Report of 17th meeting for MEDiterranean International Acoustic Surveys (MEDIAS)

in the framework of European Data Collection Framework (DCF)

Palermo, Italy and ZOOM (Hybrid meeting)

09-11 April 2024

Steering Committee Report

Contents

1. Introduction

The MEDIAS (MEDiterranean International Acoustic Surveys) Steering Committee met in Palermo, Italy, on 09-11 April 2024, hosted by CNR-IAS and chaired by Tarek Hattab from IFREMER. The hybrid meeting was also virtually hosted on Zoom platform. Meeting participants were representatives from the European Union countries involved in acoustic surveys in the Mediterranean Sea (i.e. Croatia, France, Greece, Italy, Malta, Slovenia and Spain) and in the Black Sea (i.e. Bulgaria). One representative of EC from DG-MARE, and two representatives from RDBFIS & RDBFIS-II projects were invited to participate. In total, 36 participants attended the meeting including 22 in-person attendees and 14 virtual participants (see list of participants in Annex I and Institute's acronyms in Annex II).

All participants (see Annex III) adopted the agenda of the 17th hybrid MEDIAS Coordination Meeting.

In accordance to the Agenda adopted, the main aims of the 17th MEDIAS Coordination Meeting were:

- To present the outcomes related to the MEDIAS activities carried out in 2023;
- To review and discuss information provided by EC representative;
- To review issues from other meetings related to MEDIAS;
- To work on standardization of biological analyses (e.g. age and maturity estimates);
- To share and discuss fish shoals descriptors;
- To present all TS values used in the different surveys for the different pelagic species;
- To work on MEDIAS regional database structure;
- To make progress on the standardization of zooplankton sampling;
- To update regional scale NASC maps;
- To establish the ToRs and plan the 18th MEDIAS meeting in 2025.

Following the agenda, during the first day activities and outcomes related to the 2023 MEDIAS acoustic surveys, carried out by the MEDIAS teams (Fig. 1.1), were presented, as well as results from the pelagic trawl surveys carried out by Bulgaria in the Black Sea.

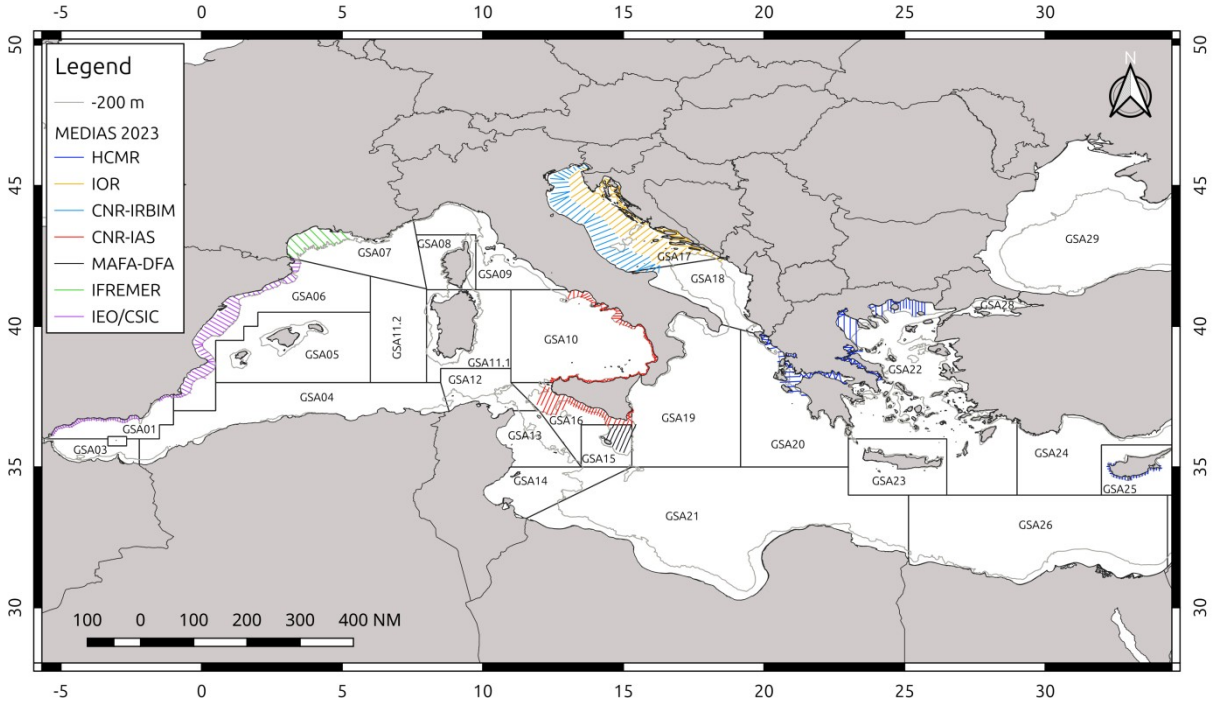


Figure 1.1. Acoustic surveys performed in the MEDIAS framework during 2023.

2. Results of the surveys carried out in 2023 in the framework of the Mediterranean International Acoustic Surveys (MEDIAS)

2.1. MEDIAS 2023 in Iberian coast (ESP): GSA 1 - Northern Alboran Sea and GSA 6 - Northern Spain (Magdalena Iglesias, Ana Ventero, Pilar Córdoba, José Carlos Rodríguez, Miriam Troyano & Gloria Blaya, IEO/CSIC)

a) General information on the survey

MEDIAS 2023 acoustic survey was carried out in the Mediterranean Spanish waters (GSA06, Northern Spain and GSA01, Northern Alboran Sea) from 11th July to 13th August 2023 (34 days) on board the R/V "Miguel Oliver" (70 m long, 14 m wide, 2 x 1000 kW). Target species were European anchovy (*Engraulis encrasicolus*) and European sardine (*Sardina pilchardus*).

b) Type of echosounder and frequencies in use

The split beam scientific echosounder used is SIMRAD EK80 operating at 18, 38, 70, 120 and 200 kHz frequencies. There is no threshold limit applied in the raw data. The threshold for processing for the assessment (38 kHz) is –70 dB. Elementary Sampling Distance Unit (EDSU) was 1 nmi, minimum bottom depth 30 m, pulse duration 1.024 ms for all frequencies and ping rate was set to maximum. The surveying acoustic vessel speed is 10 knots. The Echoview software v. 13.1 was used to visualize and analyse acoustic data.

c) Calibration results

The acoustic system was calibrated at the beginning of the survey (12th July) using the standard sphere method (Demer *et al*., 2015) (Table 2.1.1).

Table 2.1.1. Calibration results in MEDIAS 2023.

Frequency (kHz)	**18 kHz**	**38 kHz**	**70 KHZ**	**120 kHz**	**200 kHz**
Echo-sounder type			EK80		
Transducers Serial no.	2068	453	142	354	297
Vessel			Miguel Oliver		
Date			12/07/2023		
Place			39°28.999N 2°39.855E		
Bottom depth (m)			40		
Temperature (°) at sphere depth			23.22		
Salinity (psu) at sphere depth			37.51		
Sound Velocity (m/s)			1533.54		
TS of sphere (dB)[1]	-42.36	-42.33	-41.66	-39.95	-38.81
Pulse duration (ms)			1.024		
Ping rate			0.5		
RMS beam	0.10	0.05	0.08	0.17	0.35
Transducer Gain (dB)	22.90	26.70	27.44	27.30	25.92
Sa Correction (dB)	0.01	-0.0096	-0.04	-0.04	-0.09
Beam witdth atwarth (°)	10.17	6.67	6.51	5.74	5.34
Beam witdth along (°)	10.27	6.68	6.53	5.80	5.86

Atwarth. Offset (°)	-0.04	0.00	-0.18	-0.01	-0.08
Along. Offset (°)	0.00	-0.05	-0.25	-0.19	-0.42

d) Survey design

Acoustic data were collected during daytime (6:00am - 6:00pm, UTC) over a grid of systematic parallel transects perpendicular to coastline/bathymetry, covering the continental shelf (30-200 m depth) (Fig. 2.1.1). Inter-transect distance was 8 nmi in GSA06 (wide continental shelf) and 4 nmi in GSA01 (narrow continental shelf).

Acoustic data were collected from 51 transects (867 nmi) in GSA06 and 47 transects (227 nmi) in GSA01 (Fig. 2.1.1 & 2.1.2) and processed. Due to problems with the operation of the scientific echosounder at the beginning of the survey, together with a few days of bad weather at sea, only 47 of the 59 planned transects were covered in GSA01 (Fig. 2.1.2). However, the 12 unprospected transects are located in the Gulf of Vera area where the presence of sardine and anchovy is very scarce.

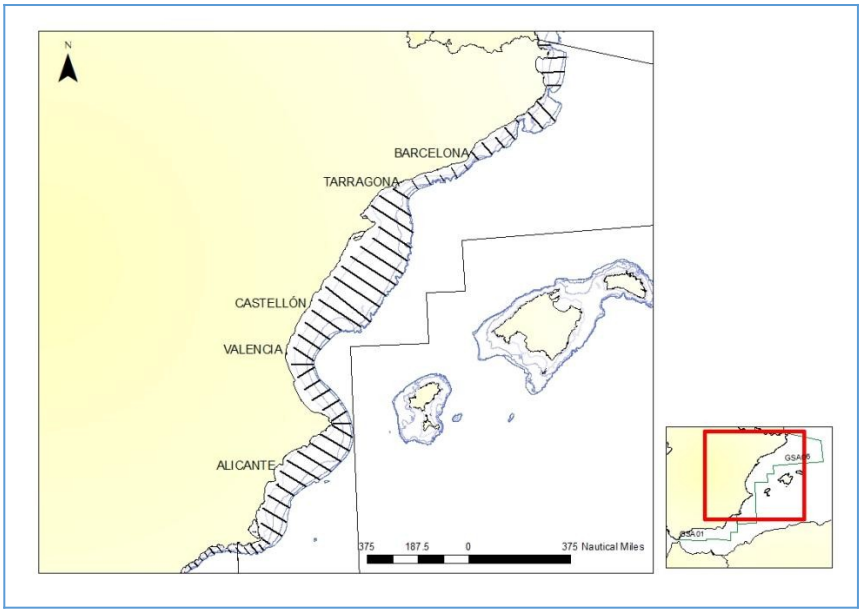


Figure 2.1.1. Acoustic survey design in GSA06: 51 transects prospected.

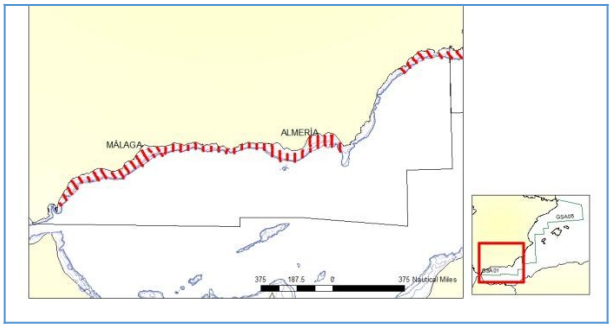


Figure 2.1.2. Acoustic survey design in GSA01: 47 transects prospected.

e) Fish sampling

Echotraces are identified with pelagic hauls. Fifty-two (52) pelagic hauls were carried out during daytime in Northern Spain (GSA06) (Fig. 2.1.3) and twenty (20) pelagic hauls during daytime/ night time in Northern Alboran Sea (GSA01) (Fig. 2.1.4). The pelagic net used has headline length of 63.5 m, a sideline dimension of 51 m, and a codend mesh size of 20 mm. Vessel speed was 3.5-4.5 knots during fishing. Trawls were monitored by means of SIMRAD FS70 trawl sonar for efficient monitoring of the net opening and fishing conditions and a MARPORT Speed Explorer that combines the functions of a trawl eye headline sounder with a trawl speed sensor.

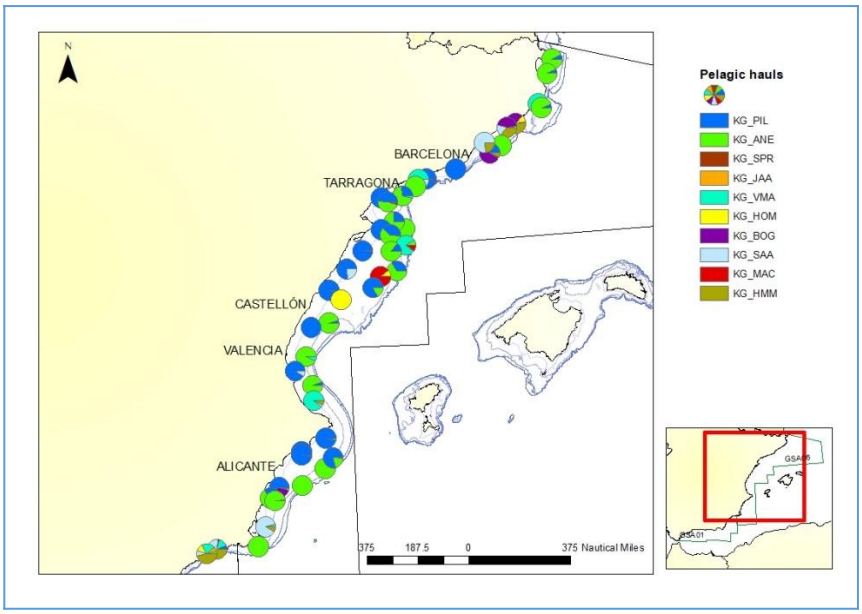


Figure 2.1.3. Pelagic hauls (52) composition (percentages in weight) carried out in GSA06 during the Spanish acoustic survey MEDIAS 2023.

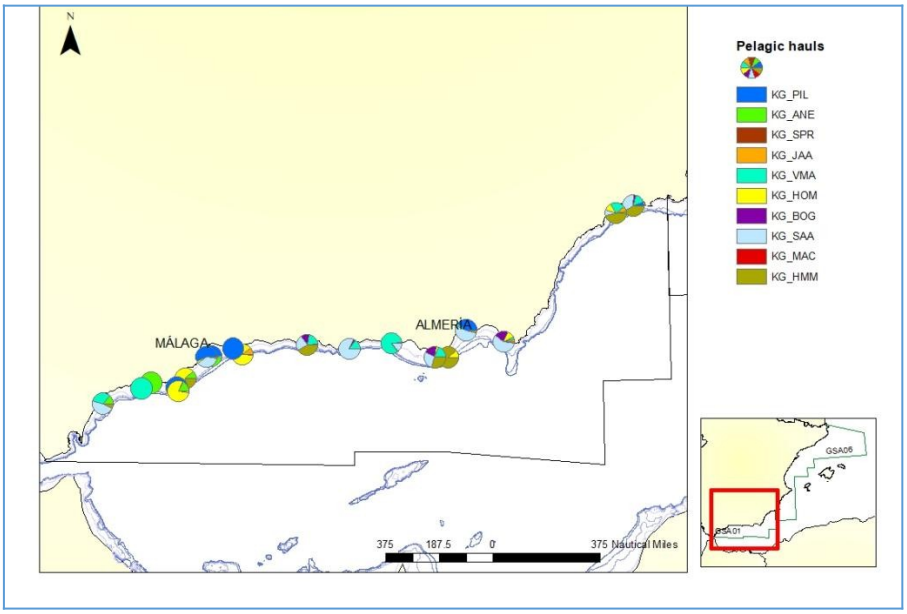


Figure 2.1.4. Pelagic hauls (20) composition (percentages in weight) carried out in GSA01 during the Spanish acoustic survey MEDIAS 2023.

f) Oceanographic parameters

120 hydrological stations have been conducted in GSA06 (Fig. 2.1.5) and 44 in GSA01 (Fig. 2.1.6), using a Seabird (SBE) 19 plus CTD, which measures conductivity, temperature, pressure, fluorescence and dissolved oxygen.

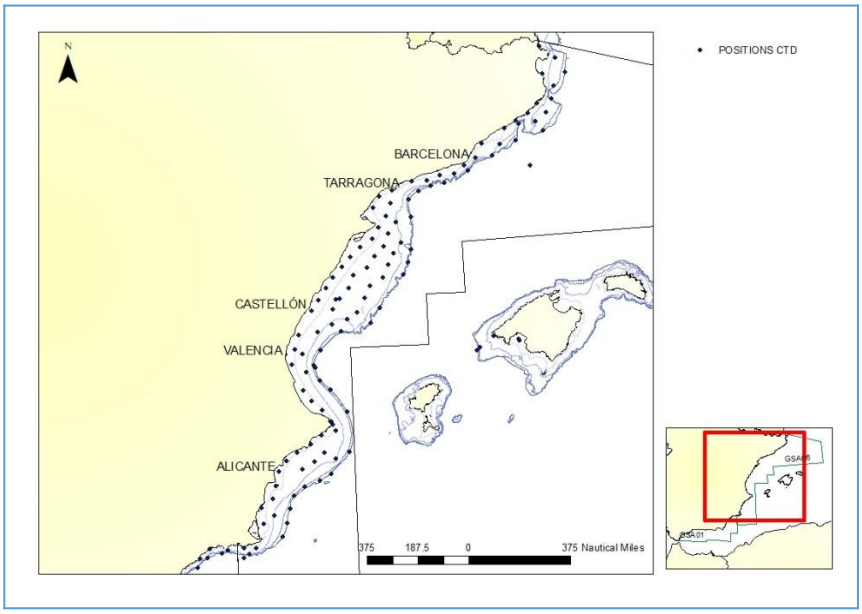


Figure 2.1.5. CTD stations (120) in GSA06 carried out during the Spanish acoustic survey MEDIAS 2023.

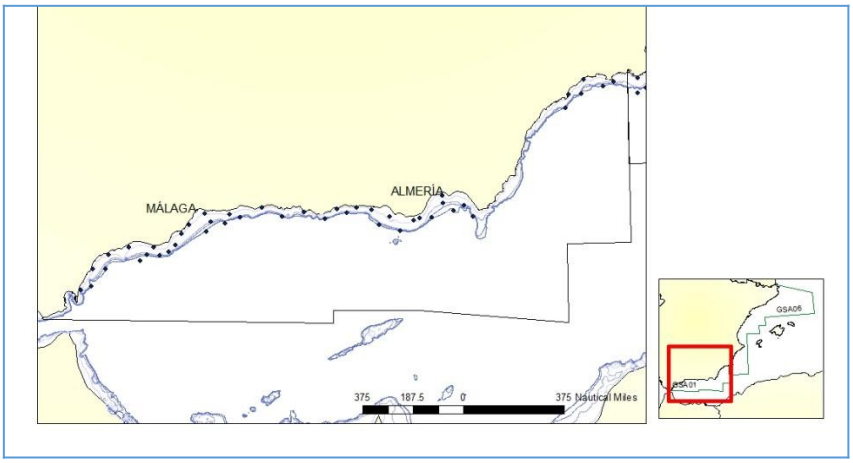


Figure 2.1.6. CTD stations (44) in GSA01 carried out during the Spanish acoustic survey MEDIAS 2023.

g) Biomass estimations of target species

The biomass estimation of sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) in GSA's 06 and 01, as well as the associated CVs of geostatistical simulations, are reported in the table 2.1.2. The historical trend of sardine and anchovy in GSA06 and 01 are shown in Fig 2.1.7 and 2.1.8. Biomass per length class for the two species is shown in Fig 2.1.9 and 2.1.10 for GSA 06 and 01, respectively.

Table 2.1.2. Estimates of biomass and CV for sardine and anchovy in GSA's 06 and 01 in MEDIAS 2023.

	GSA06		GSA01	
	Biomass (t)	**CV**	**Biomass (t)**	**CV**
Sardine	91329	11%	15095	42%
Anchovy	39330	13%	5525	40%

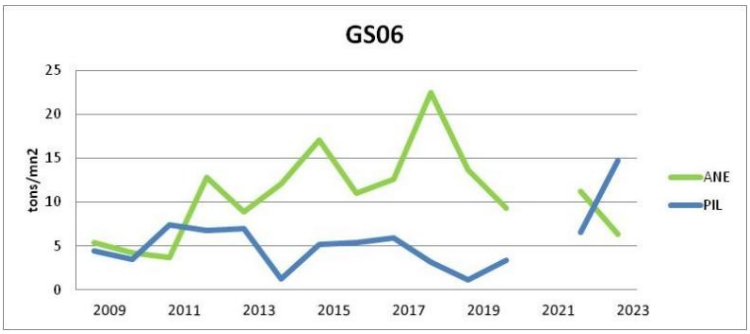


Figure 2.1.7. Historical trends in GSA06 (Northern Spain). PIL: *Sardina pilchardus*; ANE: *Engraulis encrasicolus.*

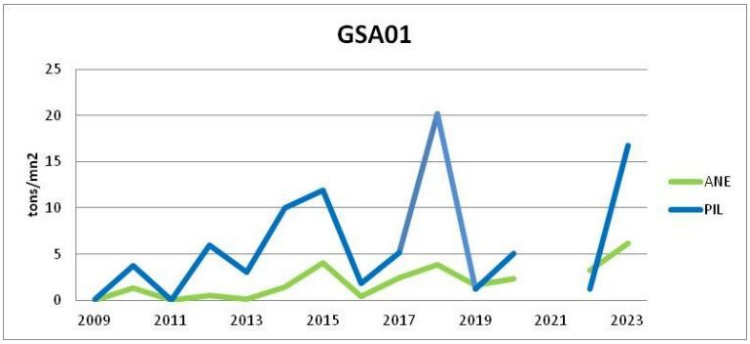


Figure 2.1.8. Historical trends in GSA01 (Northern Alboran Sea). PIL: *Sardina pilchardus*; ANE: *Engraulis encrasicolus*.

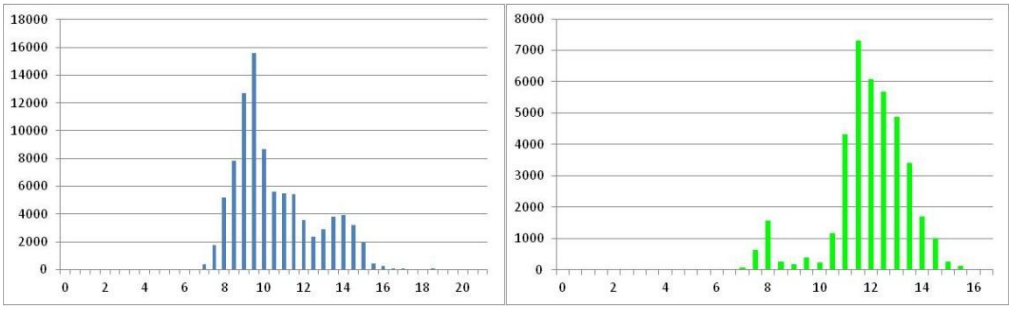


Figure 2.1.9. Sardine and anchovy biomass (in tons) per length class in Northern Spain (GSA06). MEDIAS 2023.

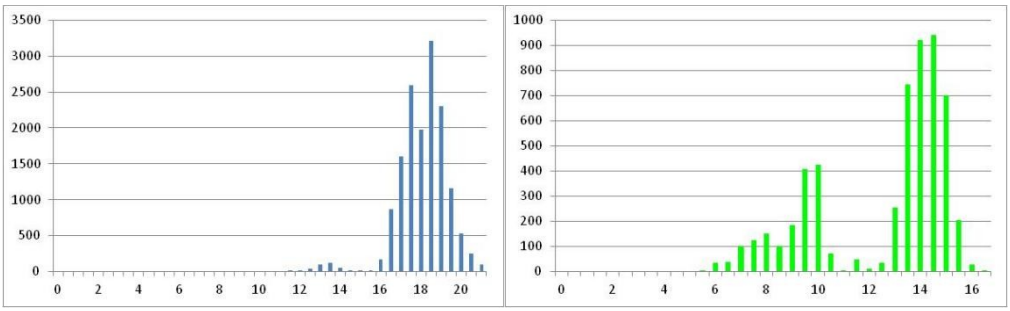


Figure 2.1.10. Sardine and anchovy biomass (in tons) per length class in Northern Alboran Sea (GSA01). MEDIAS 2023.

Biomass per age class was estimated for sardine and anchovy using otoliths reading and age length key was assessed. Age length key (ALK) for sardine in GSA06, MEDIAS 2023, was composed by 4 years classes (0-3). The number of otoliths readings was 1135 (individuals) (Fig. 2.1.11). In GSA01, the number of sardine otoliths readings was 227, the number of age classes were also 4 (0-3) (Fig. 2.1.11).

Age length key (ALK) for anchovy in GSA06, MEDIAS 2023, was composed by 3 years classes (0-2). The number of otoliths readings was 729 (individuals) (Fig. 2.1.12). In GSA01, the number of anchovy otoliths readings was 267 and the number of age classes observed were also 3 (0-2) (Fig. 2.1.12).

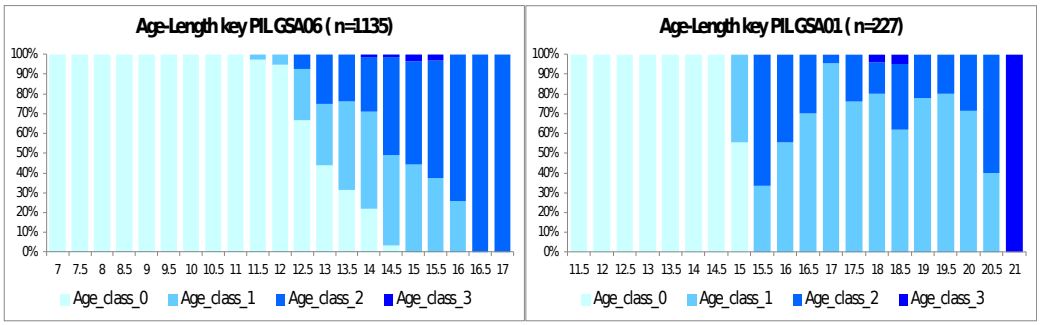


Figure 2.1.11. Sardine ALK in Northern Spain (GSA06). MEDIAS 2023.

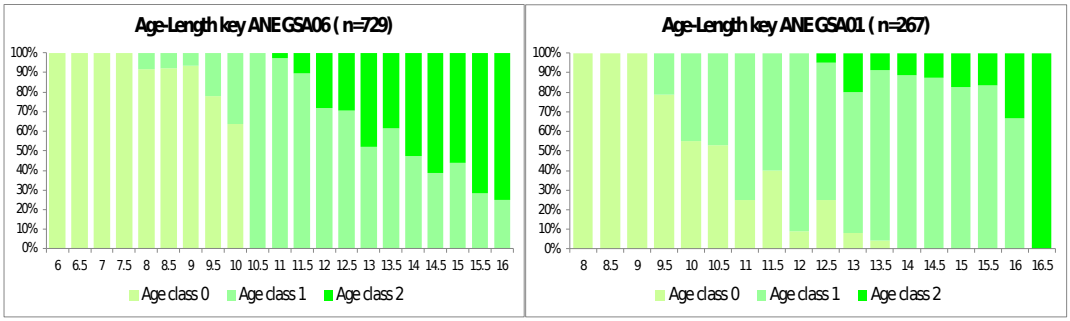


Figure 2.1.12. Anchovy ALK in Northern Alboran Sea (GSA01). MEDIAS 2023.

Subsequently, biomass per age class for the two species is shown in Fig. 2.1.13 and 2.1.14 for GSA06 and GSA01, respectively.

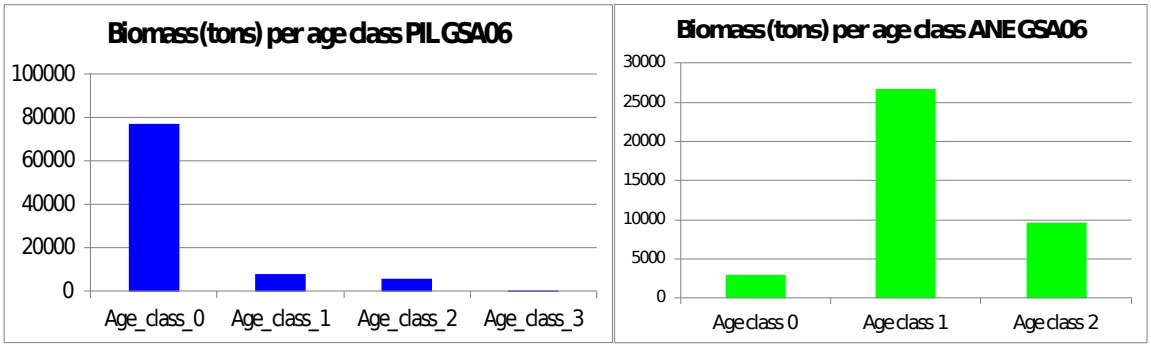


Figure 2.1.13. Sardine and anchovy biomasses (in tons) per length class in Northern Spain (GSA06). MEDIAS 2023.

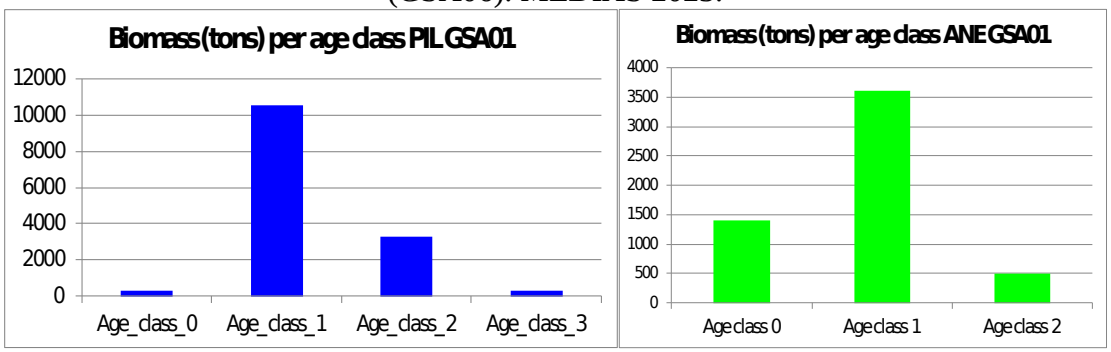


Figure 2.1.14. Sardine and anchovy biomasses (in tons) per length class in Northern Alboran Sea (GSA01). MEDIAS 2023.

h) <u>Abundance indices of target species</u>

Spatial distributions of sardine and anchovy abundance indices, in terms of NASC (m^2/mn^2) in GSA 06 in 2023 (Fig. 2.1.15 & 2.1.16, respectively) was mainly coastal for sardine, and covering all the continental shelf depth for anchovy.

