Data preparation ARS GSAs 8-9-10-11 for EWG 25-09

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1 Stock identity and Biology

In the Mediterranean, *Aristaeomorpha foliacea* (Risso, 1827) is a dominant species of bathyal megafaunal assemblages, and it is sympatric with *Aristeus antennatus*. Both species have considerable interest for fisheries. The giant red shrimp is mainly found in the epibathyal and mesobathyal waters of the Mediterranean. Due to a lack of enough information about the structure of giant red shrimp (*A. foliacea*) in the western Mediterranean, this stock was assumed to be confined within the GSAs 8, 9, 10 and 11 boundaries (Figure 1). In the GSA 9, *A. foliacea* is more abundant in the Tyrrhenian Sea, while lower concentrations are present in the Ligurian Sea, where the blue and red shrimp, *A. antennatus*, is more abundant, and the giant red shrimp considerably decreased over time (Masnadi et al., 2018). In GSA10, this species and the blue and red shrimp are characterised by seasonal variability and annual fluctuations of abundance (Spedicato et al., 1994), as reported for different geographical areas (e.g. Relini, 2007). The giant red shrimp is distributed beyond 350 m depth, but mainly in water deeper than 500 m. The giant red shrimp shows high densities and well-structured populations with a clear multimodal size pattern in the GSA 11. Seasonal changes have been reported from southern Sardinia in both the vertical distribution and size-related spatial abundance of *A. foliacea*, with large females (preferentially) tending to move gradually deeper (to 650-740 m) from spring to summer (Mura et al., 1997).

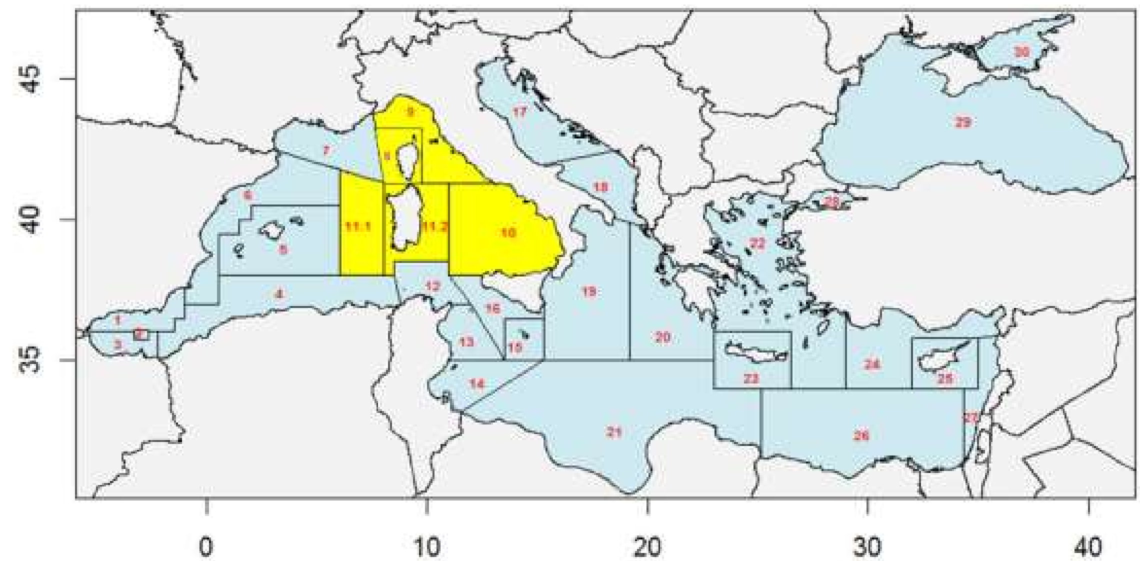

Figure 1: Limit of Geographical Sub-Areas (GSAs) 8, 9, 10 & 11.

2 Growth Maturity and Natural Mortality

Several sets of von Bertalanffy growth function (VBGF) parameters have been reported in the DCF database for *A. foliacea*. VBGF curves by sex are available for the three main GSAs and they are summarize in Figure 2. In the previous assessment the parameter of GSA 10 was selected as the best proxy for the average of the VBGF parameters (Ref in Figure 2). The latter was compared with the VGBF obtained from the mean values of each GSA and the VGBF reported for the current year (2024). Despite the reference could not properly represents the VGBF of GSA 9, in particular for female, it was selected to be coherent with previous assessment and applied to build the stock assessment object. As done in the last assessments, the parameters were adjusted to shift length slicing by adding a value of 0.5 to the t0 value. A summary of the parameter obtained from the present analysis is shown in Table 1

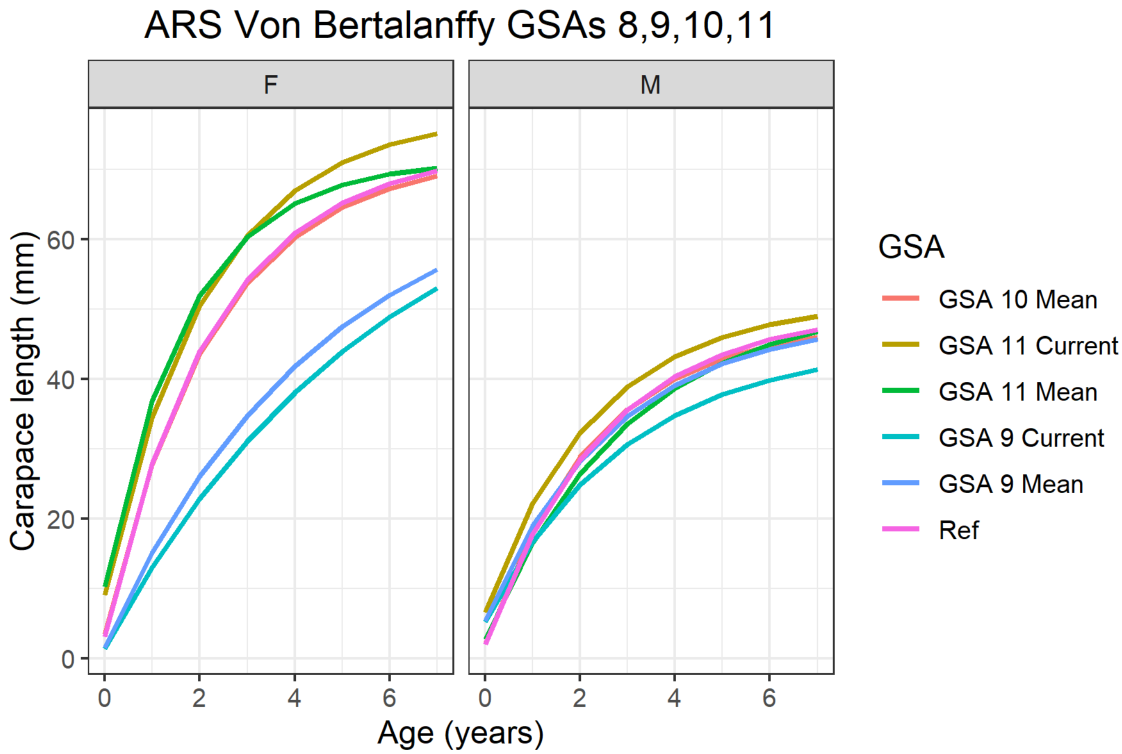

Figure 2: Comparison of the available Von Bertalanffy growth curve. Ref = VBGF parameters of GSA 10, current = VBGF available for 2024, mean = Mean of all available years

Table 1: VBGF parameters.

sex	Linf	k	t0	GSA
F	75.60000	0.1700000	-0.1099995	GSA 9 Current
M	45.00000	0.3400000	-0.3605086	GSA 9 Current
F	77.86000	0.4600000	-0.2700000	GSA 11 Current
M	51.15000	0.4300000	-0.3200000	GSA 11 Current
F	73.00000	0.4380000	-0.1000000	Ref
M	50.00000	0.4000000	-0.1000000	Ref
F	72.25000	0.4370000	-0.1125000	GSA 10 Mean
M	48.16667	0.4333333	-0.1000000	GSA 10 Mean
F	71.25077	0.5735385	-0.2700000	GSA 11 Mean
M	51.52500	0.3325000	-0.1625000	GSA 11 Mean
F	70.74286	0.2178571	-0.1026119	GSA 9 Mean
M	48.84643	0.3735714	-0.3143761	GSA 9 Mean

For the Length-Weight relationship as well, several sets of parameters by sex are provided for the three main GSAs. In the previous assessment the parameter of GSA 10 in 2019 was selected as the best proxy of the average of the a and b parameters (Ref in Figure 4). The comparison carried out in the present report with the mean of combined GSAs and single GSAs shows a good agreement with the reference values. Therefore, to be coherent with previous assessment, the a and b parameters of GSA 10 available for 2019 were applied to build the stock assessment object. A summary of the parameters is shown in Table 2

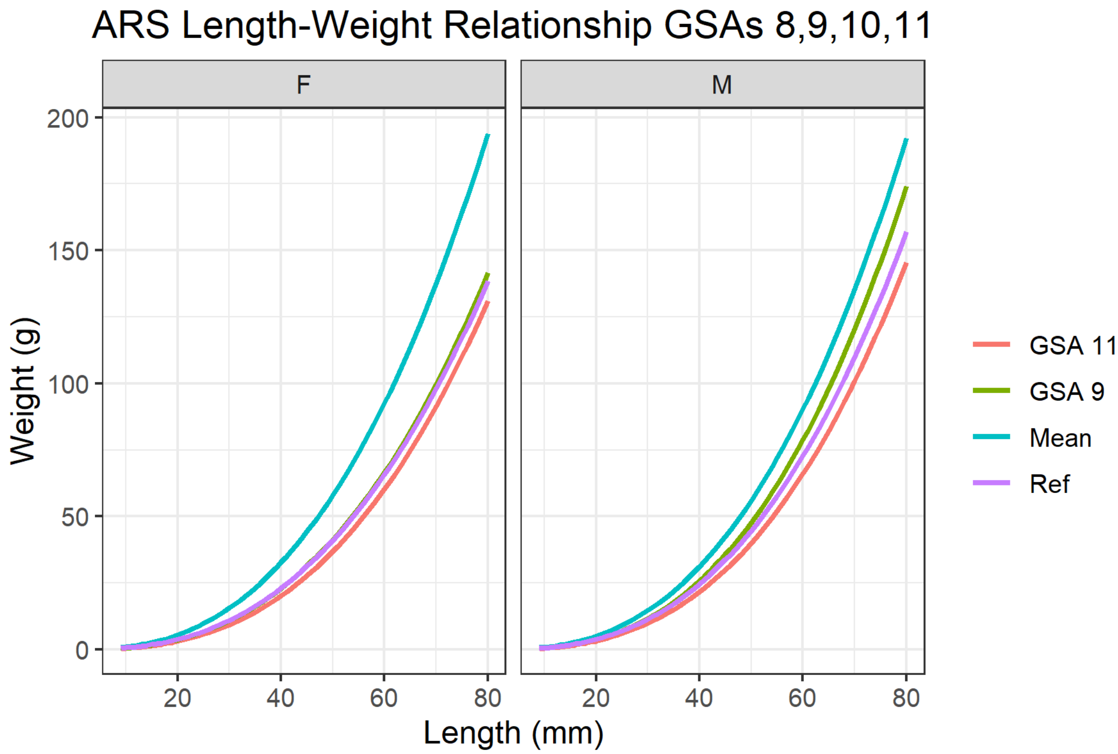

Figure 3: Comparison of the available a and b parameters for GSAs. REf = available parameters for GSA 10 in 2019, Mean = mean of all available years of combined GSAs

Table 2: L-W relationship parameters.

sex	a	b	GSA
F	0.0014400	2.623320	GSA 9
M	0.0009900	2.756010	GSA 9
F	0.0009500	2.700750	GSA 11
M	0.0008600	2.747280	GSA 11
F	0.0016400	2.588550	Ref
M	0.0012700	2.675740	Ref
F	0.0024968	2.569604	Mean
M	0.0019500	2.623973	Mean

3 Catch

3.1 Landings

The annual total landings of giant red shrimp available in the DCF database are reported in Table 3 and Figure 4. Landings data are available from 2003 for GSA 9 10 and 11, while for GSA 8 they are available only from 2021 (Italian data). In general, landings show a fluctuating pattern along the time series, with peaks in 2005, 2014 and 2019. In 2024 the landings decreased compared to 2023 for all the GSAs and there is a general declining trend from 2021 with the exception of GSA 9. GSA 10 account for the bulk of the capture, while the landings of GSA 8 are very low.

