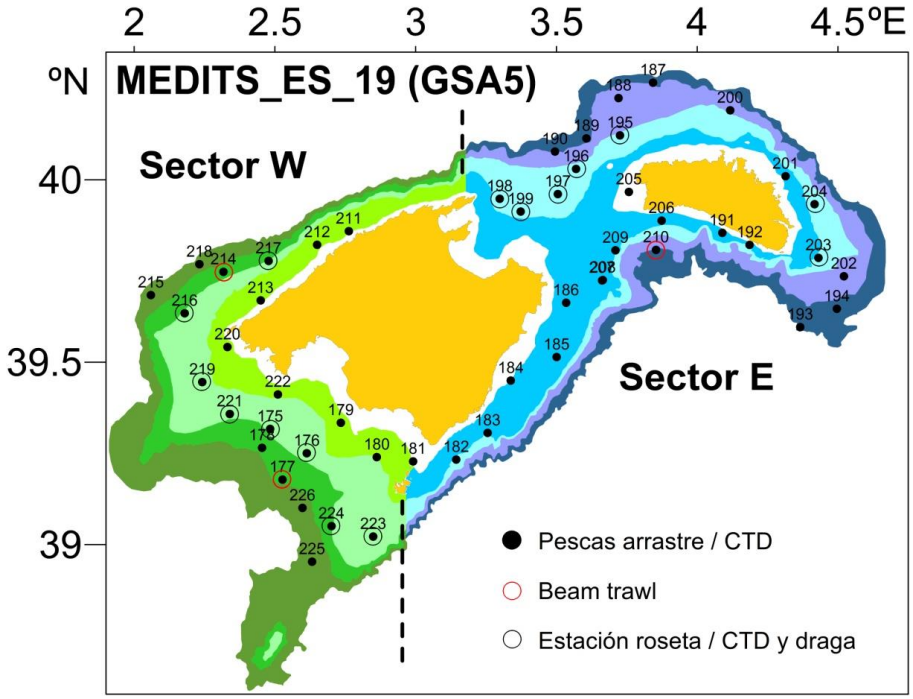

Figure 4.1.2-1: Map of the position of MEDITS survey trawls (2019), beam trawls and CTD's in GSA 05.

4.1.2 Spatial distribution of the resources

M. surmuletus is mainly distributed in the fishing grounds sited in the Menorca channel, as well as, at lesser extent, in the south and east of Menorca (Fig 4.1.2.-1).

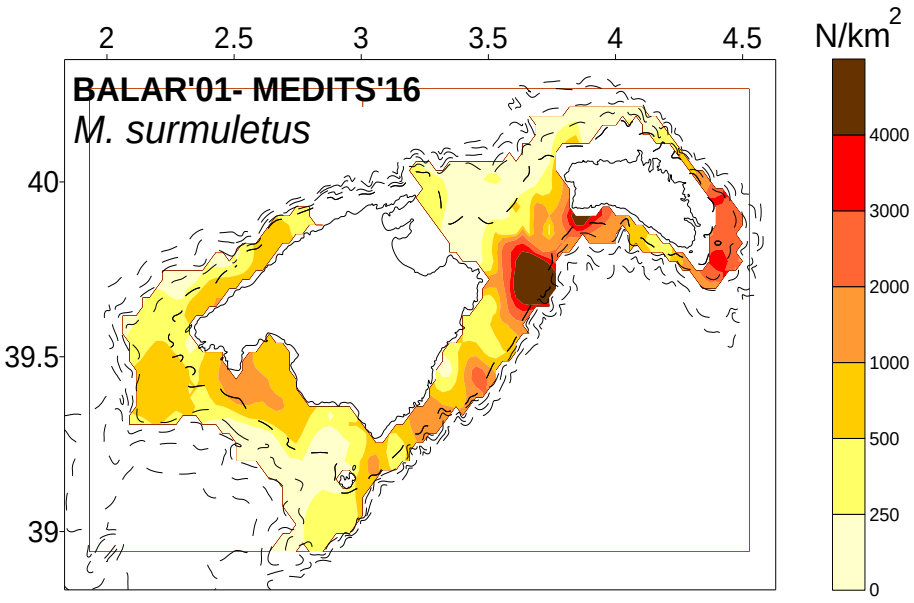

Fig 4.1.2-1. Spatial distribution of *M. surmuletus* around the Balearic Islands using information obtained from surveys.