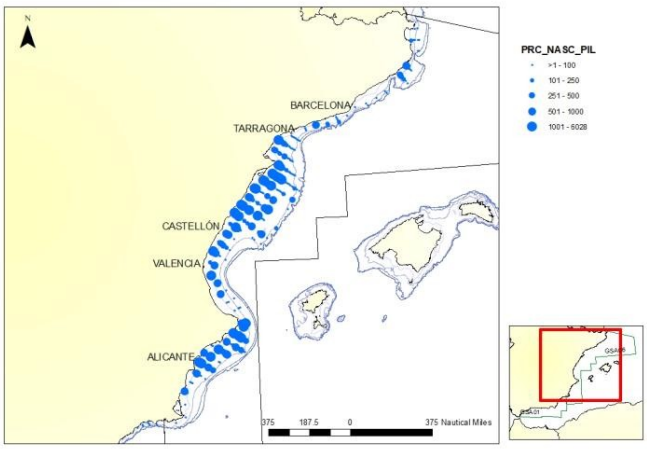


Figure 2.1.15. Sardine (PIL) spatial distribution in Northern Spain (GSA06) in MEDIAS 2023.

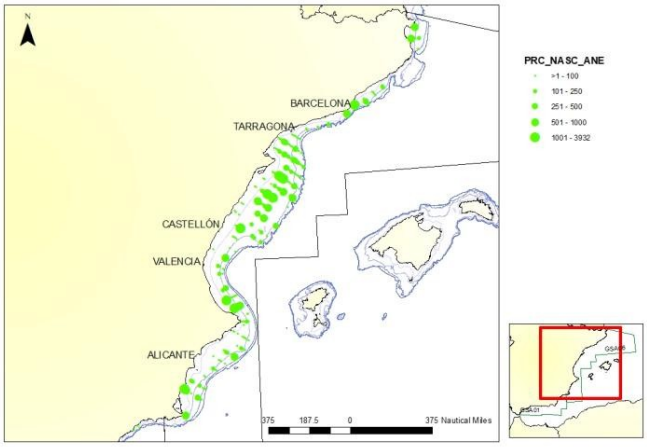


Figure 2.1.16. Anchovy (ANE) spatial distribution in Northern Spain (GSA06) in MEDIAS 2023.

Spatial distributions of sardine and anchovy abundance indices, in terms of NASC (m^2/mn^2) in GSA 01 in 2023 (Fig. 2.1.17 & 2.1.18, respectively) was mainly in the Bay of Málaga and surroundings for sardine, and between Malaga and the Strait of Gibraltar for anchovy.

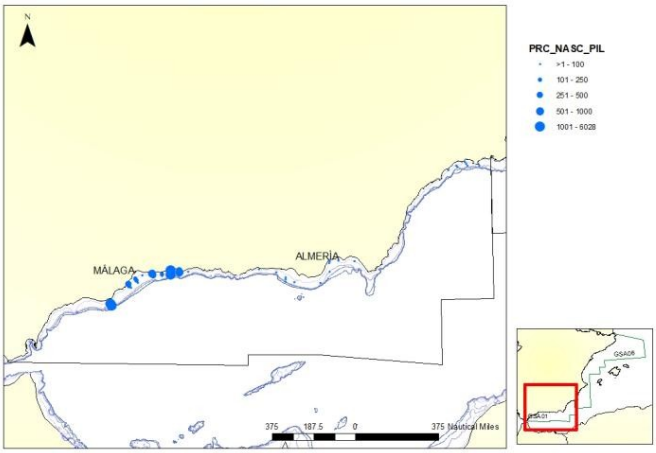


Figure 2.1.17. Sardine (PIL) spatial distribution in Northern Alboran Sea (GSA01) in MEDIAS 2023.

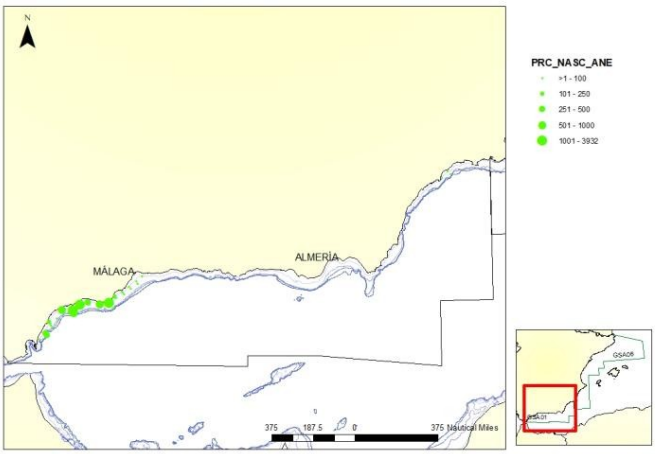


Figure 2.1.18. Anchovy (ANE) spatial distribution in Northern Alboran Sea (GSA01) in MEDIAS 2023.

2.2. MEDIAS 2023 in GSA 07 (Gulf of Lions, FRA) - (Tarek Hattab & Jean Hervé Bourdeix, IFREMER)

a) General information on the survey

The surveys took place from June 29 to July 31 2023. (lasts 33 days at sea, but only 24 days of effective work due to bad weather) and covered the Gulf of Lions (3300 nm2) with the fishery Research Vessel L'Europe (29.60 m length. 469 × 2 HP).

b) Type of echosounders and frequencies in use

The equipment was composed by SIMRAD ER60 split beam echo sounder, with the 38. 70. 120. 200 and 333 kHz frequencies. The threshold for acquisition is –80 dB and that for processing for the assessment (38 kHz) is –60 dB. The pulse duration is 1.024 ms. The surveying acoustic vessel speed is 8 knots. Additionally, the multi-beam echo sounder SIMRAD ME70 was used in order to visualize 3D echos and improve species allocation. The MOVIES 3D software was used to visualize and analyze acoustic data.

c) Calibration results

The acoustic system was calibrated on May 22 2023. Calibration results are shown in Table 2.2.1.

Table 2.2.1. Calibration results in MEDIAS 2023.

Frequency (kHz)	**38kHz**	**70kHz**	**120kHz**	**200kHz**	**333kHz**
Echo-sounder type	ES38B	ES70_7C	ES120_7	ES200_7C	ES333_7C
Transducer serial no.	31288	127	29497	288	159
Vessel	RV l'Europe	RV l'Europe	RV l'Europe	RV l'Europe	RV l'Europe
Date	22/05/23	22/05/23	22/05/23	22/05/23	22/05/23
Place	Toulon - Baie de la Garonne	Toulon - Baie de la Garonne	Toulon - Baie de la Garonne	Toulon - Baie de la Garonne	Toulon - Baie de la Garonne
Bottom depth (m)	15.19	15.19	15.19	15.19	16.18
Temperature (°C) at sphere depth	17.8	17.8	17.8	17.8	17.8
Salinity (psu) at sphere depth	38	38	38	38	38
TS of sphere (dB)	-42.4	-41.5	-39.6	-39	-44

Pulse duration (ms)	1.024	1.024	1.024	1.024	1.024
Ping rate	0.3	0.3	0.3	0.3	0.3
Rms beam	0.05	0.3	0.15	0.11	0.2
resulting gain (dB)	**26.44**	**25.95**	**25.29**	**26.39**	**27.52**
Sa corr (dB)	-0.59	-0.55	-0.34	-0.3	-0.36
Beam width atwarth°	6.94	6.69	7.13	6.58	6.97
Beam width along°	6.99	6.69	7.22	6.67	6.97
Atwarth offset°	-0.01	-0.09	-0.02	-0.09	0.05
Along offset°	0.03	0.04	0.04	-0.16	0.03

d) Survey design

The survey design is made of 9 parallel transects (min and max lengths are 13 and 42 nautical miles) perpendicular to the coastline and 12 nm apart, from the 15 m isobath to the 200 m one. In 2023 total nautical miles effectively used for acoustic analysis (minus pelagic trawls tracks and linking transects) were 274.

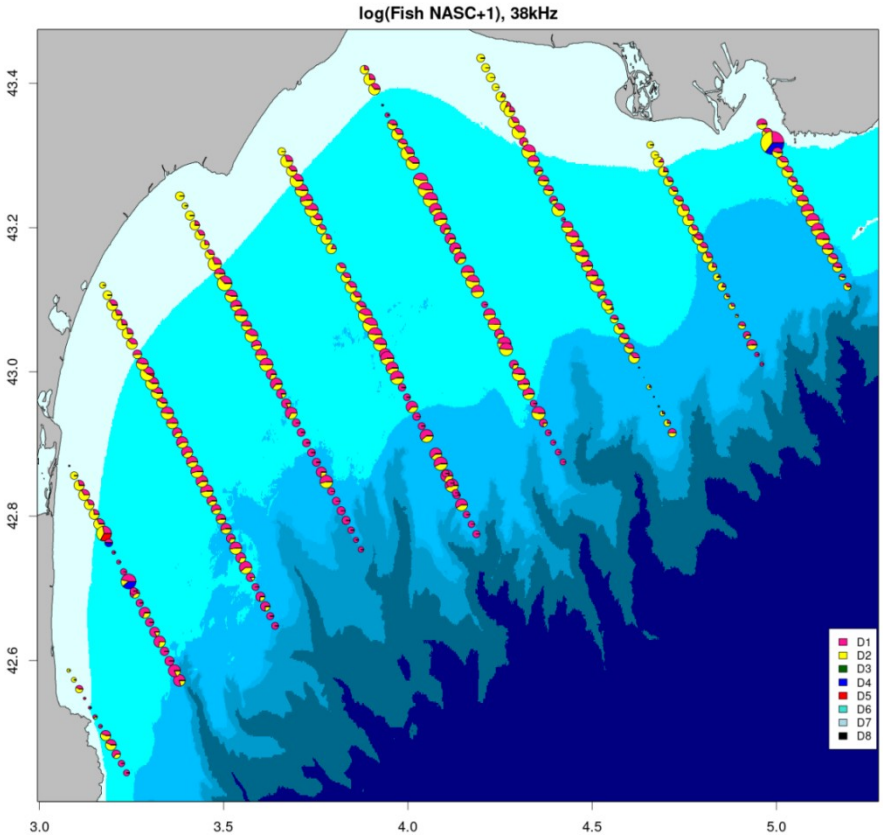


Figure 2.2.1. The survey design in GSA 7 (MEDIAS. 2023). The size of the pie charts is proportional to the log(Fish NASC+1) while the color shows the echotyping result.

e) Fish sampling

Echotraces are identified with a pelagic haul. Twenty-seven (27) pelagic hauls were then carried out in GSA07 to be used for the scrutinizing of the echograms (Fig. 2.2.2). Each time a fish trace was observed for at least 2 nm on the echogram, the boat turned around to conduct a 30 min-trawl at 4 $nm.h^{-1}$ in order to evaluate the proportion of each species (by randomly sampling and sorting of the catch before counting and weighing each individual species). Acoustic recording and trawl hauls are performed during daytime. The pelagic net used has headline length of 83.2m, a sideline dimension of 65.20 m and a codend mesh size of 18mm.

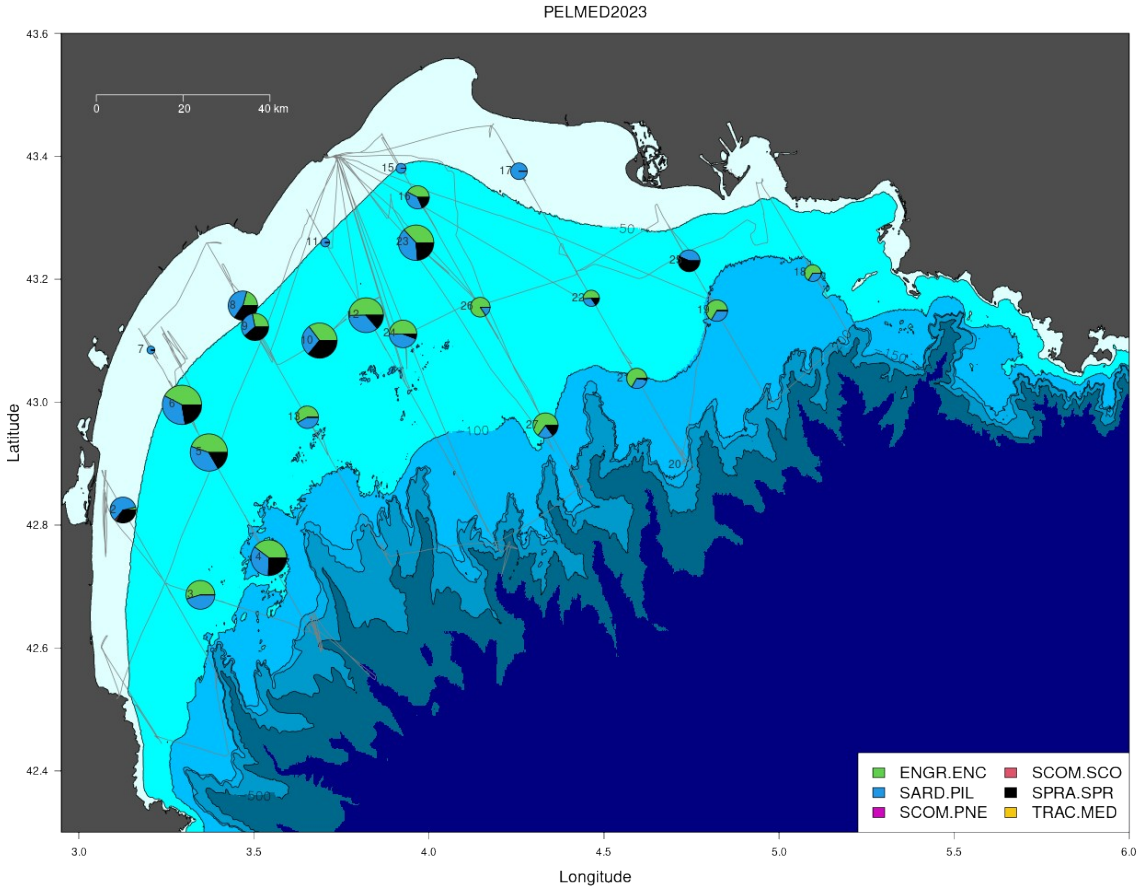


Figure 2.2.2. Catch compositions of pelagic hauls (27) carried out in GSA07 during the French acoustic survey MEDIAS 2023.

f) Oceanographic parameters

Thirty-three hydrological stations have been sampled using a SBE 19plus V2 CTD which measures conductivity, temperature, pressure, fluorescence, PAR (Photosynthetically active radiation), pH, oxygen and turbidity (Fig. 2.2.3). Zooplankton was sampled through WP2 vertical nets, while phytoplankton was sampled through Niskin bottles in subsurface (5m depth).

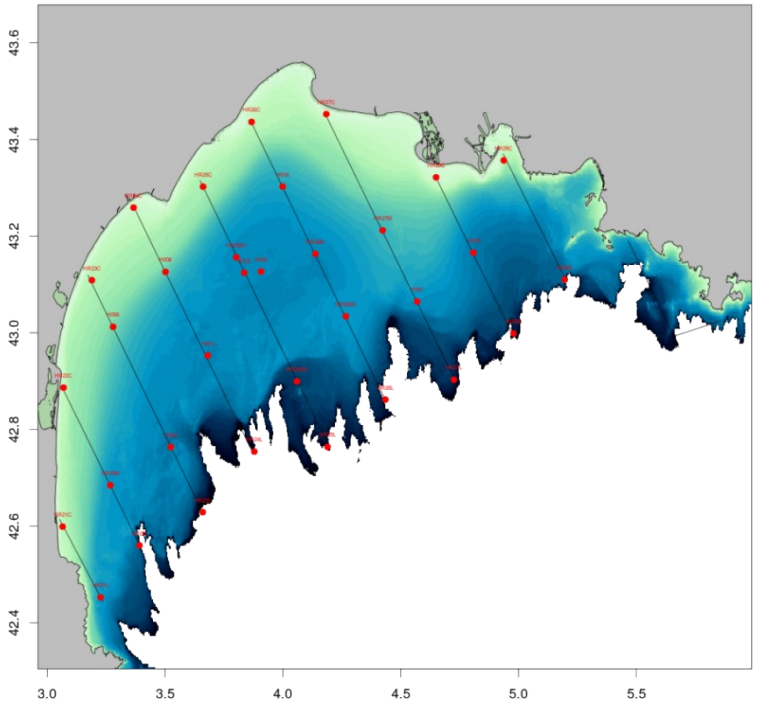


Figure 2.2.3. CTD stations (33) carried out during the French acoustic survey MEDIAS 2024.

g) Biomass estimations of target species

Acoustic data analyses (stock estimation. length-weight relationships. etc.) were performed using R scripts (EchoR package). The sardine and anchovy biomasses were estimated to be respectively 69555t and 33832t in 2023. The CVs of geostatistical simulations were 3.6 and 0.6 % while the CV associated to Hauls / ESDUs associations were 14 % and 12 % for respectively for sardine and anchovy.

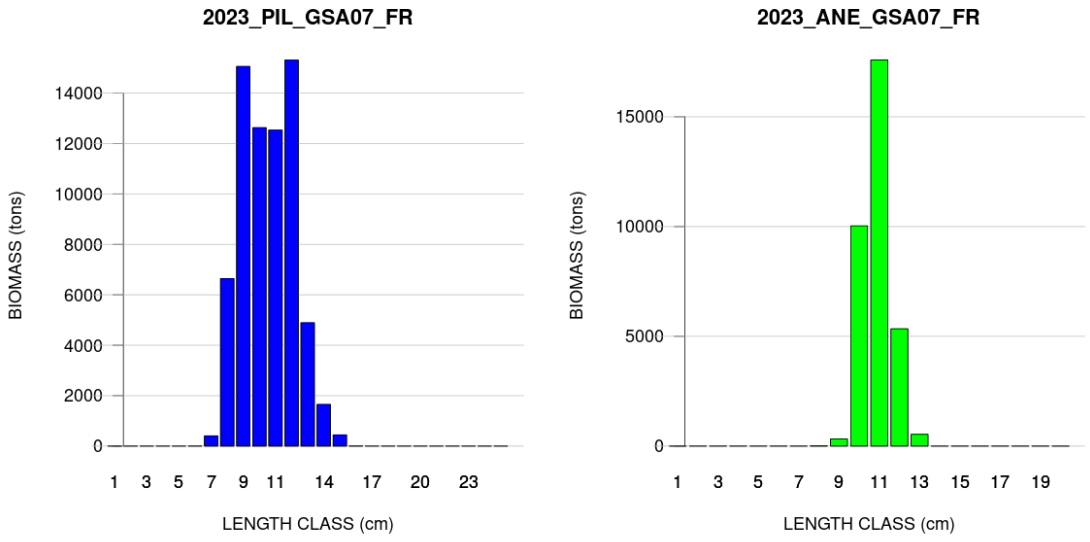


Figure 2.2.4. Biomass estimates per length classes for sardine and anchovy (MEDIAS 2023).

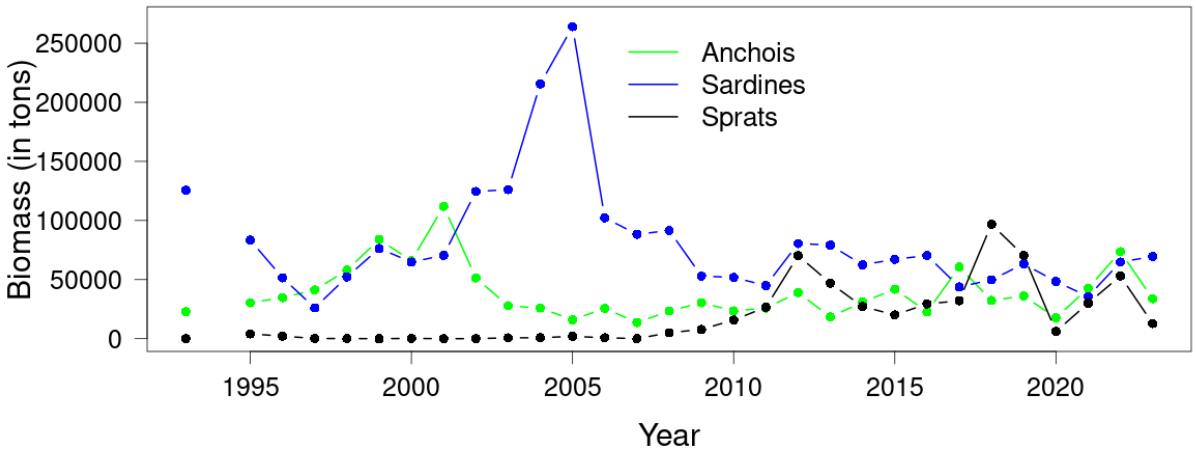


Figure 2.2.5. Long-term biomass estimates in GSA 7 for anchovy, sardine and sprat (DCF-MEDIAS estimates have started in 2009).

Biomass per age was estimated for sardine and anchovy using otoliths reading and survey specific age-length keys (Fig. 2.2.6).

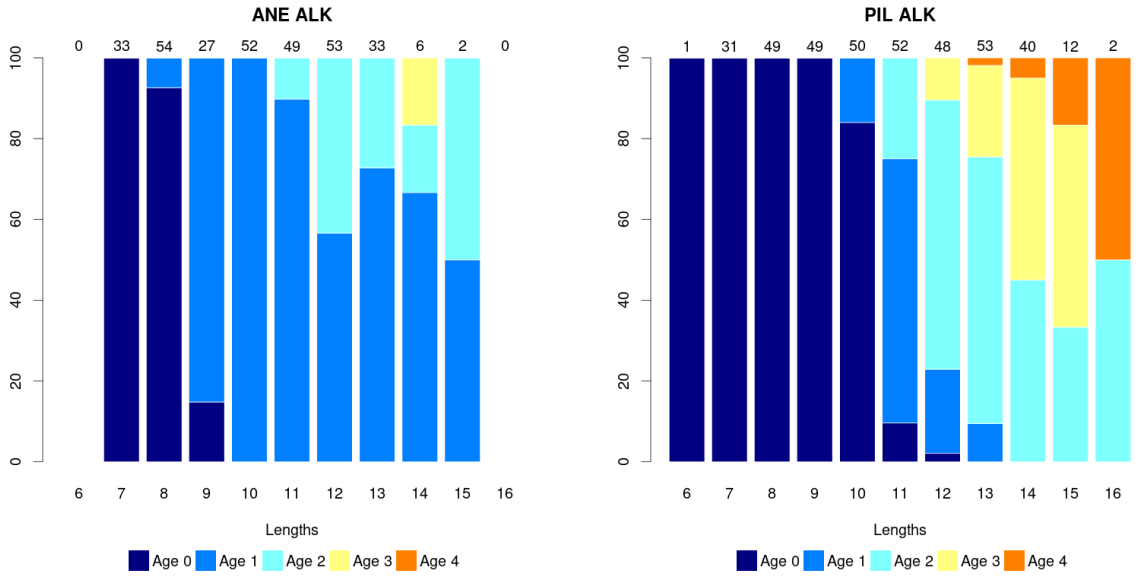


Figure 2.2.6. Age-length keys for sardine and anchovy in GSA 7 (MEDAIS 2023). The number of observations per size class are shown at the top of each bar in the barplot.

Sardine and anchovy population's age structures, estimated as biomass at age are shown in Fig. 2.2.7.

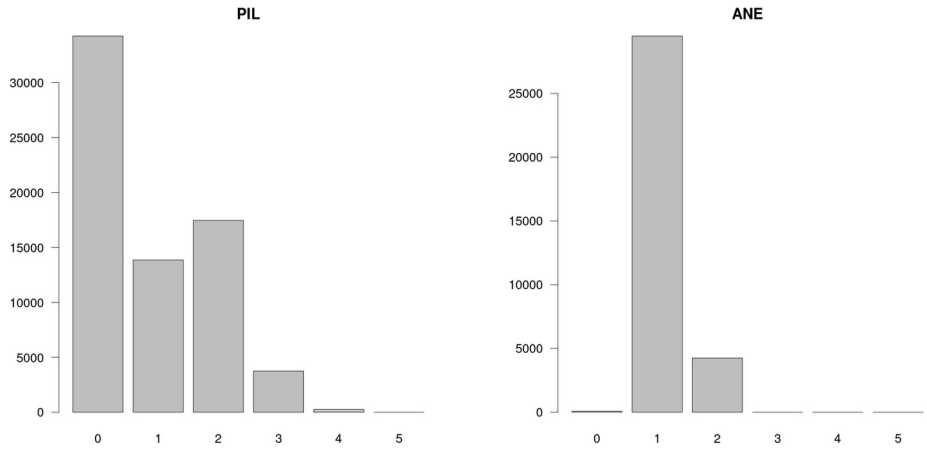


Figure 2.2.7. Biomass at age (in tons) estimates in MEDIAS 2023

h) Abundance indices of target species

Spatial distributions of abundance indices of sardine and anchovy in GSA 7 during MEDIAS 2023 are shown in Fig. 2.2.8.

Abundance at length estimates for sardines and anchovy are shown in Fig. 2.2.9. Long-term abundance estimates are shown in Fig. 2.2.10 and Fig. 2.2.11.

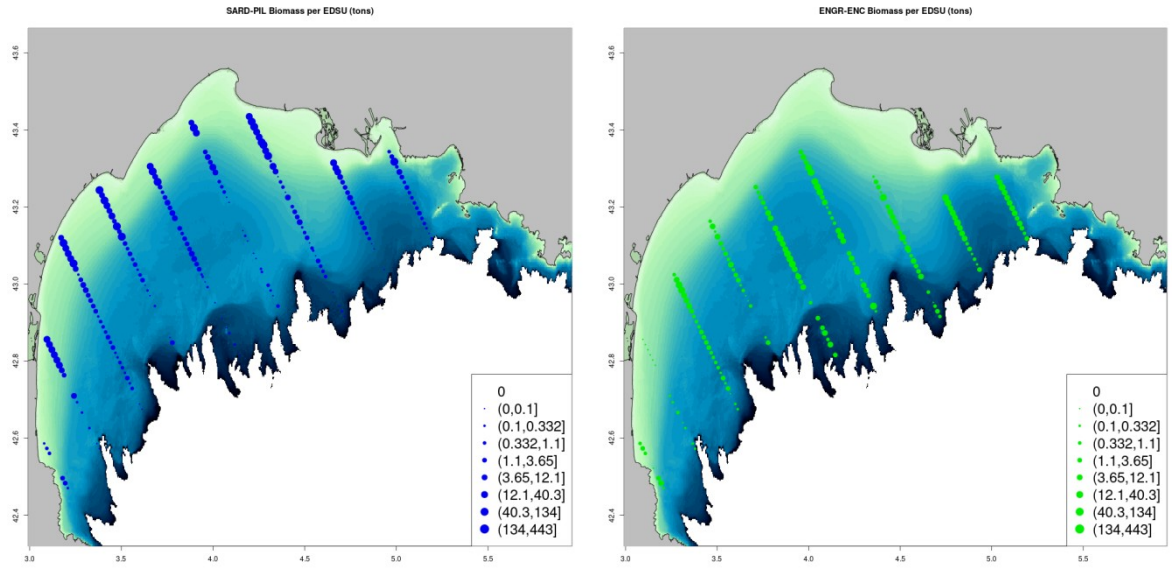


Figure 2.2.8. Spatial distributions of abundance indices of sardine (left) and anchovy (right) in GSA 7 during MEDIAS 2023.

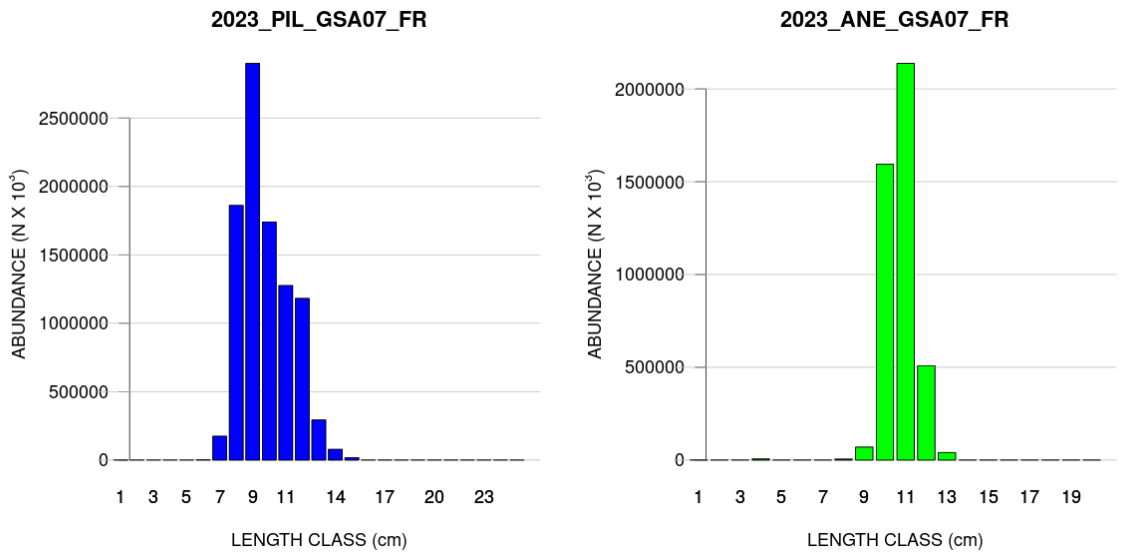


Figure 2.2.9. Abundance estimates per length classes for sardine and anchovy (MEDIAS 2023).

