Data Preparation: Blue and red shrimp in GSA 6 and 7

Contenido

TORs

For the stock/s ARA 6-7 given in this ad hoc, the contractor is requested to update the stock assessment input files by:

ToR 1. To compile and provide the most updated information on stock identification and boundaries, length and age composition, growth, maturity, feeding, essential fish habitats including spawning grounds and seasonality as well as natural mortality.

ToR 2. To compile and provide complete sets of annual data on landings and discards as well as the standardized MEDITS Index for the longest time series available up to and including 2024, including length frequency distribution over time. To provide a complete and updated stock assessment input file in the format of those used in 2024.

Stock Identity and Biology

The data come primarily from GSA6 (ESP), providing catch information, biological parameters, and length-frequency distributions. Additional contributions include length-frequency and catch data from GSA7 (ESP), while GSA7 (FRA) contributes catch data only.

This stock was assessed for the last time in 2024 (STECF EWG 24-09) using a4a. No information was documented regarding stock delimitation of blue and red shrimp, *Aristeus antennatus* (Risso, 1816). It is assumed that the stock geographical distribution corresponds to GSA 6&7 (Figure 1).

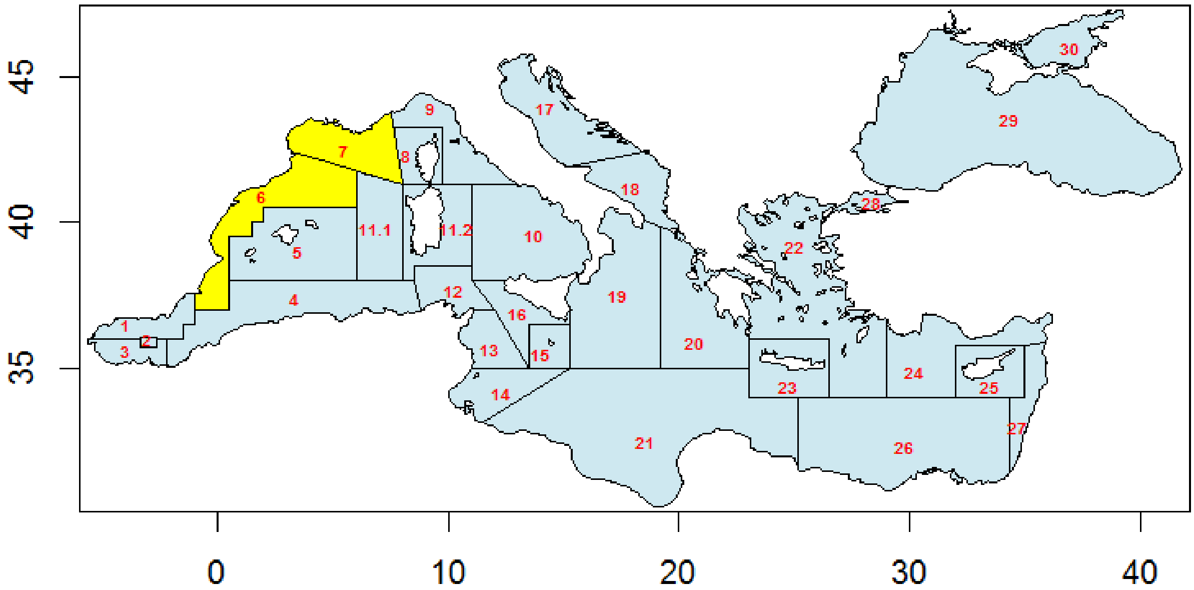

Figure 1. Geographical location of the stock

For the final object, the growth parameters used were taken from Garcia-Rodriguez (2001), just as in the previous assessment (STECF EWG 24-10); these are estimated from length frequency distributions analysis (Linf = 77.0 mm (carapace length); K = 0.38 year $^{-1}$; t0= -0.065 year).

The parameters of the length-weight relationship were taken from DCF data call 2004 (a= 0.0020; b= 2.5120) and corresponded to the ones used in the previous assessment (STECF EWG 24-10). Only data for the GSA6 was available (Table 1)

Table 1. VBGF and LW relationship parameters from GSA6. No data in the GSA7

YEAR (20XX)	SEX	VB_LINF	VB_K	VB_T0	A	B
02-04	C	77	0.38	-0.07	0.002	2.512
05-07	C	75	0.285	-0.45	0.0024	2.496
08-10	C	77	0.209	-0.1	0.0024	2.462
11	C	80	0.41	-0.03	0.0021	2.498
12	C	77	0.31	0.18	0.002	2.506
13	C	80	0.33	0.06	0.0022	2.484
14	C	80	0.37	0.03	0.0025	2.458
15	C	80	0.37	0.03	0.0029	2.41
16	C	75	0.38	0.05	0.002	2.515
17-19	C	77	0.273	-0.78	0.0024	2.4897
20-22	C	77	0.33	0.25	0.0021	2.5217

Other available parameters for the area shown in Table 2

Table 2. VBGF and LW relationship parameters from GSA6

Year	Sex	VB_LINF	VB_K	VB_T0	A	B	Reference
95-98	M	51	0.386	-0.52	0.002	2.5323	(Garcia-Rodriguez & Esteban, 2001)
95-98	F	77	0.38	-0.065	0.0019	2.5627	(Garcia-Rodriguez & Esteban, 2001)
2024	C				0.0028	2.4725	(ICATMAR, 2025)
2024	M				0.0124	2.0142	(ICATMAR, 2025)
2024	F				0.0026	2.4871	(ICATMAR, 2025)

This species shows sexual dimorphism, as females reach larger sizes compared to males (Figure 2). Length frequency distributions from the commercial data as well as from survey data (MEDITS) were sliced to catch-at-age, using combined growth parameters.

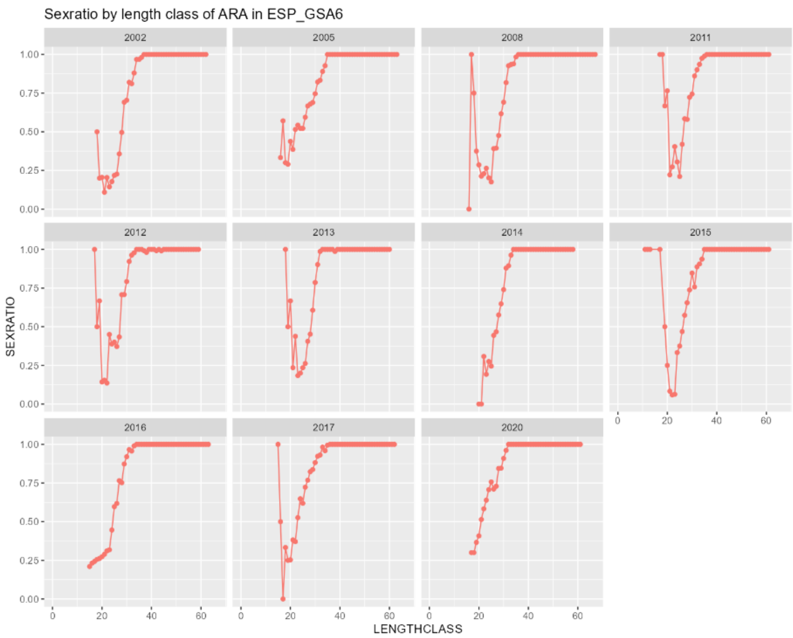

Figure 2. Sex ratio at length

The proportion of mature individuals at age used, was the same as in the previous assessment report (STECF EWG 24-10,Table 3).