4.1.3 Historical trends

Biomass index of *M.surmuletus* in GSA 05 show oscillations along the data series, with a decrease until minimum values in 2012 and a slight recovery from 2016 with constant values to 2019 (Fig 4.1.3-1).

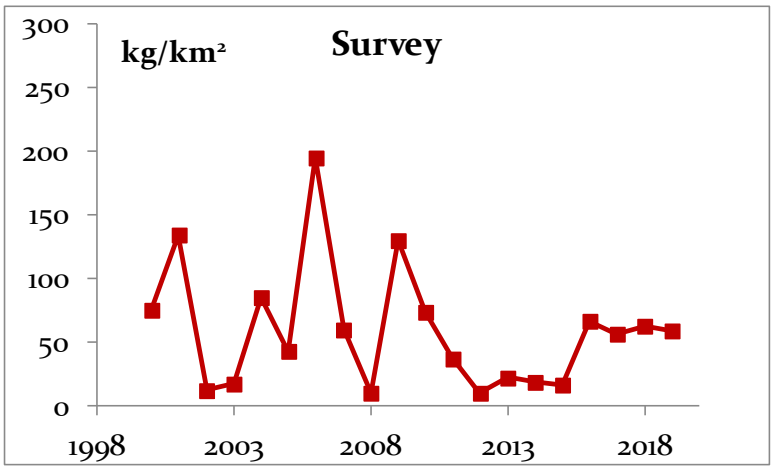

Fig 4.1.3-1. Biomass index of *M. surmuletus* in GSA 05 from scientific surveys (2000-2019).

Most of the catches during the survey correspond to age 2 individuals, followed by ages 1 and 3 (Fig 4.1.3-2).

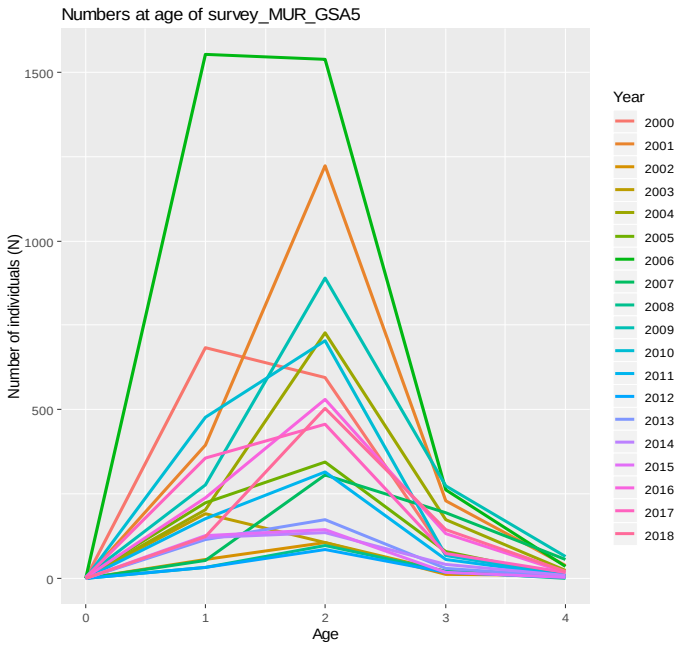

Fig 4.1.3-2. Age structure of *M. surmuletus* in GSA 05 from scientific surveys (BALAR-MEDITS).

5 Ecological information

5.1 Protected species potentially affected by the fisheries

5.2 Environmental indexes

6 Stock Assessment

In this section there will be one subsection for each different model used, and also different model assumptions runs should be documented when all are presented as alternative assessment options.

6.1 Statistical Catch-at-Age (a4a) model

6.1.1 Model assumptions

FLR libraries were employed in order to carry out a Statistical-Catch-at-Age (a4a) assessment. Several models were run with different configurations (Table 6.2.1-1).