Table 3: Landings by GSA and total landings.

year	GSA 10	GSA 11	GSA 9	GSA 8	Total
2003	147.9863	71.83020	30.04292	NA	249.8594
2004	206.5937	313.91254	142.69772	NA	663.2040
2005	505.0900	170.66686	77.39838	NA	753.1553
2006	419.6169	128.67191	62.60995	NA	610.8987
2007	300.2677	81.68139	36.65032	NA	418.5994
2008	120.1344	67.11518	33.82538	NA	221.0750
2009	211.6815	117.43395	34.29335	NA	363.4088
2010	190.2240	98.60755	54.55408	NA	343.3857
2011	140.8548	94.72759	68.43207	NA	304.0144
2012	159.8017	117.25722	61.96762	NA	339.0265
2013	399.3778	124.11800	23.07843	NA	546.5742
2014	454.0862	123.85500	16.81916	NA	594.7604
2015	232.1295	97.78200	44.18901	NA	374.1005
2016	179.1250	127.55168	35.81900	NA	342.4957
2017	325.9973	249.17500	33.59272	NA	608.7651
2018	416.1510	188.42500	36.35781	NA	640.9338
2019	530.3360	141.05212	44.10243	18.247	733.7376
2020	224.6280	96.29900	30.15900	NA	351.0860
2021	317.1270	170.60945	30.81789	0.327	518.8813
2022	224.2350	138.27500	42.51951	0.638	405.6675
2023	172.7900	113.34434	113.58319	1.955	401.6725
2024	165.1710	114.66174	22.97372	1.445	304.2515

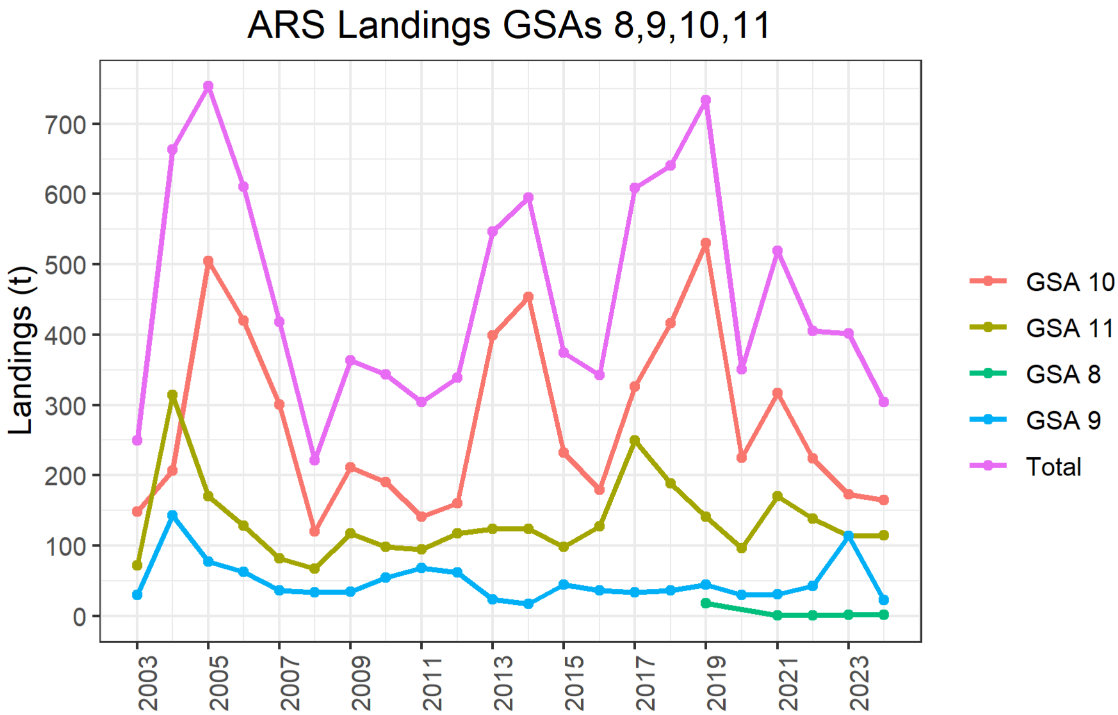

Figure 4: Landings by GSA and total

The time series of landings by GSA and gear is shown in Table 4 and 5 and Figure 5. The bulk of the capture comes from the Otter Trawls fleet, while, until 2014, a small proportion of the catch came from the trammel nets in GSA 10. A detailed otter trawls landings is shown in Figure 6.

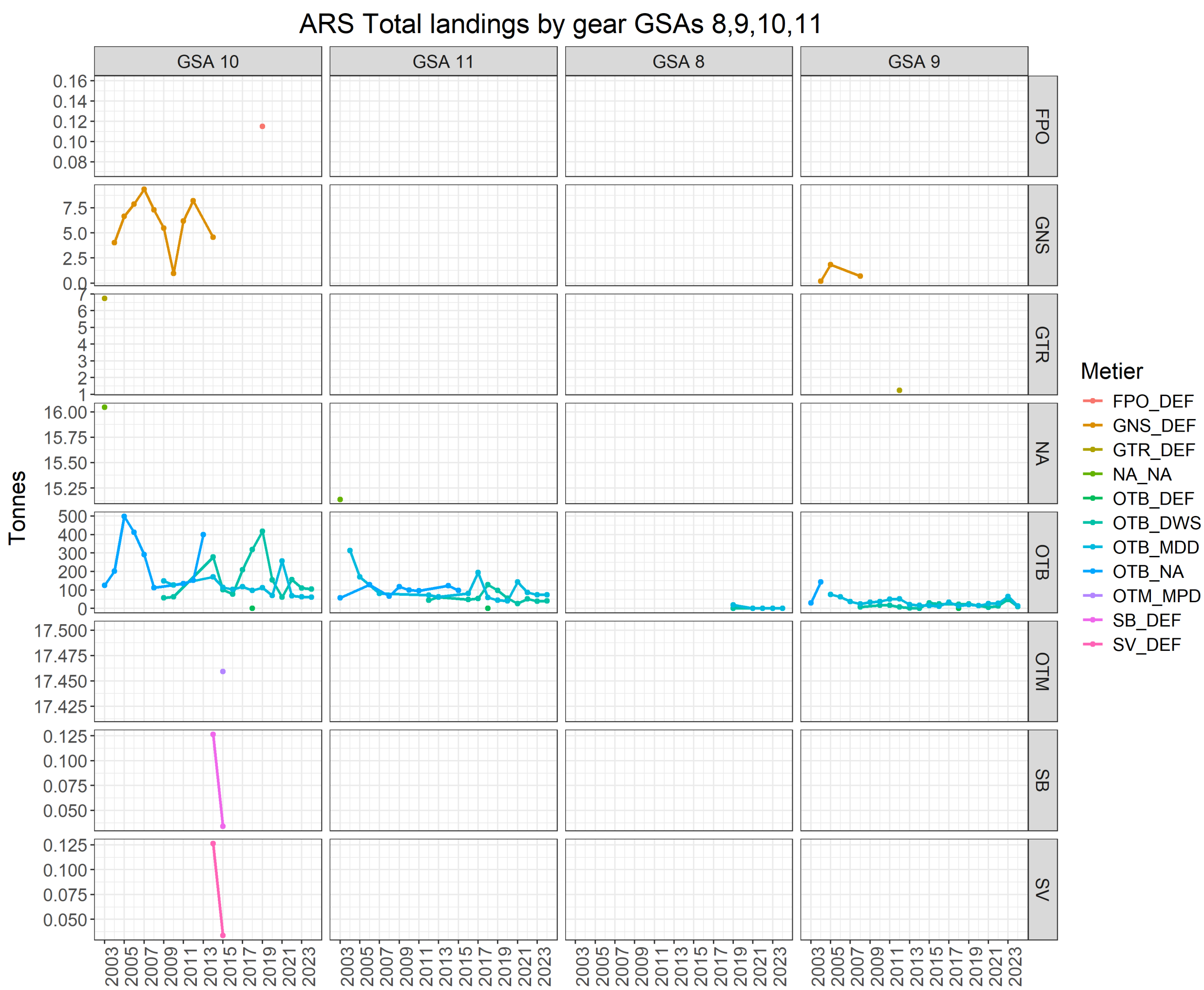

Figure 5: Landings by GSA and gear

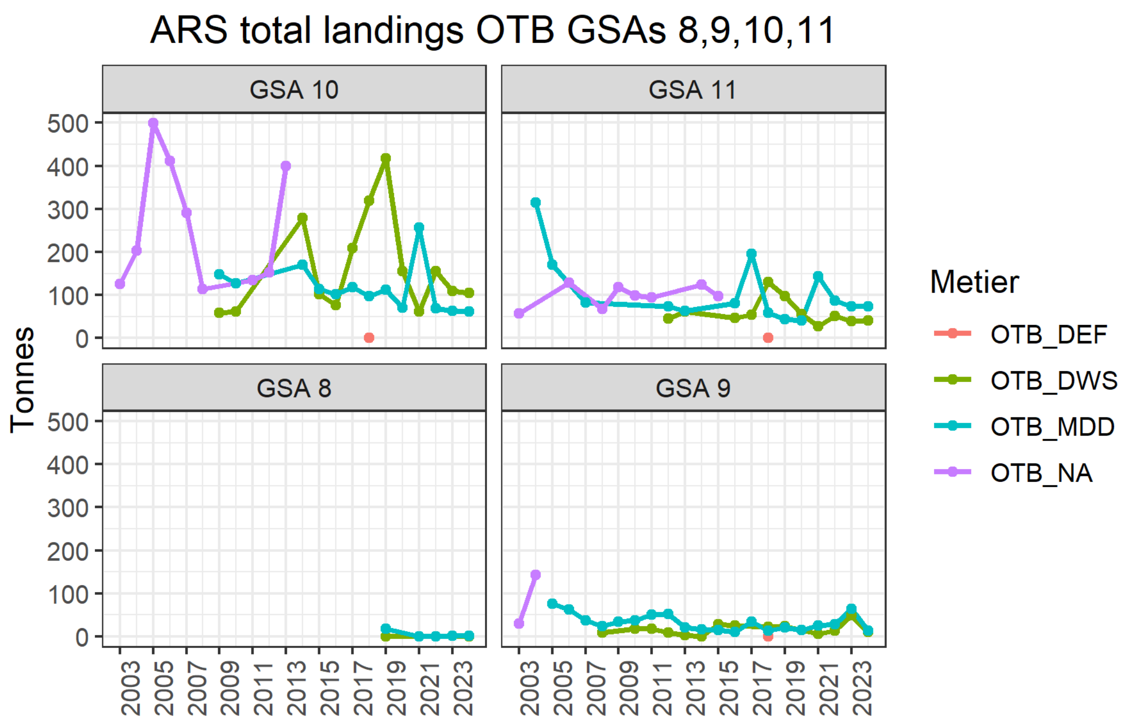

Figure 6: Landings by OTB metier and GSA

Table 4: Landings by GSA and gear.

year	gear	GSA 10	GSA 11	GSA 9	GSA 8
2003	OTB	125.19545	56.69202	30.04292	NA
2003	Other	22.79086	15.13818	NA	NA
2004	OTB	202.55883	313.91254	142.52726	NA
2004	Other	4.03488	NA	0.17046	NA
2005	OTB	498.42363	170.66686	75.54915	NA
2005	Other	6.66639	NA	1.84923	NA
2006	OTB	411.76002	128.67191	62.60995	NA
2006	Other	7.85686	NA	NA	NA
2007	OTB	290.92094	81.68139	36.65032	NA
2007	Other	9.34675	NA	NA	NA
2008	OTB	112.83067	67.11518	33.12687	NA
2008	Other	7.30376	NA	0.69851	NA
2009	OTB	206.20399	117.43395	34.29335	NA
2009	Other	5.47752	NA	NA	NA
2010	OTB	189.26366	98.60755	54.55408	NA
2010	Other	0.96037	NA	NA	NA
2011	OTB	134.68963	94.72759	68.43207	NA