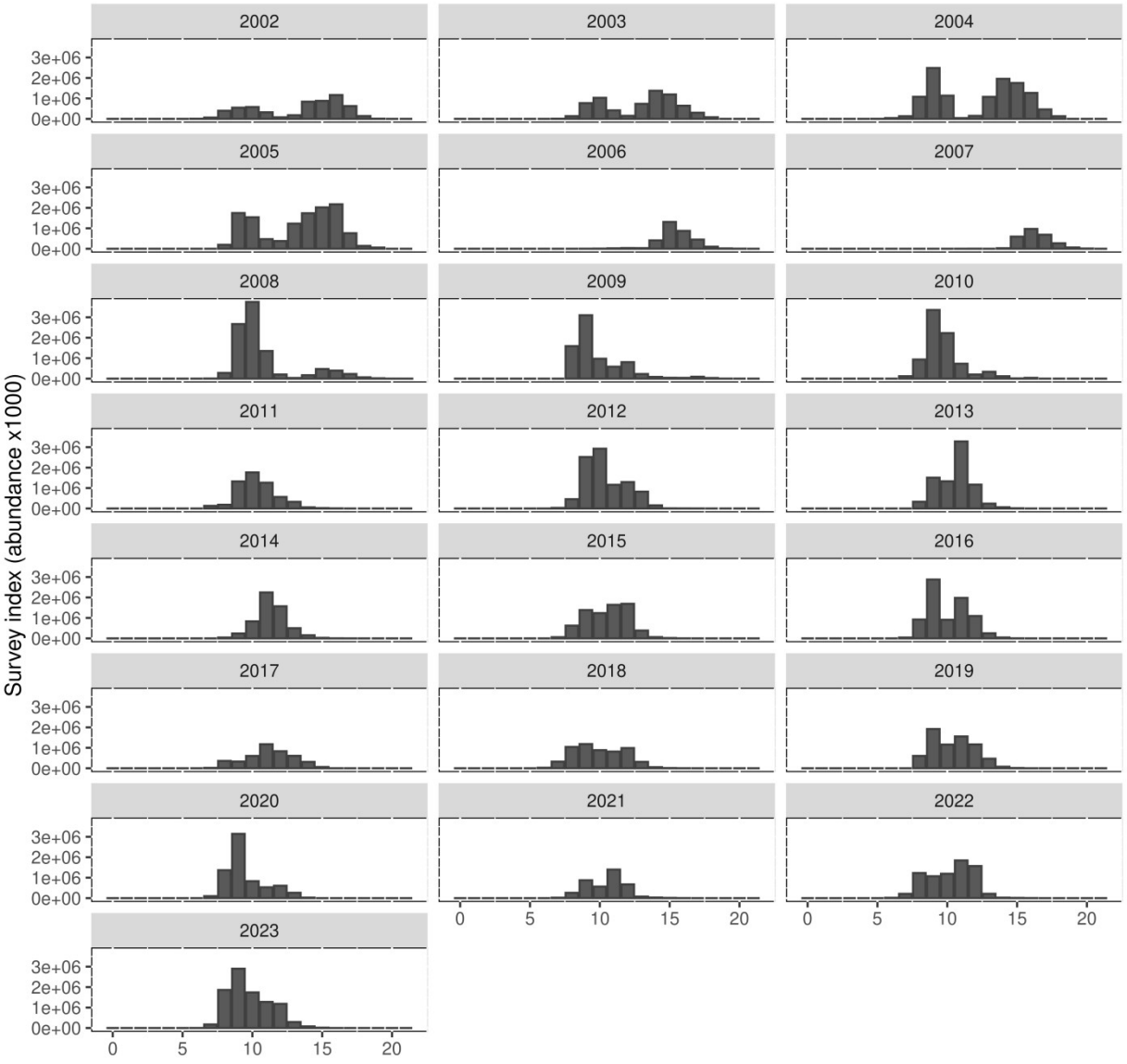


Figure 2.2.10. Length structured abundance estimates for sardine in GSA 07.

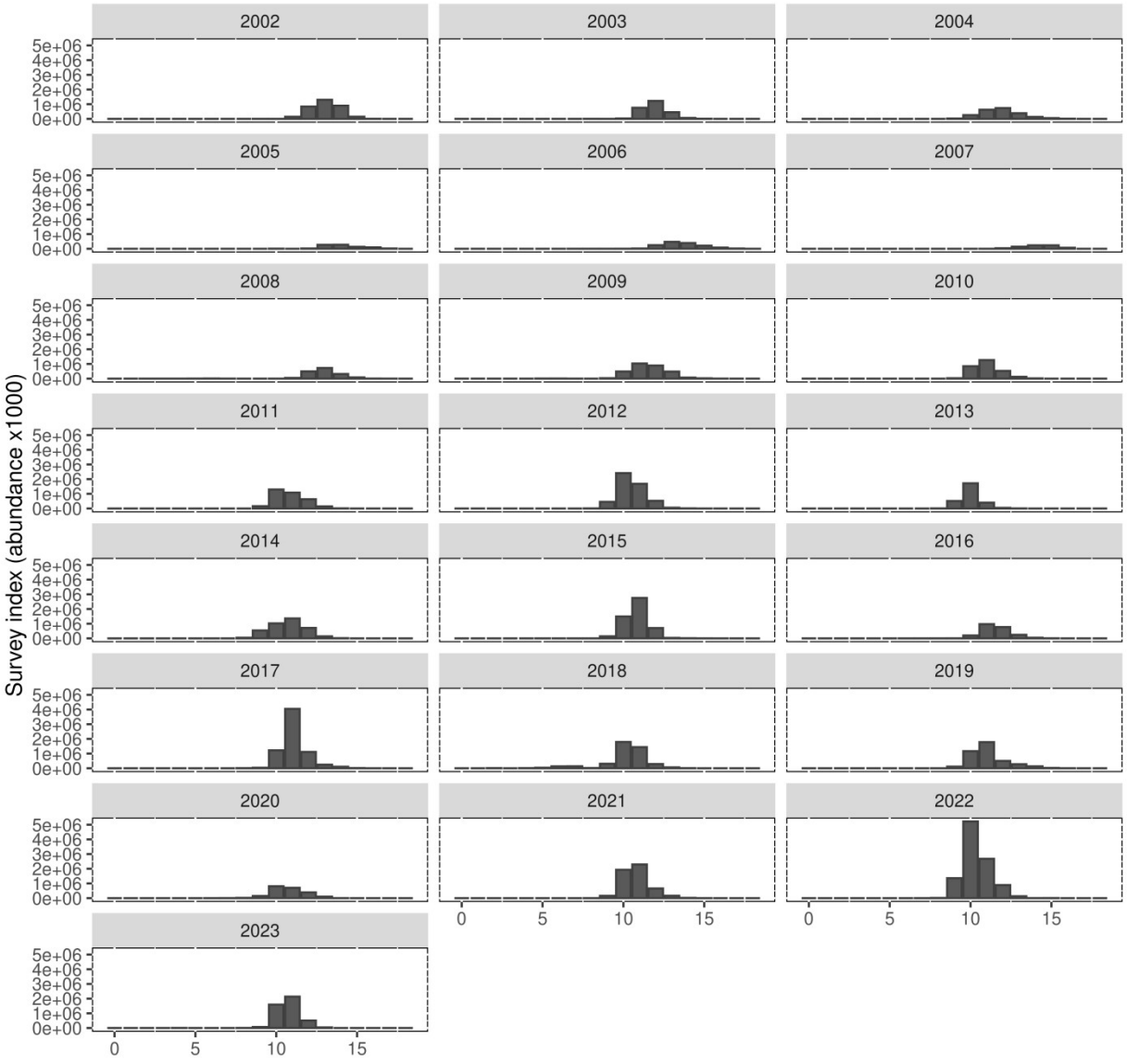


Figure 2.2.11. Length structured abundance estimates for anchovy in GSA 07.

Age-structured estimates from acoustic surveys, related to sardine and anchovy populations, are shown in Fig. 2.2.12 and Fig. 2.2.13.

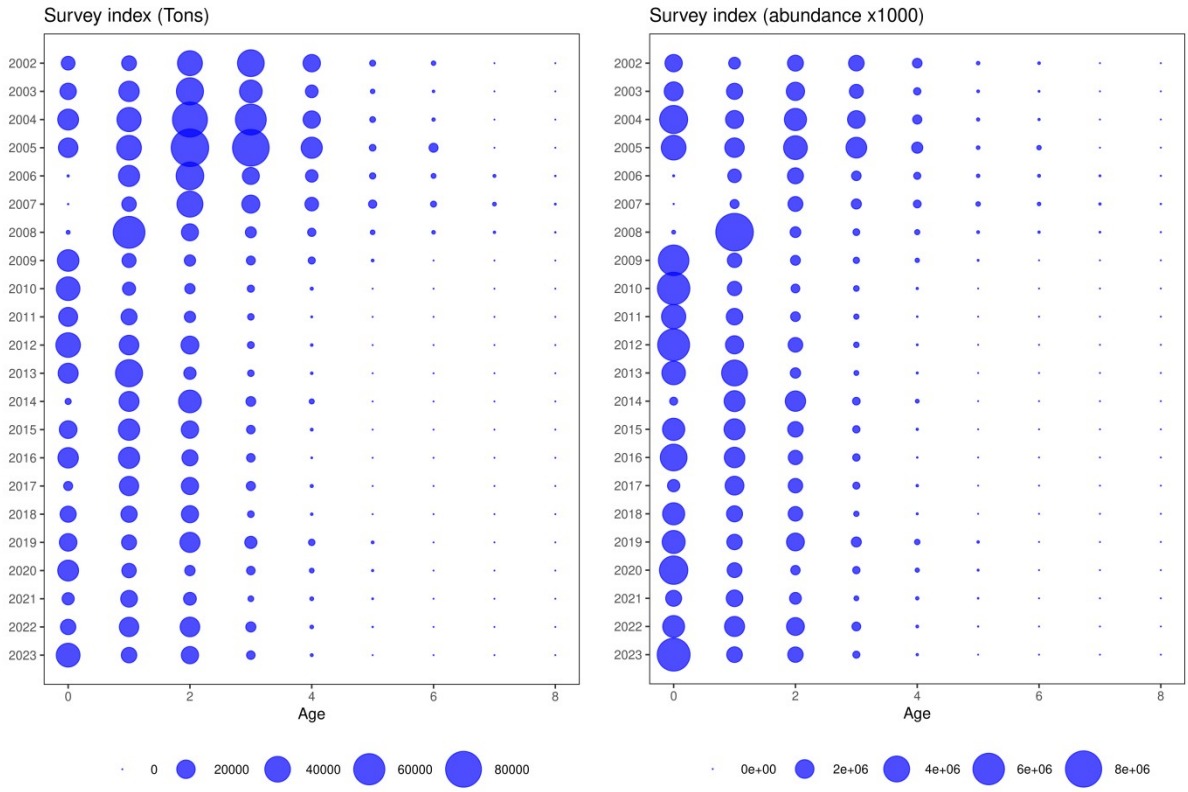


Figure 2.2.12. Age-structured estimates from acoustic surveys for sardine's population in GSA 7.

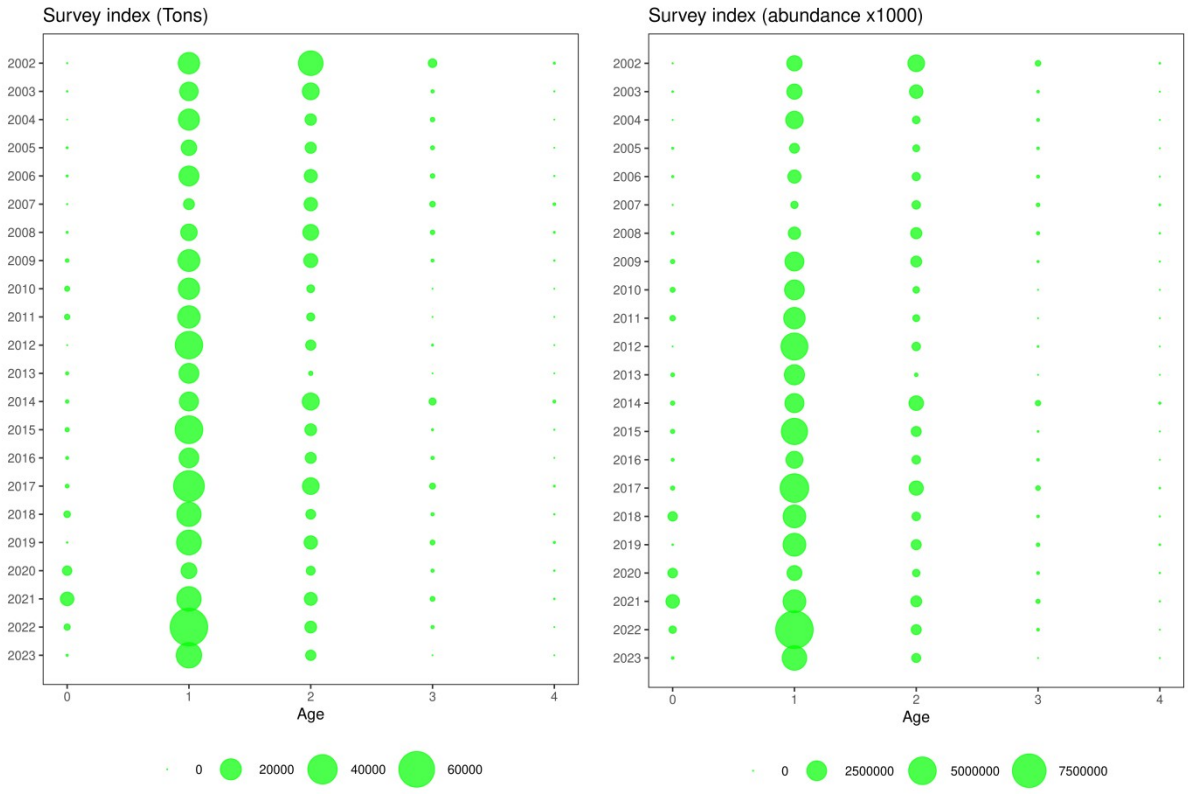


Figure 2.2.13. Age-structured estimates from acoustic surveys for anchovy's population in GSA 7.

2.3. MEDIAS 2023 in GSA 10 (ITA) – South Tyrrhenian Sea (Angelo Bonanno, Gualtiero Basilone, Marco Barra, Simona Genovese, Rosalia Ferreri, Giovanni Giacalone, Ignazio Fontana, CNR)

a) General information on the survey

MEDIAS 2023 in GSA 10 took place from July 21 to August 4 (lasts 14 days at sea) and covered the continental shelf in the central and south Tyrrhenian sea (2086 nm^2) with the fishery Research Vessel "G. Dallaporta" (35.7 m length, 1086 HP).

b) Type of echosounders and frequencies in use

A SIMRAD split beam echo sounder, working at 38, 70, 120 and 200 kHz, was used. The threshold for acquisition was –80 dB and that for processing for the assessment (38 kHz) was -60 dB. The pulse duration was 1.024 ms. The mean surveying acoustic vessel speed was 9 knots. The Echoview software was used to visualize and analyse acoustic data.

c) Calibration results

The acoustic system was calibrated in the Bay of Siracusa (37°02.810 N 15°16.948 E) on 27 July 2023.

Table 2.3.1. Calibration results in MEDIAS 2023.

Transducer Frequency	38 kHz	70 kHz	120 kHz	200 kHz
Transducer model	ES38-7	ES70-7C	ES120-7C	ES200-7C
Transducer serial no.	502	271	480	365
Bottom depth (m)	15	15	15	15
Temperature at sphere depth	27°C	27°C	27°C	27°C
Salinity (PSU) at sphere depth	39.2	39.2	39.2	39.2
TS of copper sphere (dB)	-33.6	-39.1	-40.4	-45.0
Pulse duration (ms)	1.024	1.024	1.024	1.024
Ping interval (s)	1	1	1	1
RMS	0.26	0.25	0.35	0.81
Transducer gain (dB)	24.82	24.78	23.58	24.08
Sa corr. (dB)	-0.36	-0.29	-0.40	-0.50
Athw. Beam angle (deg)	6.86	6.69	6.68	7.61
Along Beam angle (deg)	6.67	6.51	6.59	6.85
Athw. Offset Beam angle (deg)	0.13	0.05	-0.16	-0.20
Along Offset Beam angles (deg)	0.14	-0.10	-0.07	-0.04

d) Survey design

Most of the survey design is made of parallel transects perpendicular to the coastline, from the 10-20 m isobath to the 200 m one. Due to the narrow continental shelf along the northern coast of Sicily and the western coast of Calabria, a zig-zag transects design was adopted. The total length of the route covered by the survey was 954 nm, while the number of EDSUs

effectively used for acoustic analysis (minus pelagic trawls tracks and linking transects) was 918.

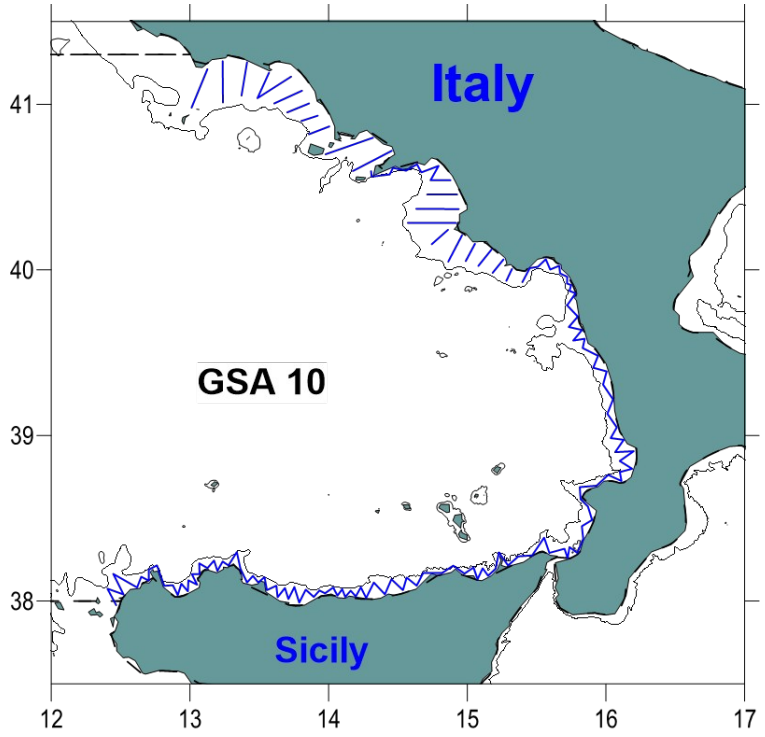


Figure 2.3.1. Acoustic survey design. MEDIAS 2023 in GSA 10.

e) Fish sampling

Pelagic fishes are identified with a pelagic haul. In summer 2023, twenty (20) pelagic hauls were carried out in GSA 10 to be used for echograms scrutinizing (Fig. 2.3.2). Trawl hauls were performed during daytime.
The pelagic net used has a total length of 78 m (Cod end length 22 m), Cod end mesh size of 18 mm, and Vertical opening of 7 m, Horizontal opening 13 m, Initial mesh size 182x800 mm and Lateral mesh size 400 mm.

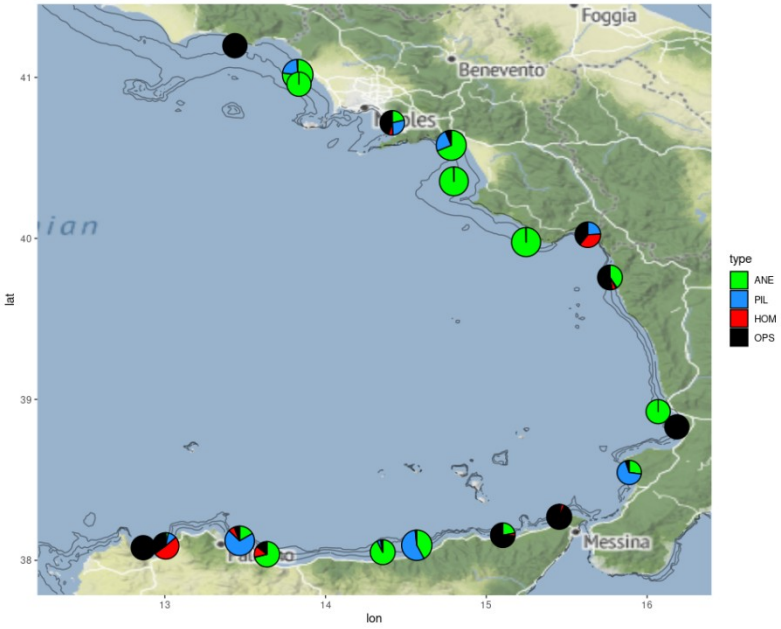


Figure 2.3.2. Map with pie charts reporting percentages in weight of anchovy, sardine and other species for hauls carried out during the acoustic survey in GSA 10. MEDIAS 2023.

f) Oceanographic parameters

During the survey in summer 2023, 41 hydrological stations have been conducted in GSA 10 using a SBE19plus CTD which measures conductivity, temperature, pressure, fluorescence, oxygen and turbidity. (Fig. 2.3.3). Due to the bad weather conditions during the survey period, CTD data in some of the foreseen hydrological stations were not collected.

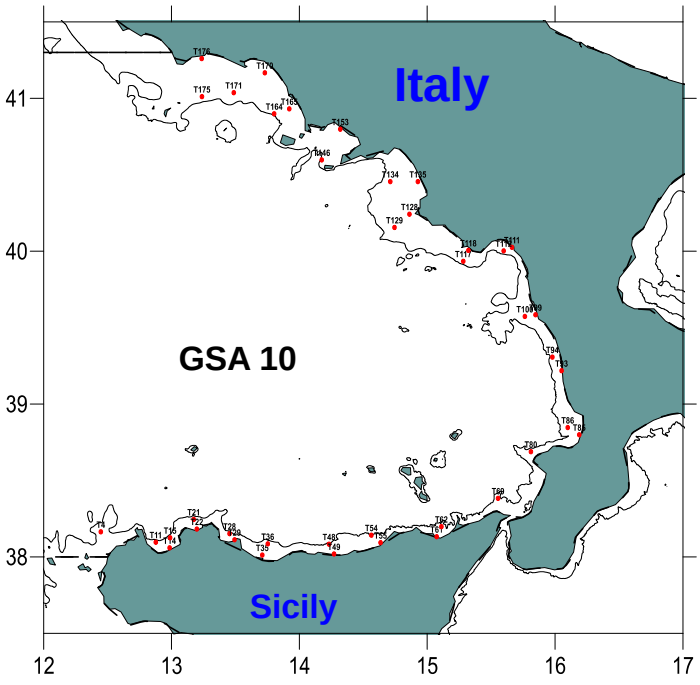


Figure 2.3.3. CTD stations performed during the echosurvey in GSA 10. MEDIAS 2023.

g) Biomass estimations of target species

The biomass estimation of sardine and anchovy in GSA 10, as well as the associated CVs of geostatistical simulations, are reported in the following table:

	GSA 10	
	Biomass (t)	CV
Anchovy	21226.6	11.5
Sardine	7811.3	24.4

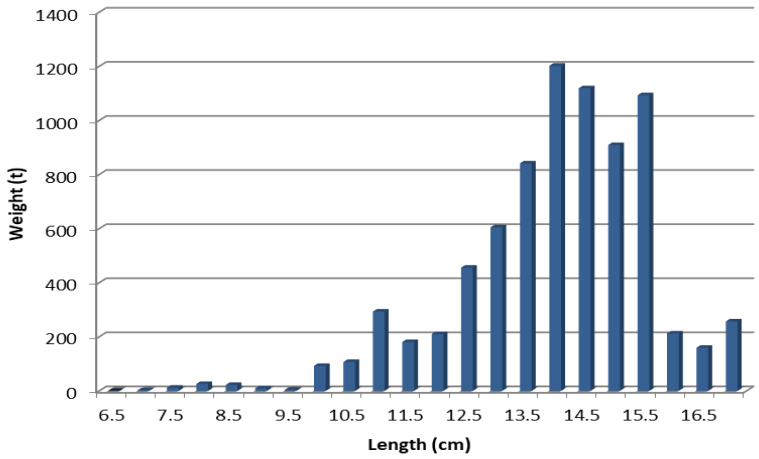


Figure 2.3.4. Sardine (PIL) biomass in tons by length (LFD) in GSAs 10. MEDIAS 2023.

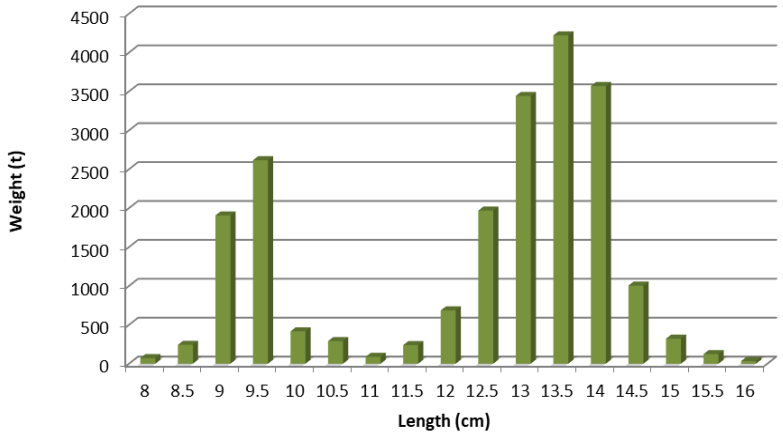


Figure 2.3.5. Anchovy (ANE) biomass in tons by length (LFD) in GSA 10. MEDIAS 2023.

Age length key (ALK) for sardine in GSA 10, MEDIAS 2023, was composed of three year classes. The number of otoliths readings was 281 (no. of individuals) (Fig. 2.3.6).

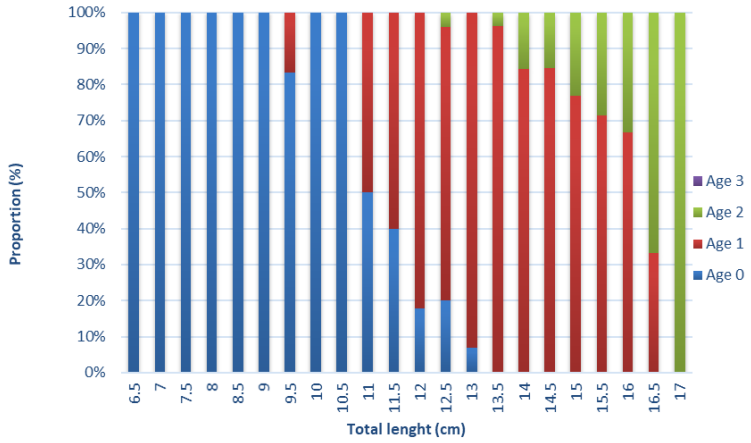


Figure 2.3.6. Sardine ALK in GSA 10, MEDIAS 2023.

Anchovy ALK in GSA 10 was composed by four year classes; the number of otoliths readings was 461 (no. of individuals).

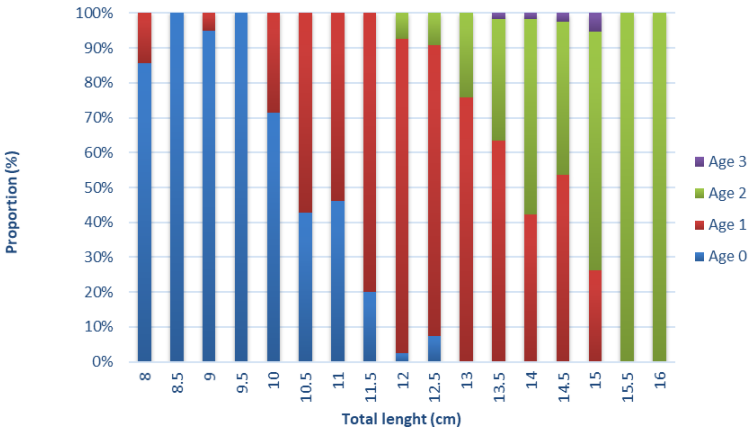


Figure 2.3.7. Anchovy ALK in GSA 10, MEDIAS 2023.

h) Abundance indices of target species

Spatial distribution of sardine and anchovy in GSA 10 in summer 2023 is shown in Fig. 2.3.8 and 2.3.9.

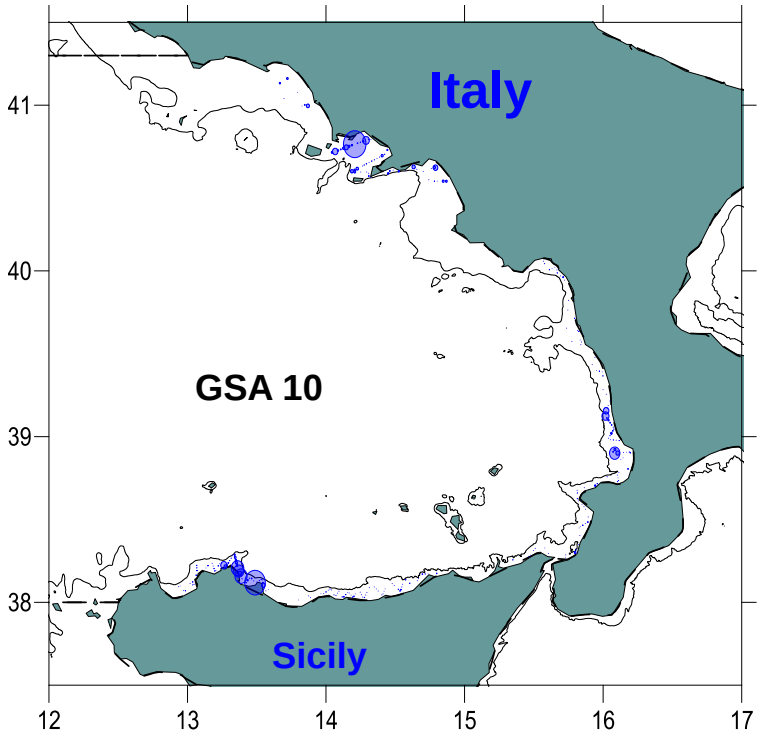


Figure 2.3.8. Sardine (PIL) spatial distribution in GSA 10. MEDIAS 2023.

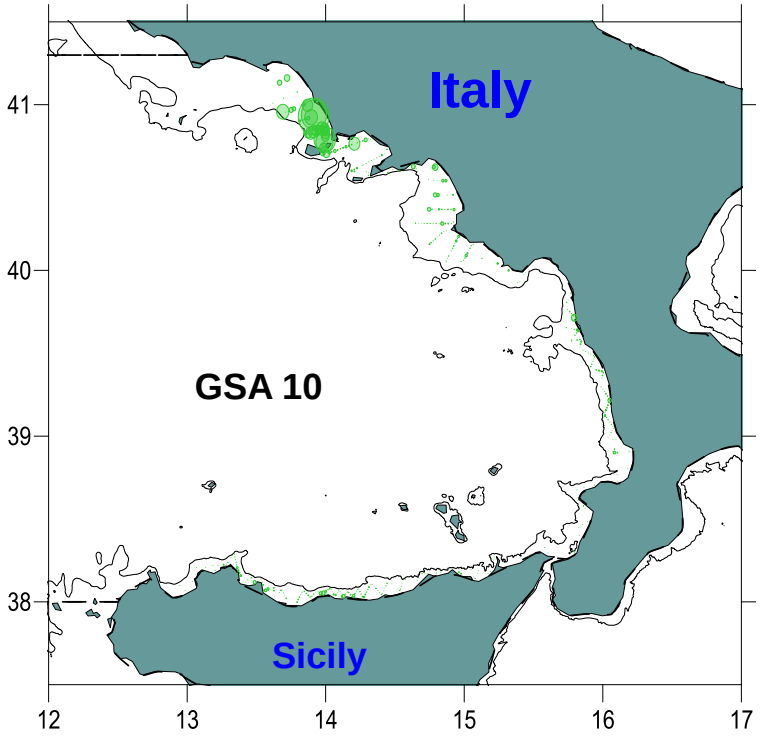


Figure 2.3.9. Anchovy (ANE) spatial distribution in GSA 10. MEDIAS 2023.

Abundance of sardine (*Sardina pilchardus*) in GSA 10 is reported in Fig. 2.3.10. During this survey, the presence of smaller specimens is less evident than in previous surveys in GSA 10.