Table 3. Proportion of mature specimens (Pmat) at age

Age	**0**	**1**	**2**	**3**	**4**	**5+**
Pmat	0.07863	0.7669	0.998	1	1	1

All available maturity at length data is for sex combined, which is different between years (Figure 3). Another sources of maturity at length for females is from ICATMAR, as in Figure 4 shows, since catched males are always mature.

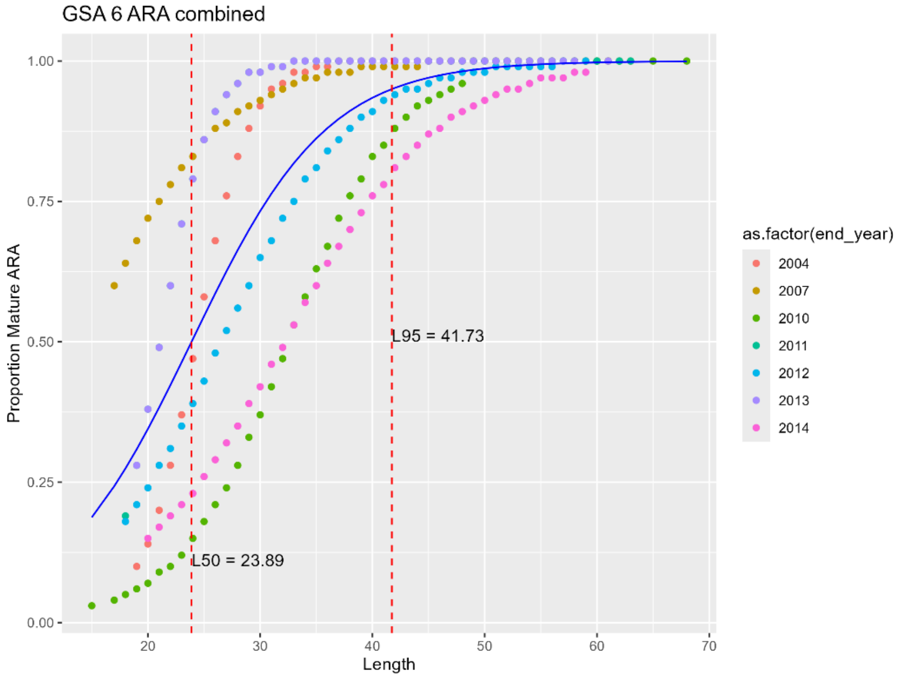

Figure 3. Size at maturity from DCF

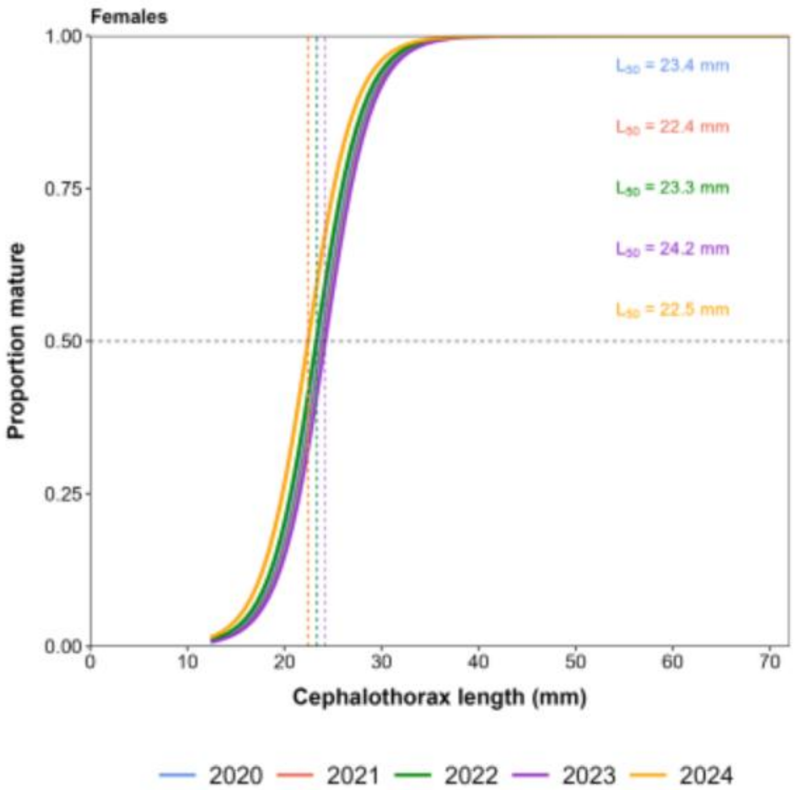

Figure 4. Size at maturity from ICATMAR

The natural mortality of blue and red shrimp in the present assessment was calculated as a vector using the Chen and Watanabe (1989) equation (Table 4)

Table 4. Natural mortality (M) at age Chen and Watanabe (1989)

Age	0	1	2	3	4	5+

M	1.967	0.848	0.610	0.512	0.461	0.432

Figure 5 presents natural mortality (M) estimates across different age classes. During the EWG25-01, criteria to identify the most reliable M values from various estimation methods was developed. Due to time constraints, we present only the estimated values for M, but no further analysis was performed. The methods of Petersen, Hoenig J.M., and Then et al. produced unreliable estimates and were excluded.

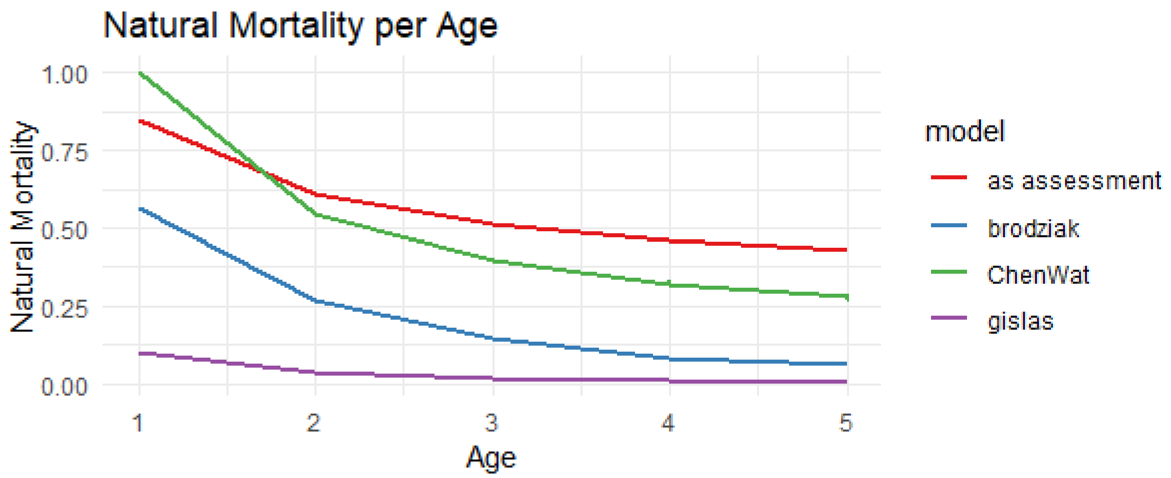

Figure 5. Natural mortality (M) at age from different methods

Catch (landings and discards)