Several models were run and the final model selected was the following:

f<- ~factor(replace(age, age>2,2)) + s(year, k=9)

q <- list(~factor(replace(age,age>2,2)))

sr <- ~geomean(CV=0.25)

6.1.2 Scripts

6.1.3 Input data and Parameters

Catch-at-age data from the commercial fleet is included in the following table:

	0	1	2	3	4	5+
2000	28.3	638.6	1174.5	380.9	61.9	27.8
2001	3.1	845.7	1412	359.3	59.1	21.6
2002	23.2	927.4	1064.8	294.7	45.5	17.8
2003	27.2	910.7	772.3	271.8	47.8	16.6
2004	4.7	722.1	916.9	264.8	54.2	17.4
2005	16	752.1	783.8	328	83.8	35.5
2006	69.1	1064.7	1007.7	411.4	89.4	35.4
2007	0.8	384.1	1025.6	386.6	67.6	24.4
2008	9.4	451.3	680.6	334.7	75.1	21.1
2009	19.3	536.1	718.4	301.2	69.7	25.5
2010	8.4	511	918.1	372.5	80.7	35.1
2011	21.4	608.5	729.6	262.8	58.8	20.7
2012	0.6	286.6	608	180	38	11.1
2013	0.5	224.7	510.4	236.5	50.9	20.7
2014	1.4	266.1	511.1	170	40.1	17.2
2015	4.8	299.7	546.8	149.5	28	8.2
2016	6.2	433.2	752.9	250.7	50.2	19.1
2017	10.4	653.7	695	211.1	52.9	19
2018	0.1	224.1	680.4	201.3	40.8	13.1
2019	5	394.5	640.4	199.5	43.3	15.4

6.1.4 Tuning data

Index data from the survey is included in the following table:

	0	1	2	3
2001	56.8	308.5	16.4	0.1
2002	264.6	235.3	19.5	1.9
2003	38	70.9	6.4	0.3
2004	0.9	28.1	4.1	0.3
2005	0.1	10.8	3.6	0.3
2006	3.4	10.6	5.4	0.5
2007	3.4	4	0.8	0
2008	35.7	18.6	1.5	0
2009	8.4	31.7	2.1	0.4
2010	28.7	30.2	7.2	0.4
2011	3.2	8.8	2.6	0.4
2012	40.4	26.7	2.4	0.1
2013	4.8	49.5	7.1	0.5
2014	25.9	22.1	1.2	0
2015	2.7	11.1	2	0
2016	92	45	2.1	0
2017	435.3	212.5	1.3	0
2018	200.1	306.7	15	0
2019	238.5	126.2	3.2	0.3

6.1.5 Results

Tables and graphs of Total biomass, SSB, Recruitment, F or other outcomes of the stock assessment model with comments on trends in stock size, recruitment and exploitation.