Table 5: Landings by GSA and gear.

year	gear	GSA 10	GSA 11	GSA 9	GSA 8
2003	OTB	125.19545	56.69202	30.04292	NA
2011	Other	6.16515	NA	NA	NA
2012	OTB	151.61706	117.25722	60.72631	NA
2012	Other	8.18465	NA	1.24131	NA
2013	OTB	399.37780	124.11800	23.07843	NA
2014	OTB	449.26245	123.85500	16.81916	NA
2014	Other	4.82377	NA	NA	NA
2015	OTB	214.60257	97.78200	44.18901	NA
2015	Other	17.52697	NA	NA	NA
2016	OTB	179.12499	127.55168	35.81900	NA
2017	OTB	325.99735	249.17500	33.59272	NA
2018	OTB	416.15100	188.42500	36.35781	NA
2019	OTB	530.22100	141.05212	44.10243	18.247
2019	Other	0.11500	NA	NA	NA
2020	OTB	224.62800	96.29900	30.15900	NA
2021	OTB	317.12700	170.60945	30.81789	0.327
2022	OTB	224.23500	138.27500	42.51951	0.638
2023	OTB	172.79000	113.34434	113.58319	1.955
2024	OTB	165.17100	114.66174	22.97372	1.445

3.2 Discards

Discards of giant red shrimp are negligible. Nevertheless, the available discards presented in Table 6 were added to the landings for the assessment to generate the catch table shown in Tables 7-10

Table 6: Discard by GSA.

year	GSA	fishery	discard
2010	GSA 9	OTB_MDD	0.45335
2011	GSA 10	OTB_NA	0.05099
2012	GSA 10	OTB_NA	0.35069
2017	GSA 10	OTB_DWS	0.96424

3.3 Catch

Table 7: Catch by GSA and gear.

year	fishery	GSA 10	GSA 11	GSA 8	GSA 9
2003	GTR_DEF	6.74611	NA	NA	NA
2003	NA_NA	16.04475	15.13818	NA	NA
2003	OTB_NA	125.19545	56.69202	NA	30.04292
2004	GNS_DEF	4.03488	NA	NA	0.17046
2004	OTB_NA	202.55883	NA	NA	142.52726
2005	GNS_DEF	6.66639	NA	NA	1.84923
2005	OTB_NA	498.42363	NA	NA	NA
2006	GNS_DEF	7.85686	NA	NA	NA
2006	OTB_NA	411.76002	128.67191	NA	NA
2007	GNS_DEF	9.34675	NA	NA	NA
2007	OTB_NA	290.92094	NA	NA	NA
2008	GNS_DEF	7.30376	NA	NA	0.69851
2008	OTB_NA	112.83067	67.11518	NA	NA
2009	GNS_DEF	5.47752	NA	NA	NA
2009	OTB_DWS	57.88350	NA	NA	NA
2009	OTB_MDD	148.32049	NA	NA	34.29335
2010	GNS_DEF	0.96037	NA	NA	NA
2010	OTB_DWS	62.07427	NA	NA	17.70095
2010	OTB_MDD	127.18939	NA	NA	37.30648
2011	GNS_DEF	6.16515	NA	NA	NA
2011	OTB_NA	134.74062	94.72759	NA	NA

Table 8: Catch by GSA and gear.

year	fishery	GSA 10	GSA 11	GSA 8	GSA 9
2003	GTR_DEF	6.74611	NA	NA	NA
2012	GNS_DEF	8.18465	NA	NA	NA
2012	OTB_NA	151.96775	NA	NA	NA
2013	OTB_NA	399.37780	NA	NA	NA
2014	GNS_DEF	4.57079	NA	NA	NA
2014	OTB_DWS	278.53096	NA	NA	0.61360
2014	OTB_MDD	170.73149	NA	NA	16.20556
2014	SB_DEF	0.12649	NA	NA	NA
2014	SV_DEF	0.12649	NA	NA	NA
2015	OTB_DWS	100.96675	NA	NA	28.96271
2015	OTB_MDD	113.63582	NA	NA	15.22630
2015	OTM_MPD	17.45935	NA	NA	NA
2015	SB_DEF	0.03381	NA	NA	NA
2015	SV_DEF	0.03381	NA	NA	NA
2016	OTB_DWS	76.83191	47.22768	NA	25.12600
2016	OTB_MDD	102.29308	80.32400	NA	10.69300
2017	OTB_DWS	209.06178	54.25400	NA	NA
2017	OTB_MDD	117.89981	194.92100	NA	33.59272
2018	OTB_DEF	0.04400	0.15000	NA	0.03873
2018	OTB_DWS	319.18100	129.30500	NA	22.42133
2018	OTB_MDD	96.92600	58.97000	NA	13.89775

Table 9: Catch by GSA and gear.

year	fishery	GSA 10	GSA 11	GSA 8	GSA 9
2003	GTR_DEF	6.74611	NA	NA	NA
2019	FPO_DEF	0.11500	NA	NA	NA
2019	OTB_DWS	417.43500	97.04193	0.135	23.85064
2019	OTB_MDD	112.78600	44.01019	18.112	20.25179
2020	OTB_DWS	154.76100	54.95000	NA	14.60200
2020	OTB_MDD	69.86700	41.34900	NA	15.55700
2021	OTB_DWS	60.88700	26.89982	NA	5.58932
2021	OTB_MDD	256.24000	143.70963	0.327	25.22857
2022	OTB_DWS	155.16600	51.73700	NA	14.04863
2022	OTB_MDD	69.06900	86.53800	0.638	28.47088
2023	OTB_DWS	109.33600	39.63134	1.030	48.87205
2023	OTB_MDD	63.45400	73.71300	0.925	64.71114
2024	OTB_DWS	104.33300	40.92347	0.420	10.14108
2024	OTB_MDD	60.83800	73.73827	1.025	12.83264
2004	OTB_MDD	NA	313.91254	NA	NA
2005	OTB_MDD	NA	170.66686	NA	75.54915
2007	OTB_MDD	NA	81.68139	NA	36.65032
2009	OTB_NA	NA	117.43395	NA	NA
2010	OTB_NA	NA	98.60755	NA	NA
2012	OTB_DWS	NA	44.54844	NA	8.34909
2012	OTB_MDD	NA	72.70878	NA	52.37722

Table 10: Catch by GSA and gear.

year	fishery	GSA 10	GSA 11	GSA 8	GSA 9
2003	GTR_DEF	6.74611	NA	NA	NA
2013	OTB_DWS	NA	60.769	NA	2.56350
2013	OTB_MDD	NA	63.349	NA	20.51493
2014	OTB_NA	NA	123.855	NA	NA
2015	OTB_NA	NA	97.782	NA	NA
2006	OTB_MDD	NA	NA	NA	62.60995
2008	OTB_DWS	NA	NA	NA	8.73874
2008	OTB_MDD	NA	NA	NA	24.38813
2011	OTB_DWS	NA	NA	NA	17.62392
2011	OTB_MDD	NA	NA	NA	50.80815
2012	GTR_DEF	NA	NA	NA	1.24131

3.4 Length frequency Distribution

In 2024 at least one metier was sampled for each GSA as shown in Figure 7. Unlike in 2023, all quarters were covered in 2024 as shown in Figure 8. In GSA 10 no samples were carried out for LFD in 2023 and few quarters were sampled in 2019,2020 and 2021. Therefore, the LFD was for these years was computed merging the LFD data with the average of the LFD data from the same years from GSA 9 and 11, and then expanded it to match the production of GSA 10 as described also in the previous assessment (STECF 24-10). No data for GSA 8 are present in the MED and BS data call.

Figure 7: LFD data availability along the time series by GSA

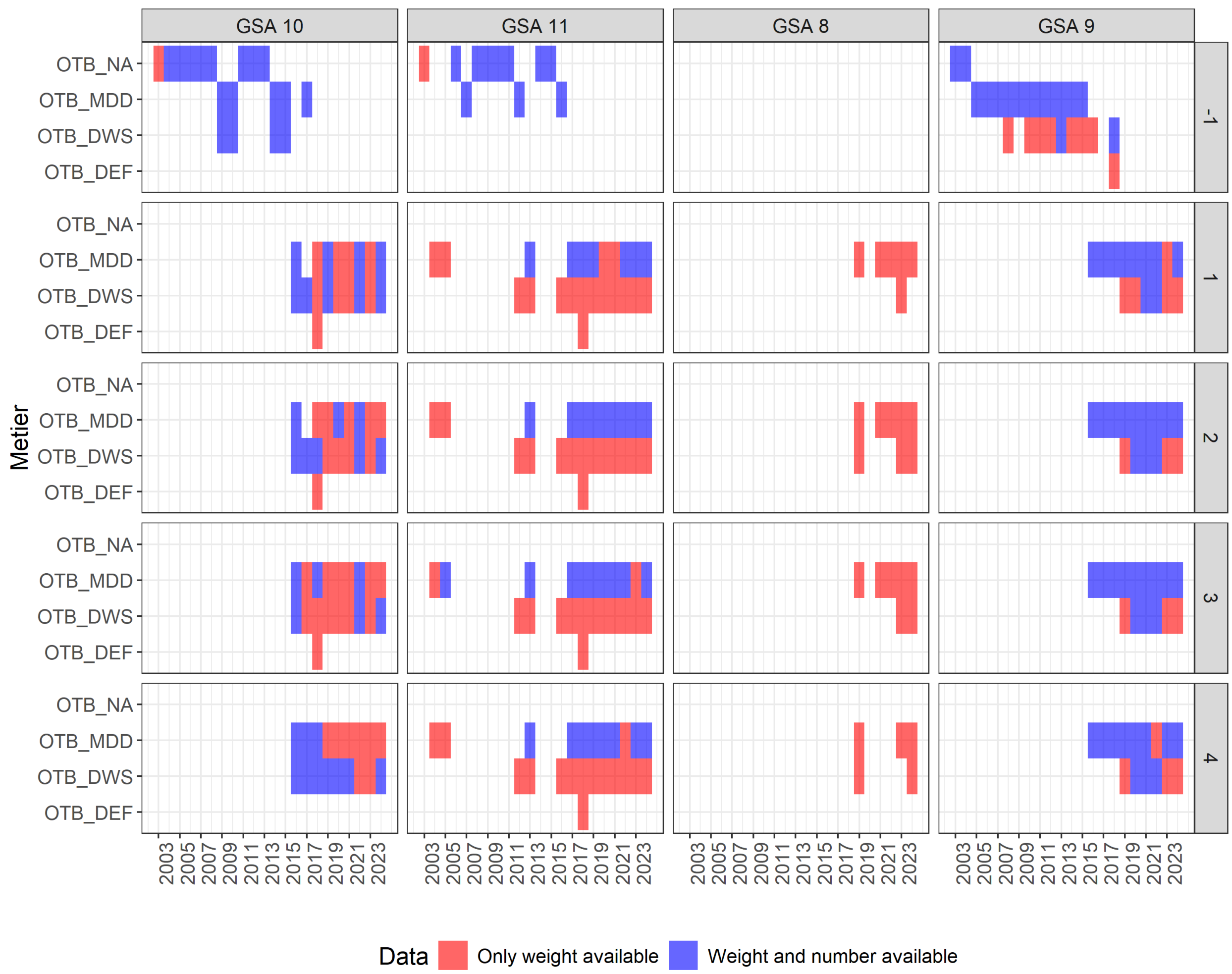

Figure 8: LFD data availability along the time series by quarter and GSA

The landings structure is shown in Figures 9, 10 and 11. In 2024 the bulk of capture is composed by small individuals, despite in GSA 9 a bimodal distribution was detected (Figure 10).