General description of Fisheries

Blue and red shrimp is one of the most important crustacean species in catches and value of GSAs 6&7. It is a deepwater species caught exclusively by bottom trawl. The blue and red shrimp has a wide bathymetric distribution, between 80 and 3300 m depth (Sardà et al., 2004), although commercial fishing grounds are located between 450 and 900 m depth. Deeper areas may act as a refuge for the stock, especially for the juvenile fraction, as they are located far from the main fishing ports and below 1000 m of depth where the trawl fishing is banned (GFCM resolution 2005/1). Females predominate in the landings, representing nearly 80% of the total landings. Discards of the blue and red shrimp are practically null because of the high commercial value of the species. Recently, a conservation size of 25 mm has been applied (Orden APA/312/2025). Other accompanying species of commercial value in the catches are large individuals of hake, greater forkbeard, Norway lobster and blue whiting. Exploitation is based on young age classes, mainly 1 and 2 years old.

Figure 6 shows the landings by year, where a comparison is also presented with the landings reported by Catalonia (which produces around 70% of the total landings in GSAs 6 & 7), GFCM 2024 and the STECF 2024. As reported in EWG 22-03, there is a large discrepancy between landings in the first two years (2002-2003), which is why they were excluded from the input data. It is impossible for total landings in GSA 6 to be lower than those from Catalonia. In the GFCM ARA 2024 report, the series starts in 1996, aligning with the Catalonia data; as expected, GSA 6 totals are slightly higher across the time series. From 2011 onward, DCF and GFCM landings match, but prior to 2011 there are inconsistencies.

The discarded component of the catch is small (Table 5), therefore catch and landings are considered as equal and the term catch will be used throughout this report. Main contribution of landings comes from the OTB fleet, specifically from the DWS metier.

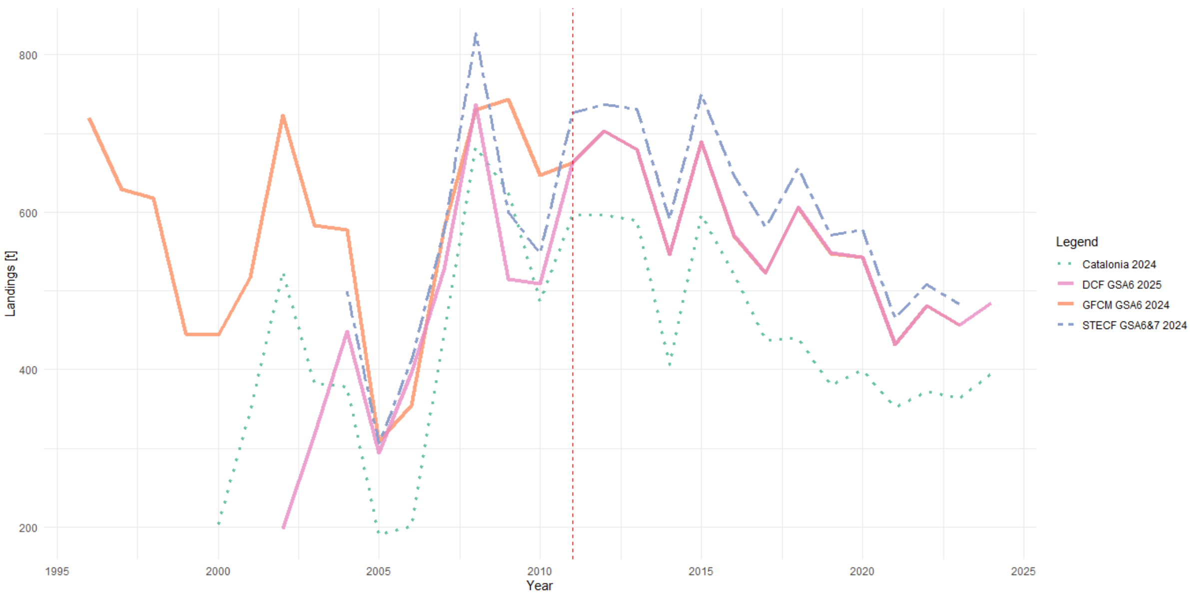

Figure 6. Comparison of total landings reported in Catalonia 2024, DCF GSA6 2025, GFCM GSA6 2024 and STECF GSA6&7 2024.

Table 5. DCF landings (t) and discards (t) by OTB (all metiers).

Year	Landings(t)	Discards (t)
2004	498.80	0.00
2005	305.90	0.00
2006	411.70	0.00
2007	574.50	0.00
2008	827.50	1.14
2009	599.50	0.52
2010	547.11	1.31
2011	725.80	7.97
2012	735.90	15.10
2013	730.70	12.11
2014	591.00	0.60
2015	750.10	0.33
2016	646.50	3.38
2017	581.48	6.88
2018	655.60	0.04
2019	571.00	2.84
2020	577.60	0.49
2021	465.60	0.00
2022	507.80	0.221
2023	483.66	0.65
2024	516	0.091

Extracted length frequencies are in the Figure 7. For the GSA 6, coverage of LF for the DWS metier is 100%, but 18.8% for MDD and 77.8% for NA. For the GSA 7, coverage of LF for the DWS metier is 68.8%, while for the rest is 0. For both GSA 6 & 7, the LFD per year and metier were reconstructed and later corrected according to the landings (Figure 8).

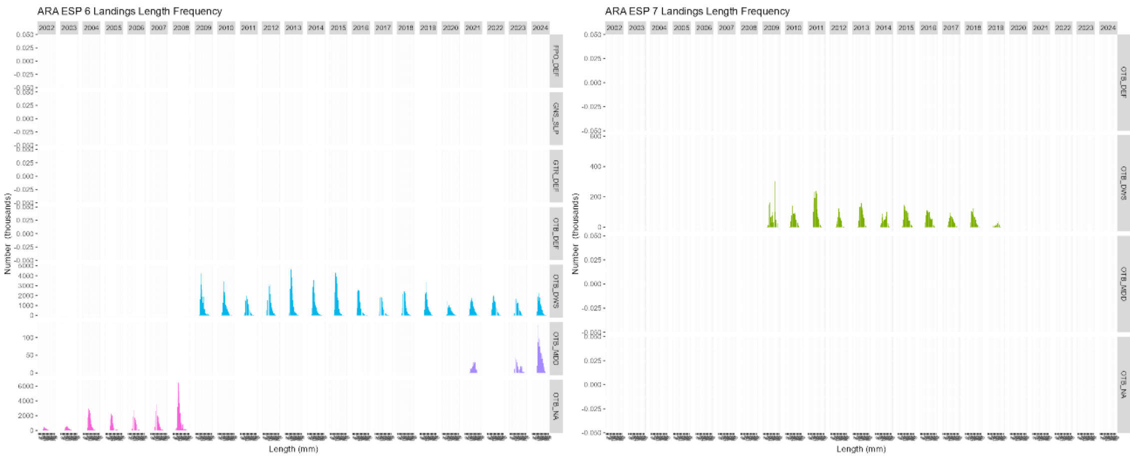

Figure 7. Length frequency distribution of landings by year and metier in GSA 6 and 7