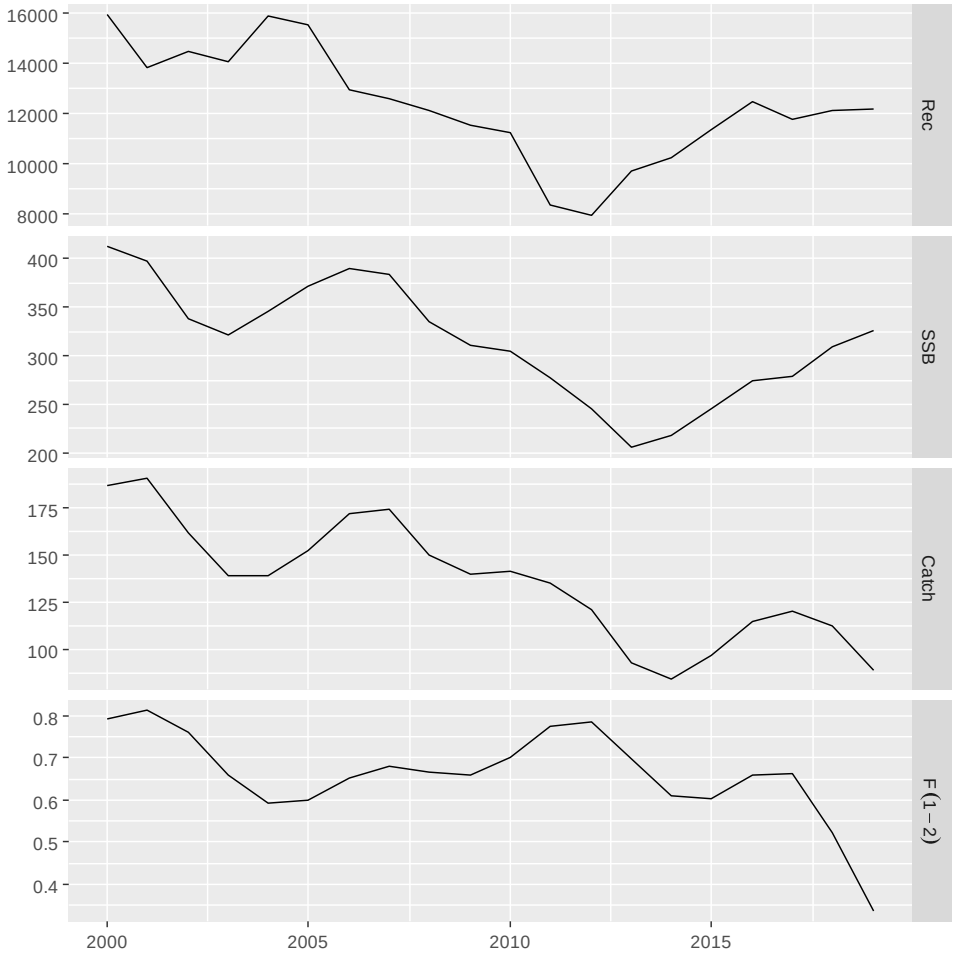

Fig 6.1.5-1. A4a results for *Mullus surmuletus* in GSA 05.

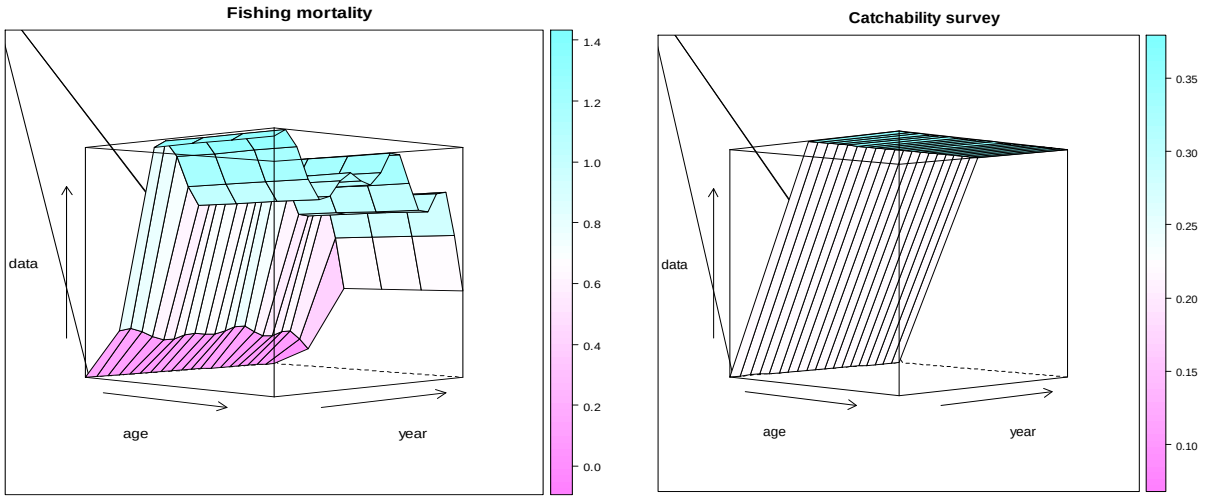

Figure 6.1.5-2. 3D contour plots of estimated fishing mortality and of estimated catchability at age and year for *M. surmuletus* from GSA 05.

6.1.6 Robustness analysis

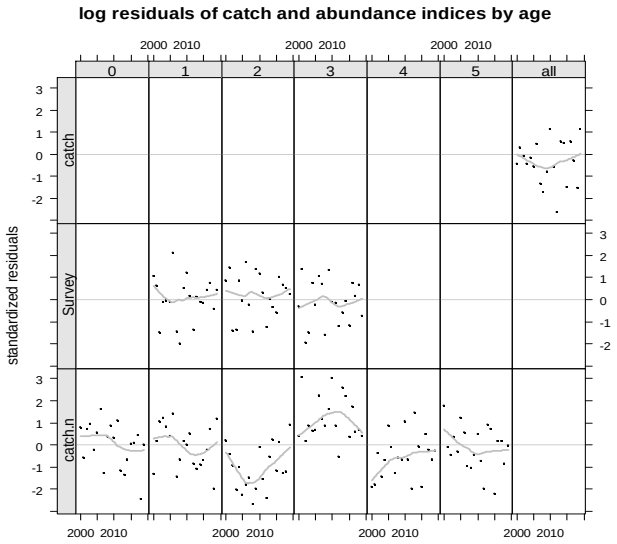

Figure 6.1.6-1. Residuals from the catches and the tuning fleet for *M. surmuletus* from GSA 05.