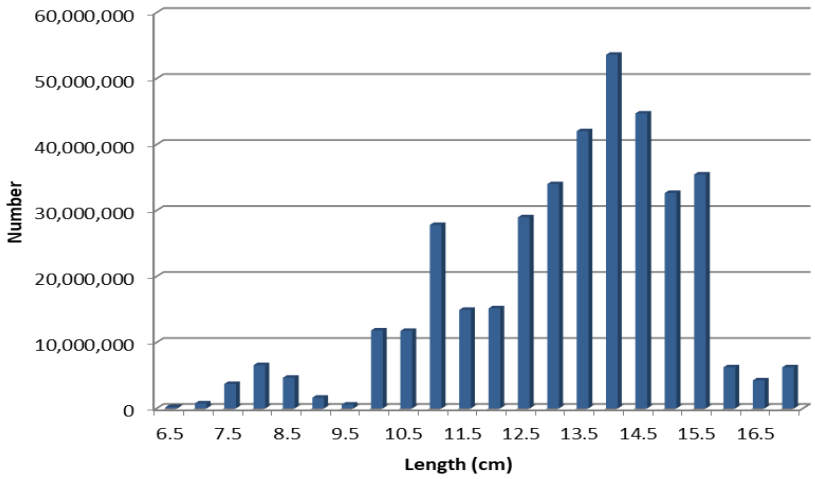


Figure 2.3.10. Sardine (PIL) abundance in numbers by length (LFD) in GSA 10. MEDIAS 2023.

Abundance of anchovy (*Engraulis encrasicolus*) estimated in GSA 10 revealed the presence of two modes centred at 9.5 and 13.5 cm (Fig. 2.3.11).

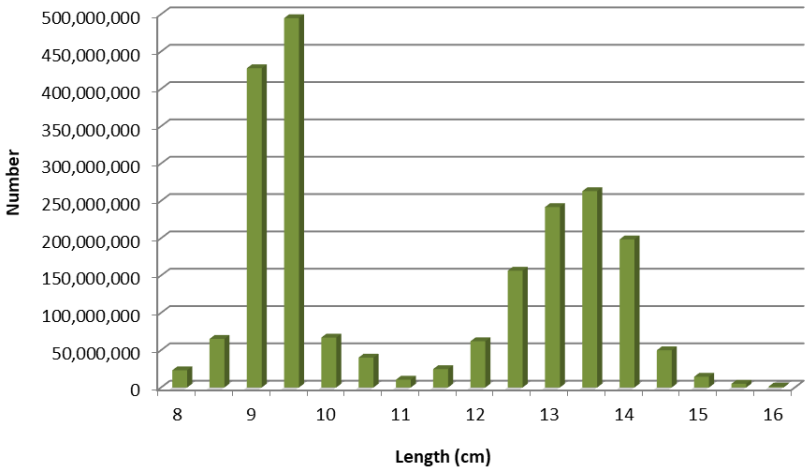


Figure 2.3.11. Anchovy (ANE) abundance in numbers by length (LFD) in GSA10. MEDIAS 2023.

2.4. MEDIAS 2023 in GSA 15 (MLT) – MALTA (Kelly Camilleri, Michelle Mizzi, Jurgen Mifsud, MAFA)

a) General information on the survey

MEDIAS 2023 acoustic survey was conducted between 17th July and 20th July 2023 (4 days at sea). It was conducted in the western GSA15, following MEDIAS protocol (MEDIAS Handbook, 2023) with the help of our Sicilian colleagues. The Vessel used was the Research/Survey Vessel G. Dallaporta (35.7m length, 1086HP).

b) Type of echosounders and frequencies in use

The equipment was composed by a split beam echo sounder used was SIMRAD EK60, with the 38, 70, 120 and 200 kHz frequencies. The threshold for acquisition was –80dB and that for processing was -60 dB with a pulse duration of 1.024 ms. The mean surveying acoustic vessel speed was 9 knots. The Echoview software was used to visualize and analyse acoustic data.

c) Calibration results

The acoustic system was calibrated in the Bay of Siracusa on 27 July 2023. The calibration results are reported in the section belonging to the MEDIAS 2023 in GSA 10.

d) Survey design

Acoustic data were collected through 6 parallel transects (Fig. 2.4.1). The total nautical miles effectively used for acoustic analysis (minus pelagic trawls tracks and linking transects) were 302.5.

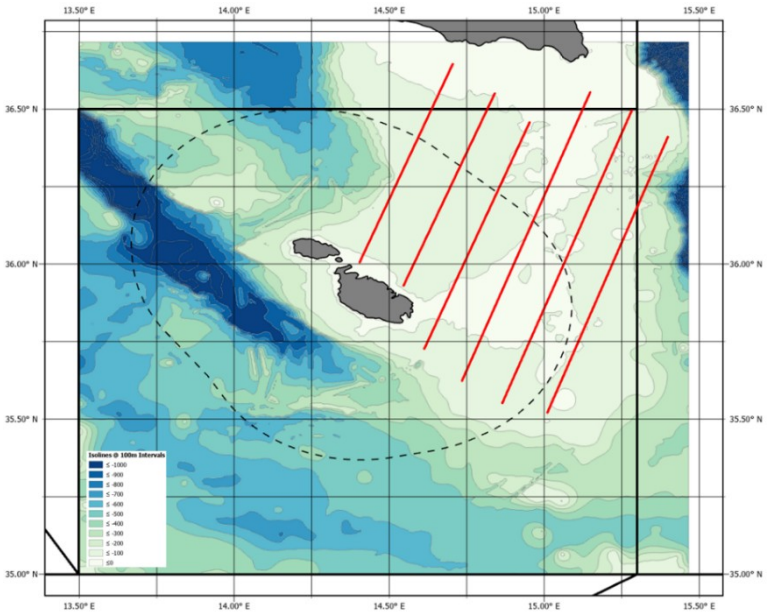


Figure 2.4.1. Acoustic survey design (show transects as lines). MEDIAS 2023.

e) Fish sampling

During the summer of 2023, seven pelagic hauls were conducted in GSA15; six out of the seven hauls were successful (Fig. 2.4.2). The echogram data collected was analysed and scrutinised using the software Echoview. The pelagic net used had a total length of 78m. The initial mesh size was 182 by 800mm with a lateral mesh size of 400mm. The Cod-end mesh had a mesh size of 18mm, with the vertical opening being 7m and the horizontal opening being 13m. Only anchovies were caught.

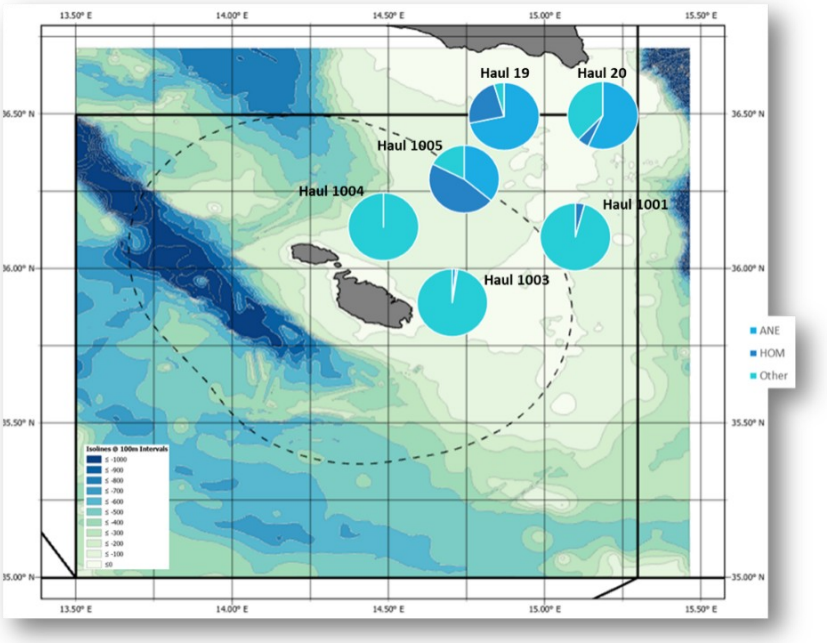


Figure 2.4.2. Pelagic hauls (7) composition carried out during the acoustic survey in GSA15. MEDIAS 2023.

f) Oceanographic parameters

During the survey in summer 2023, 27 hydrological stations have been conducted in GSA15 using a SBE 9/11plus CTD which measures conductivity, temperature, pressure, fluorescence, PAR (Photosynthetically active radiation), pH, oxygen and turbidity Fig. 2.4.3.

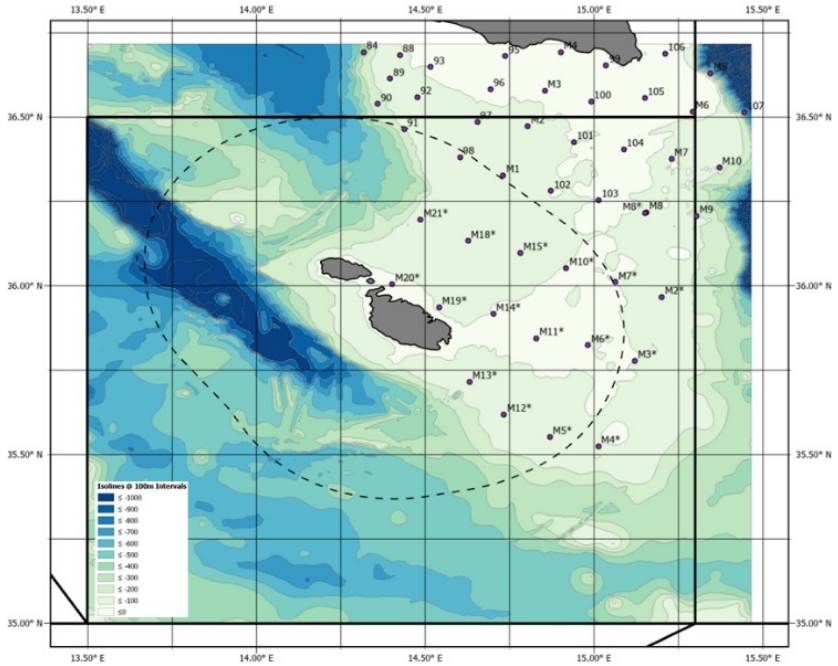


Figure 2.4.3. CTD stations (27) carried out during the acoustic survey in GSA15. MEDIAS 2023.

g) Biomass estimations of target species

The biomass estimations were only on Anchovy given that this species was only caught in GSA15 which included a biomass of 4048.800 tonnes (Fig. 2.4.4).

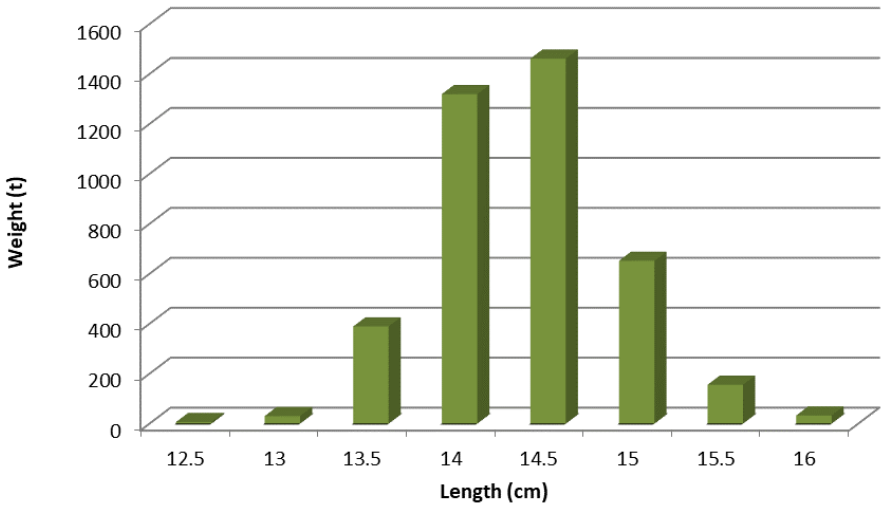


Figure 2.4.4. Anchovy (ANE) biomass in tons by length (LFD) in GSA15. MEDIAS 2023.

Age length key (ALK) for anchovy in GSA15, MEDIAS 2021, was composed by 3-year classes. The number of otolith readings was 428 (no. individuals) (Fig. 2.4.5).

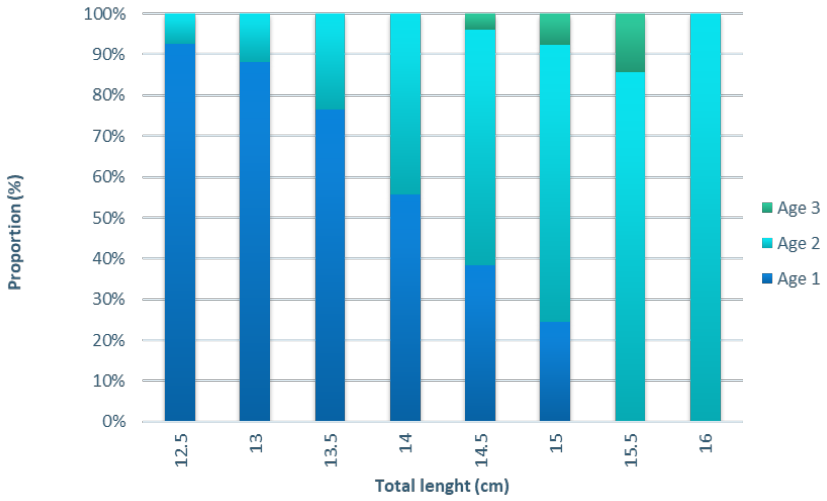


Figure 2.4.5. Anchovy ALK GSA15. MEDIAS 2023.

h) Abundance indices of target species

Spatial distribution of anchovy in GSA 15 in July 2023 is reported in Fig 2.4.6.

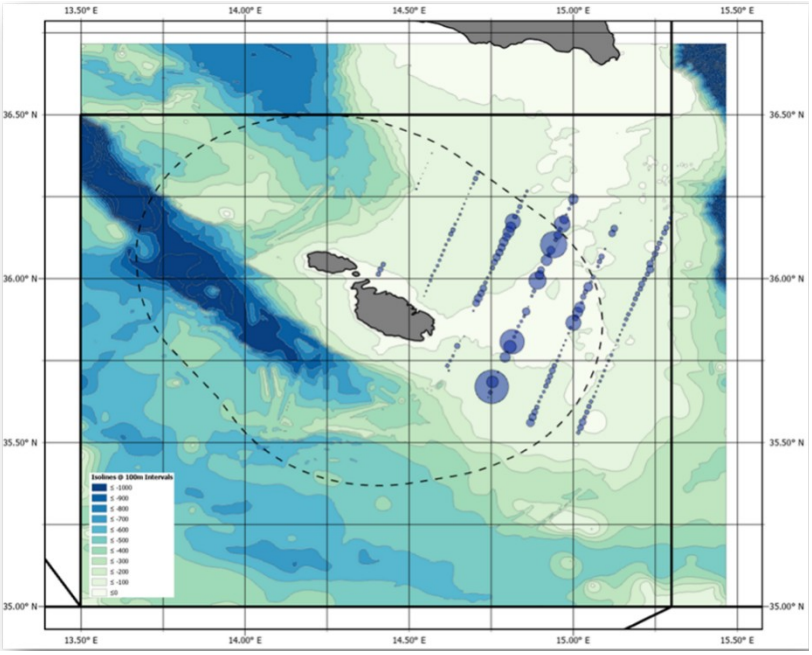


Figure 2.4.6. Anchovy (ANE) spatial distribution in GSA15 in July. MEDIAS 2023.

During this survey, the LFD is characterized by a main mode at 14.0 cm and two modes centered at 12cm and 15cm (Fig. 2.4.7).

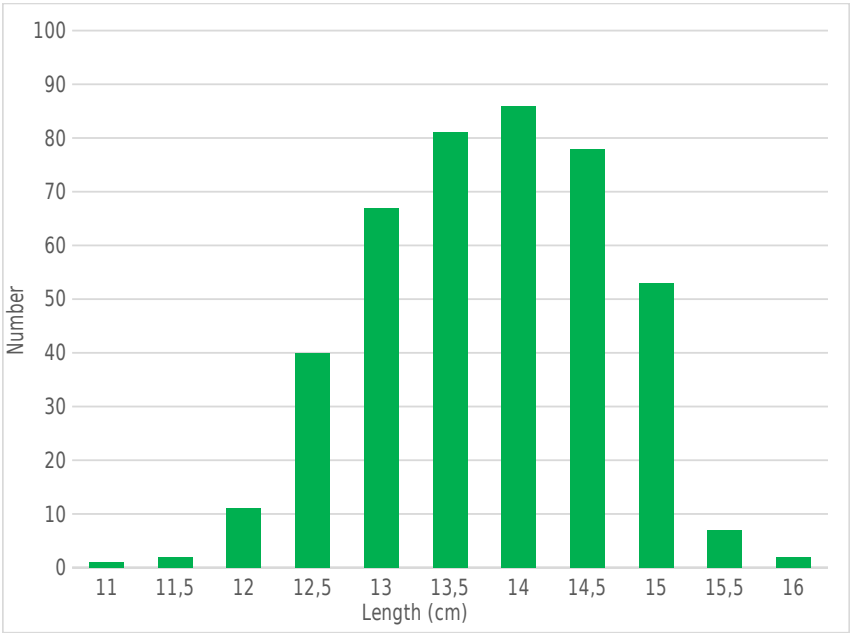


Figure 2.4.7. Anchovy (ANE) abundance in thousands by length (LFD) in GSA15. MEDIAS 2023.

2.5. MEDIAS 2023 in GSA 16 (ITA) – South Sicily (Angelo Bonanno, Gualtiero Basilone, Marco Barra, Simona Genovese, Rosalia Ferreri, Giovanni Giacalone, Ignazio Fontana, CNR)

a) General information on the survey

MEDIAS 2023 in GSA 16 took place from 10 to 21 July (lasts 12 days at sea) and covered the continental shelf along the southern coast of Sicily (3424 nm^2) with the fishery Research Vessel "G. Dallaporta" (35.7 m length, 1086 HP).

b) Type of echosounders and frequencies in use

A SIMRAD split beam echo sounder, working at 38, 70, 120 and 200 kHz, was used. The threshold for acquisition was –80 dB and that for processing for the assessment (38 kHz) was -60 dB. The pulse duration was 1.024 ms. The mean surveying acoustic vessel speed was 9 knots. The Echoview software was used to visualize and analyse acoustic data.

c) Calibration results

The acoustic system was calibrated in the Bay of Siracusa on 27 July 2023. The calibration results are reported in the section belonging to the MEDIAS 2023 in GSA 10.

d) Survey design

The survey design is made of 30 parallel transects (min and max lengths are 7 and 43 nautical miles) perpendicular to the coastline, from the 10-20 m isobath to the 200 m one; a small part of the survey, located in the easternmost area, adopted a zig-zag design due to the very narrow extension of the continental shelf. In summer 2023, the total length of the route covered by the survey was 907 nm, while the number of EDSUs effectively used for acoustic analysis (minus pelagic trawls tracks and linking transects) was 886.

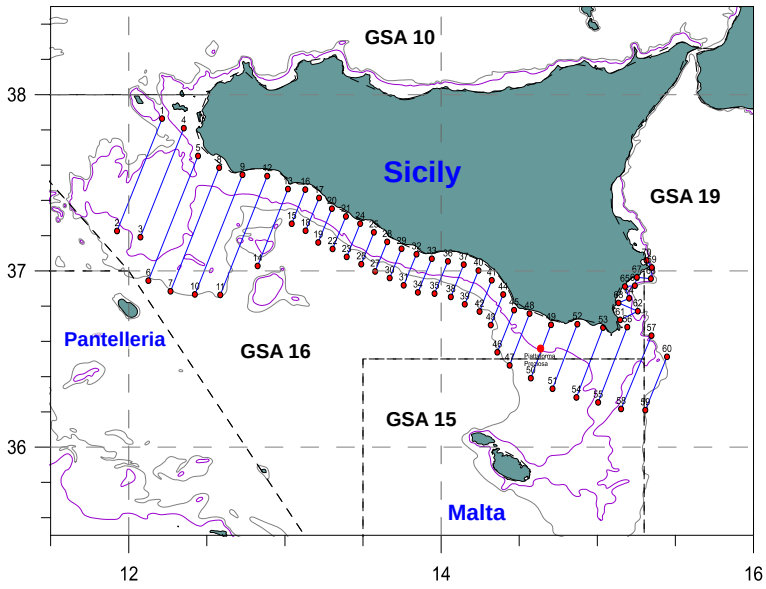


Figure 2.5.1. Acoustic survey design in GSA 16. MEDIAS 2023.

e) Fish sampling

Pelagic fishes are identified with a pelagic haul. In summer 2023, twenty-one (21) pelagic hauls were carried out in GSA 16 to be used for echograms scrutinizing. Trawl hauls performed during day time both in GSA 16 and in GSA 15 are shown in Fig 2.2.2. The pelagic net used has a total length of 78 m (Cod end length 22 m), Cod end mesh size of 18 mm, Vertical opening of 7 m, Horizontal opening 13 m, Initial mesh size 182x800 mm and Lateral mesh size 400 mm.

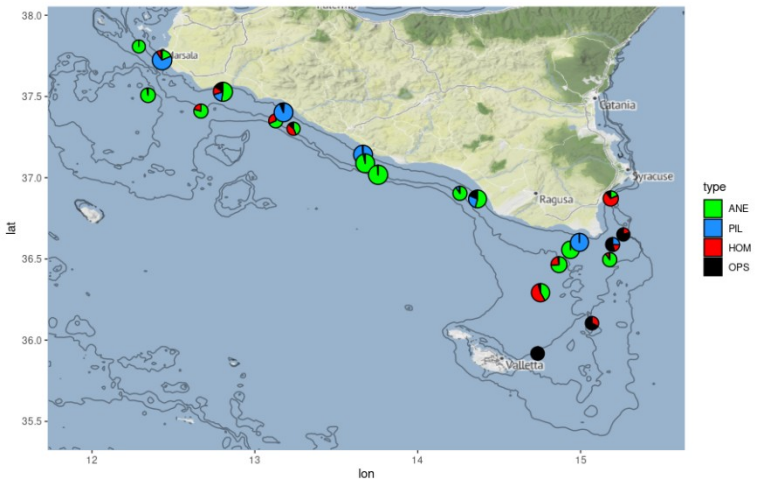


Figure 2.5.2. Map with pie charts reporting percentages in weight of anchovy, sardine and other species for hauls carried out during the acoustic survey in GSA 15. MEDIAS 2023.

f) Oceanographic parameters

During the survey in summer 2023, 97 hydrological stations have been conducted in GSA 16 using a SBE19plus CTD which measures conductivity, temperature, pressure, fluorescence, oxygen and turbidity (Fig. 2.5.3).

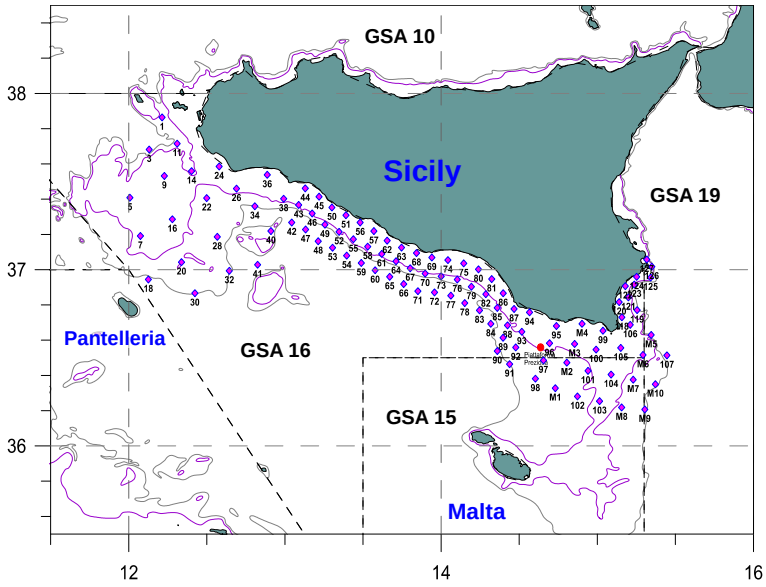


Figure 2.5.3. CTD stations performed during the echosurvey in GSA16. MEDIAS 2023.

g) Biomass estimations of target species

The biomass estimations of sardine and anchovy in GSA 16, as well as the associated CVs of geostatistical simulations, are reported in the following table:

	GSA 16	
	Biomass (t)	CV
Anchovy	36516.4	16
Sardine	7873.9	19

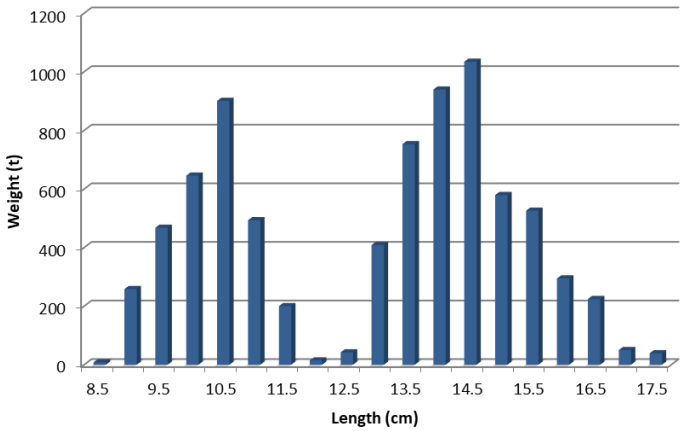


Figure 2.5.4. Sardine (PIL) biomass in tons by length (LFD) in GSA 16. MEDIAS 2023.

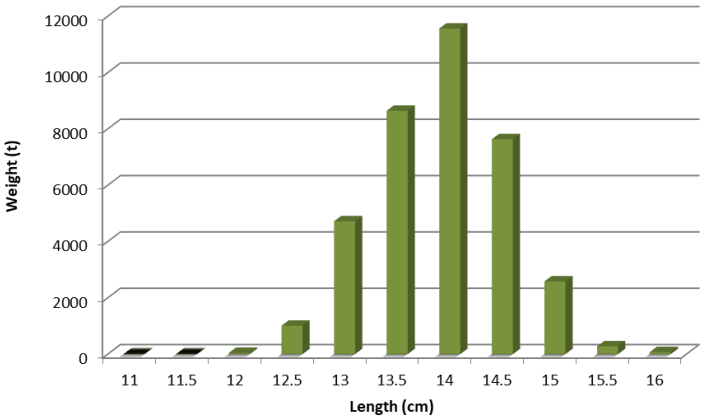


Figure 2.5.5. Anchovy (ANE) biomass in tons by length (LFD) in GSA 16. MEDIAS 2023.

Age length key (ALK) for sardine in GSA 16, MEDIAS 2023, was composed of four year classes. The number of otoliths readings was 301 (no. of individuals) (Fig. 2.5.6).

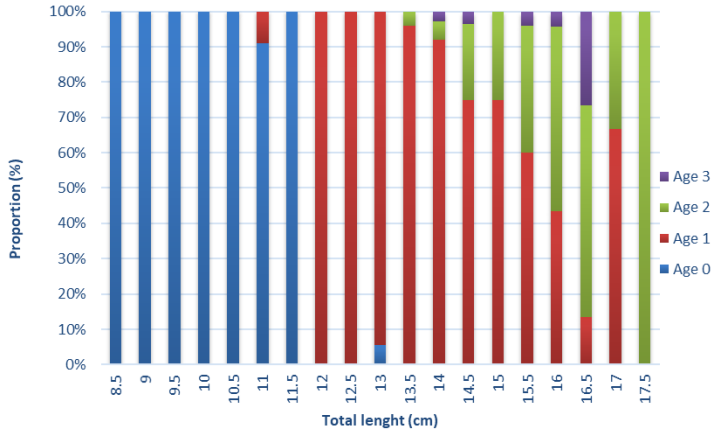


Figure 2.5.6. Sardine ALK in GSA 16. MEDIAS 2023.

Anchovy ALK in GSA 16, MEDIAS 2023, was represented by four year classes; the number of otoliths readings was 428 (no. of individuals) (Fig. 2.5.7).

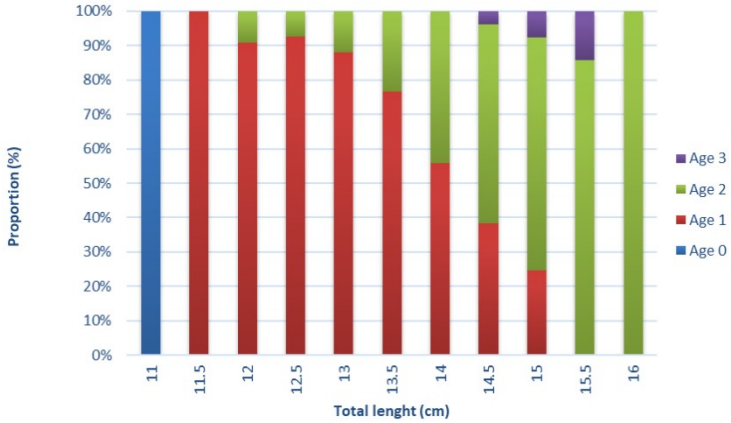


Figure 2.5.7. Anchovy ALK in GSA 16. MEDIAS 2023.

h) Abundance indices of target species

Spatial distribution of sardine and anchovy in GSA 16 in summer 2023 is shown in Fig 2.5.8 and 2.5.9, respectively.

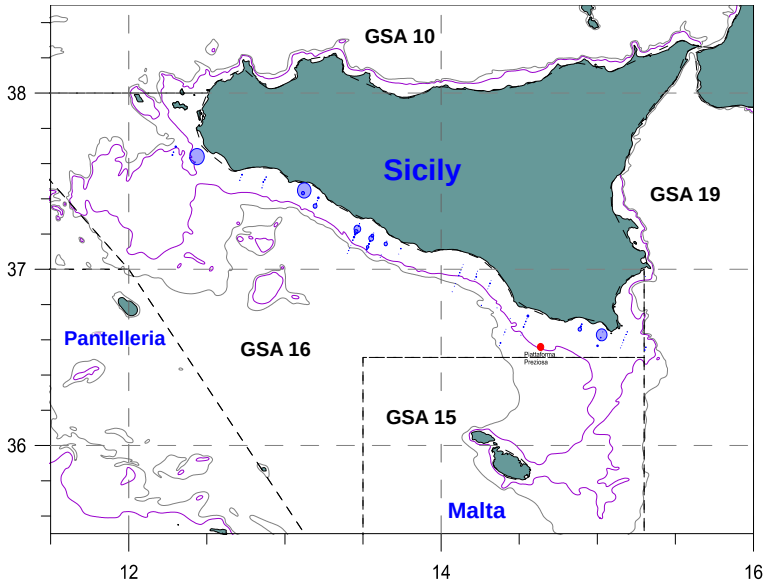


Figure 2.5.8. Sardine (PIL) spatial distribution in GSA 16. MEDIAS 2023.