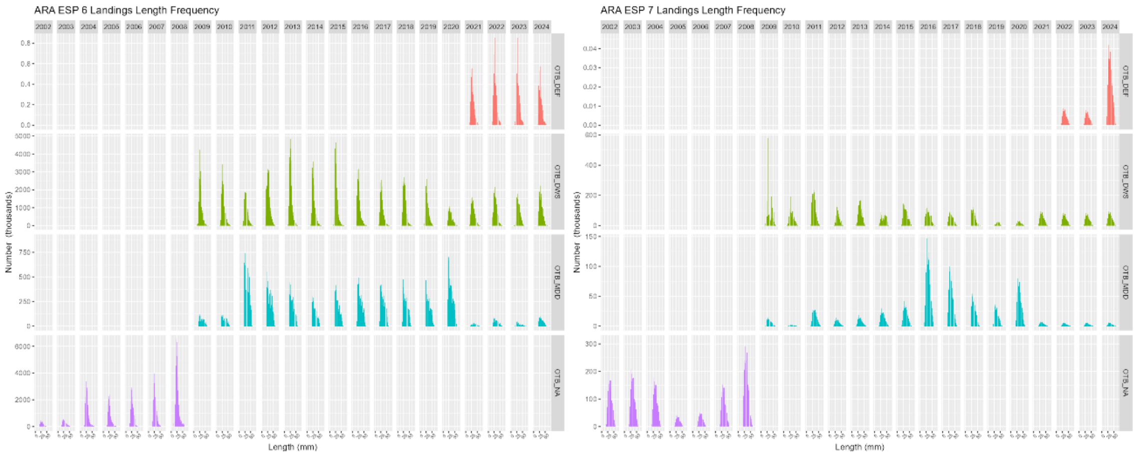

Figure 8. Reconstructed length frequency distribution of landings by year and metier in GSA 6 and 7

Sum of Products (SoP) correction was applied in catch numbers at age to match the total catch by year reported in the DCF (Table 6).

Table 6. Sum of Products (SoP) correction array

Year	SoP
2004	1.01
2005	1.00
2006	1.00
2007	1.01
2008	1.01
2009	1.01
2010	1.00
2011	1.01
2012	1.02
2013	1.02
2014	1.01
2015	1.01
2016	1.01
2017	1.02
2018	1.00
2019	1.01
2020	1.00
2021	1.00
2022	1.00
2023	1.00
2024	1.00

If growth is defined on a birth date mid-year and the assessment is from January to December then slicing needs to occur at age 0 from 0 to 0.49 and age 1 from 0.5 to 1.5, this is arranged by adding 0.5 to t0. When processing length frequency data here, 0.5 years was added to to in catch and survey data. This was necessary because without adding 0.5, there were large numbers of age 0 in both catch and particularly survey adjusted to the start of assessment year (January), which are not expected.

This correction is necessary, because without it, age estimates are displaced, omitting length frequencies from the exploitable biomass, particularly at age 1 (Figure 9 and Figure 10).

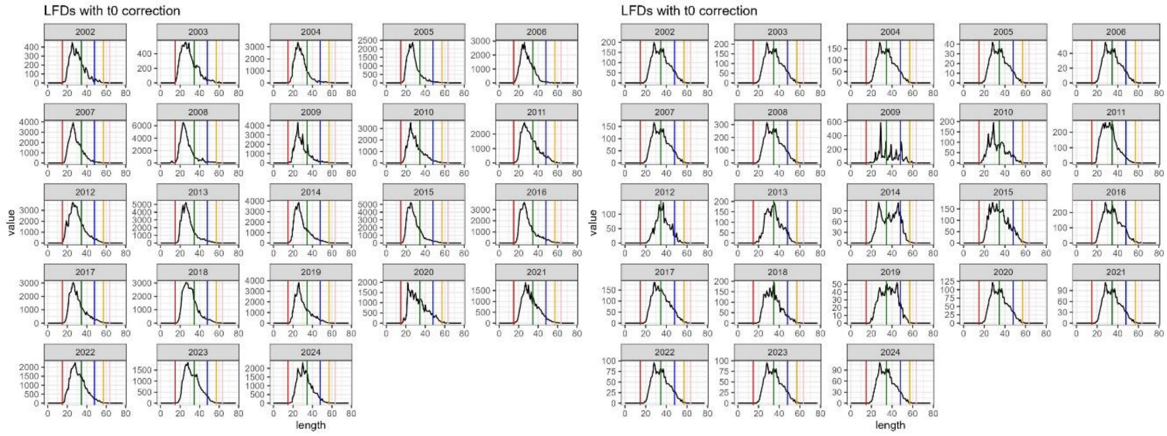

Figure 9. LFDs with t0 correction for GSA 6 and 7

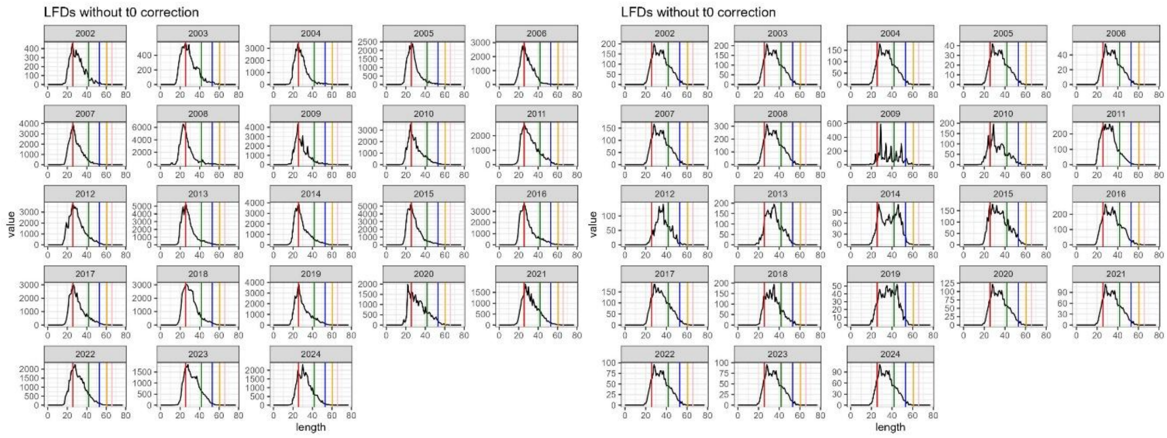

Figure 10. LFDs without t0 correction for GSA 6 and 7

Cohort consistency in the catch is low between ages 1 and 2, high between ages 2 and 3, and moderate across the remaining age classes. In the final years of the time series, fishing pressure appears relatively stable, with no major changes in the trend over the last decade (Figure 11).