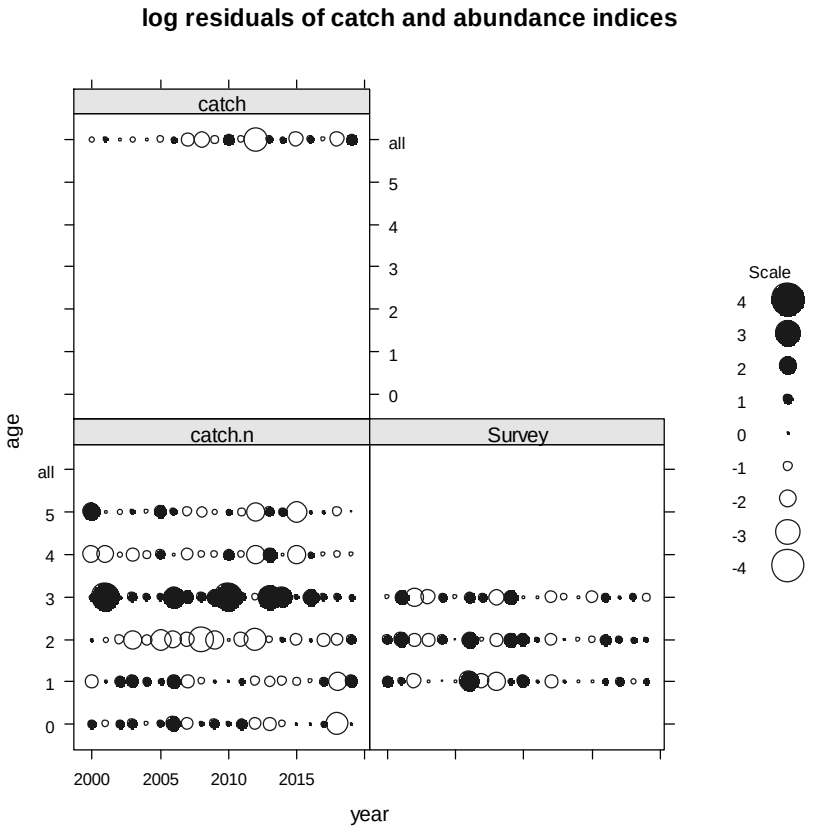

Fig. 6.1.6-2. *Mullus surmuletus* GSA05: Log residuals for the surveys and the commercial fleet.