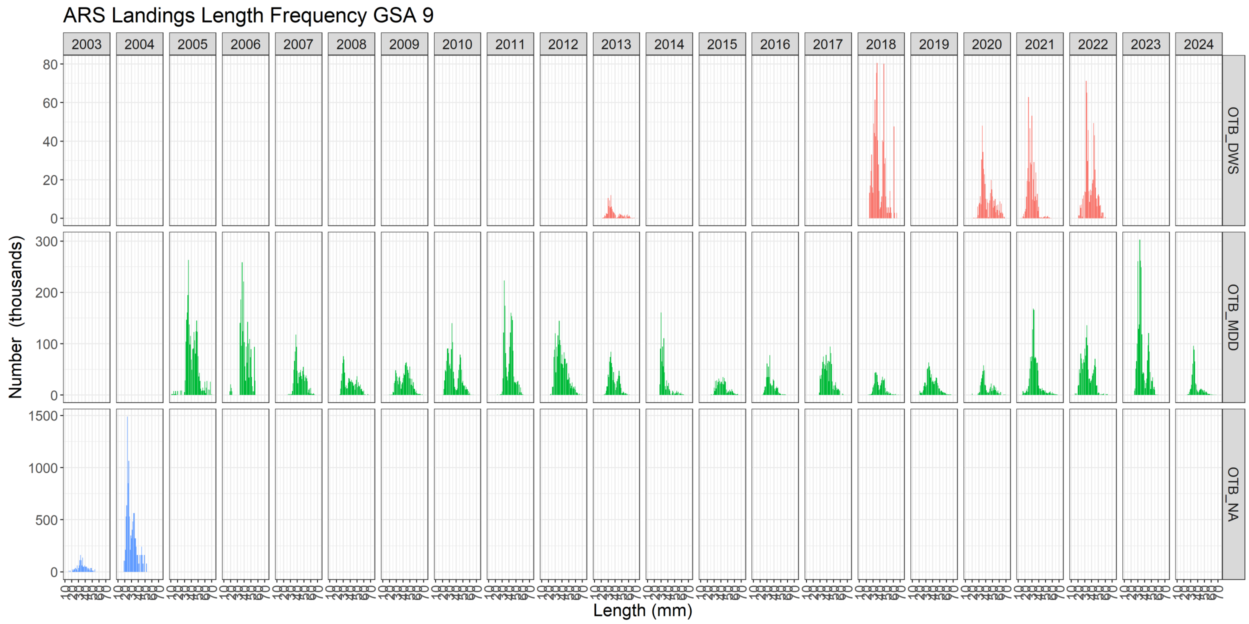

Figure 9: LFDs of landings by year and gear of giant red shrimp in GSA 9

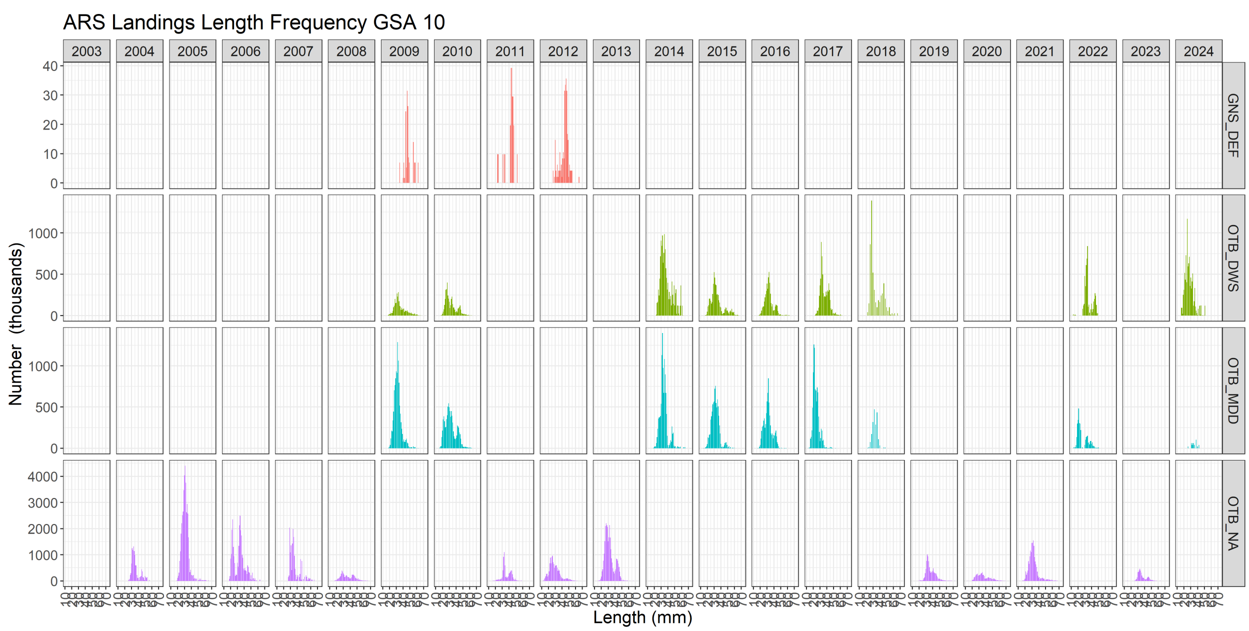

Figure 10: LFDs of landings by year and gear of giant red shrimp in GSA 10

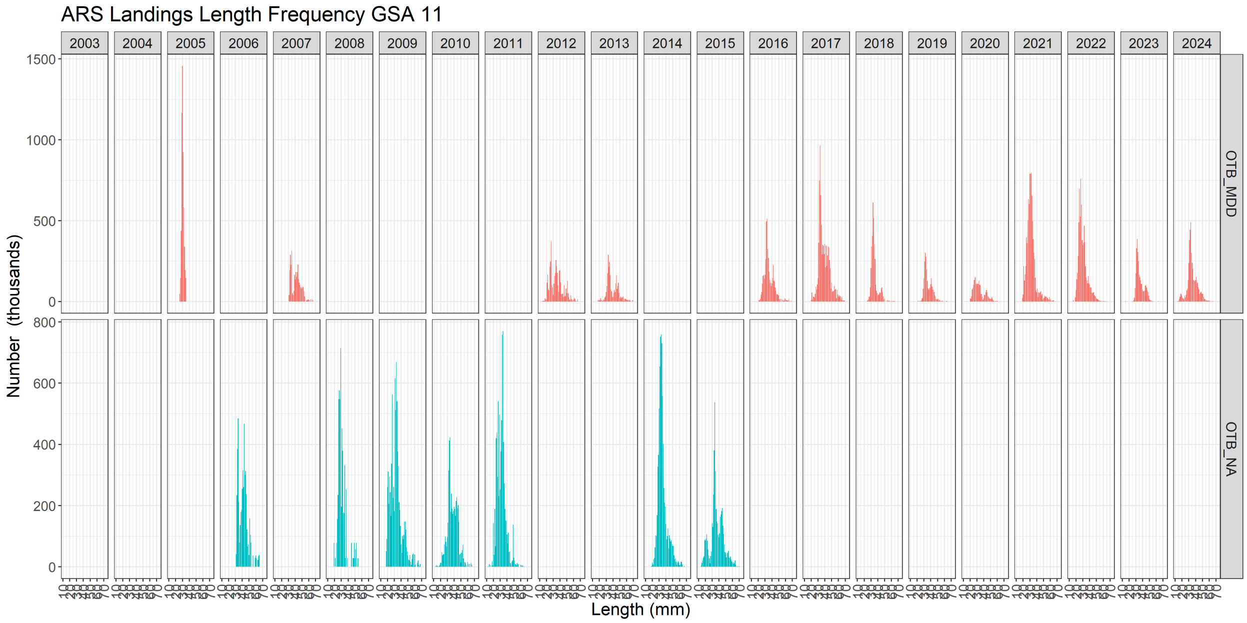

Figure 11: LFDs of landings by year and gear of giant red shrimp in GSA 11

Despite the low values of discards, the available LFDs shown in Figure 12 were included in the stock object.

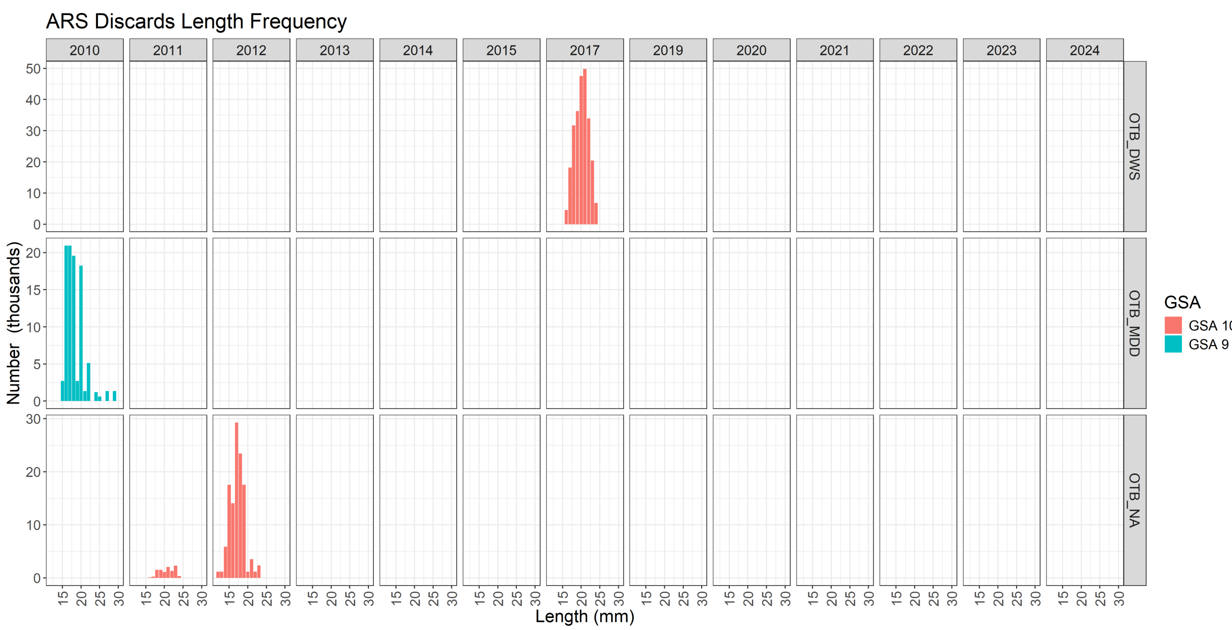

Figure 12: LFDs of discard by year, GSA and gear of giant red shrimp

4 Survey data

Since 1994, MEDITS trawl surveys had been regularly carried out each year (centred in the early summer). A random stratified sampling by depth (five strata with depth limits at 50, 100, 200, 500 and 800 m) is applied. Haul allocation was proportional to the stratum area. All the abundance data (number and total weight of fish per surface unit) are standardized to the km2 using the swept area method. Length distributions represented an aggregation (sum) of all standardized length frequencies (subsamples raised to standardized haul abundance) over the stations of each stratum. Aggregated length frequencies were then raised to stratum abundance*100 (because of low numbers in most strata) and finally aggregated (sum) over the strata to the three GSAs. Medits has been regularly carried out since 1994 mainly during the spring-summer season. In 2024 a total of 289 valid hauls were performed in GSA 8, 9, 10 and 11. In 2002 and 2020 the survey was not carried out in GSA 8 while in 2022, the survey was not conducted in the Italian GSAs.

4.1 Survey period and spatial distribution

In some years (2017, 2020, 2021 and 2023) surveys were delayed in some GSAs. In 2023, in particular, in GSA 8 the survey was done in spring, in GSA 11 in summer, in GSA 9 in autumn while in GSA 10 at the end of autumn (and not all the hauls were performed).

MEDITS in 2024 was carried out between spring and early summer as shown in Figure 13 and 14. Figure 14 underline a shift in the period compared to 2020, 2021 and 2023, while it is in line with other years along the time series.