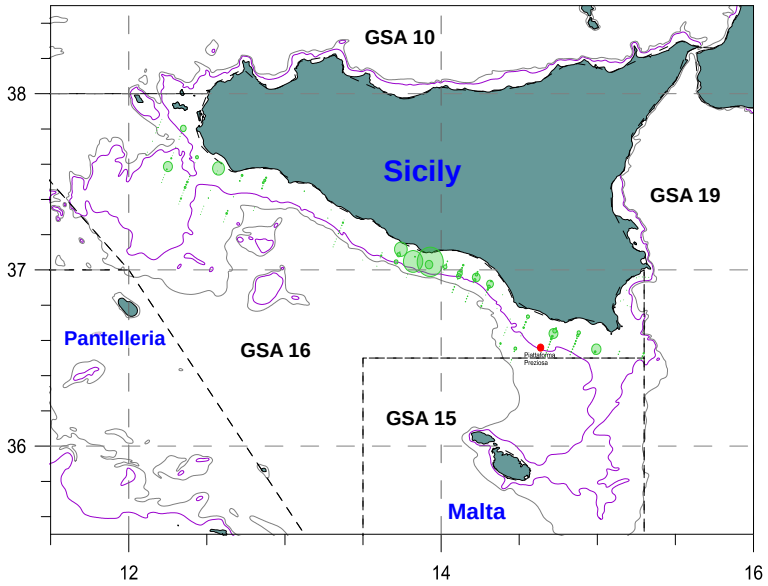


Figure 2.5.9. Anchovy (ANE) spatial distribution in GSA 16. MEDIAS 2023.

Abundance of sardine (*Sardina pilchardus*) in GSA 16 reported in Fig. 2.5.10. During this survey, the LFD is characterized by two modes centered at 10.5 cm and 14 cm.

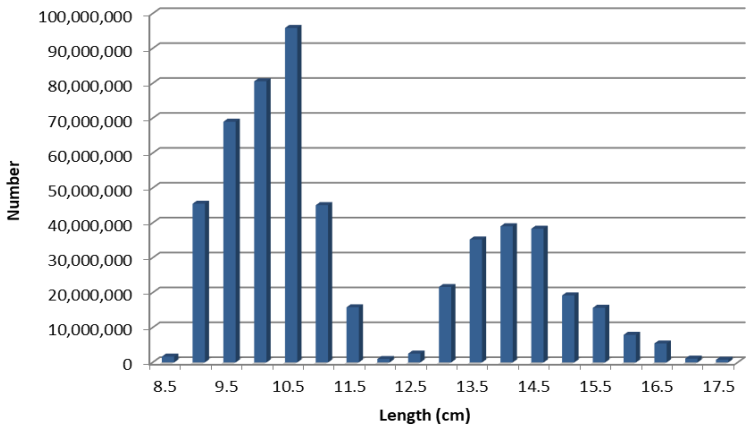


Figure 2.5.10. Sardine (PIL) abundance in numbers by length (LFD) in GSA 16, MEDIAS 2023.

Abundance of anchovy (*Engraulis encrasicolus*) estimated in GSA 16 revealed an unimodal structure for LFD centered at 14 cm (Fig. 2.5.11).

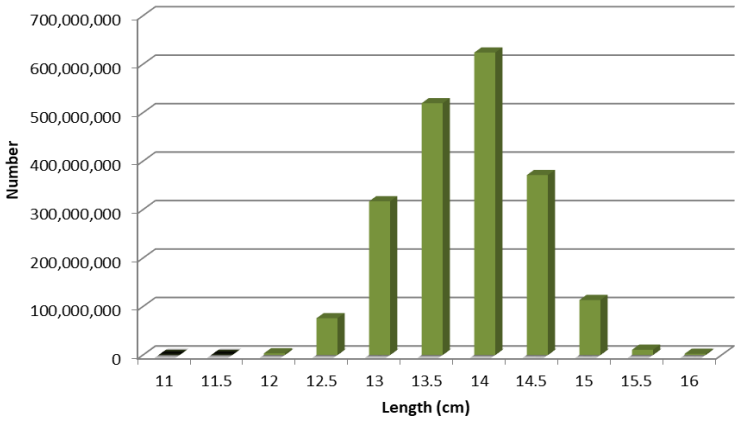


Figure 2.5.11. Anchovy (ANE) abundance in numbers by length (LFD) in GSA 16, MEDIAS 2023.

2.6. MEDIAS 2023 in the eastern part of the Adriatic Sea (HRV) – GSA 17 - Northern Adriatic Sea (Juretić Tea, Gašparević Denis, Boban Marija, et al., IOR)

a) General information on the survey

Acoustic survey on the eastern part of GSA 17 in 2023 was performed from 25.08. to 04.10.2023. Acoustic survey in Slovenian territorial waters was performed on 02.09.2023. For this purpose, in total, R/V BIOS DVA (length: 36m, engine power: 1200HP) was used for 37 days, in order to research the area of 13.578 NM2 (Croatian territorial waters) and 117 NM2 (Slovenian territorial waters).

b) Type of echosounders and frequencies in use

R/V BIOS DVA is equipped with SIMRAD scientific echosounder system (EK80), including GPT (38kHz) and WBT (120kHz) transceivers connected to hull-mounted transducers (ES38B and ES120-7). In line with MEDIAS Handbook, the principal frequency for the survey was 38 kHz, while 120 kHz acoustic equipment was used as complementary with aim to improve categorization of different acoustic targets. The system was operating with SIMRAD EK80 software. In order to improve the quality of acoustic data collected in the rough sea conditions, echosounder system is connected to the vessel's motion reference unit (MRU3).

c) Calibration results

The acoustic system on R/V BIOS DVA was calibrated on the 1st day of the survey (25.08.2023.) in the Kašuni Bay using the standard WC-sphere (38.1 mm) and EK80 software. Calibration results are shown in Table 2.6.1.

Table 2.6.1. Calibration of 38 kHz scientific sounder system at R/V BIOS DVA (MEDIAS, 2023)

Frequency (kHz):	**38**
Transducer model:	ES38B
Serial number:	30825
Date:	25.08.2023.
Latitude:	43°30,38022' N
Longitude:	16°23,79972' E
Bottom depth (m):	25
Temperature (C°):	18.362
Salinity (psu):	38.393
Beam Width Alongship:	6.82
Beam Width Athwartship:	6.98
Angle Offset Alongship:	0.01
Angle Offset Athwartship:	0.04
Transducer Gain (dB):	22.86
S_A Correction (dB):	-0.4776

Acoustic data calibration and processing has been done with Echoview software (Ver. 14.), considering Elementary Sampling Distance Unit (EDSU) of 1 NM and data integration depth range up to 200 m.

d) Survey design

Survey design in eastern part of GSA 17 (Croatia) (Fig. 2.6.1) is made of two long transects adapted to geomorphology of inner sea area (channel areas between small islands), and 30 parallel transects (direction: 43°-223°) in the open Adriatic (i.e. within Croatian territorial waters and EEZ). Inter-transect distance between parallel transects is 10 NM. Parallel transect lengths are in the range from 6 to 55 NM.

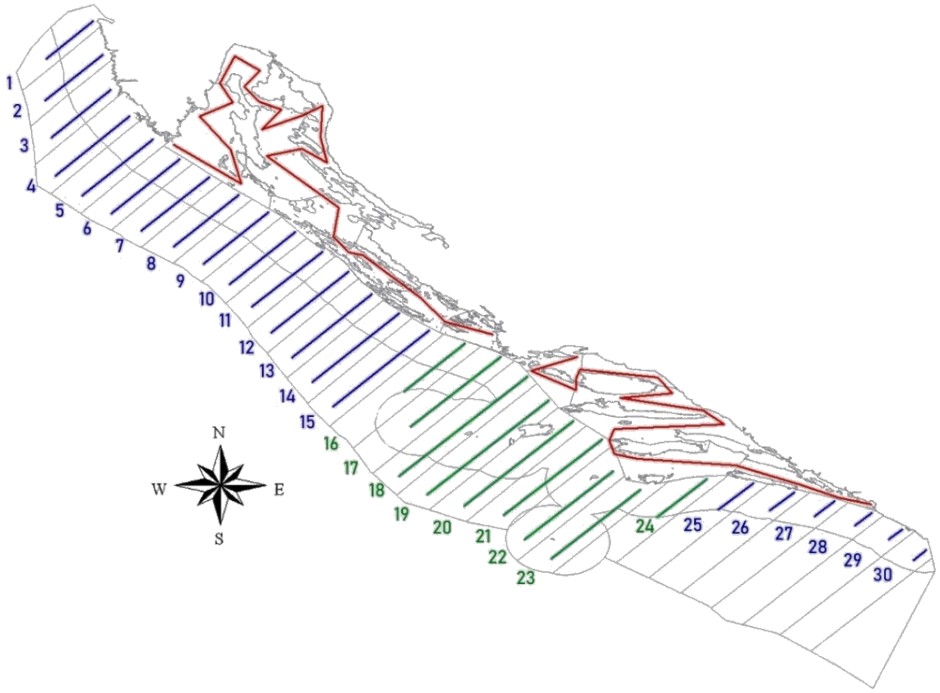


Figure 2.6.1. Acoustic survey design in the eastern part of GSA 17 (red transects in inner sea, green and blue transects in open sea).

The MEDIAS survey design in eastern part of GSA 17 (Slovenia) (Fig. 2.6.2) consists of 2 transects defined by 4 waypoints (Table 2.6.2), with inter-transect distance of 7 NM.

Table 2.6.2. Waypoints that defined Transect 1 and Transect 2 in Slovenian territorial waters.

	Waypoint	**Latitude**	**Longitude**
Transect 1	1	45°34.4	13°42.1
	2	45°37.6	13°36.9
Transect 2	3	45°33.1	13°34.3
	4	45°35.6	13°29.7

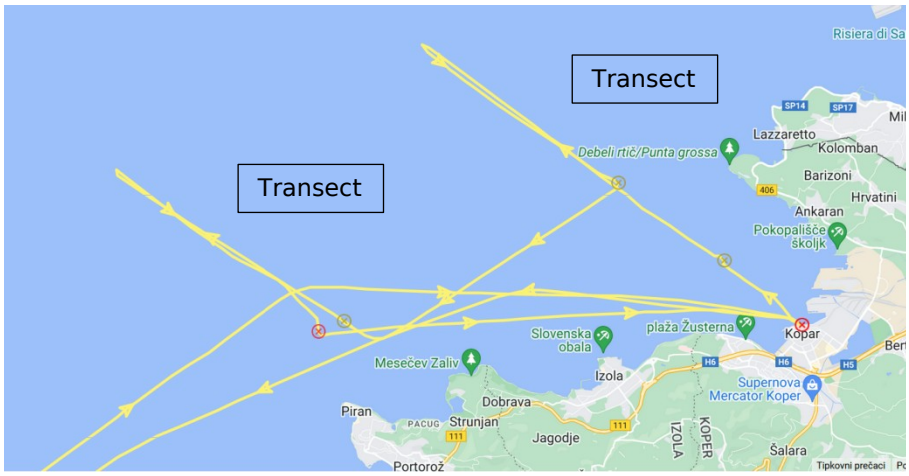


Figure 2.6.2. Vessel route in Slovenian territorial waters during MEDIAS 2023 expedition tracked by AIS.

Number of nautical miles effectively processed for biomass estimation in 2023 was 1192 for Croatia and 19 for Slovenia.

e) Fish sampling

57 samplings (HRV) and 2 samplings (SLO) have been made by pelagic trawl with otter boards. Pelagic trawl sampling net has headline length 29.40 m and side-line lengths 24.80 m, with 18 mm mesh size in the cod-end. Trawling speed was around 4 knots (i.e. 3.5 – 4.5 knots), and haul's duration was 30 min or more. During sampling operations, trawl was monitored by Simrad ITI System, mostly indicating vertical opening 9 – 11 m. Locations and species composition of samples obtained are shown in Fig. 2.6.3.

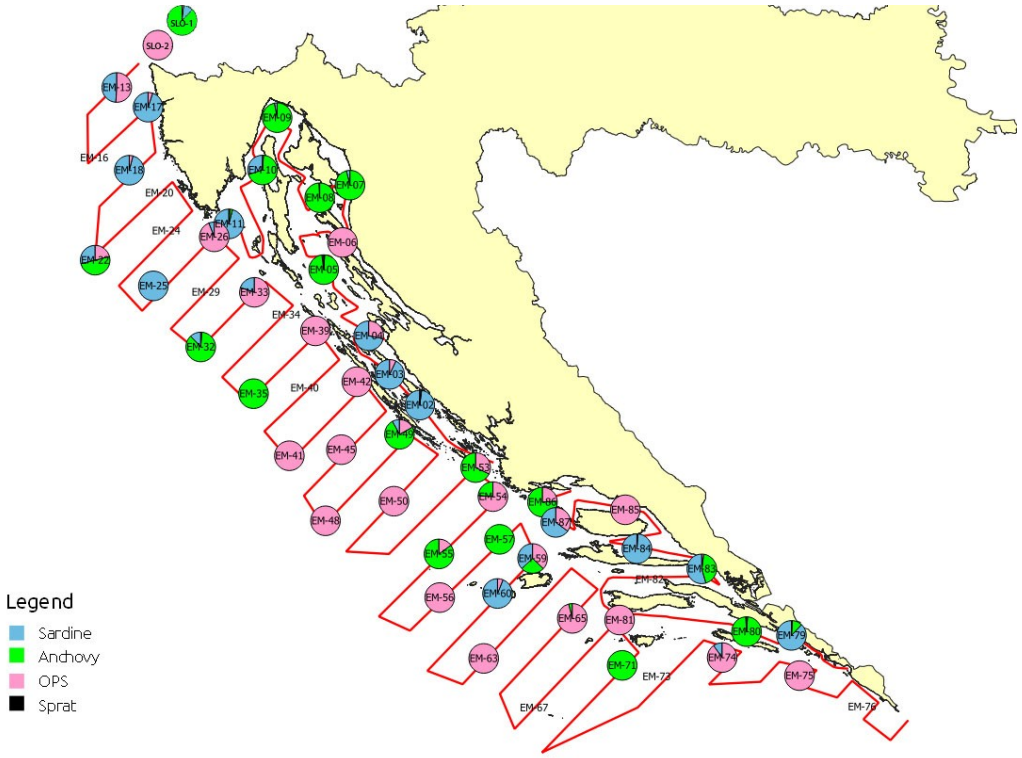


Figure 2.6.3. Pelagic hauls (HRV 57; SLO 2) composition (W%) carried out during the acoustic survey in the eastern part of GSA17 (MEDIAS, 2023).

f) Oceanographic parameters

Oceanographic parameters (temperature and salinity) were measured by CTD probe at 89 different locations in Croatia and 2 in Slovenia at the beginning of each transect (Fig. 2.6.4). Based on measurements made, sound speeds were calculated and used to update echosounder during survey, as well as for surveyed area oceanographic description.

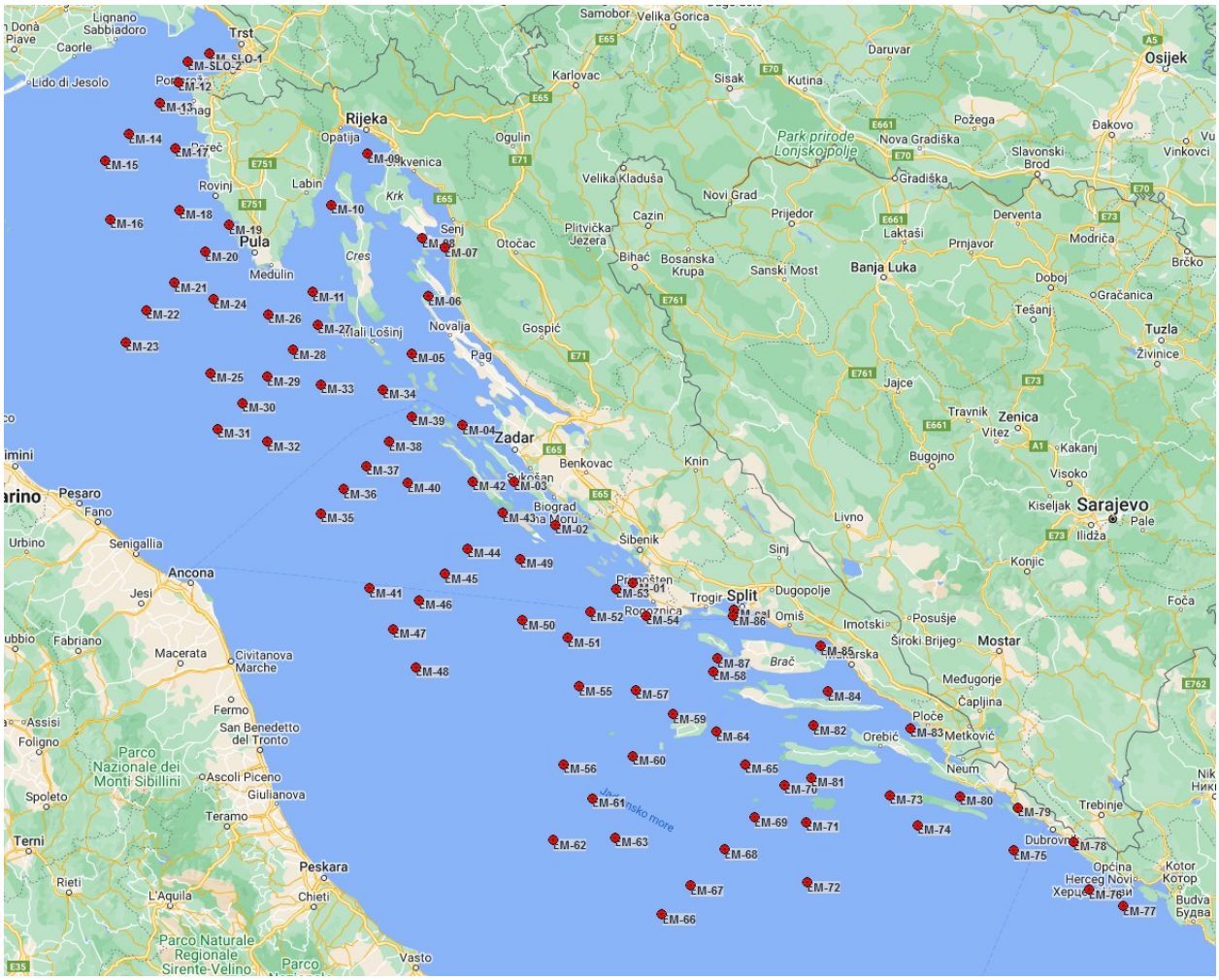


Figure 2.6.4. CTD stations (HRV 89; SLO 2) carried out during the acoustic survey in the eastern part of GSA17 (MEDIAS, 2023).

g) Biomass estimations of target species

In the eastern part of GSA17 HRV, 102 285 tons of anchovy and 189 689 tons of sardine were estimated. Anchovy length frequency distribution was from 3 to 16 cm, with peak at 12-13 cm. Sardine length frequency distribution was from 6 to 17 cm, mostly 13 cm.

In the Slovenian territorial waters 1 010 tons of anchovy and 222 tons of sardine were estimated. Frequency length distribution for anchovy was from 7 to 12 cm, mostly 11cm. Sardine frequency length distribution was from 10 to 15 cm, mostly 12 cm. Biomass estimates per length classes for Croatia are shown in the Fig. 2.6.5. and for Slovenia in the Fig. 2.6.6.

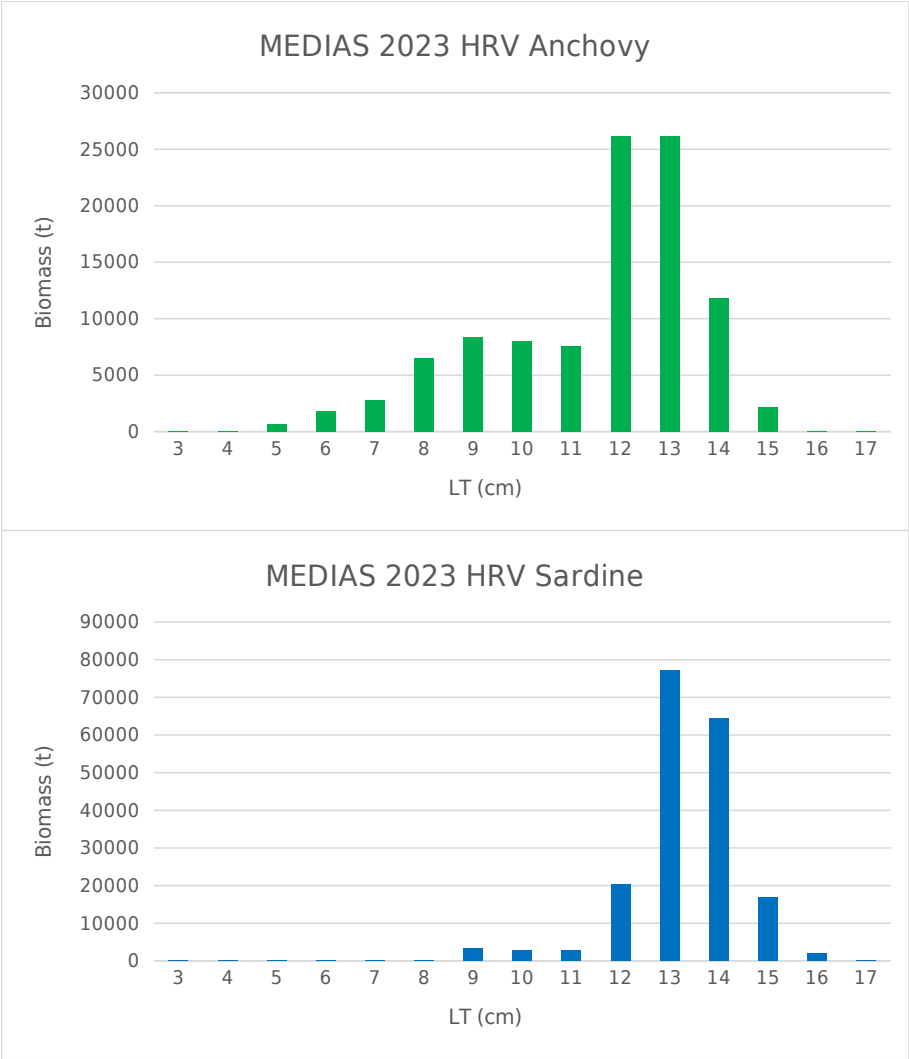


Figure 2.6.5. Biomass estimates per length classes in the eastern part of GSA17 HRV (MEDIAS, 2023).

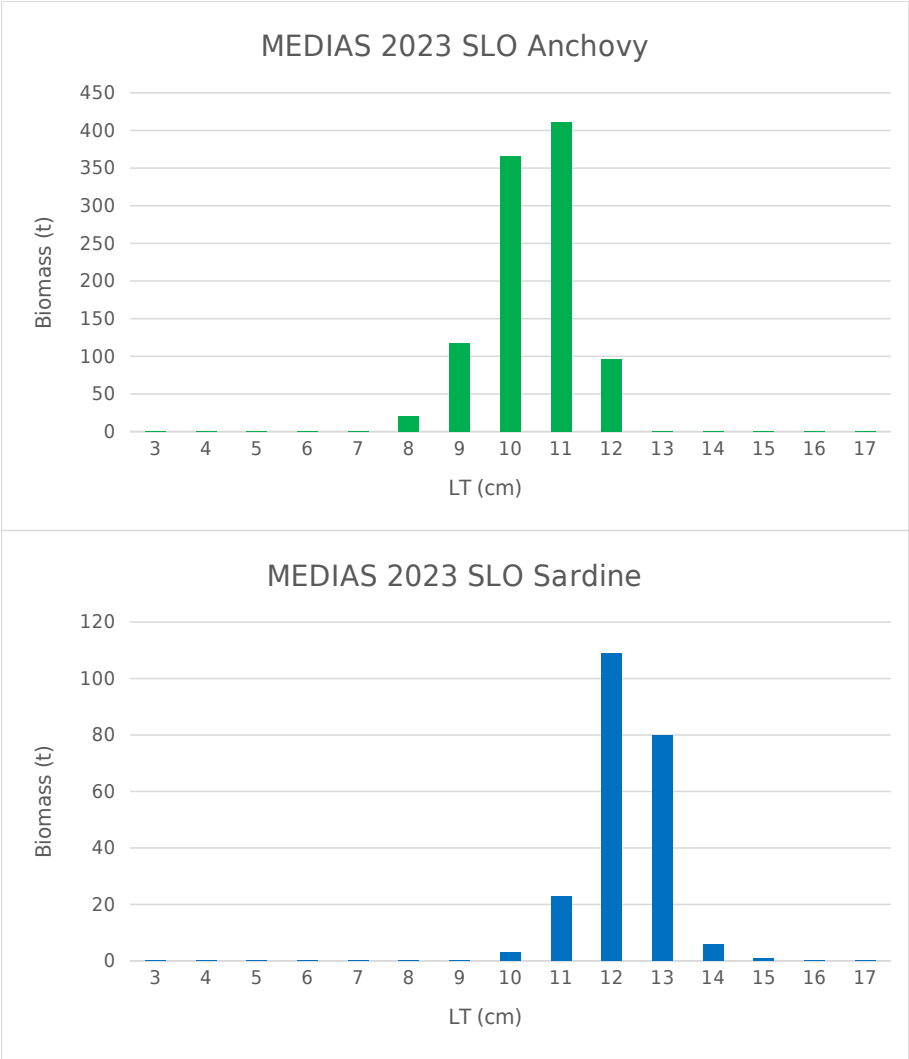


Figure 2.6.6. Biomass estimates per length classes in the eastern part of GSA17 SLO (MEDIAS, 2023).

Time series of biomass estimated for anchovy and sardine in Croatia are shown in Fig 2.6.7. a); and time series of average density are shown in Fig 2.6.7.b).

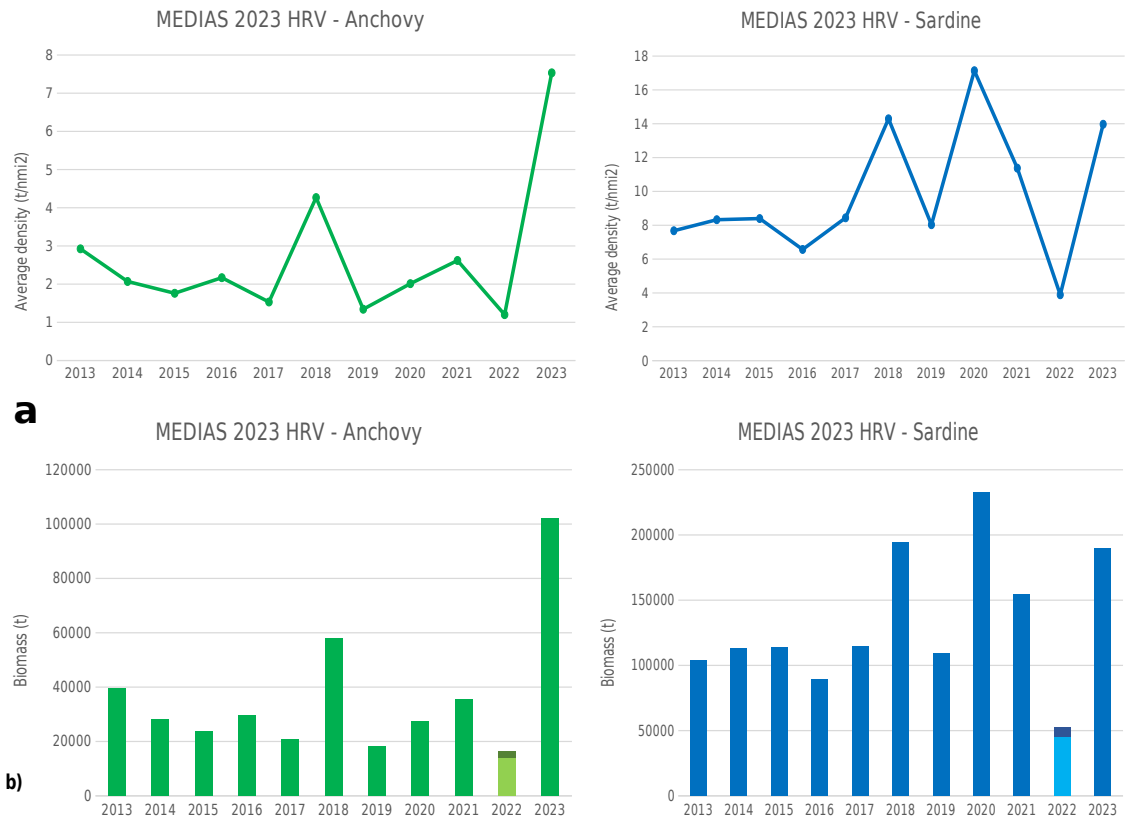


Figure 2.6.7 a) Time series of average density for anchovy and sardine in the eastern part of GSA17 HRV. **b**) Time series of biomass estimation for anchovy and sardine in the eastern part of GSA17 HRV (MEDIAS, 2023). Two different shades of colours in 2022 indicate two periods of survey: the first leg of expedition (light shade) and the second leg of expedition (dark shade).

Age analyses, made in line with ICES WKARA2 report (2017) recommendations, resulted in survey specific ALKs for anchovy and sardine (Fig. 2.6.8 and 2.6.9). Results of analyses indicated that both in HRV and SLO anchovy population consisted of two age groups: 0 and 1. Sardine populations consisted of three age groups (0, 1 and 2) in Croatia, but two age groups (0 and 1) in Slovenia. The number of otolith readings for anchovy and sardine in Croatia was 578 and 572 respectfully, and in Slovenia 43 and 42 respectfully. In terms of biomass, for sardine population, during Medias 2023 survey in the Croatian territorial waters age group 1 was dominant, while in the Slovenian waters the same was true for age group 0. For anchovy population, in both territorial waters, age group 0 and 1 were more even, with the slight dominance of age group 0 in Croatia, and age group 1 in Slovenia (Fig. 2.6.10 and 2.6.11).