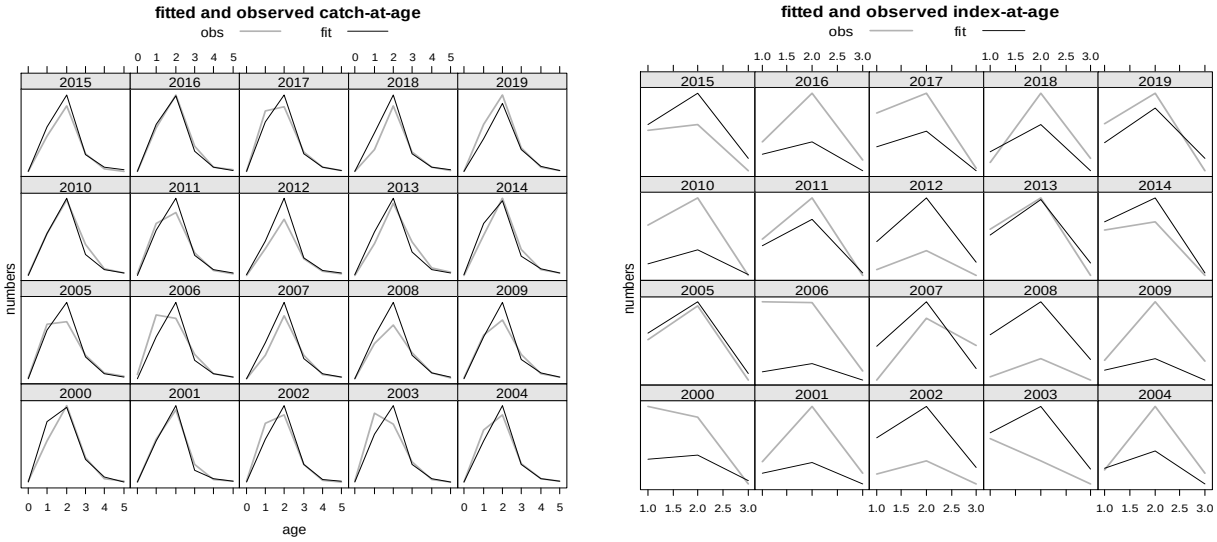

Figure 6.1.6-3. Model fit for *M. surmuletus* for the commertial fleet and survey from GSA 05.

6.1.7 Retrospective analysis, comparison between model runs, sensitivity analysis, etc.

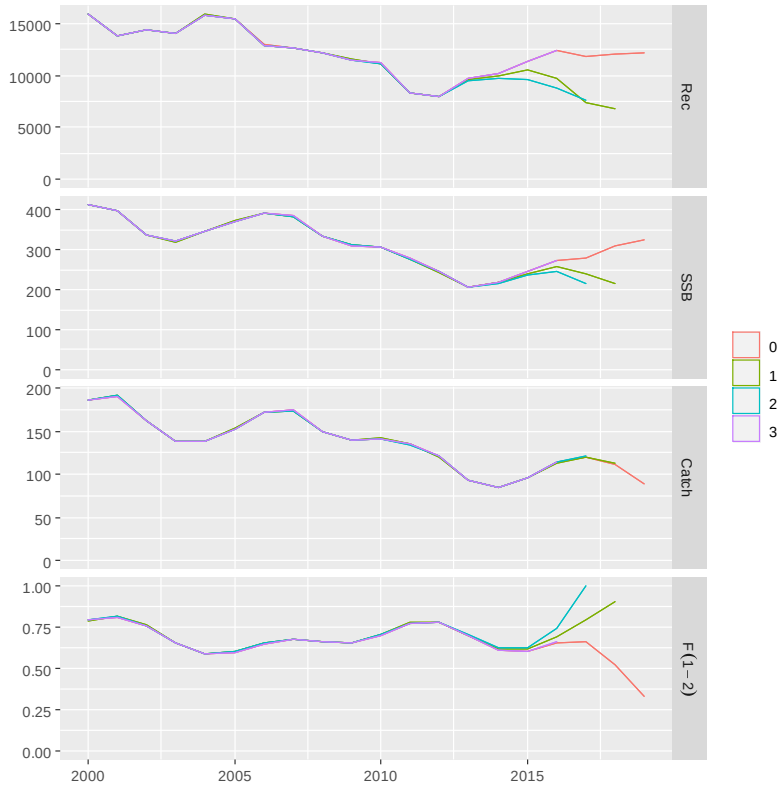

Figure 6.1.7-1. Retrospective analysis for *M. surmuletus* from GSA 05.

6.1.8 Assessment quality

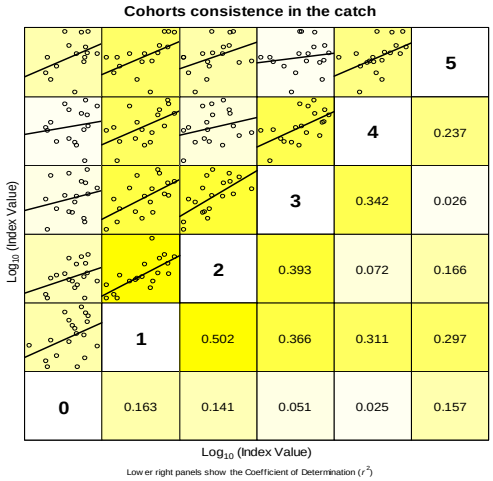

Figure 6.1.8.1. Internal consistency of the catch at age data, commercial fleet, for *M. surmuletus* from GSA5