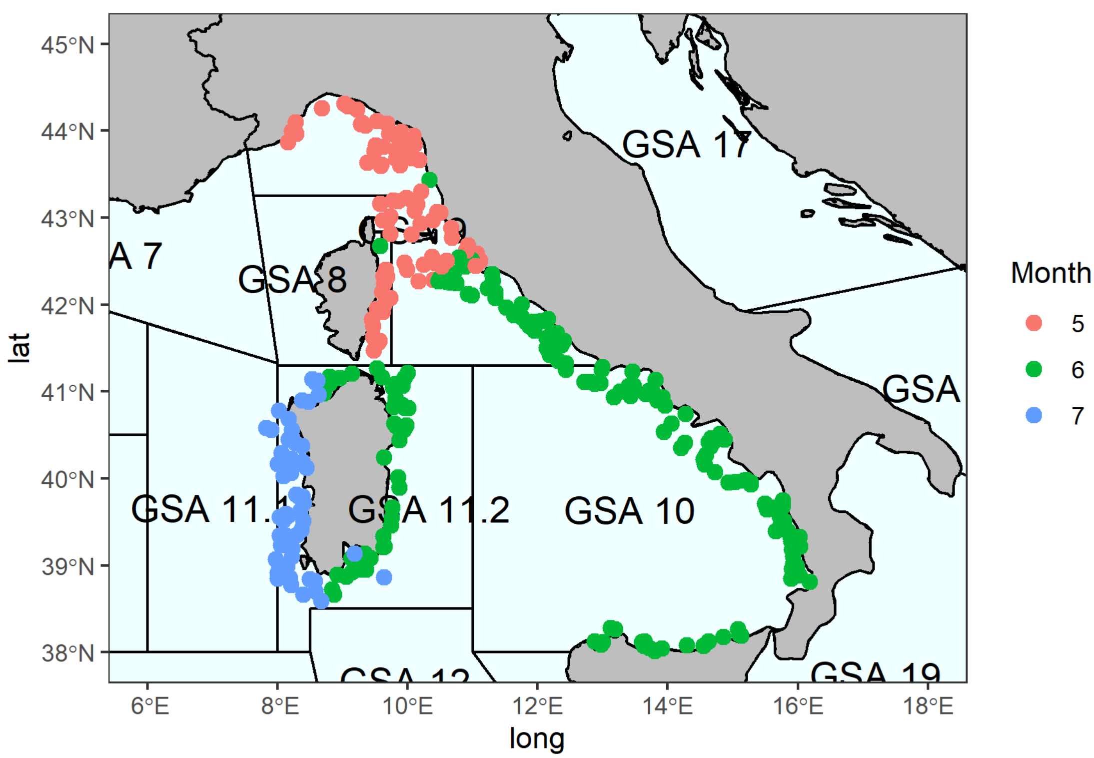

Figure 13: Hauls distribution of MEDITS 2024 by month

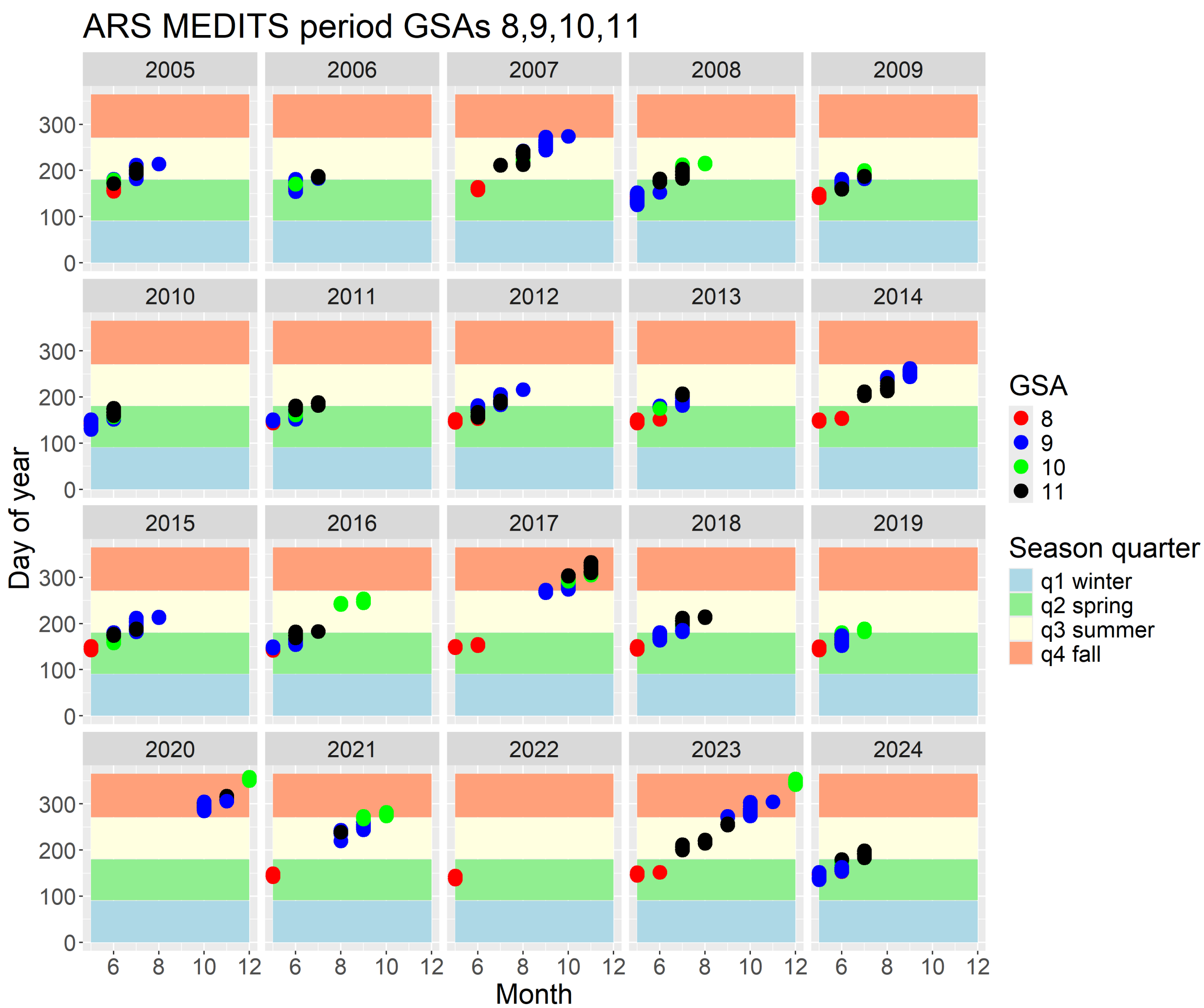

Figure 14: Survey periods MEDITS 1994-2024 in GSAs 8,9,10,11

A map showing the spatial distribution of adults and juveniles in 2024 was made by splitting the dataset based on the maturity stage of the individual collected during MEDITS. Figure 15 shows that the adults are mostly concentrated in GSA 11 following by an high occurrence between GSA 9 ans GSA 8 and an high density area also in the southern part of GSA 10. Conversely, the juveniles are more present in the southern area of GSA 10 and in GSA 9, with low density in GSA 11.

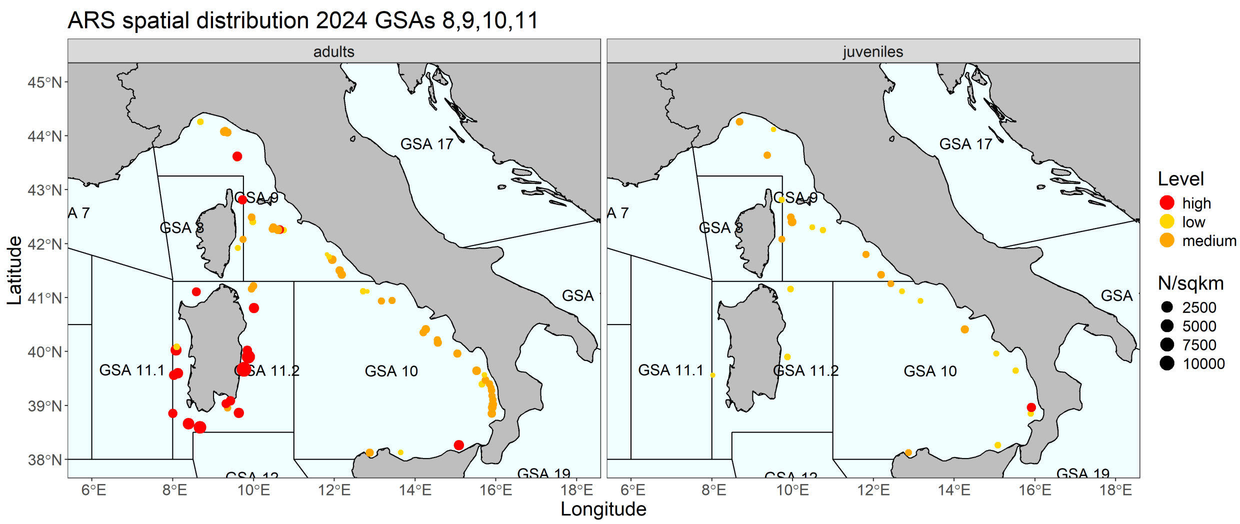

Figure 15: Distribution map of juveniles and adults in 2024 from MEDITS abundance data

The time series spatial distribution maps shown in Figure 16 underline that the resources is more widespread in GSA 10 and 11 with a general low density in GSA 9 and 8. Despite the results could be affected by the shifting period of MEDITS shown in Figure 14, no clear trend of geographical shift was observed along the time series.

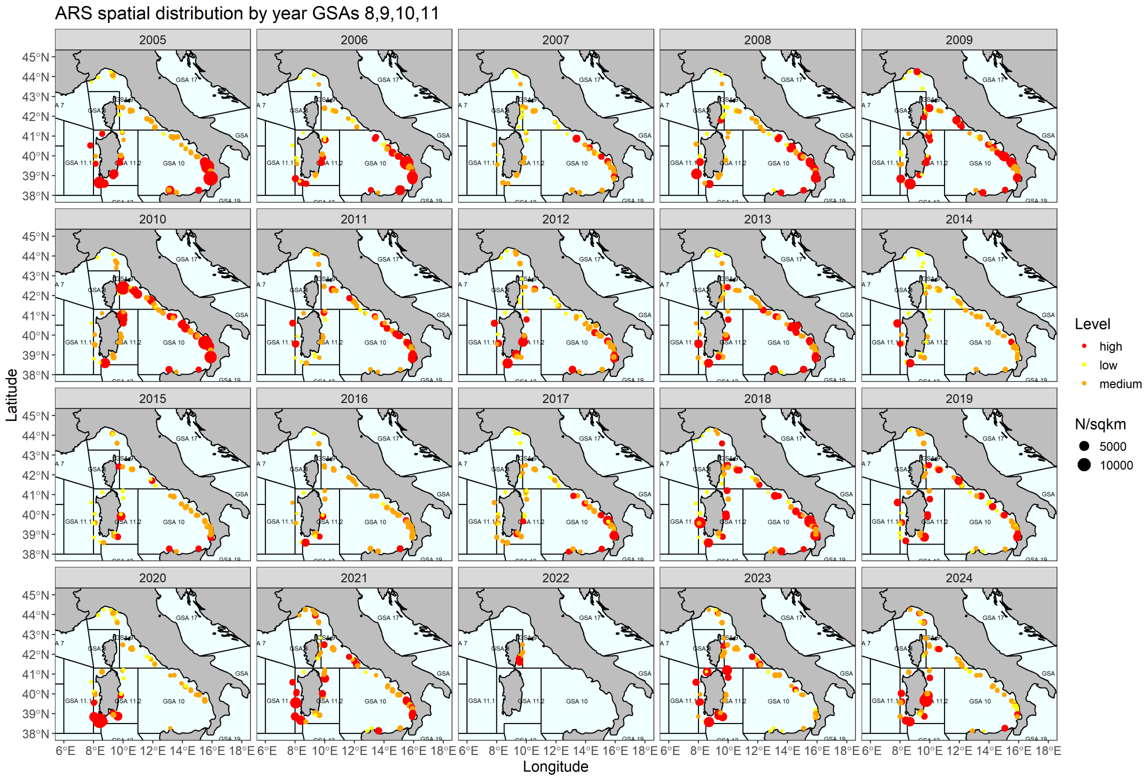

Figure 16: Distribution pattern of abundance along the available time series of MEDITS

4.2 Trend in abundance and biomass

The abundance and biomass trend of combined GSAs is shown in Figure 17. The time series are characterized by wide fluctuations with two main peaks in 2005 and 2010. A slightly decreasing trend can be observed for the abundance index with a value of 167 n/km2 registered in 2024. No clear trend is observed for biomass with a value of 3.09 kg/km2 registered in 2024. However, both indexes shown a reduction from 2021.