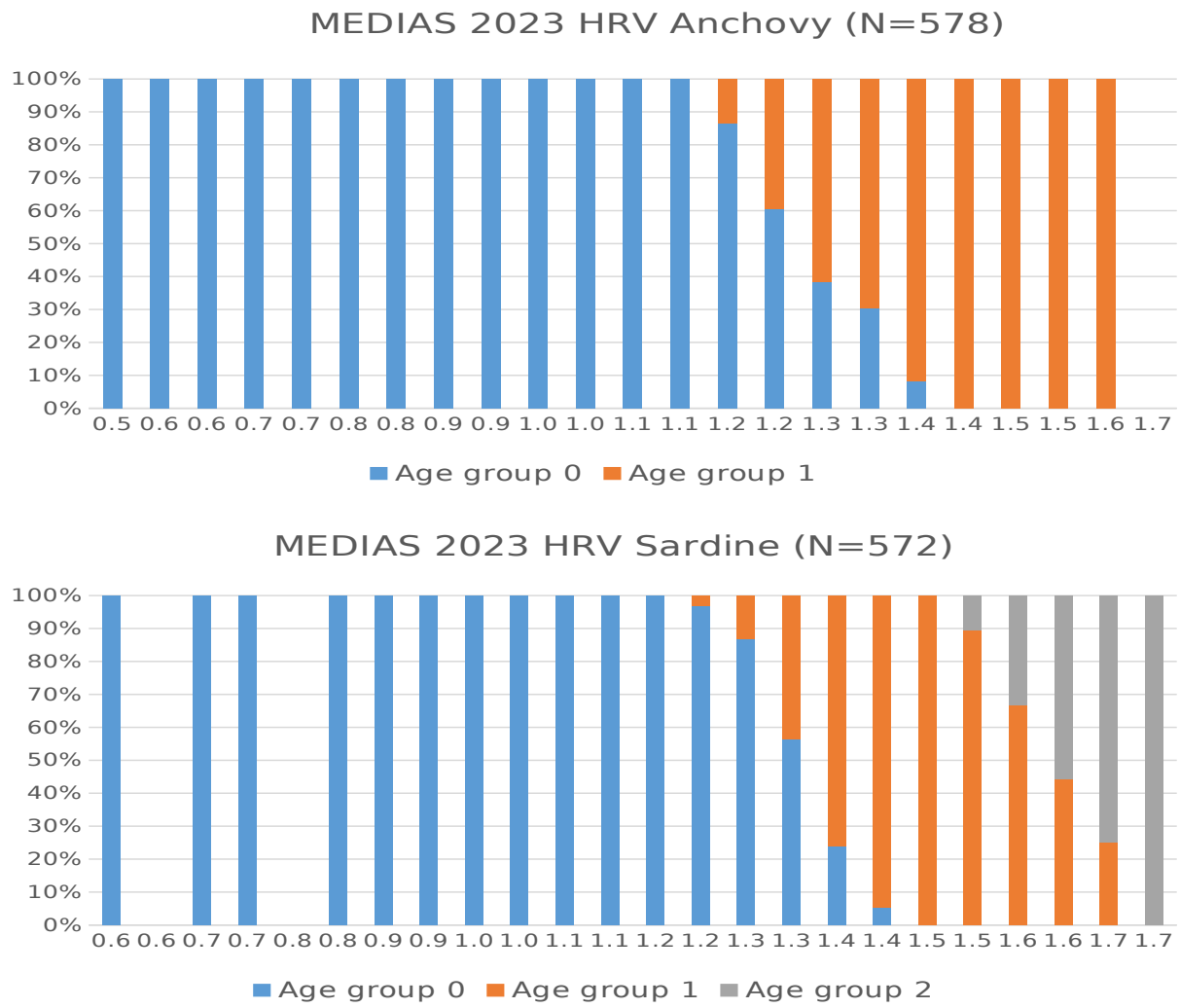


Figure 2.6.8. Age length keys (ALK) for anchovy (above) in GSA17 HRV, MEDIAS 2023, were composed of two age groups (0 and 1) for anchovy (above), and three age groups (0, 1 and 2) for sardine (below). The number of otolith readings was 578 for anchovy and 572 for sardine.

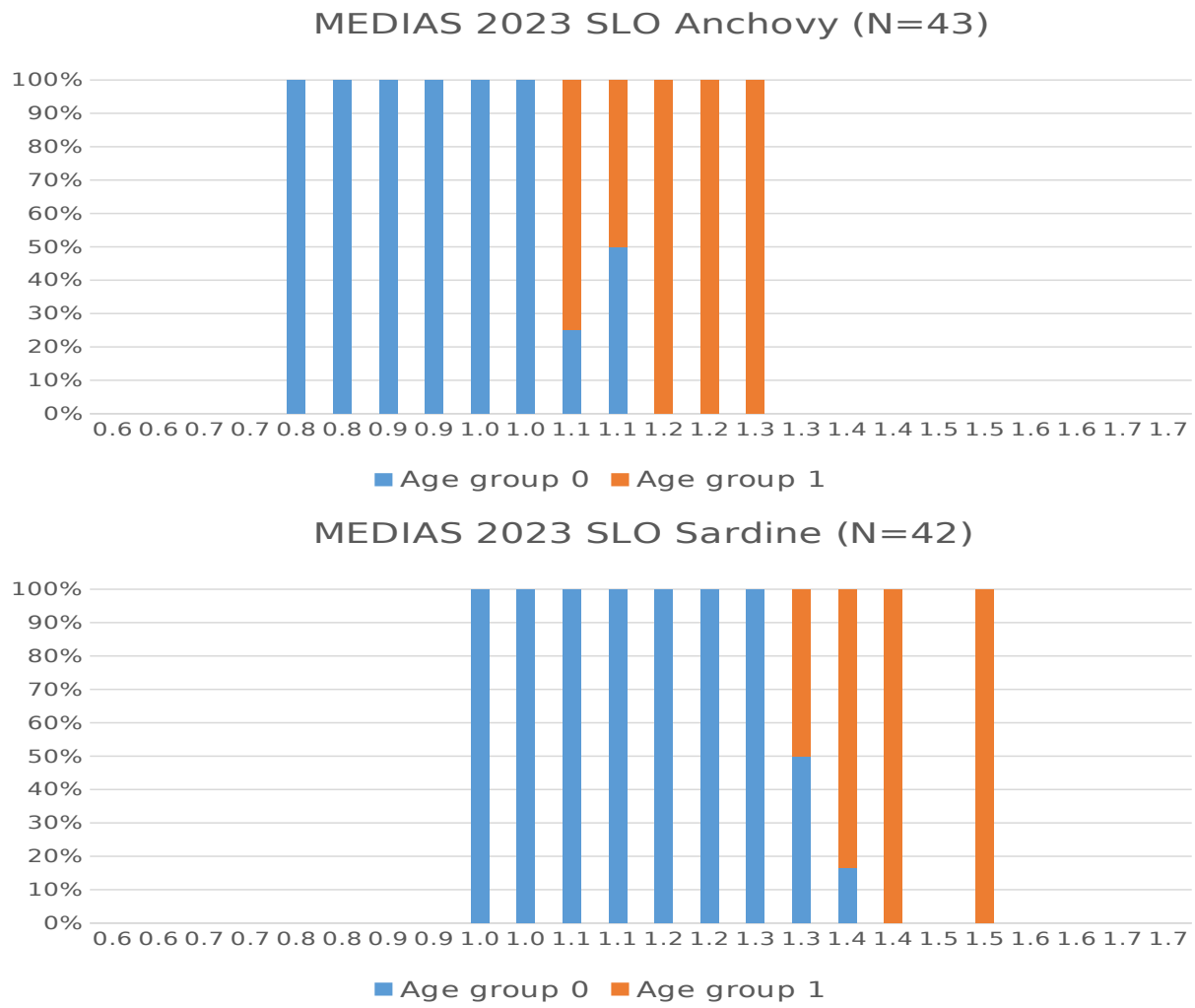


Figure 2.6.9. Age length keys (ALK) for anchovy (above) and sardine (below) in GSA17 SLO, MEDIAS 2023, were composed of two age groups (0 and 1). The number of otolith readings was 43 for anchovy and 42 for sardine.

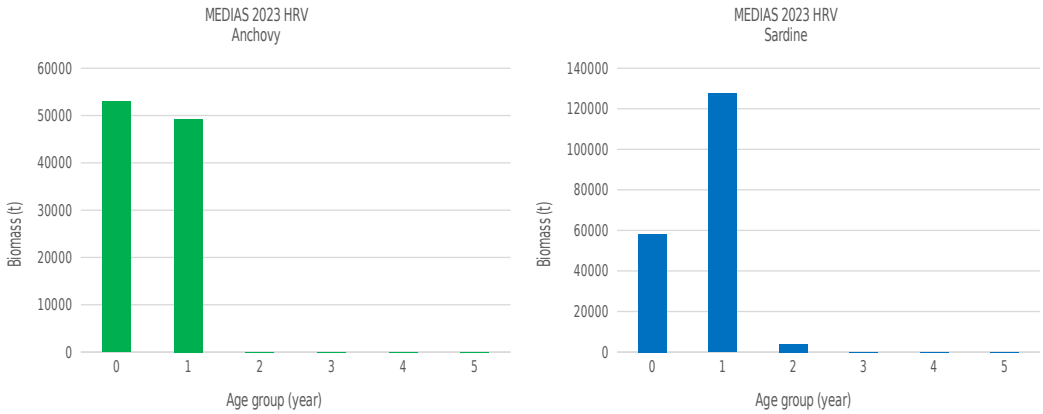


Figure 2.6.10. Biomass of anchovy and sardine estimates per age groups HRV (MEDIAS, 2023).

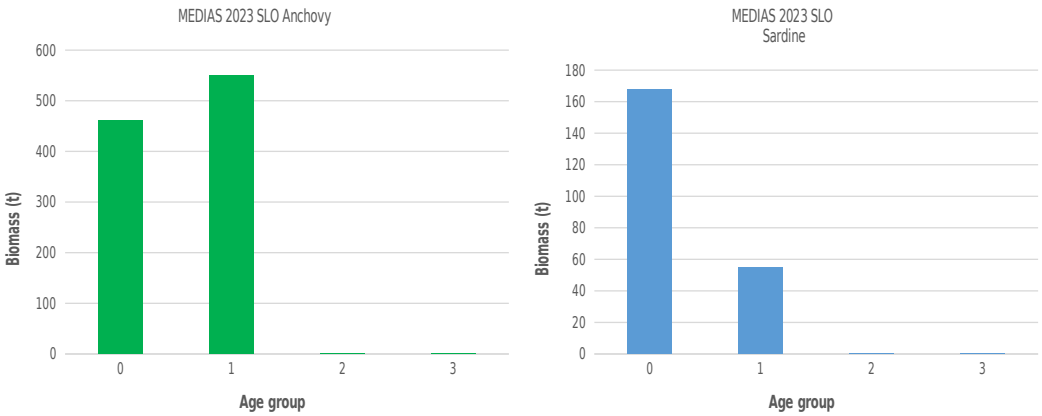


Figure 2.6.11. Biomass of anchovy and sardine estimates per age groups SLO (MEDIAS, 2023).

h) Abundance indices of target species

Spatial distributions of sardine and anchovy in the eastern part of GSA17 are presented in terms of NASC per EDSU in Fig. 2.6.12 and 2.6.13 Spatial distribution of anchovy shows biggest concentration of individuals near the coast and within channels between coast and islands (Fig. 2.6.12). Spatial distribution of sardine shows concentration of individuals in the channels between coast and islands, as well as some peaks in the open sea in the north part of Adriatic, while in the central and southern parts number of individuals in the open sea is small (Fig. 2.6.13).

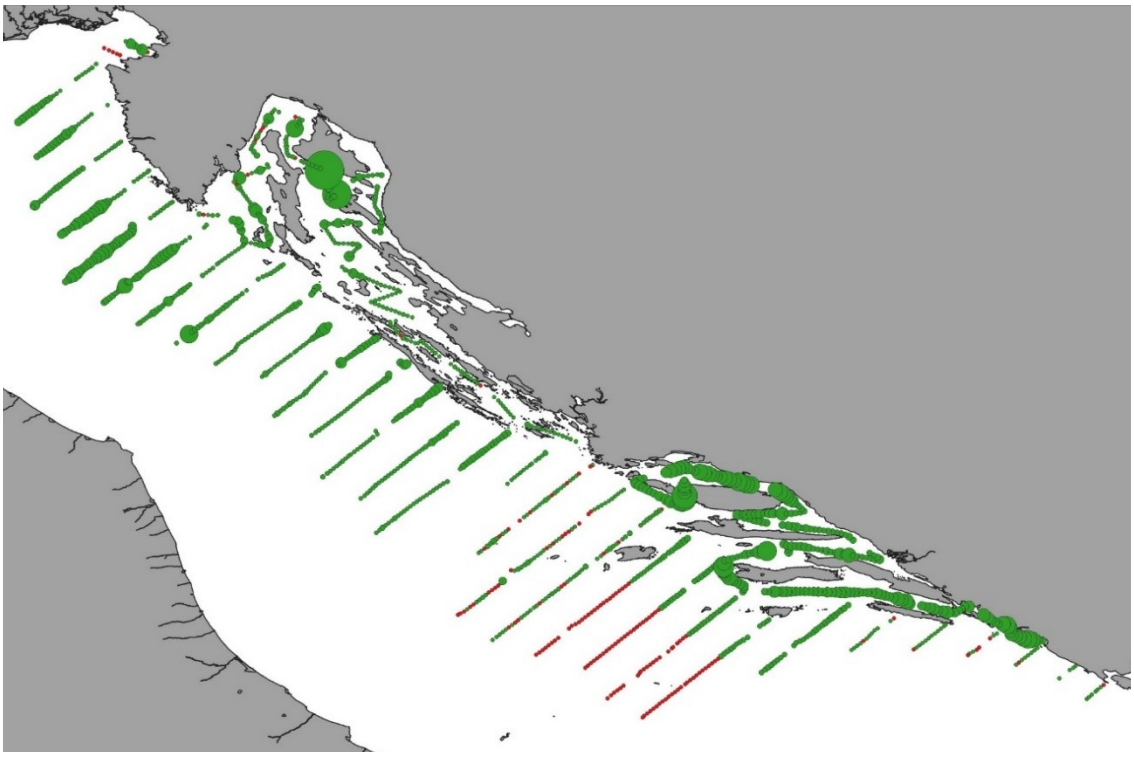


Figure 2.6.12. Anchovy spatial distribution in the eastern part of GSA17 HRV and SLO (MEDIAS, 2023).

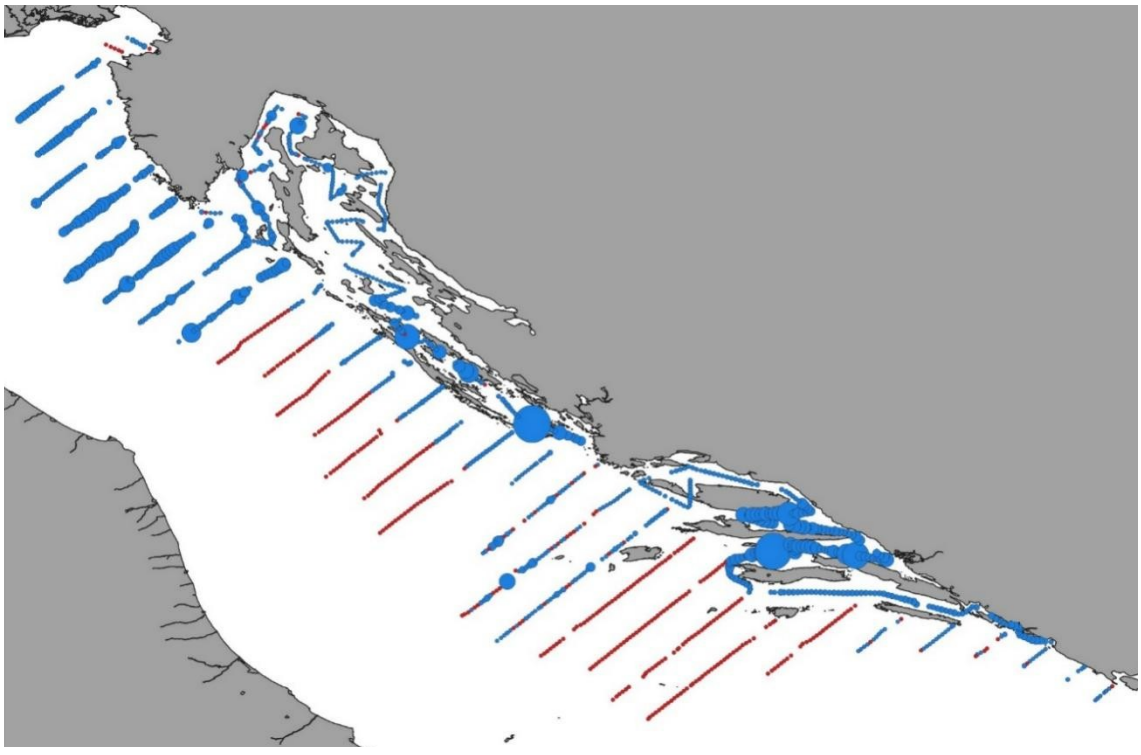


Figure 2.6.13. Sardine spatial distribution in the eastern part of GSA17 HRV and SLO (MEDIAS, 2023).

Abundance (x10^3) per length for anchovy and sardine are shown in Fig 2.6.14 for Croatian and 2.6.15 for Slovenian waters. Graphical view of anchovy shows bimodal shape with two peaks: 8-9 cm and 12-13 cm, while sardine shows a small peak around 9 cm, with larger peak

at 13 cm (HRV). Slovenian part of survey provides different graphical view where both anchovy and sardine show one peak: 10-11 cm (anchovy) and 12 cm (sardine).

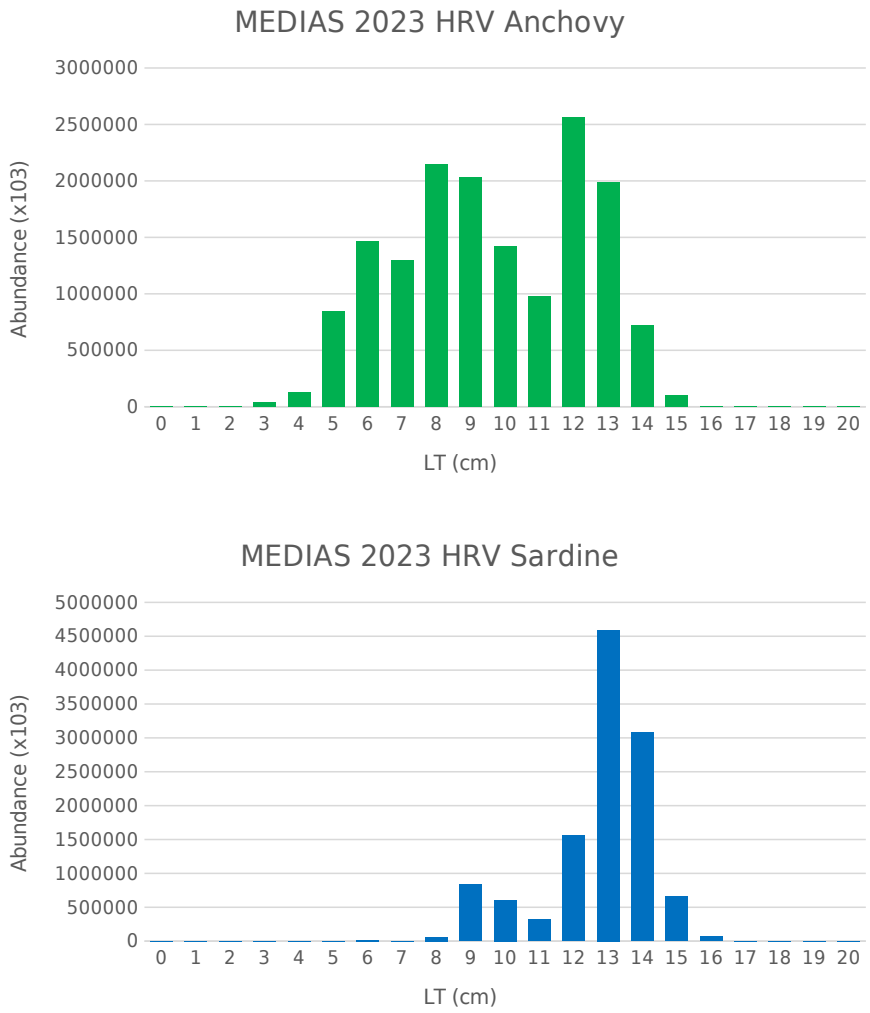


Figure 2.6.14. Abundance (x10^3) per length for anchovy and sardine in the eastern part of GSA17 HRV (MEDIAS, 2023).

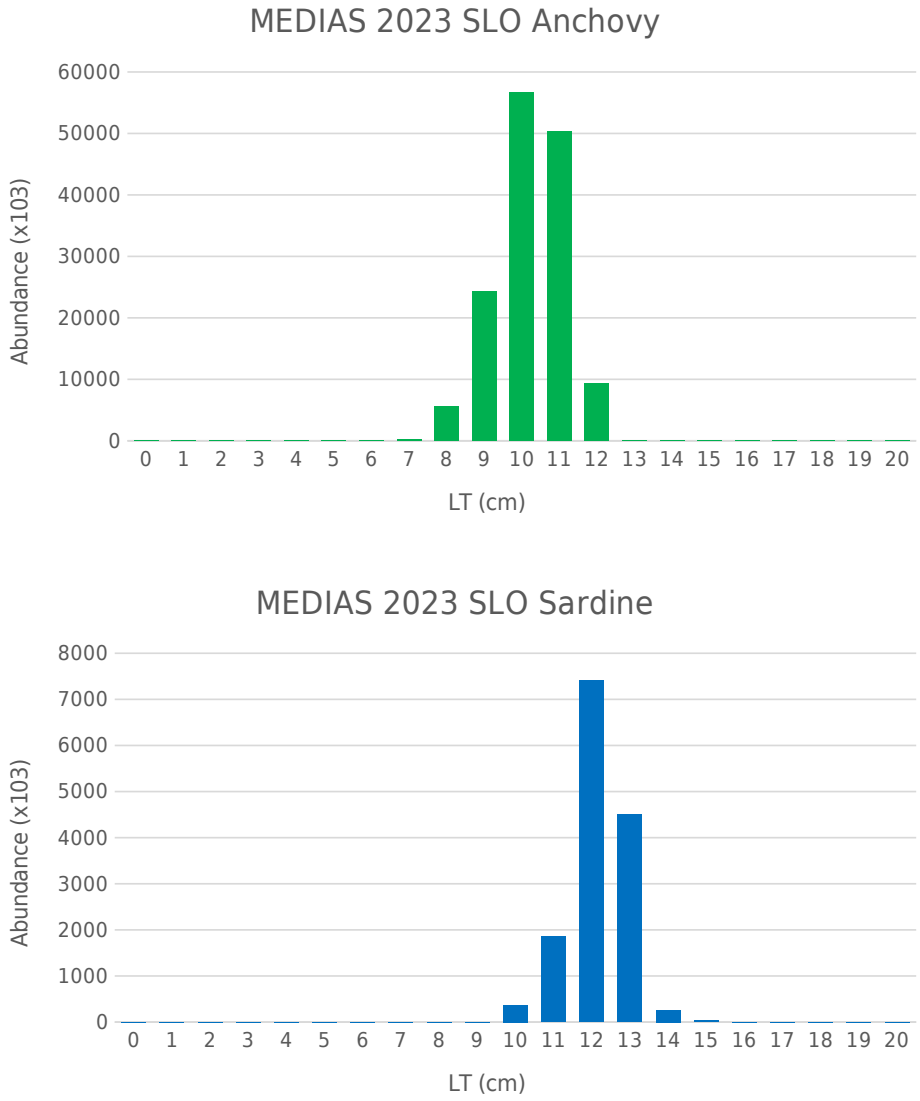


Figure 2.6.15. Abundance (x10^3) per length for anchovy and sardine in the eastern part of GSA17 SLO (MEDIAS, 2023).

2.7. MEDIAS 2023 in western GSA 17 and GSA 18 (ITA) - North-western Adriatic Sea and South-western Adriatic Sea (Iole Leonori, Andrea De Felice, Ilaria Biagiotti, Giovanni Canduci, Ilaria Costantini, Antonio Palermino, Samuele Menicucci. CNR IRBIM Ancona, ITALY)

a) General information on the survey

MEDIAS 2023 acoustic survey was carried out in the period May 31 – June 27, 2023. It was conducted in the western GSA 17, following MEDIAS protocol (MEDIAS Handbook, 2023), in the planned area of ~ 11,000 nmi^2 in western Adriatic Sea. The cruises were conducted on

board the research vessel “G. Dallaporta” (built in 2001, 35.30 m, 285 GT, 1100 CV). GSA 18 survey was not conducted due to limited vessel availability.

b) Type of echosounders and frequencies in use

The equipment was SIMRAD EK80 scientific echosounder operating at 38, 70, 120 and 200 kHz connected with hull-mounted split beam transducers. Acoustic recording was performed during daytime. No TS and Sv thresholds were set for data logging. The threshold for data processing was -70 dB or -60 dB in case of strong scattering from plankton. The pulse duration was 1.024 ms for all frequencies. The surveying acoustic vessel speed was generally 9.5 knots. Echoview software was used to analyse acoustic data.

c) Calibration results

The acoustic system was calibrated on the 30th of May 2023 at 38, 70, 120 and 200 kHz, using the standard sphere method.

Table 2.7.1. Calibration results in MEDIAS 2023.

Freq. (kHz)	**38**	**70**	**120**	**200**
Echosounder type	SIMRAD EK80	SIMRAD EK80	SIMRAD EK80	SIMRAD EK80
Transducer ser. N°	502	271	924	365
Vessel	R/V Dallaporta			
Date	30/05/2023			
Place	Ancona			
Latitude	43° 38.0'			
Longitude	13° 43.3'			
Bottom depth (m)	30.0			
Temp. At sphere depth (*)	16.5			
Salinity at sphere depth (PSU)	39.0			
Speed of sound (m s^{-1})	1515.74			
Tungsten (Wc-Co) 38. mm TS (dB)	-42.4	-41.6	-39.6	-38.9
Pulse duration (ms)	1.024	1.024	1.024	1.024
(dB)	-20.7	-20.7	-20.7	-20.7
Default TS gain	25.5	27	27	26

Iter. N°	2885	2393	2724	2507
Range to sphere (m)	16.5	16.5	16.5	16.5
Ping rate (s)	Max	Max	Max	Max
Calibrated TS gain	26.88	27.40	26.75	25.57
Time (GMT)	14:10- 14:20	14:26- 14:35	14:39- 14:49	15:35- 16:00
RMS	0.075	0.074	0.167	0.279
Sa corr.	-0.176	0.020	-0.057	-0.145

d) Survey design

Acoustic data were logged over a grid of systematic parallel transects perpendicular to coastline/bathymetry (inter-transect distance 8-10 nmi, minimum transect length: 5 nmi, maximum transect length: 40 nmi). Number of transects is 39 in GSA 17 and 11 in GSA 18 for a total of ~ 2,000 nautical miles in western Adriatic Sea.

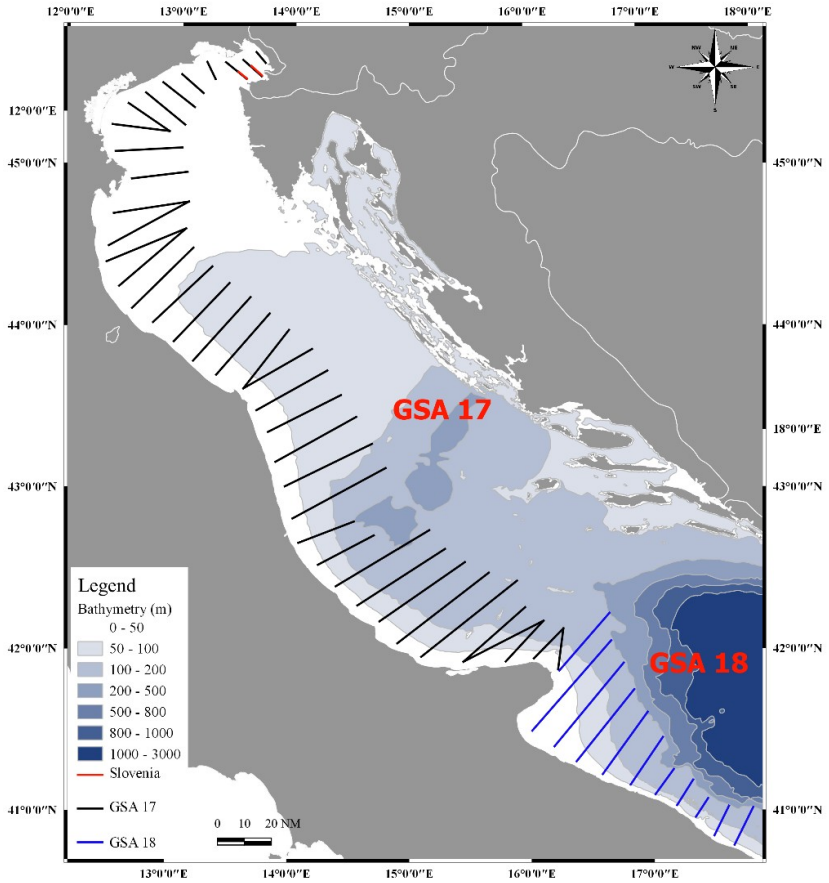


Figure 2.7.1. Acoustic survey design in western part of GSA 17 and GSA 18. MEDIAS 2023.

Survey period of the MEDIAS 2023 acoustic survey in western GSA 17 was from May 31 to June 27, 2023; area coverage was 100% over a total area of 10,519 nmi^2 and 39 transects. The number of nautical miles effectively processed for biomass estimation was 1070 (1362 nmi total).

e) Fish sampling

A midwater sampling trawl "Volante" with the following characteristics was used during the surveys: 18 mm codend mesh size, about 11 m vertical opening and 18 m horizontal opening, headline/ft rope length = 35 m; sidelines length = 27 m. Vessel speed was 3.5 – 4.5 knots during fishing. Haul's duration was about 30 min. Trawls were monitored by means of SIMRAD FX80 Trawl sonar. Fishing operations were performed at different light conditions and bathymetry. Biological samplings were conducted along the survey routes for biomass allocation into species and to know mean lengths and weights of the pelagic fish (Species, Size Composition, length-weight). The entire catch was considered to determine the proportion in species by weight; in case the catch was huge (more than 50 kg) an adequate subsample was considered for this operation. Length frequency distributions on board were obtained measuring a subsample of 100 individuals per species when available. Subsamples of target species specimens of up to 5 individuals per 0.5 cm length class were collected to determine age, by means of otoliths readings, following DCR standards, and maturity stages and frozen for successive measurements in the laboratory.