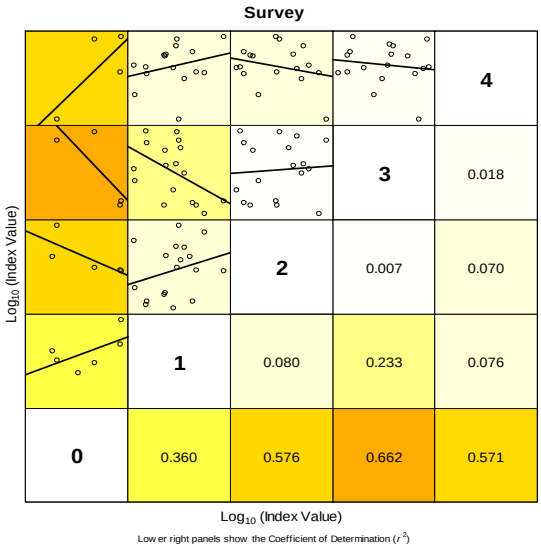

Figure 6.1.8.2. Internal consistency of the catch at age data, MEDITS survey, for *M. surmuletus* from GSA5.

6.1.9 Assessment quality

7 Stock predictions

7.1 Short term predictions

A deterministic short term prediction was performed using FLR routines, assuming an F_{stq} of 1.04 and a recruitment as the geometric average 2017-2019). Table 7.1.1 shows the results of the predictions..

Table 7.1.1 – Short term forecast in different F scenarios computed for *M. surmuletus* in GSA 5.

	Ffactor	Fbar	Catch_2019	Catch_2020	Catch_2021	Catch_2022	SSB_2020	SSB_2021	SSB_2022	Change_SSB_ 2021-2022(%)	Change_Catch _2019-2021(%)
f0.1	0.28	0.14	88.71	147.79	50.51	71.07	386.32	377.35	492.46	30.50	-43.06
F upper	0.39	0.19	88.71	147.79	68.39	90.46	386.32	377.35	468.91	24.26	-22.91
F lower	0.19	0.09	88.71	147.79	35.52	52.51	386.32	377.35	512.27	35.75	-59.96
zero catch	0.00	0.00	88.71	147.79	0.00	0.00	386.32	377.35	559.38	48.24	-100.00
status quo	1.00	0.49	88.71	147.79	143.98	140.54	386.32	377.35	370.41	-1.84	62.30
ferent scenar	0.10	0.05	88.71	147.79	19.34	30.09	386.32	377.35	533.69	41.43	-78.20
	0.20	0.10	88.71	147.79	37.35	54.89	386.32	377.35	509.84	35.11	-57.89
	0.30	0.15	88.71	147.79	54.13	75.24	386.32	377.35	487.69	29.24	-38.98
	0.40	0.20	88.71	147.79	69.77	91.84	386.32	377.35	467.09	23.78	-21.35
	0.50	0.24	88.71	147.79	84.36	105.29	386.32	377.35	447.95	18.71	-4.91
	0.60	0.29	88.71	147.79	97.97	116.09	386.32	377.35	430.15	13.99	10.43
	0.70	0.34	88.71	147.79	110.67	124.68	386.32	377.35	413.58	9.60	24.75
	0.80	0.39	88.71	147.79	122.53	131.42	386.32	377.35	398.15	5.51	38.12
	0.90	0.44	88.71	147.79	133.62	136.62	386.32	377.35	383.79	1.71	50.61
	1.10	0.54	88.71	147.79	153.68	143.39	386.32	377.35	357.93	-5.15	73.23
	1.20	0.59	88.71	147.79	162.75	145.38	386.32	377.35	346.29	-8.23	83.46
	1.30	0.64	88.71	147.79	171.25	146.64	386.32	377.35	335.43	-11.11	93.04
	1.40	0.68	88.71	147.79	179.22	147.33	386.32	377.35	325.28	-13.80	102.02
	1.50	0.73	88.71	147.79	186.69	147.53	386.32	377.35	315.80	-16.31	110.44
	1.60	0.78	88.71	147.79	193.70	147.36	386.32	377.35	306.94	-18.66	118.35
	1.70	0.83	88.71	147.79	200.29	146.88	386.32	377.35	298.65	-20.86	125.77
	1.80	0.88	88.71	147.79	206.48	146.17	386.32	377.35	290.88	-22.92	132.75
	1.90	0.93	88.71	147.79	212.31	145.27	386.32	377.35	283.61	-24.84	139.32
	2.00	0.98	88.71	147.79	217.79	144.23	386.32	377.35	276.79	-26.65	145.50

7.2 Medium term predictions

No medium term prediction was carried out due to the lack of a reliable model fit for the spawning stock biomass-recruitment relationship.