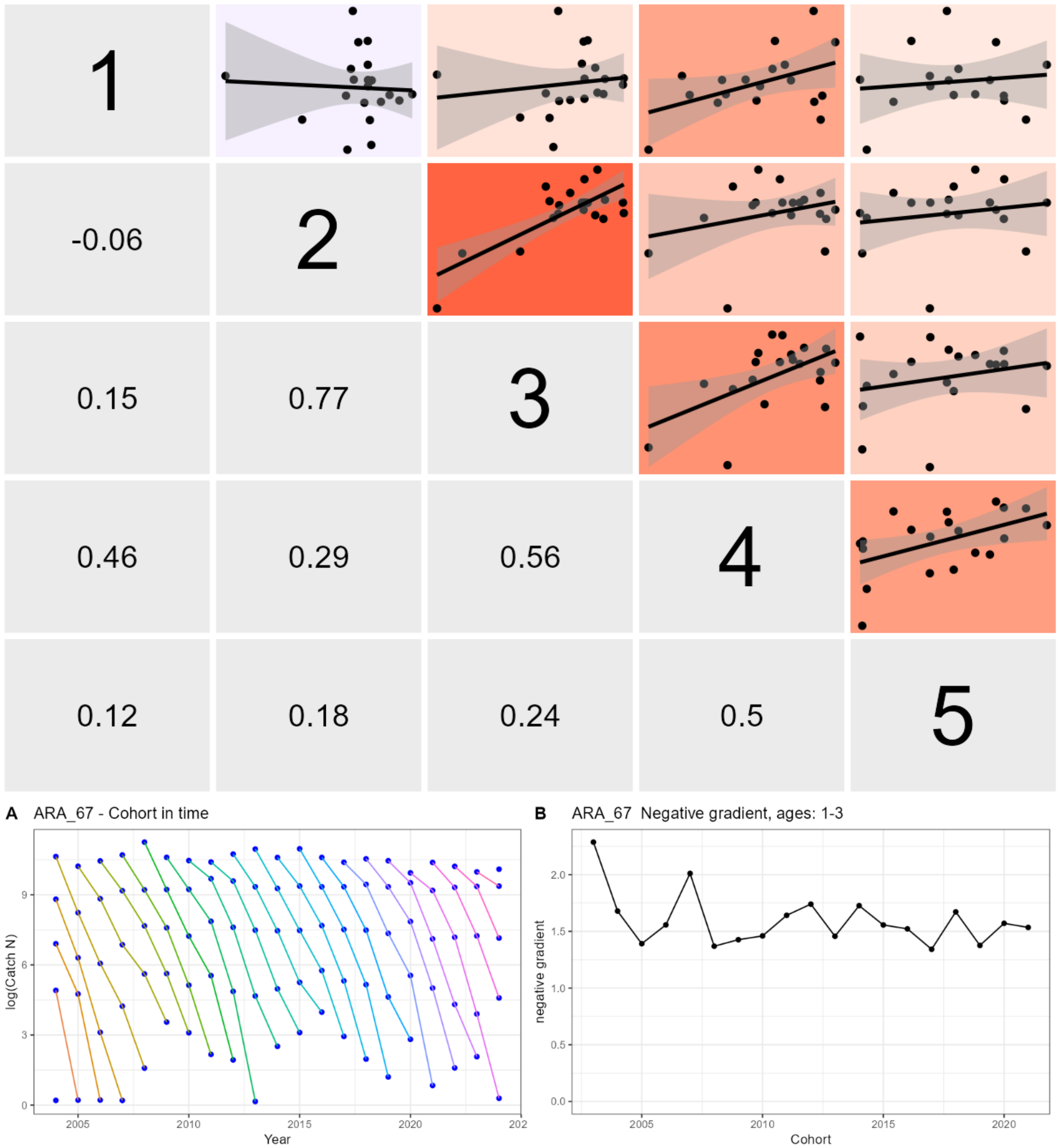

Figure 11. Cohort consistency in the catch

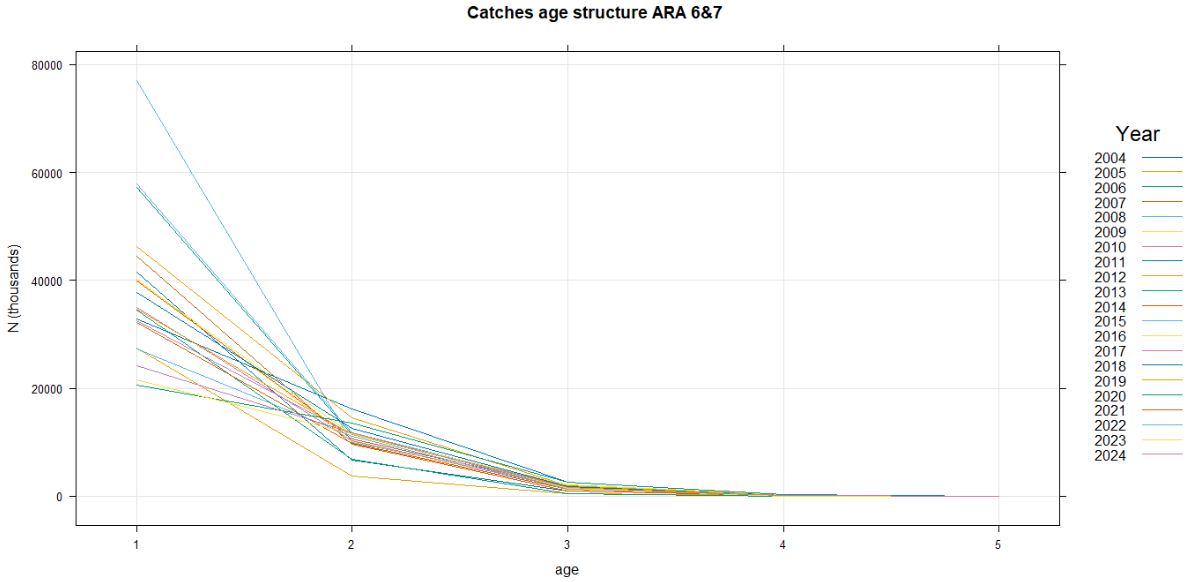

Figure 12. Catch-at-age structure for the catches

Figure 13. Summary of stk object

Survey data

Description and timing

The MEDITS surveys are carried mainly from May to July (Figure 14). Tables TA, TB, TC were provided according to the MEDITS protocol. Data were assigned to strata based upon the shooting position and average depth (between shooting and hauling depth). Data errors (e.g. length ranges) had been noted and were corrected prior to the analysis.

The abundance and biomass indices for GSA 6&7 were calculated through stratified means. This implies weighting of the average values of the individual standardized catches and the variation of each stratum by the respective stratum areas.

Figure 14. Month of the year when the MEDITS survey is conducted.

Geographical distribution

The blue and red shrimp are mainly concentrated in the northern and southern parts of the region, while it is rare in the centre of the Spanish area where waters are shallower. The distribution did not show substantial variation across time (Figure 15).