In western Adriatic Sea, in 2023, 26 pelagic hauls were done in GSA 17 (Fig. 2.7.2.). Catch composition, desumed from pelagic hauls, showed among the most abundant species *Engraulis encrasicolus*, *Sardina pilchardus* and *Sprattus sprattus.*

Other pelagic fish species, minor for occurrence, were: *Trachurus mediterraneus, Trachurus trachurus, Spicara spp, Scomber colias, Scomber scombrus, Sardinella aurita, Boops boops, Aphia minuta.*

Other species found in some catches were: *Loligo volgaris, Illex coindetii, Alloteuthis media, Merlangius merlangus, Aequorea Aequorea, Aurelia aurita, Salpa spp.*

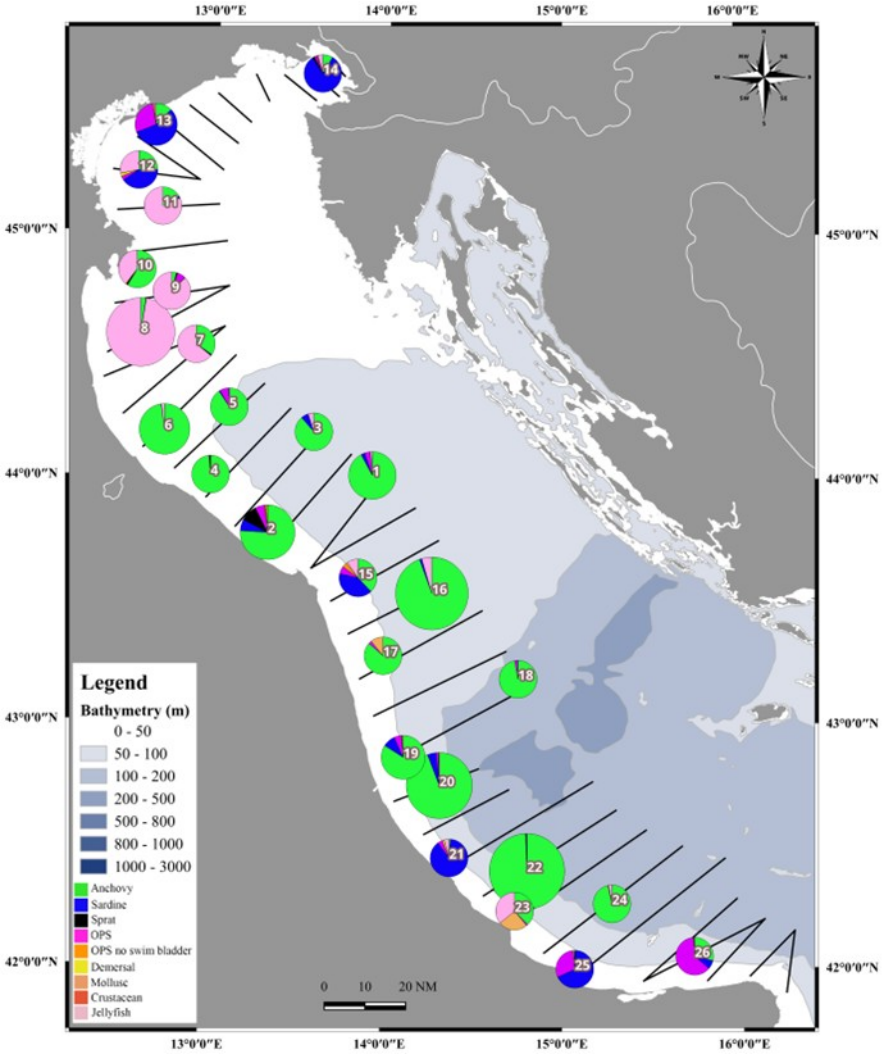


Figure 2.7.2. Pelagic hauls composition (26) carried out during the acoustic survey in western GSA 17. MEDIAS 2023.

f) Oceanographic parameters

In total, 56 CTD stations were performed in GSA 17 (Fig. 2.7.3.), western Adriatic Sea, using a CTD (Seabird 19 plus) probe to collect temperature, salinity, fluorescence, and dissolved oxygen data from the water column.

As Extra activity samplings, 59 mesozooplancton stations were done in GSA 17 using a WP2 vertical net.

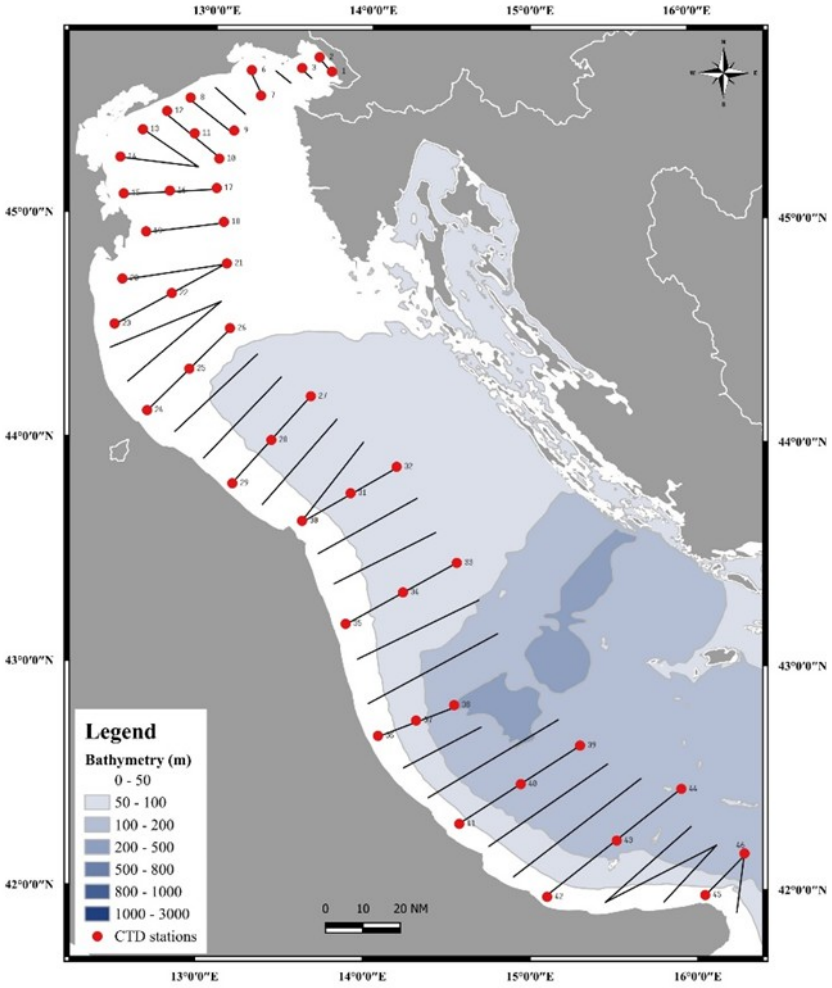


Figure 2.7.3. Planned CTD stations carried out during the acoustic survey in the western part of GSA 17. MEDIAS 2023.

g) <u>Biomass estimations of target species: Western GSA 17</u>

Biomass of sardine (Sardina pilchardus) (Fig. 2.7.4) and anchovy (Engraulis encrasicolus) (Fig. 2.7.5) and related (geostatistical simulations) CVs in 2023 in western GSA 17 were estimated :

Year	Sardine	CV	Anchovy	CV	Sampled Area
2023	49,854 t	12 %	230,013 t	9%	10,519 nmi^2

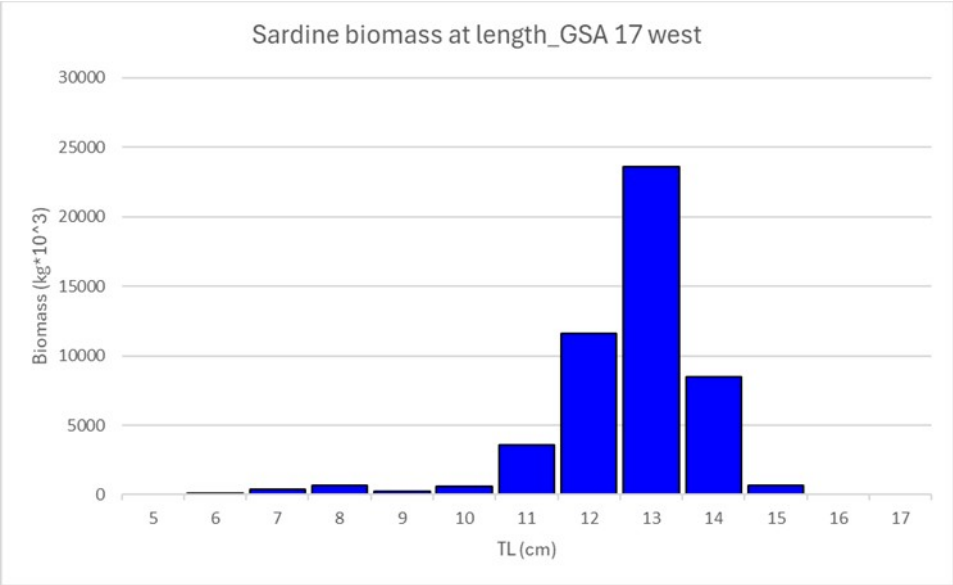


Figure 2.7.4. Sardine (PIL) biomass in tons by length (LFD) in western GSA 17. MEDIAS 2023.

For sardine, biomass per length class is bimodal (7-9 cm; 11-15 cm) with low recruitment.

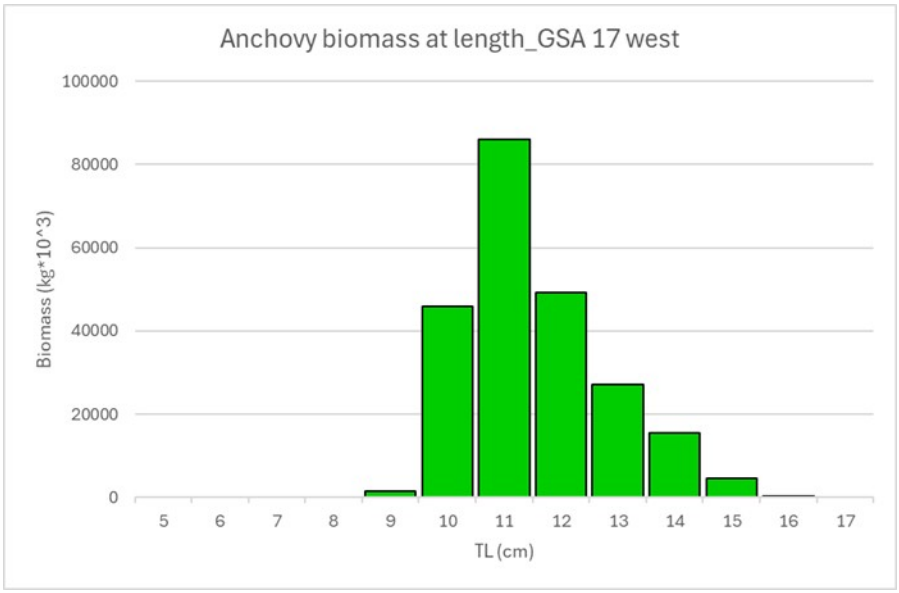


Figure 2.7.5. Anchovy (ANE) biomass in tons by length (LFD) in western GSA 17. MEDIAS 2023.

Anchovy biomass per length class show a distribution concentrated in the range 10-15 cm. Recruitment was absent.

In 2023 we see, in western GSA 17 MEDIAS (Fig. 2.7.5.b), a further decrease in sardine biomass. Anchovy has a slight increase, but remains almost constant, around the average value of the last 10 years.

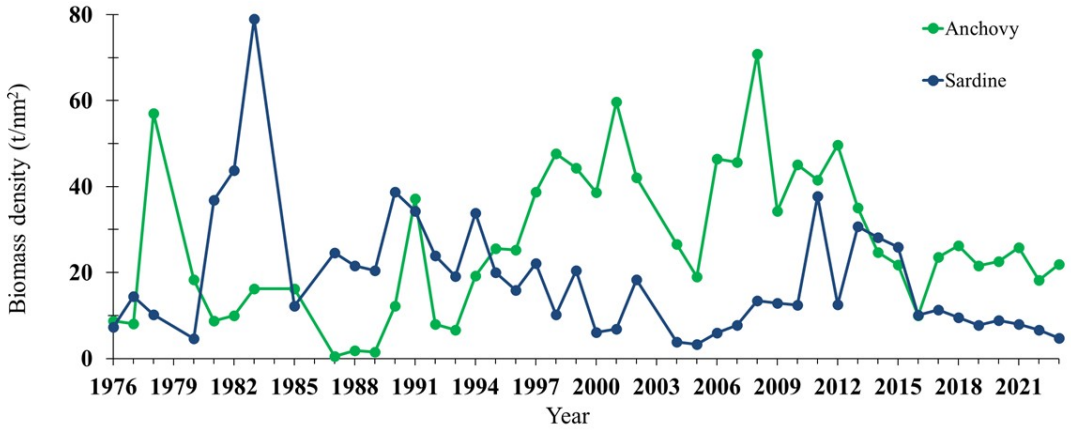


Figure 2.7.5.b. Historical trends in North-western Adriatic Sea 1976-2023.

Age length key (ALK) for sardine in western GSA 17, MEDIAS 2023, was composed by 3 years classes: age 0, age 1 and age 2. The number of otoliths readings was 334 for sardine (no. individuals) (Fig. 2.7.6).

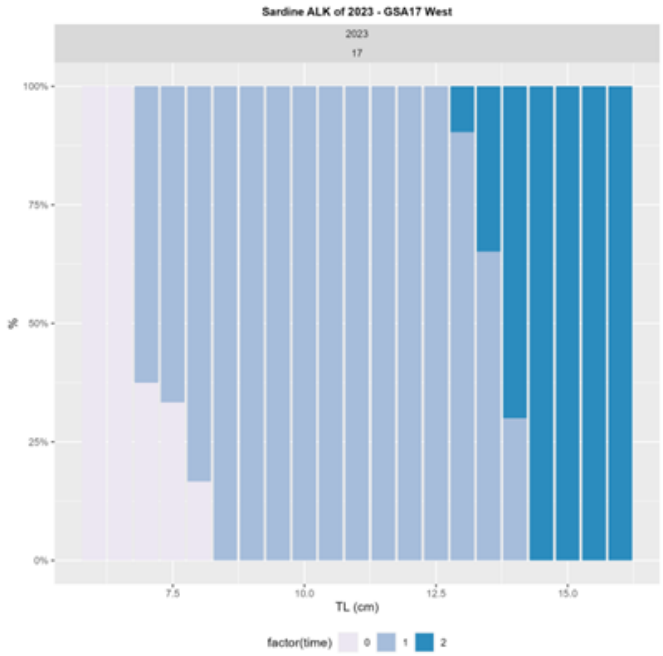


Figure 2.7.6. Sardine ALK western GSA17, MEDIAS 2023.

Anchovy ALK in western GSA 17, MEDIAS 2023, was represented by 2 years' classes: age 1 and age 2. The number of otoliths readings was 586 for anchovy (no. individuals) (Fig. 2.7.7.a).

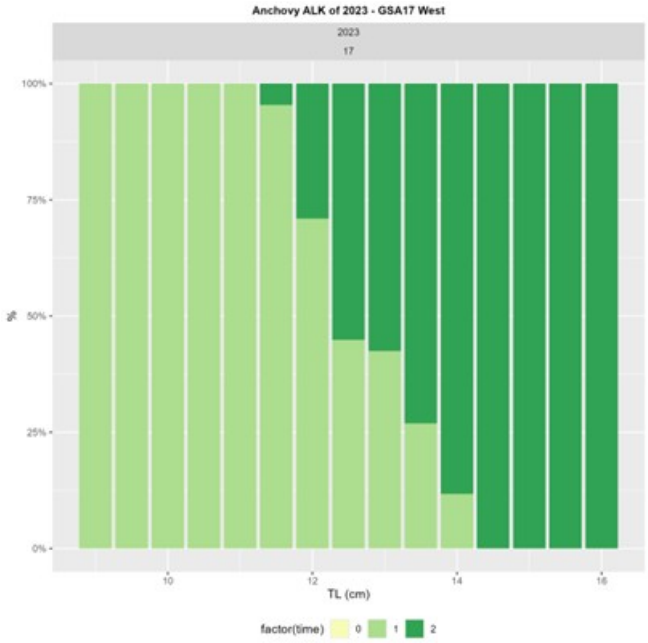
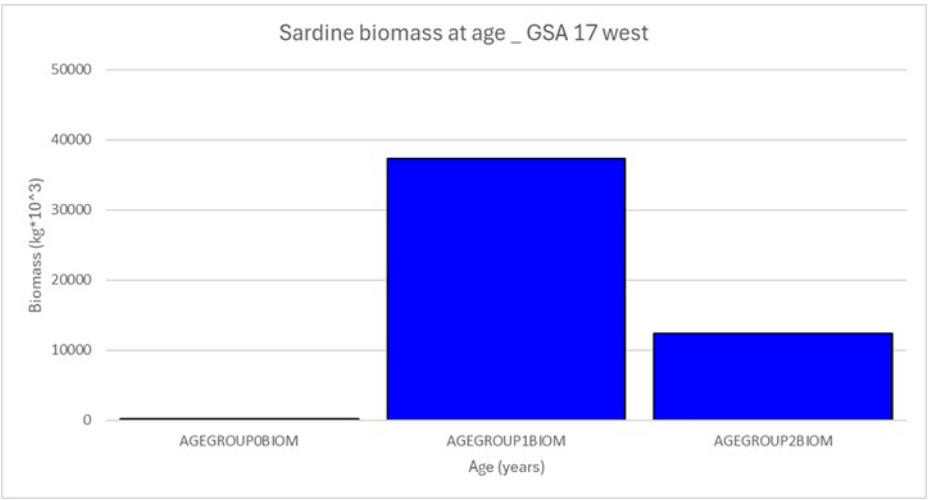


Figure 2.7.7.a. Anchovy ALK western GSA17, MEDIAS 2023.

Sardine and anchovy biomass per age were estimated (Fig. 2.7.7.b) using the ALKs.

For sardine biomass at age was mainly composed by age group 1 (dominant) and 2.

Anchovy biomass at age distribution showed that there were mainly 2 age groups: 1, 2. Age 1 was dominant.



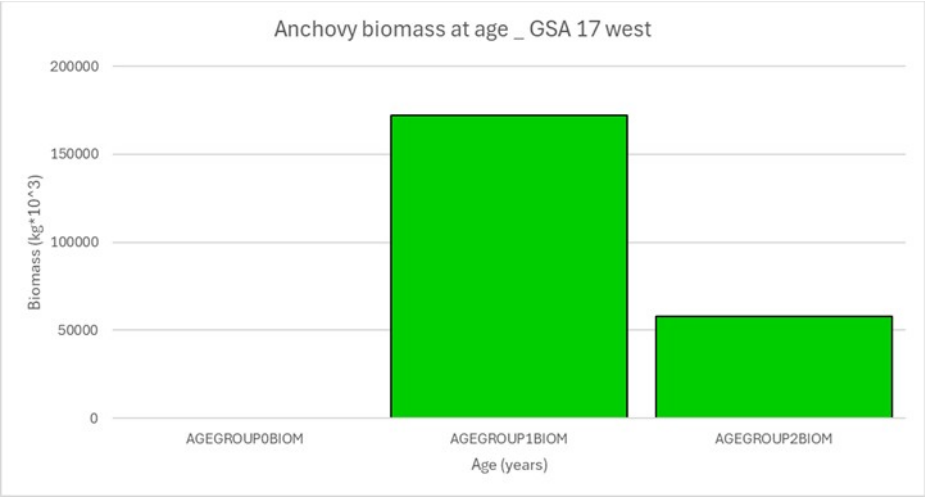


Figure 2.7.7.b. Sardine and anchovy biomass at age in western GSA 17 in 2023.

h) Abundance indices of target species: Western GSA 17

Spatial distribution of sardine and anchovy in western GSA 17 in June 2023 (Figure 2.7.8 and 2.7.9) was shown.

Sardine covers mainly the northern part of the basin, while in the central part it is scarce and mainly present along the coast. In the Po River mouth area sardine is very scarce.

Anchovy covers all the continental shelf in GSA 17 (also in the Trieste Gulf). Anchovy is also present offshore except in the southern part of the Middle Adriatic.

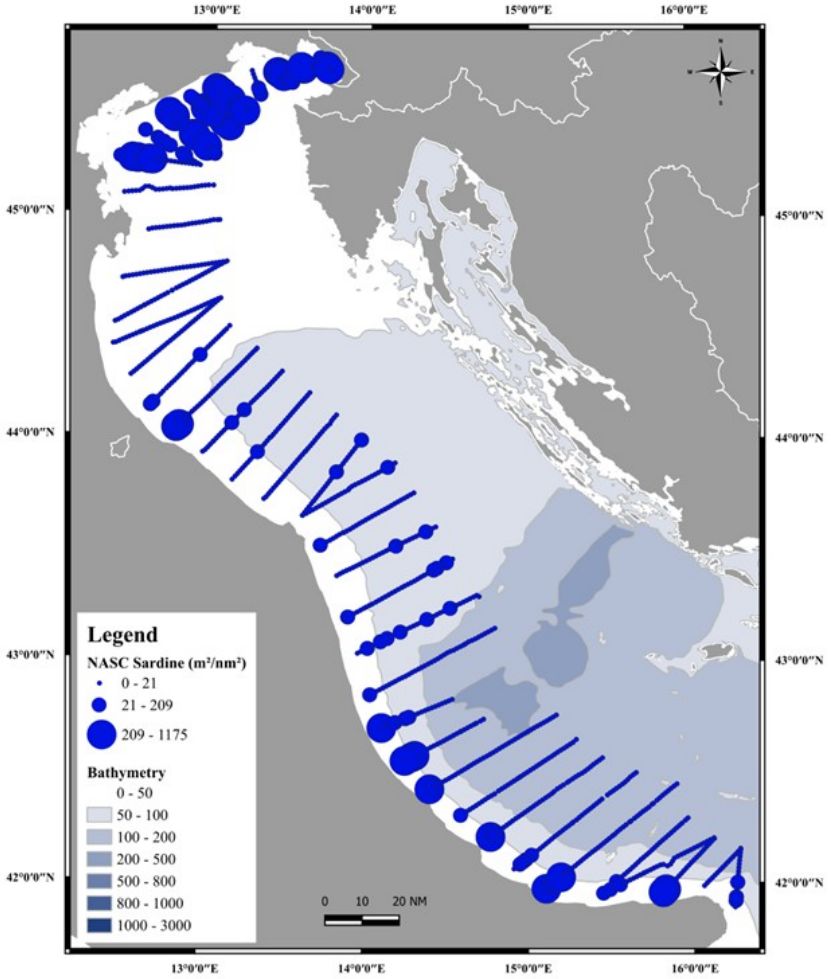


Figure 2.7.8. Sardine spatial distribution in western GSA 17 in June. MEDIAS 2023.

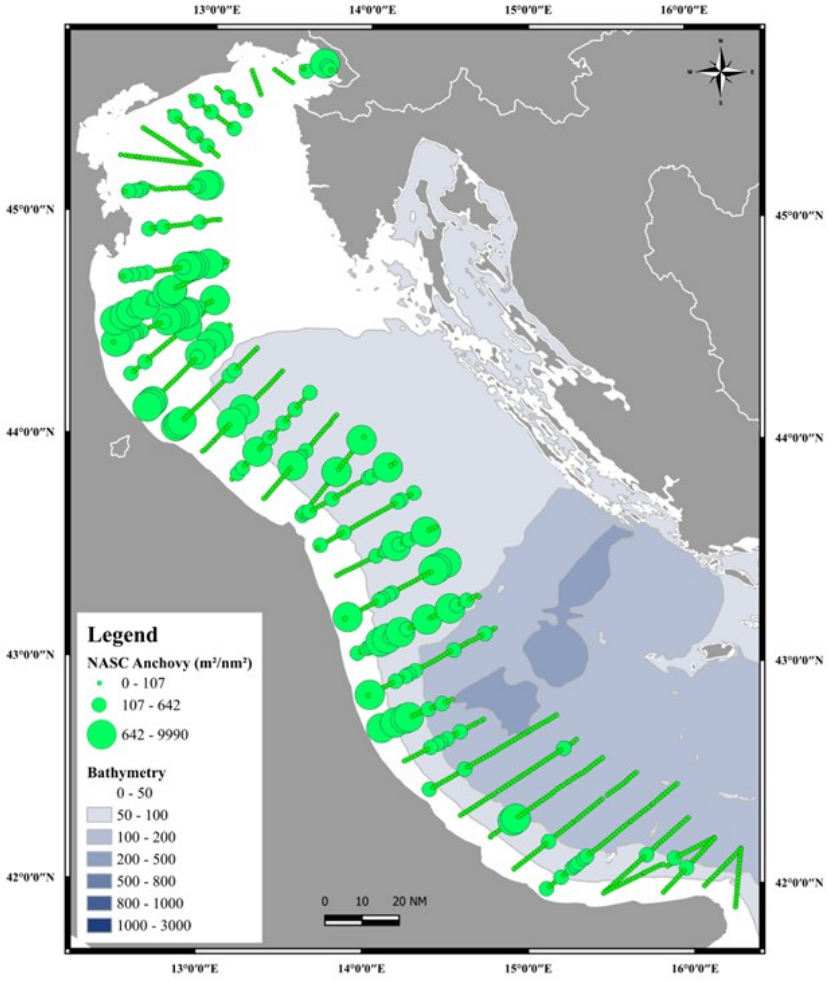


Figure 2.7.9. Anchovy spatial distribution in western GSA 17 in June. MEDIAS 2023.

2.8. MEDIAS 2023 in Eastern Ionian and Aegean Seas (GRC): GSAs 20 & 22 (A. Machias, K. Tsagarakis, Z. Kapelonis, M.M. Pyrounaki, S. Somarakis, E. Schismenou, K. Markakis & M. Giannoulaki, HCMR)

a) General information on the survey

MEDIAS 2023 acoustic surveys covered 4906 nm^2 in northern Aegean Sea during August - September, and 3275 nm^2 in eastern Ionian Sea during September - October with the fishery Research Vessel PHILIA (26 m length, 2× 340 HP).

b) Type of echosounders and frequencies in use

The split beam echo sounder used is SIMRAD EK80, with the 38, 120, 200 and 333 kHz frequency. There is no threshold limit applied in the raw data. The threshold for processing for the assessment (38 kHz) is -70 dB. The pulse duration is 1.024 ms. The surveying acoustic

vessel speed is 8 knots. The Echoview software was used to visualize and analyse acoustic data.

c) Calibration results

The acoustic system was calibrated at the beginning of the MEDIAS 2023 in northern Aegean Sea.

Table 2.8.1. Calibration results of the MEDIAS 2023.

	38 kHZ (ES38-7)	**120 kHz (ES120-7c)**	**200 kHz (ES200-7c)**	**333 kHz (ES333-7c)**
Target	Copper (Cu) 60 mm	Copper (Cu) 23 mm	Copper (Cu) 13.7 mm	Tungsten (Wc-Co) 22 mm
Beam Angle [deg]	7	7	7	7
Gain (adj., final) [dB]	0.81, 26.31	0.59, 27.96	1.27, 28.58	0.83, 24.72
Sa correction [dB]	-0.10	-0.04	-0.09	-0.04
Offset alongship [deg]	0.01	-0.07	-0.07	-0.26
Offset athwartship [deg]	-0.06	-0.02	0.01	-0.26
Beamwidth alongship [deg]	7.88	6.43	6.51	6.33
Beamwidth athwartship [deg]	8.02	6.29	6.56	6.03
Depth [m]	14.5	14.7	14.7	14.7
RMS TS error [dB]	0.08	0.11	0.10	0.31

d) Survey design

Acoustic data were collected from 51 transects in GSA 22 and 45 transects in GSA 20. The transects were either parallel, perpendicular to the coastline and 10 nm apart from the 10m isobath to 200m isobaths (reaching the 1500m isobath in certain areas like the Thracian Sea plateau) or zigzag inside gulfs (Fig. 2.8.1-2.8.2). Total nautical miles effectively used for acoustic analysis were 789 and 477 in GSA 22 and GSA 20, respectively.

e) Fish sampling

Echotraces are identified with pelagic hauls. Sixteen (16) pelagic hauls were carried out in GSA 22 and thirteen (13) in GSA 20 to be used for the scrutinizing of the echograms (Fig.

2.8.3 - 2.8.4). Acoustic recording was conducted during daytime and trawl hauls during daytime/ night time. The pelagic net used has headline length of 28m, a sideline dimension of 55m and codend mesh size of 8mm.

f) Oceanographic parameters

74 hydrological stations have been conducted in GSA 22 and 83 hydrological stations in GSA 20 in 2023, using a SBE 19plus CTD, which measures conductivity, temperature, pressure, fluorescence, PAR (Photosynthetically active radiation), oxygen and turbidity (Fig.2.8.1-2.8.2).

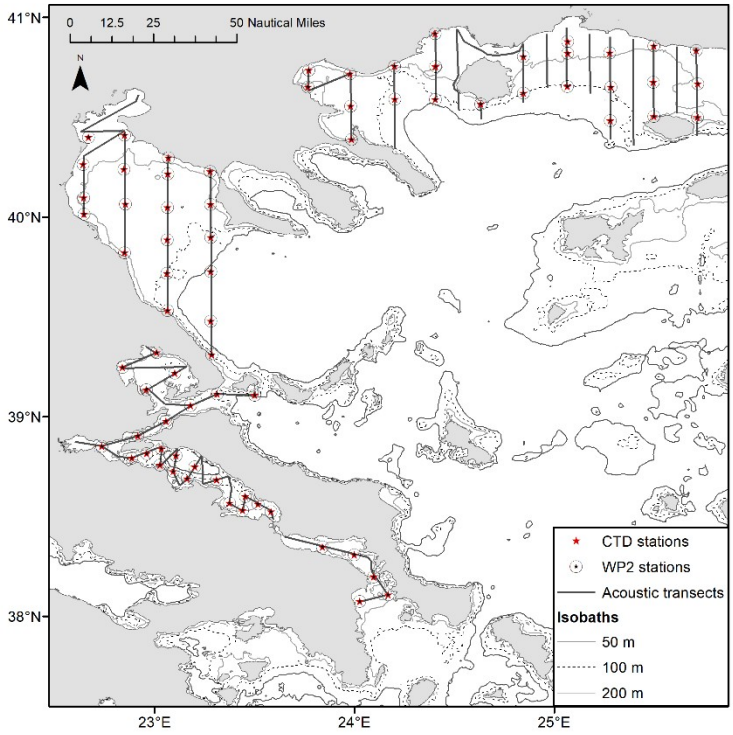


Figure 2.8.1. Acoustic transects sampled in the MEDIAS of the Hellenic part of northern Aegean Sea (GSA 22) in August - September 2023. The position of CTD stations and WP2 stations sampled are also shown.