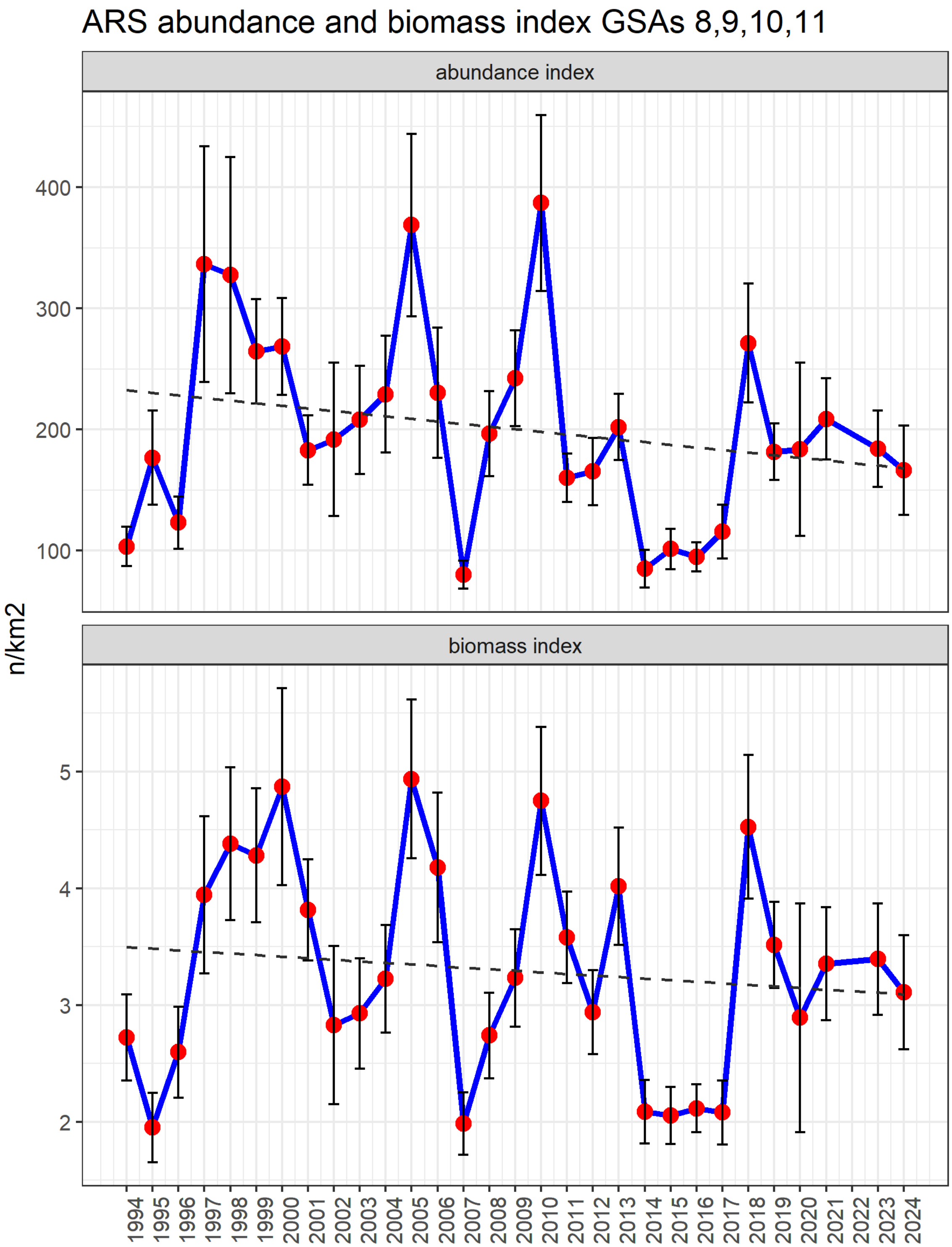

Figure 17: Standardized density index of ARS from MEDITS data. No data are presented for 2022 since the survey was not carried out

4.3 Length Frequency Distribution

The stratified abundance index was computed from MEDITS data by sex and length of combined GSAs. In order to improve the readibility, only the data used in the assessment are shown in the figures below (2005-2024). Unlike 2023, the LFD in 2024 is multimodal (Figure 18) showing a distribution closer to the ones detected in 2011, 2016 and 2019. The change can be justified by the shifting period of the survey that was carried out mainly in summer and early autumn in 2023 and during spring and early summer in 2024, 2011, 2016 and 2019. Figure 19 shown a slight shift of capture towards bigger individuals in recent years compared to the past. However, the length frequency distributions observed are not noticeably different among years. Data for 2022 are available only for GSA 8 and were not used to build the stock object.

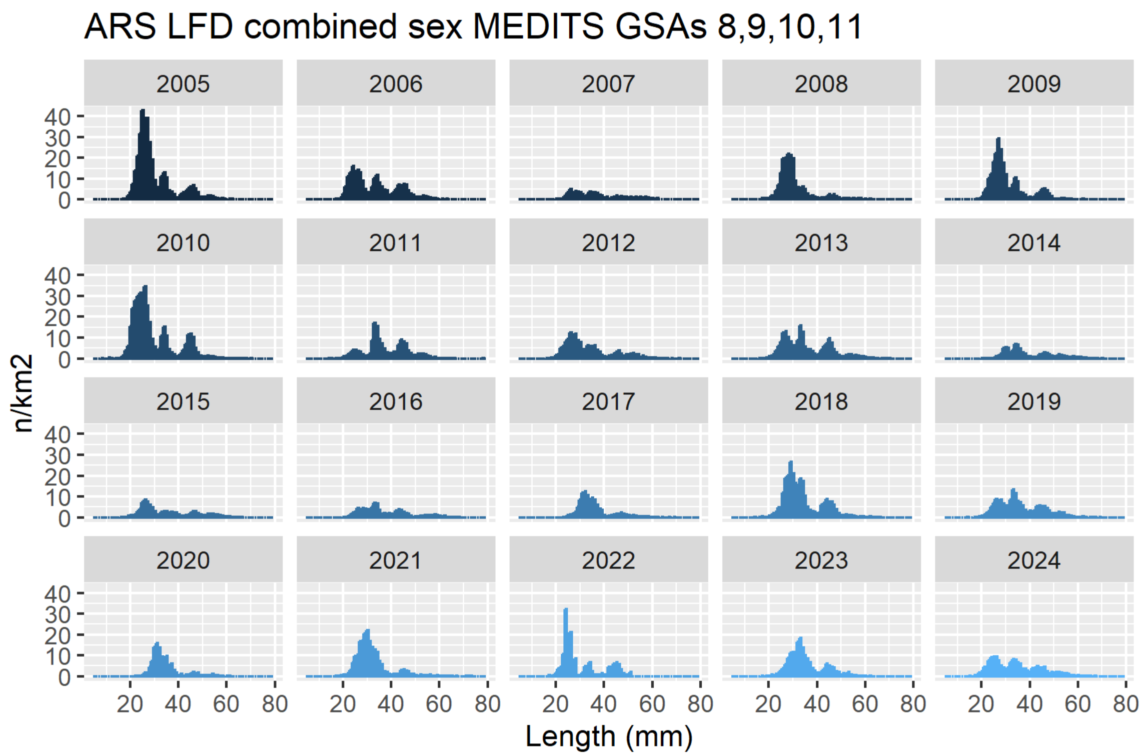

Figure 18: Sex combined stratified abundance index by size from MEDITS data. Data for 2022 are not available

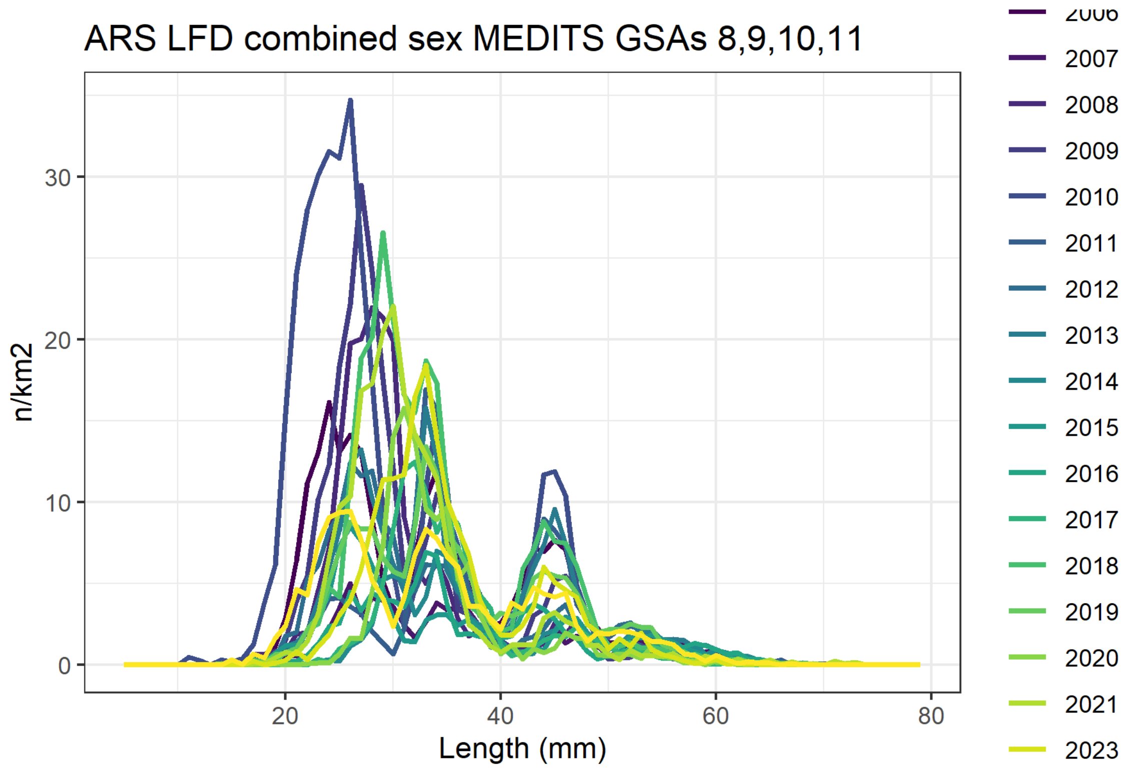

Figure 19: Sex combined overlapped stratified abundance index by size from MEDITS data. Data for 2022 are not available

The female LFD registered in 2024 is more comparable to one registered in the previous years being characterized by a bimodal distribution with two modes at approximately 25 amd 45 mm as shown in Figure 20. The same shift of capture registered for combined sex can be observed for females that are characterized by an higher presence of bigger individuals compared to the past as shown in Figure 21.