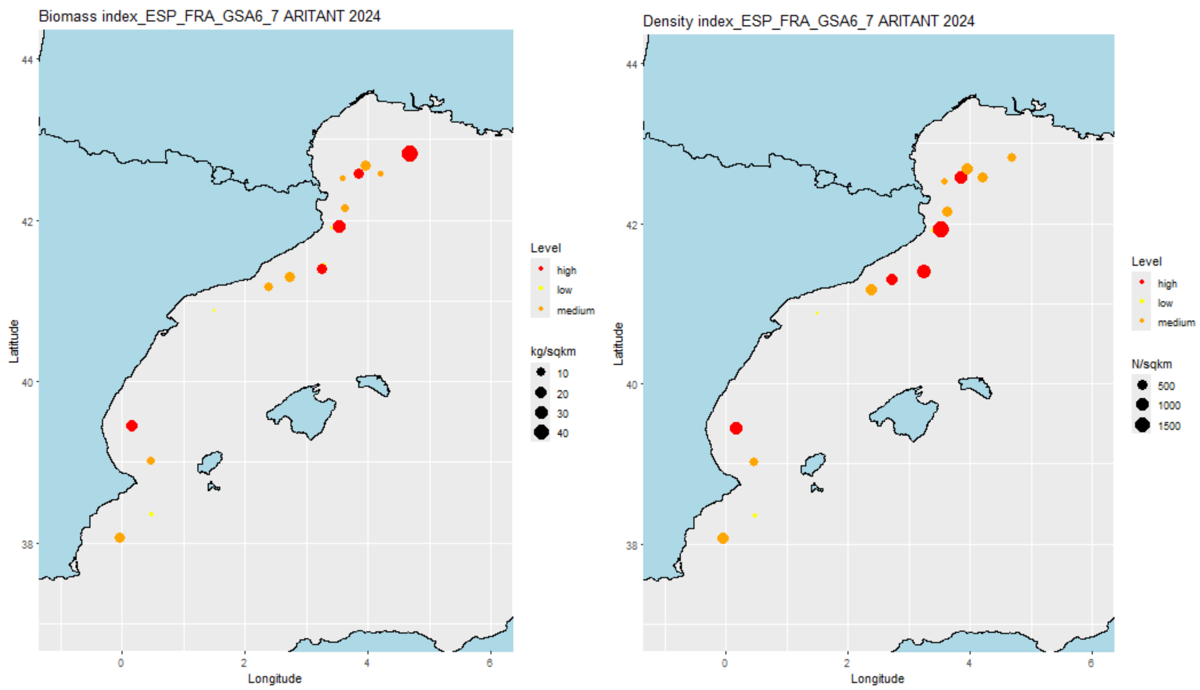

Figure 15. Geographical distribution based on the biomass and density index of MEDITS survey in 2024

Trends in abundance and biomass

The time series of abundance and biomass indices of blue and red shrimp from MEDITS bottom trawl survey in GSAs 6&7 are available since 1994 as shown in the Figure 16, Figure 17 and Table 7. The density index shows an almost stable trend across the years while the biomass index shows a slight declining trend. The trends in abundance by length are shown on Figure 18.

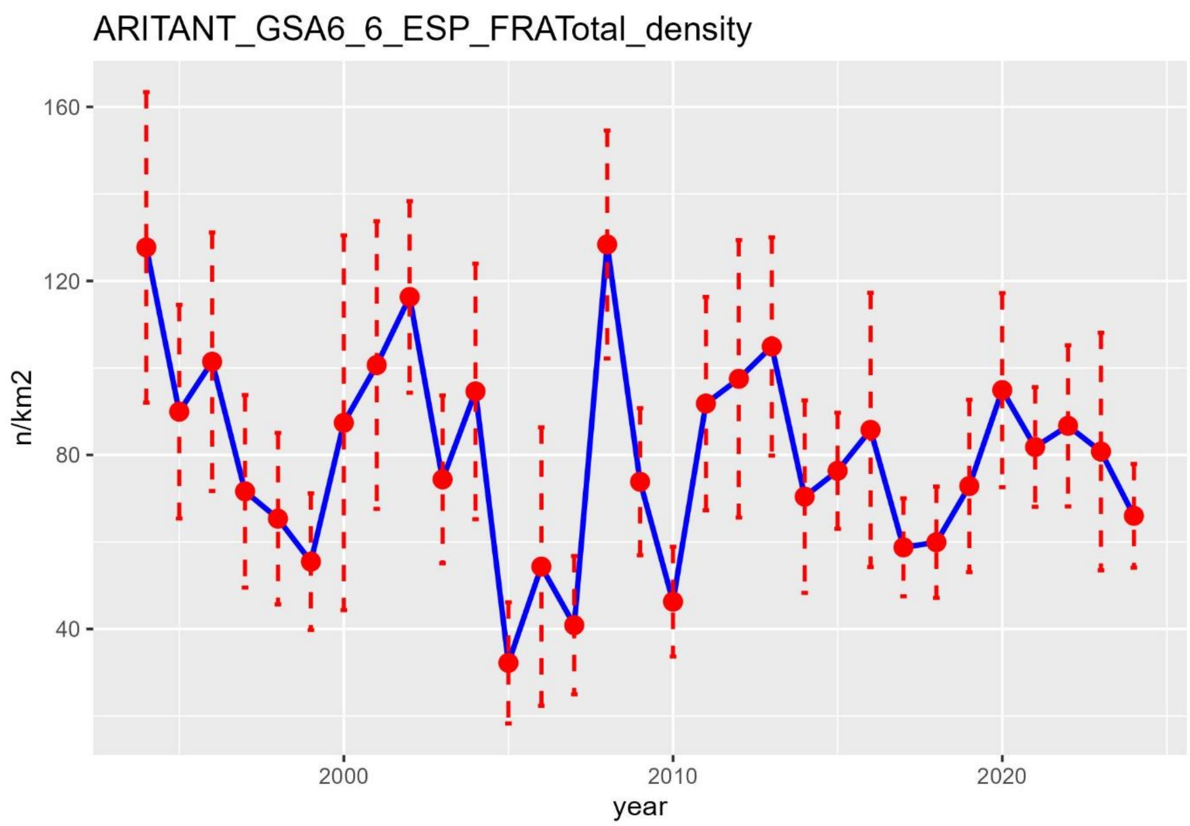

Figure 16. MEDITS survey abundance index (n/km2) of blue and red shrimp in GSA 6&7 as reported by DCF.