7.3 Long term predictions

A4a results were used as input data for the Y/R analysis, performed in R (FLBRP) using the last 3 years (2017-2019) in order to calculate the reference point ($F_{0.1}$ as a proxy of F_{MSY}) and the estimated reference fishing mortality ($F_{current}$). However, the $F_{0.1}$ considered for the final advice was those computed in 2019.

Yield per recruit analysis was used (FLBRP) to calculate the reference point ($F_{0.1}$ as a proxy of F_{MSY}) and the estimated reference fishing mortality ($F_{current}$).

$F_{0.1\ (2019)}$	0.14
$F_{current\ (1\text{-}2,\ 2019)}$	0.34

8 Draft scientific advice

Based on	Indicator	Analytic al reference point (name and value)	Current value from the analysis (name and value)	Empirical reference value (name and value)	Trend (time period)	Stock Status
Fishing mortality	Fishing mortality	$F_{0.1,2019}$ = 0.136,	$F_{(1\text{-}2,\ 2019)}$= 0.34			IO (O_H)
	Fishing effort					
	Catch					
Stock abundance	Biomass					
	SSB		327.42 tons	33_{th} percentile=287.08 66_{th} percentile=337.08		
Recruitment						
Final Diagnosis		In overexploitation with intermediate level of biomass				

State the rationale behind that diagnoses, explaining if it is based on analytical or on empirical references

Ratio $F_{(1\text{-}2,\ 2019)}/F_{0.1(2019)}$= 2.5.

8.1 Explanation of codes

Trend categories

1) N - No trend
2) I - Increasing
3) D – Decreasing
4) C - Cyclic

Stock Status

Based on Fishing mortality related indicators

1) **N - Not known or uncertain** – Not much information is available to make a judgment;
2) **U - undeveloped or new fishery** - Believed to have a significant potential for expansion in total production;
3) **S - Sustainable exploitation**- fishing mortality or effort below an agreed fishing mortality or effort based Reference Point;
4) **IO –In Overfishing status**– fishing mortality or effort above the value of the agreed fishing mortality or effort based Reference Point. An agreed range of overfishing levels is provided;

Range of Overfishing levels based on fishery reference points

In order to assess the level of overfishing status when $F_{0.1}$ from a Y/R model is used as LRP, the following operational approach is proposed:

- If $Fc^*/F_{0.1}$ is below or equal to 1.33 the stock is in **(O_L): Low overfishing**
- If the $Fc/F_{0.1}$ is between 1.33 and 1.66 the stock is in **(O_I): Intermediate overfishing**
- If the $Fc/F_{0.1}$ is equal or above to 1.66 the stock is in **(O_H): High overfishing**

*Fc is current level of F

5) **C- Collapsed**- no or very few catches;

Based on Stock related indicators

1) **N - Not known or uncertain:** Not much information is available to make a judgment
2) **S - Sustainably exploited:** Standing stock above an agreed biomass based Reference Point;
3) **O - Overexploited**: Standing stock below the value of the agreed biomass based Reference Point. An agreed range of overexploited status is provided;

Empirical Reference framework for the relative level of stock biomass index

- **Relative low biomass:** Values lower than or equal to 33rd percentile of biomass index in the time series **(O_L)**
- **Relative intermediate biomass:** Values falling within this limit and 66th percentile **(O_I)**
- **Relative high biomass:** Values higher than the 66th percentile **(O_H)**

4) **D – Depleted**: Standing stock is at lowest historical levels, irrespective of the amount of fishing effort exerted;
5) **R –Recovering:** Biomass are increasing after having been depleted from a previous period;

Agreed definitions as per SAC Glossary

Overfished (or overexploited) *- A stock is considered to be overfished when its abundance is below an agreed biomass based reference target point, like B0.1 or BMSY. To apply this denomination, it should be assumed that the current state of the stock (in biomass) arises from the application of excessive fishing pressure in previous years. This classification is independent of the current level of fishing mortality.*

Stock subjected to overfishing (or overexploitation) *- A stock is subjected to overfishing if the fishing mortality applied to it exceeds the one it can sustainably stand, for a longer period. In other words, the current fishing mortality exceeds the fishing mortality that, if applied during a long period, under stable conditions, would lead the stock abundance to the reference point of the target abundance (either in terms of biomass or numbers)*