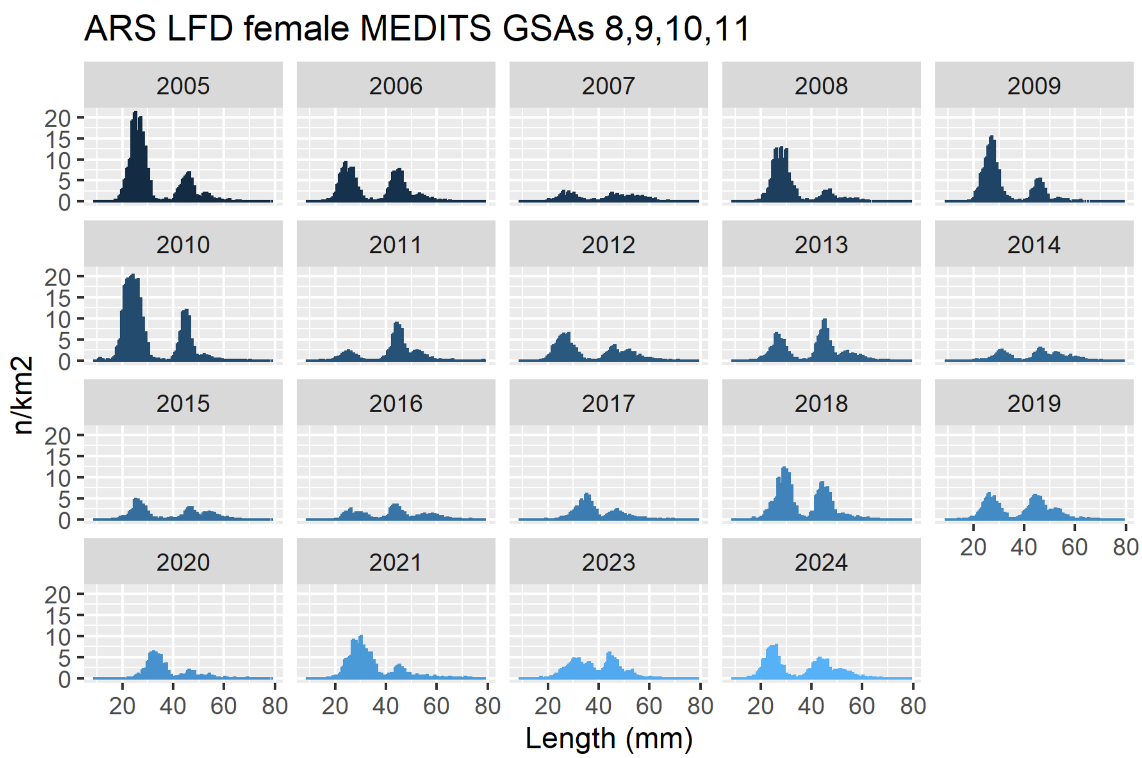

Figure 20: Female stratified abundance index by size from MEDITS data. Data for 2022 are not available

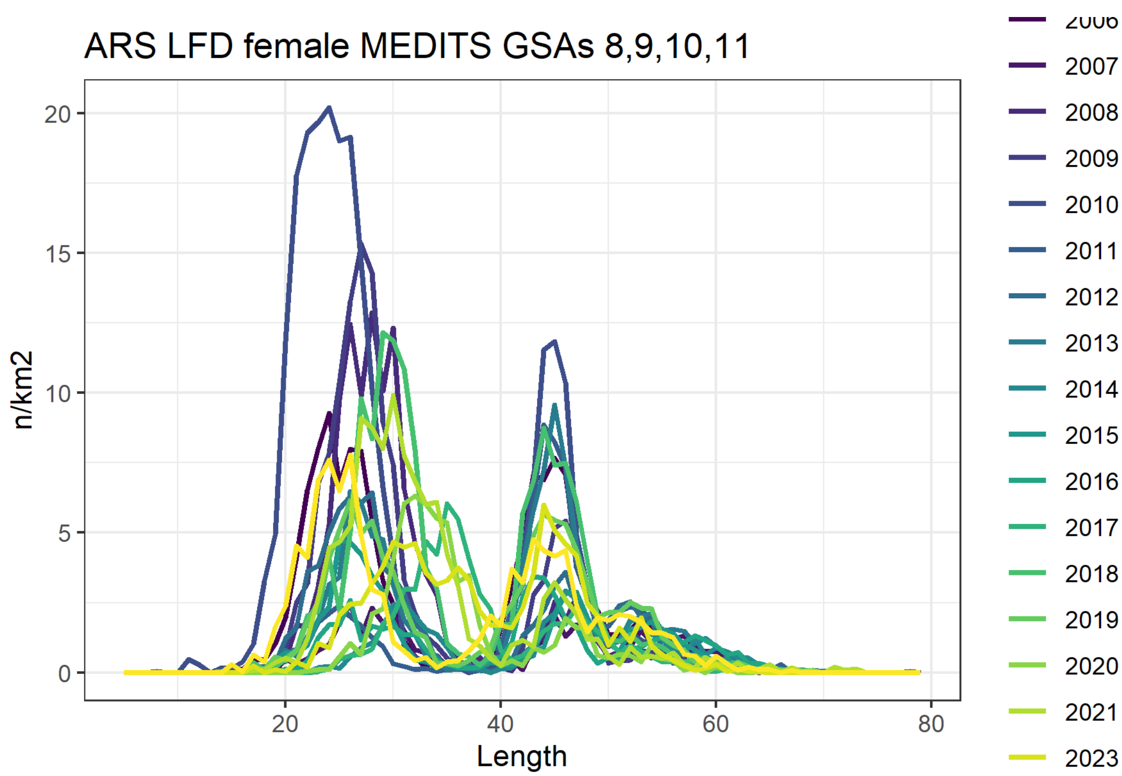

Figure 21: Female overlapped stratified abundance index by size from MEDITS data. Data for 2022 are not available

The male LFD registered in 2024 is bimodal and the bulk of the capture is composed by individuals of approximately 35 mm (Figure 22). No clear shift in the size structure along the time series is registered for males as shown in Figure 23.

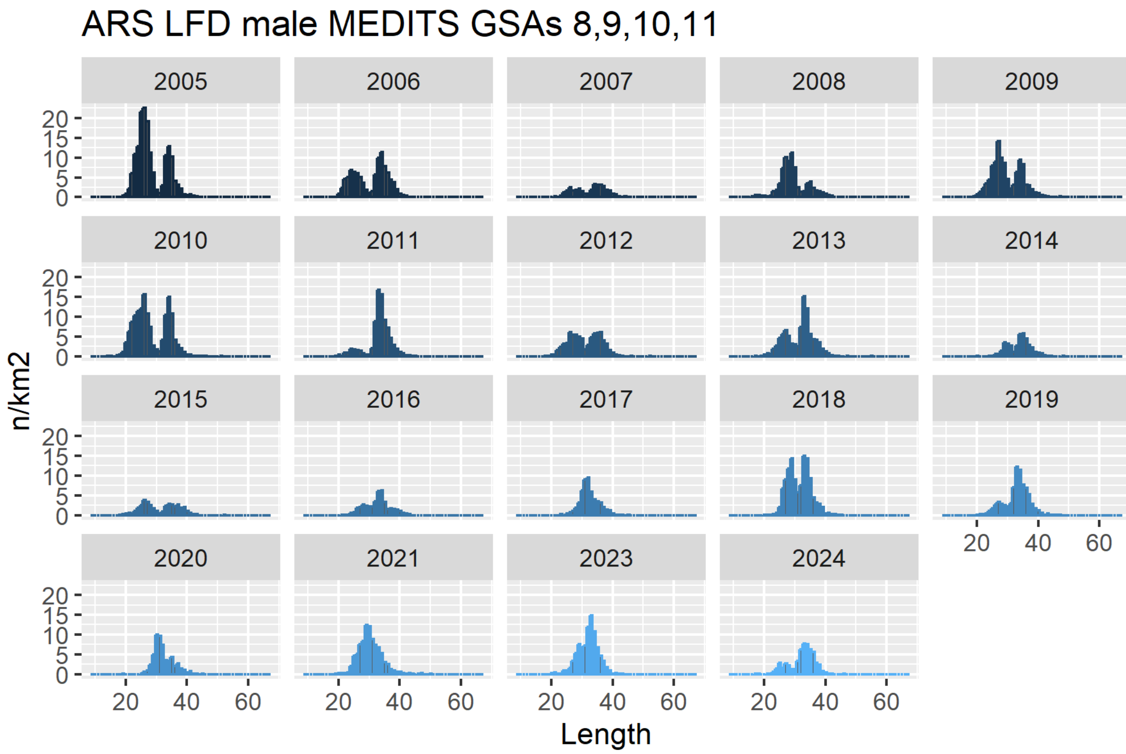

Figure 22: Male stratified abundance index by size from MEDITS data. Data for 2022 are not available

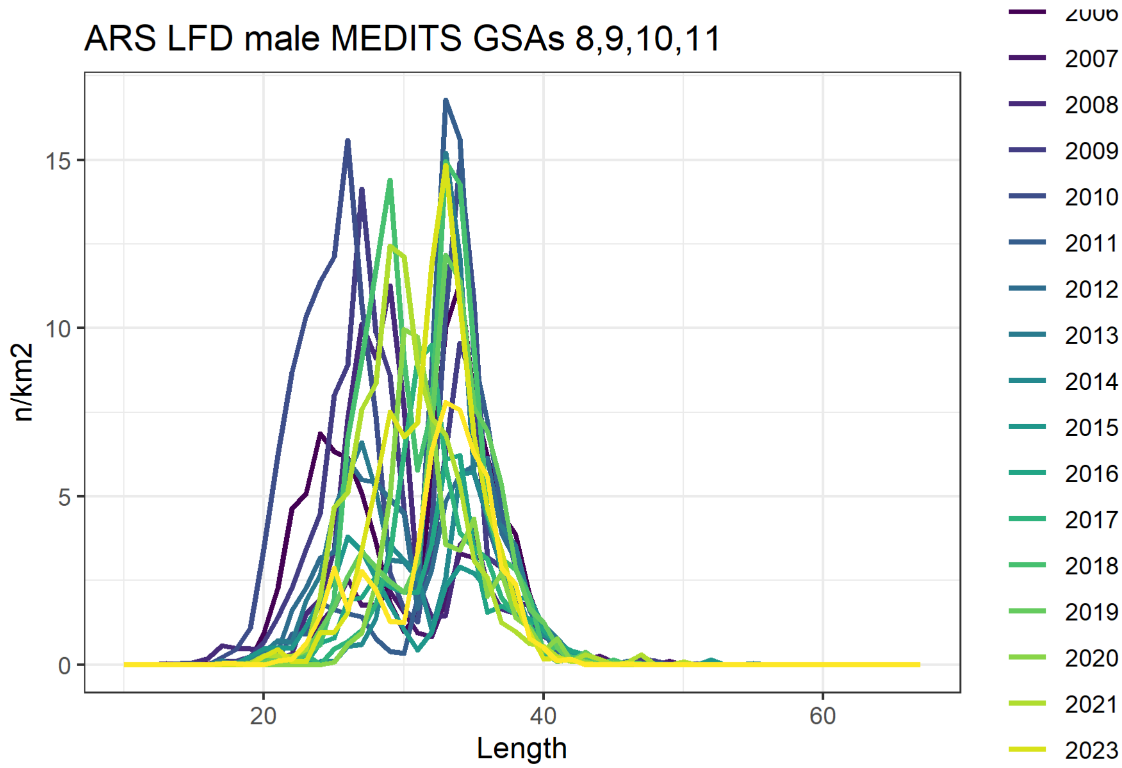

Figure 23: Male overlapped stratified abundance index by size from MEDITS data. Data for 2022 are not available

5 Stock assessment inputs

Length-frequency distributions of commercial catches and surveys were split by sex and then transformed in age classes (plus group was set at age 4) using length-to-age slicing with different growth parameters by sex. A correction of 0.5 was applied to t0 to align length slicing to assessment year to account for spawning at the middle of the year. The number of individuals by age relative to the catches was SOP corrected. In both catches and survey, a plus group at age 4 was set. The final data input are shown in the tables and figures below

Table 11: Survey index MEDITS values of numbers at age per year.

age	2005	2006	2007	2008	2009	2010	2011
0	0.1537501	0.3446493	0.0130321	0.0284232	0.0768833	1.454389	0.1054268
1	170.2185994	81.7057835	19.5559716	103.3100981	107.8053219	204.676910	18.6117565
2	135.9221857	81.1187599	25.3683614	66.9888739	88.5652673	119.979526	56.1658976
3	54.2459952	56.3004654	24.9432690	19.7285332	37.7620729	54.426819	75.5302528
4	7.9173485	10.8452002	10.3066555	6.5362937	7.1640598	5.897901	9.1389980