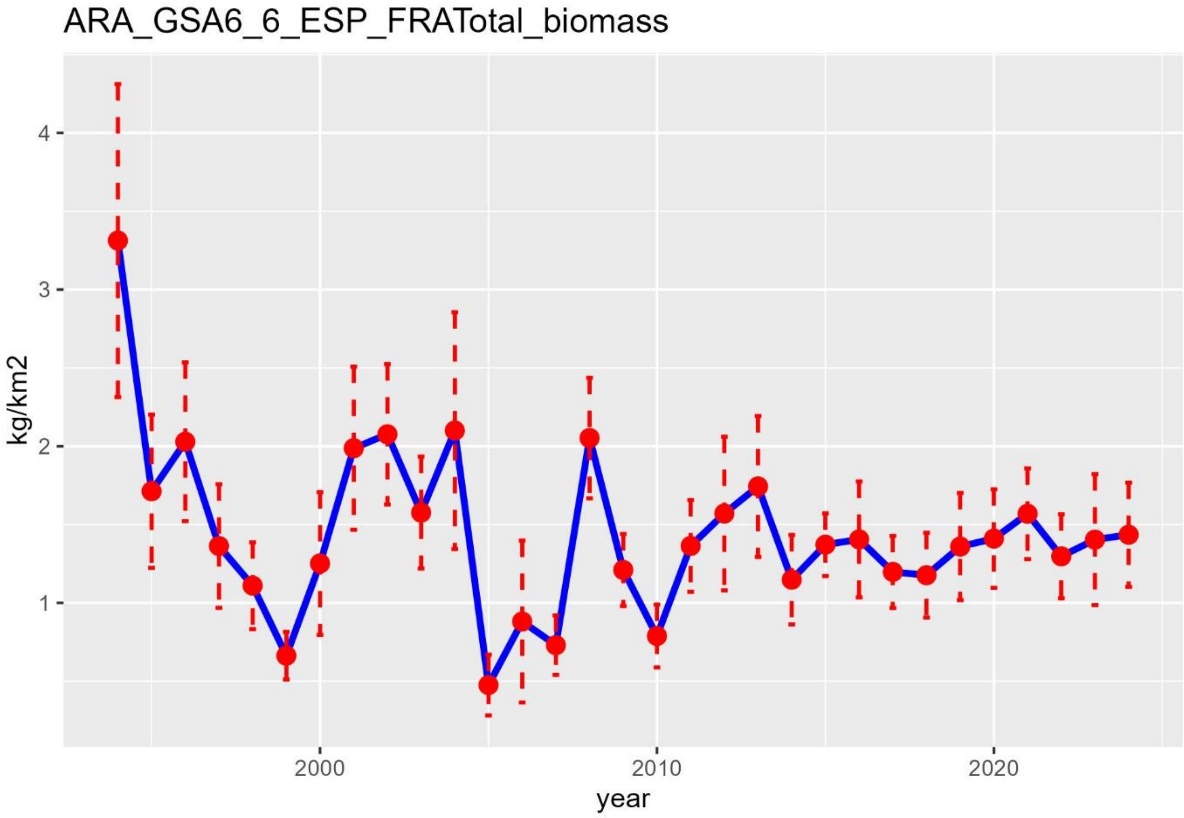

Figure 17. MEDITS survey biomass index (kg/km2) as reported by DCF.

Table 7. MEDITS survey biomass (kg/km2) and density (n/km2) index as reported by DCF. The survey is carried out from June to July.

Year	total_biomass	total_density
1994	3.31	127.71
1995	1.71	89.94
1996	2.03	101.43
1997	1.36	71.64
1998	1.11	65.35
1999	0.66	55.48
2000	1.25	87.39
2001	1.99	100.67
2002	2.08	116.31
2003	1.58	74.39
2004	2.10	94.62
2005	0.48	21.90
2006	0.88	54.33
2007	0.73	40.88
2008	2.05	128.38
2009	1.21	73.84
2010	0.79	46.28
2011	1.36	91.81
2012	1.57	97.51
2013	1.74	104.93

2014	1.15	70.43
2015	1.37	76.36
2016	1.41	85.76
2017	1.20	57.78
2018	1.18	59.93
2019	1.36	72.86
2020	1.41	84.67
2021	1.57	81.82
2022	1.30	86.69
2023	1.40	80.78
2024	1.44	66.02

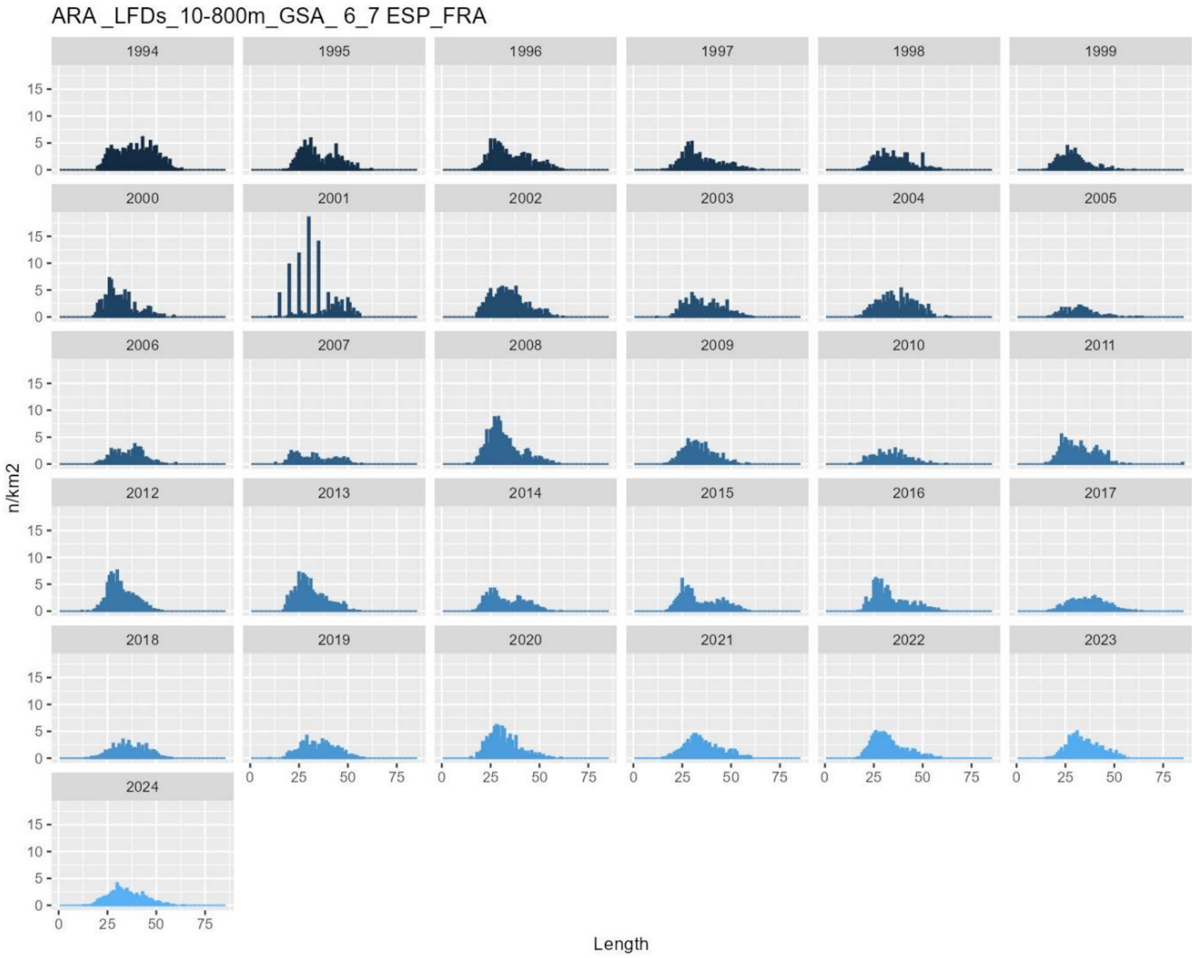

Figure 18. Length frequency distribution of the MEDITS survey abundance index (n/km2) as reported by DCF.

Cohort consistency in index is high between ages 3 and 4, but only moderately low across the other age classes. For ages 1–3, the time series shows a slight but steady upward trend, whereas age 4 exhibits considerably greater variation (Figure 19). Further analysis is needed to assess whether the age classes display coordinated dynamics.

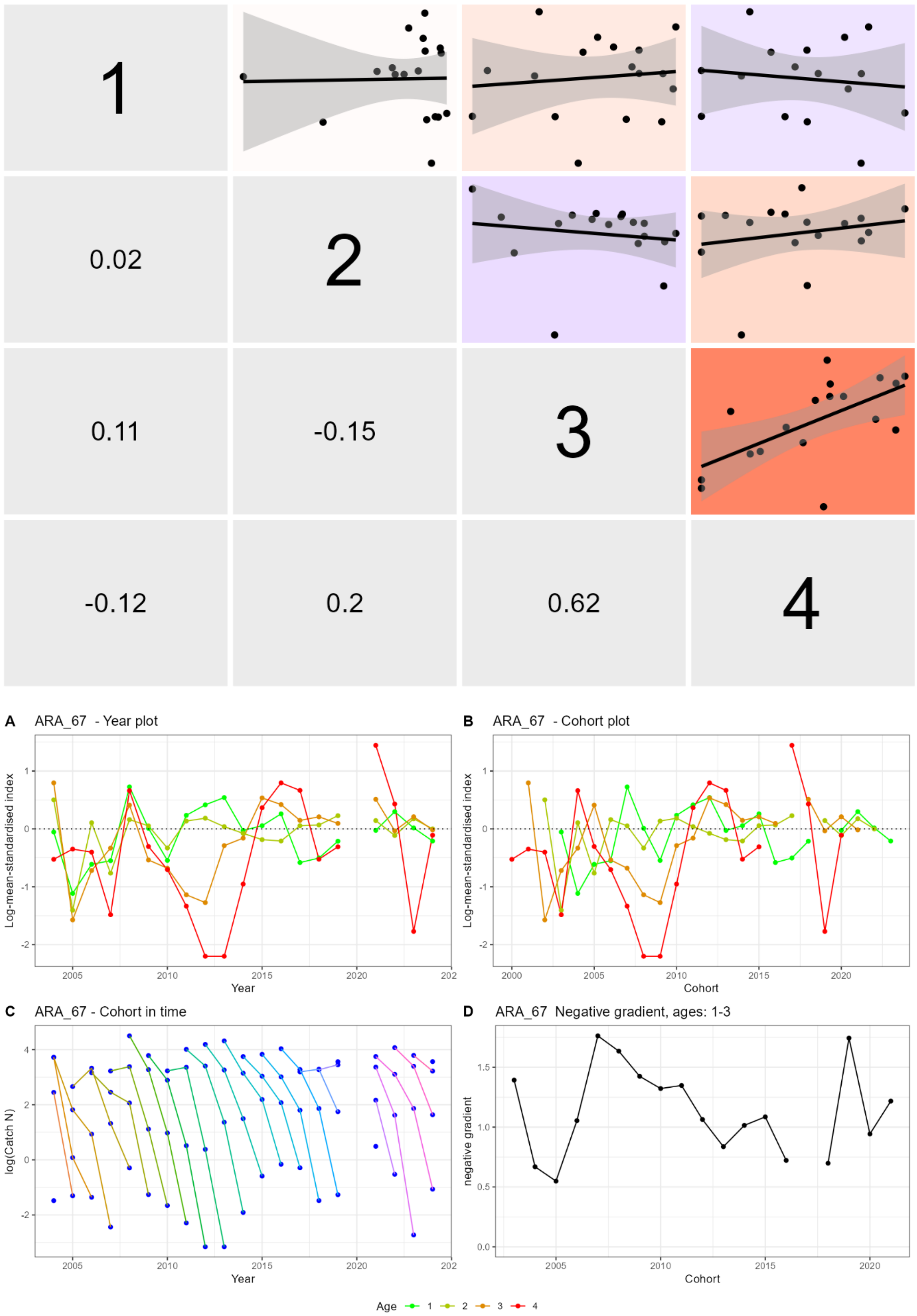

Figure 19. Cohort consistency in the index

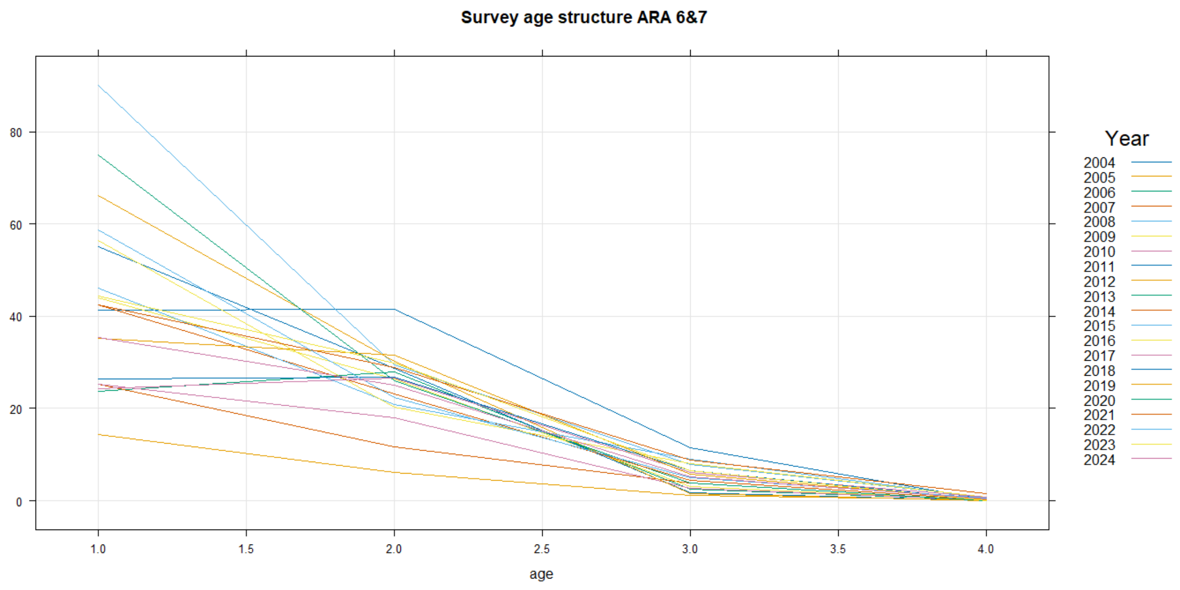

Figure 20. Catch-at-age structure for the index