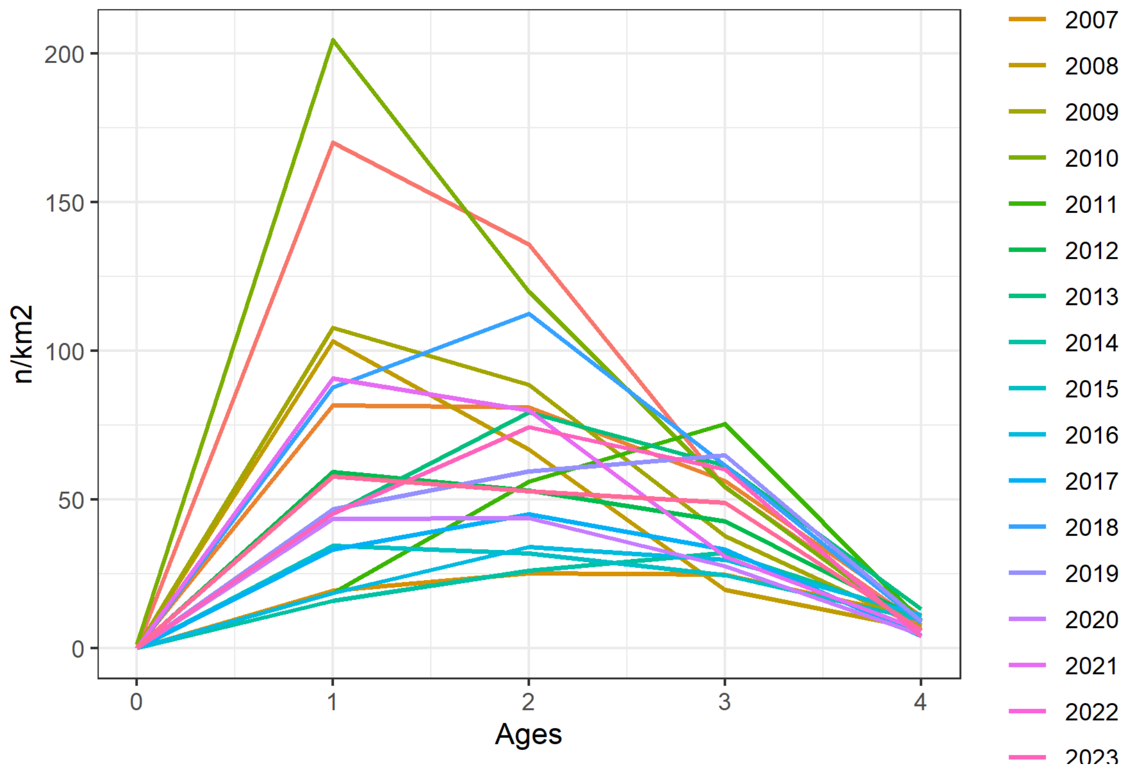

Figure 24: MEDITS index-at-age distribution by year

Table 12: Survey index MEDITS values of numbers at age per year.

age	2012	2013	2014	2015	2016	2017	2018
0	0.0130321	0.0389846	0.0130321	0.0798352	0.0130321	0.0130321	0.0130321
1	59.3130950	45.3701317	15.9938527	34.6185541	18.6678139	33.2583889	87.7583234
2	53.1434437	79.4892534	26.2494796	31.9432535	34.0287070	45.0719826	112.5095660
3	42.7624722	61.4723159	32.2687983	24.6308764	29.7952505	33.2181335	61.4636449
4	9.5490567	13.2060060	10.3626600	9.4753185	11.3140857	4.1769250	8.7912743

Table 13: Survey index MEDITS values of numbers at age per year.

age	2019	2020	2021	2022	2023	2024
0	0.075387	0.0130321	0.0260641	NA	0.0130321	0.3318835
1	46.798857	43.5212483	90.7806783	NA	45.2608023	57.9094088
2	59.629907	43.8313206	80.1229630	NA	74.3279241	52.9200414
3	65.052560	27.6248987	30.8609793	NA	60.2195107	48.9321364
4	9.066262	4.5331830	6.0433776	NA	4.0466385	6.2792924

5.1 Natuaral mortality and proportion of mature

The same approach and weighted vectors used in the previous assessment was considered to the present analysis (STECF 24-10). The Chen and Watanabe equation was applied using the Ref growth parameters reported in Table 14 to obtain a combined natural mortality vector. Due to the time constraints, no further exploration was done on natural mortality. Nevertheless, the Chen and Watanabe resulted the model with the lowest entropy in STECF 25-01.

The proportion of mature vector was computed through a weighed average starting from the mature by age data provided in MEDBS data call for GSA 9, 10 and 11.

Table 14: Natural mortality and proportion of mature vectors by age.

Natural mortality	**Proportion of mature**
1.8952478	0.1027012
0.8685851	0.4217910
0.6226113	0.9001410
0.5257375	0.9462500
0.4834982	0.9617667

Table 15: SOP correction vector for combined GSA.

year	**SOP**
2005	1.1333859
2006	0.9783727
2007	0.9832743
2008	1.0460232
2009	0.9534095
2010	1.0360272
2011	1.0447584
2012	1.1737948
2013	1.0786508
2014	0.9522105
2015	1.0960765
2016	1.2189084
2017	1.3895398
2018	2.8190199
2019	2.8263575
2020	2.0128155
2021	1.3144182
2022	1.6074346
2023	2.1417148
2024	1.5567621

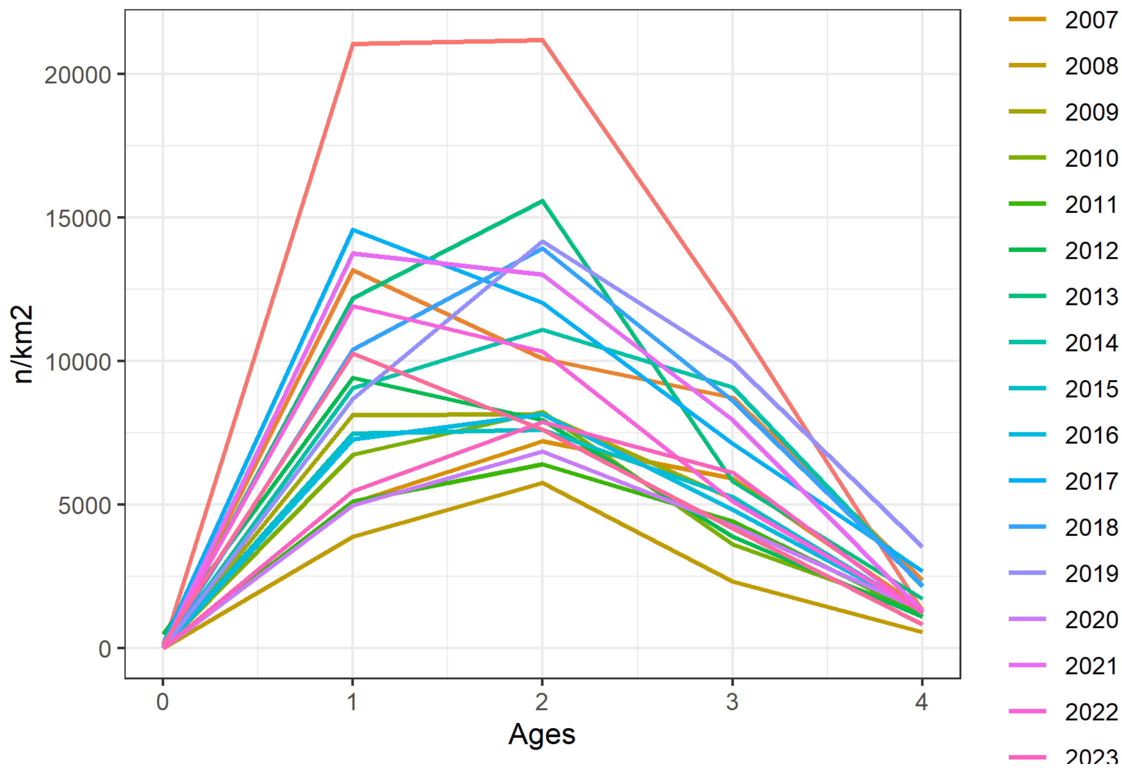

Figure 25: Catch at age distribution by year of the catches

Table 16: Values of catch at age number by year of stock assessment object.

age	2005	2006	2007	2008	2009	2010	2011
0	18.95735	1.177159e-01	0.1183056	0.1258554	0.5567657	42.81583	16.63299
1	21055.55698	1.317327e+04	5064.7815512	3893.8710116	8133.8217884	6757.26538	5114.70525
2	21196.52645	1.010184e+04	7224.9885961	5776.1524635	8154.6006150	8247.04415	6405.94283
3	11585.05228	8.725306e+03	5927.1397507	2334.8977922	5207.8867325	3633.00104	4429.06098
4	1300.65676	2.368242e+03	1374.7398970	570.4926231	1106.8962135	1261.41932	1182.74524

Table 17: Values of catch at age number by year of stock assessment object.

age	2012	2013	2014	2015	2016	2017	2018
0	487.568	9.297519	1.145681e-01	43.34023	2.942327	168.2925	5.802051e-01
1	9428.078	12198.167650	9.072259e+03	7477.62184	7286.747701	14589.3216	1.041873e+04
2	7959.063	15587.099172	1.110929e+04	7626.60652	8151.075553	12030.7537	1.393337e+04
3	3900.729	5802.373947	9.080800e+03	5272.68986	4832.526769	7137.8856	8.620032e+03
4	1094.297	1718.579121	2.155913e+03	1246.26040	1305.938359	2685.6166	2.182215e+03

Table 18: Values of catch at age number by year of stock assessment object.

age	2019	2020	2021	2022	2023	2024
0	3.400618e-01	8.11037	4.386834	104.539	10.06262	169.8619
1	8.685028e+03	4973.27005	13752.010851	11924.869	5485.11785	10265.6296
2	1.418923e+04	6865.93019	13019.073437	10338.513	7889.04815	7618.4199
3	9.969468e+03	4277.12413	7943.034828	5120.718	6112.93436	4177.8675
4	3.525818e+03	1318.82936	1269.471209	1273.613	1229.77994	829.6872

Table 19: Values of mean weight at age by year of stock assessment object.

age	2005	2006	2007	2008	2009	2010	2011
0	0.0014474	0.0018375	0.0018375	0.0018375	0.0021467	0.0018384	0.0016645
1	0.0111002	0.0091109	0.0136781	0.0098344	0.0103801	0.0094095	0.0113479
2	0.0126544	0.0225533	0.0218459	0.0172864	0.0166232	0.0195471	0.0207753
3	0.0174424	0.0217766	0.0231881	0.0270809	0.0198743	0.0216094	0.0180039
4	0.0377539	0.0308421	0.0393148	0.0345328	0.0360637	0.0320792	0.0280455

Table 20: Values of mean weight at age by year of stock assessment object.

age	2012	2013	2014	2015	2016	2017	2018
0	0.0018468	0.0020310	0.0018375	0.0019342	0.0021467	0.0020847	0.0012541
1	0.0081974	0.0098859	0.0126885	0.0104679	0.0108713	0.0081441	0.0121257
2	0.0163390	0.0172442	0.0189130	0.0177461	0.0172543	0.0206149	0.0188384
3	0.0238917	0.0177412	0.0205484	0.0218097	0.0168896	0.0209665	0.0197994
4	0.0346830	0.0315589	0.0384714	0.0364315	0.0314042	0.0345886	0.0373220

Table 21: Values of mean weight at age by year of stock assessment object.

age	2019	2020	2021	2022	2023	2024
0	0.0018375	0.0015193	0.0019650	0.0017577	0.0018164	0.0021099
1	0.0131159	0.0105950	0.0103821	0.0087438	0.0135326	0.0085033
2	0.0222442	0.0194897	0.0134855	0.0173878	0.0225190	0.0146946
3	0.0197417	0.0263382	0.0192286	0.0167497	0.0189474	0.0193778
4	0.0304564	0.0393649	0.0376503	0.0280156	0.0276057	0.0285573

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