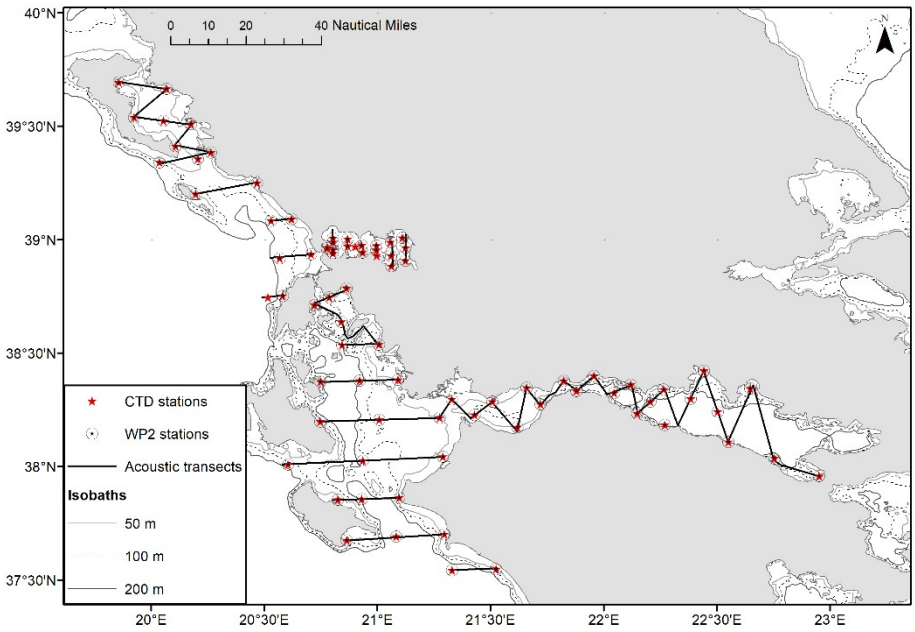


Figure 2.8.2. Acoustic transects sampled in the MEDIAS of the Hellenic part of eastern Ionian Sea (GSA 20) in September - October 2023. The position of CTD stations and WP2 stations sampled are also shown.

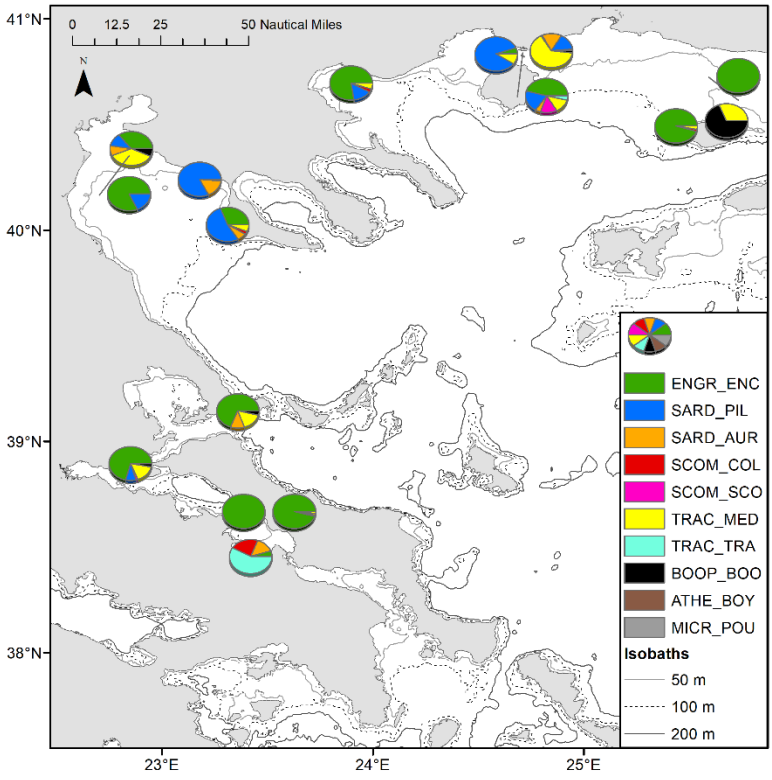


Figure 2.8.3. The catch compositions of the hauls (species kg/haul) weighted per hauling hour in northern Aegean Sea (GSA 22) during August - September 2023.

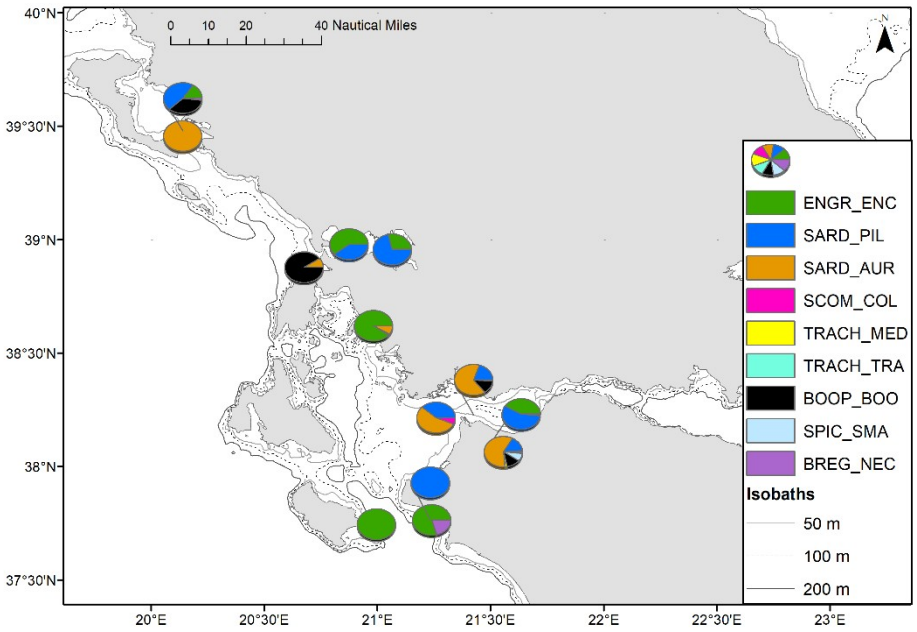


Figure 2.8.4. The catch compositions of the hauls (species kg/haul) weighted per hauling hour in eastern Ionian Sea (GSA 20) during September - October 2023.

g) Biomass estimations of target species

The biomass estimation of sardine and anchovy in GSAs 22 and 20, as well as the associated CVs of geostatistical simulations, are reported in the table 2.8.2. The historical trend of anchovy and sardine in GSAs 22 and 20 are shown in Fig 2.8.5 and Fig 2.8.6.

Table 2.8.2. Estimates of biomass and CV for sardine and anchovy in GSAs 20 and 22 in 2023.

	GSA 22		GSA 20	
	Biomass (t)	**CV**	**Biomass (t)**	**CV**
Anchovy	49329	10%	20584	14%
Sardine	16460	26%	14374	18%

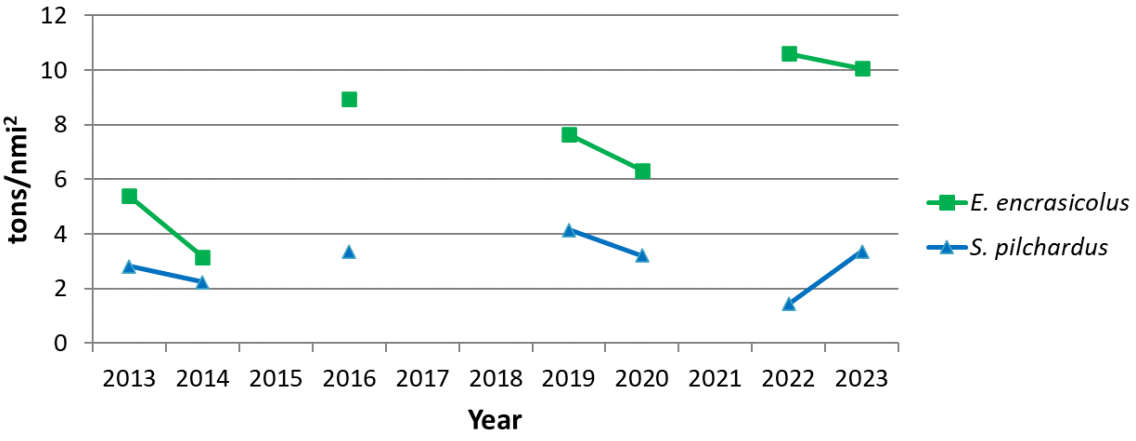


Figure 2.8.5. Historical trends in GSA 22 (northern Aegean Sea).

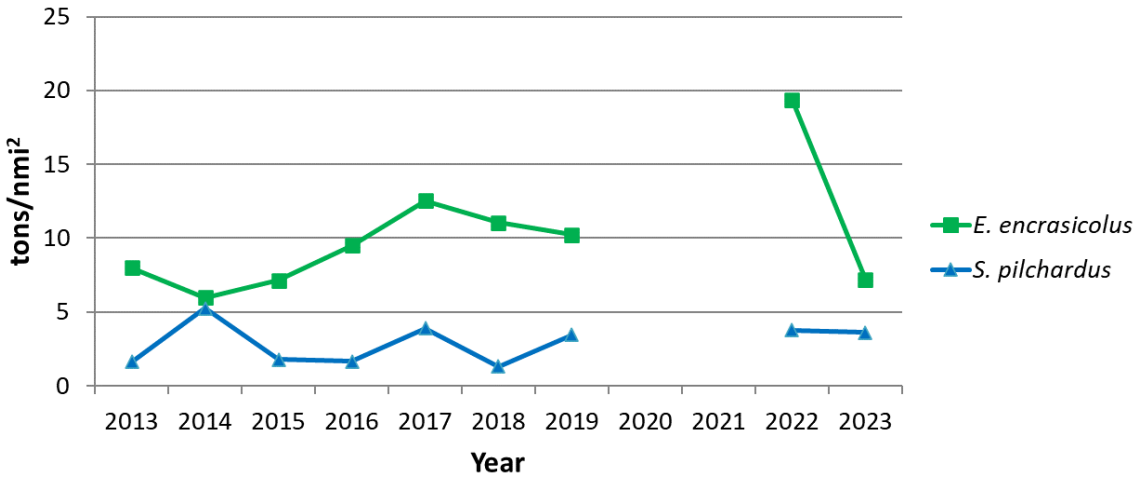


Figure 2.8.6. Historical trends in GSA 20 (eastern Ionian Sea).

Biomass per length class for the two species are shown in Fig 2.8.7 and 2.8.8 for GSA 22 and GSA 20, respectively. Biomass per age class was estimated for anchovy and sardine using otoliths reading and age-length key was assessed (Fig. 2.8.9 and 2.8.10). Subsequently, biomass per age class for the two species are shown in Fig 2.8.11 and 2.8.12 for GSA 22 and GSA 20, respectively.

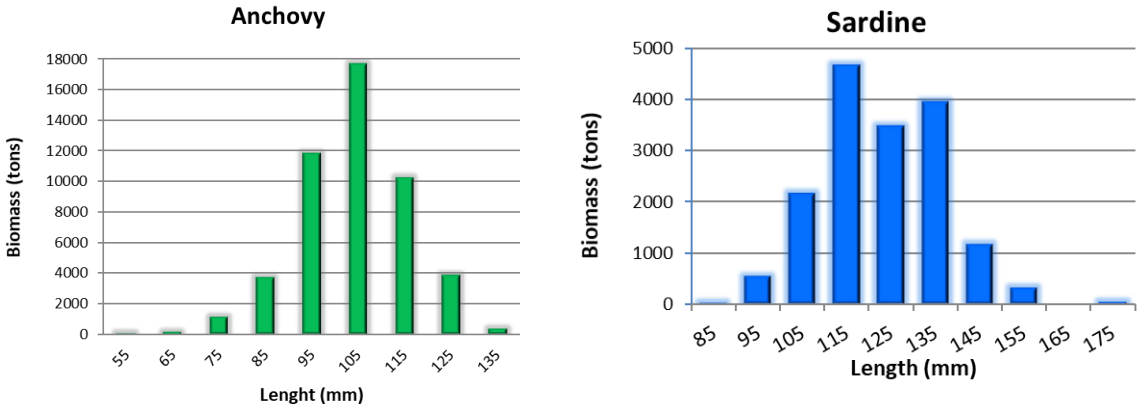


Figure 2.8.7. The anchovy and sardine biomasses (in tons) per length class in northern Aegean Sea (GSA 22) during August - September 2023.

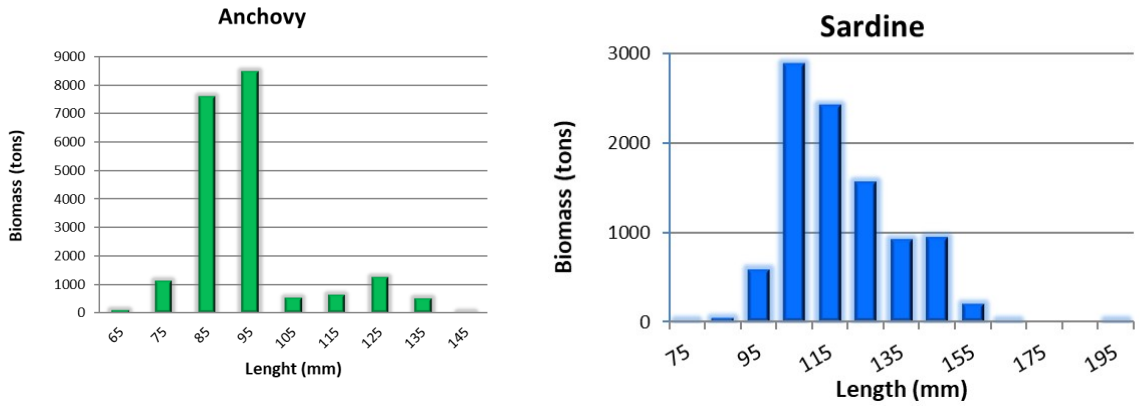


Figure 2.8.8. The anchovy and sardine biomasses (in tons) per length class in eastern Ionian Sea (GSA 20) during September – October 2023.

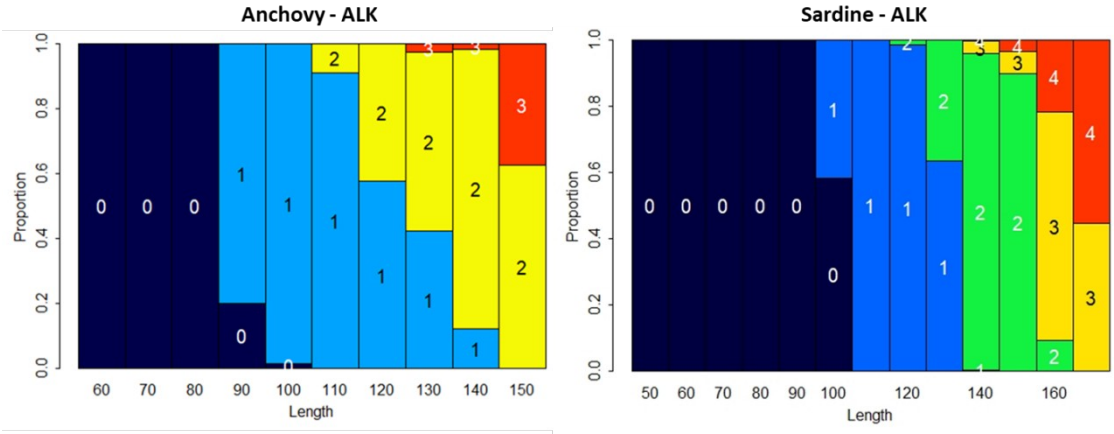


Figure 2.8.9. Age-length key assessed for anchovy and sardine in GSA 22 during August - September 2023.

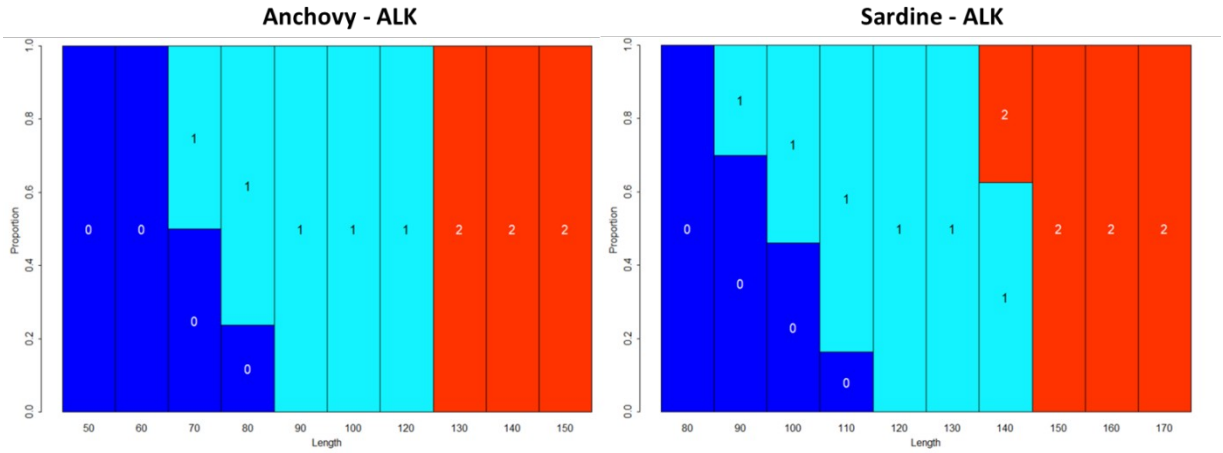


Figure 2.8.10. Age-length key assessed for anchovy and sardine in GSA 20 during September - October 2023.

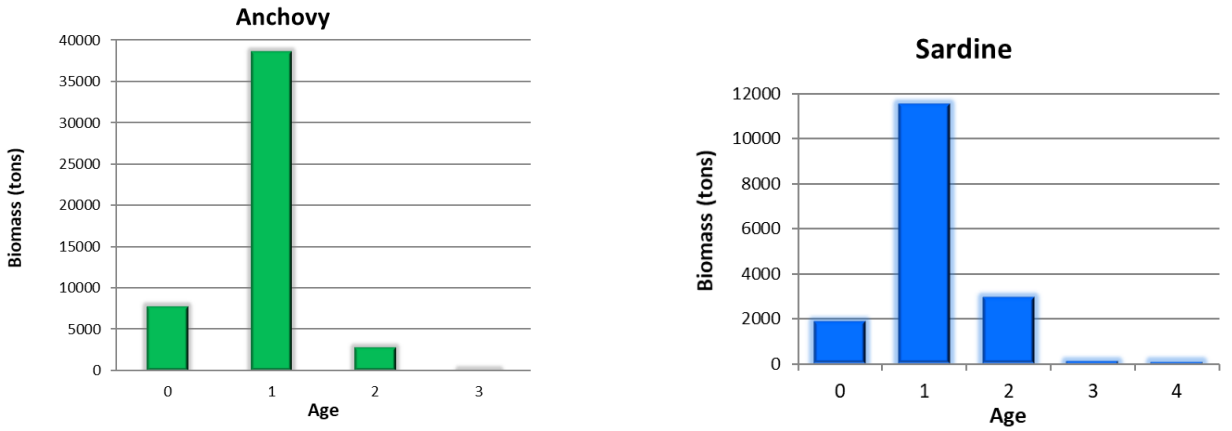


Figure 2.8.11. Anchovy and sardine biomasses (in tons) per age class in northern Aegean Sea (GSA 22) during August - September 2023.

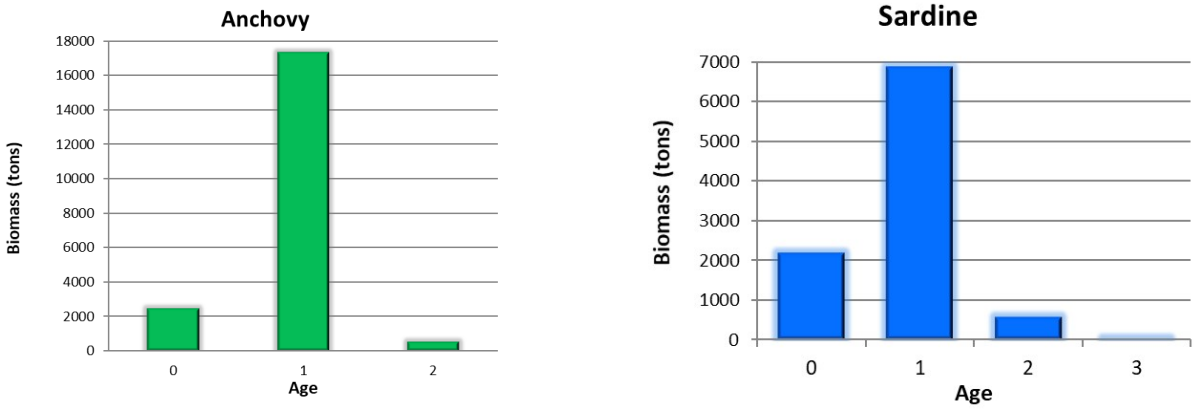


Figure 2.8.12. Anchovy and sardine biomasses (in tons) per age class in eastern Ionian Sea (GSA 20) during September - October 2023.

h) Abundance indices of target species

Spatial distributions of anchovy and sardine abundance indices, in terms of NASC (m^2/nm^2) and biomass (tons/EDSU) for GSAs 22 and 20, are given in Fig 2.8.13 - 2.8.20. The spatial distribution of total fish NASC (m^2/nm^2) is given in Fig 2.8.21 and 2.8.22.

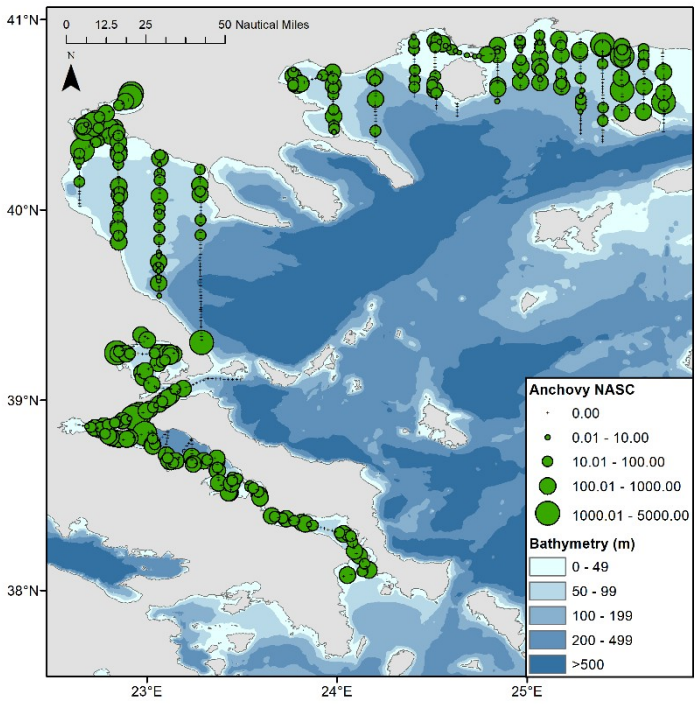


Figure 2.8.13. The distribution of anchovy NASC (m^2/nm^2) per EDSU in northern Aegean Sea (GSA 22) during August - September 2023.

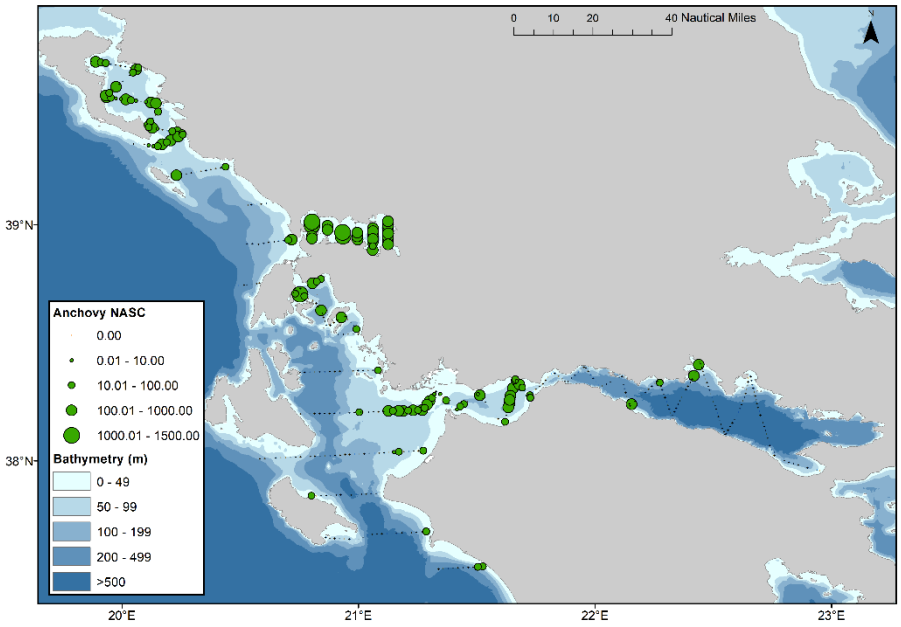


Figure 2.8.14. The distribution of anchovy NASC (m^2/nm^2) per EDSU in eastern Ionian Sea (GSA 20) during September - October 2023.

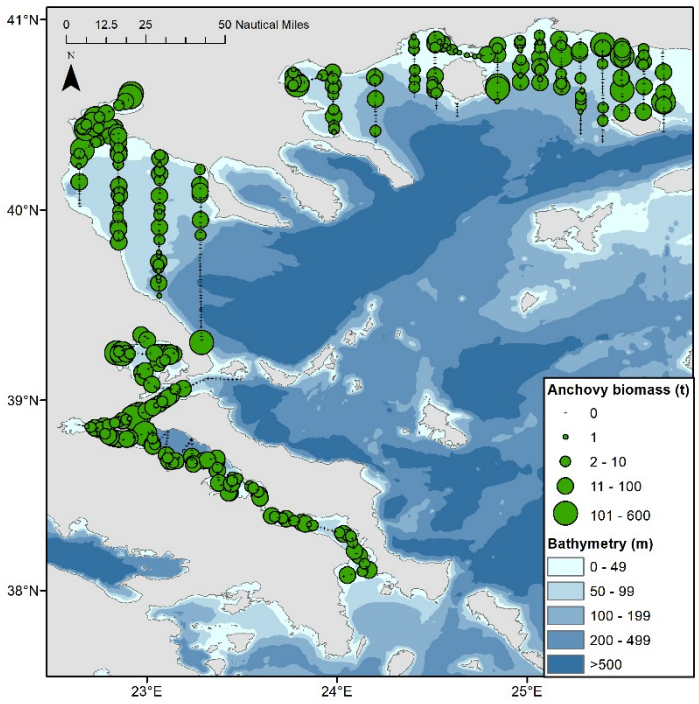


Figure 2.8.15. The distribution of anchovy biomass (t) per EDSU in northern Aegean Sea (GSA 22) during August - September 2023.

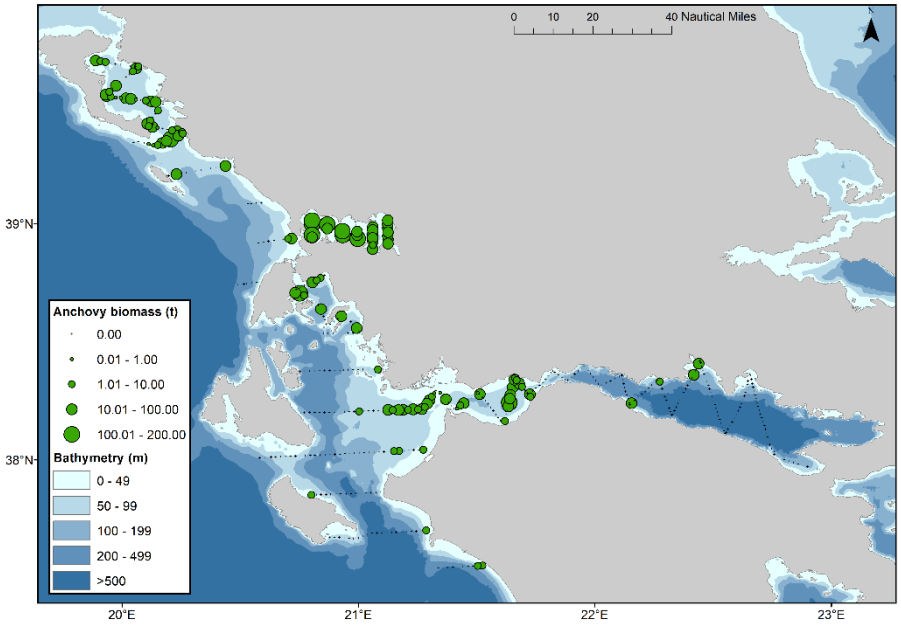


Figure 2.8.16. The distribution of anchovy biomass (t) per EDSU in eastern Ionian Sea (GSA 20) during September - October 2023.

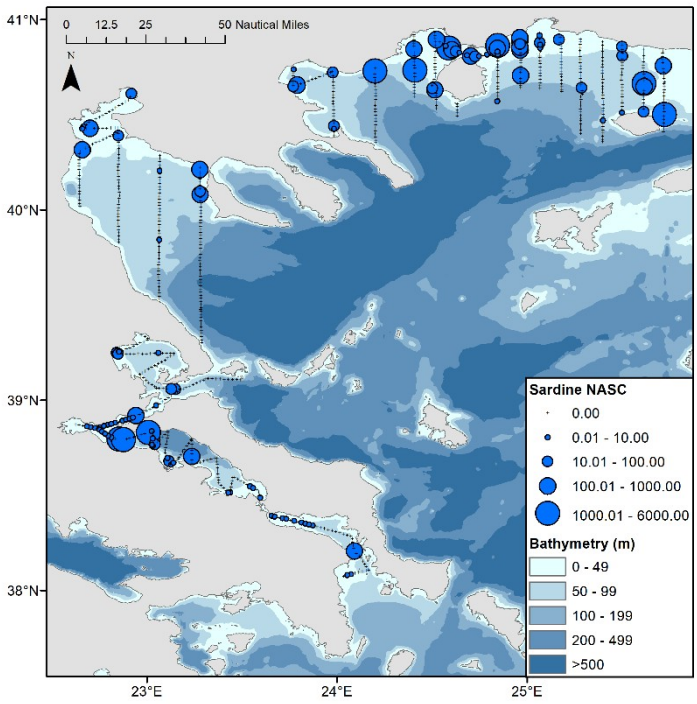


Figure 2.8.17. The distribution of sardine NASC (m^2/nm^2) per EDSU in northern Aegean Sea (GSA 22) during August - September 2023.

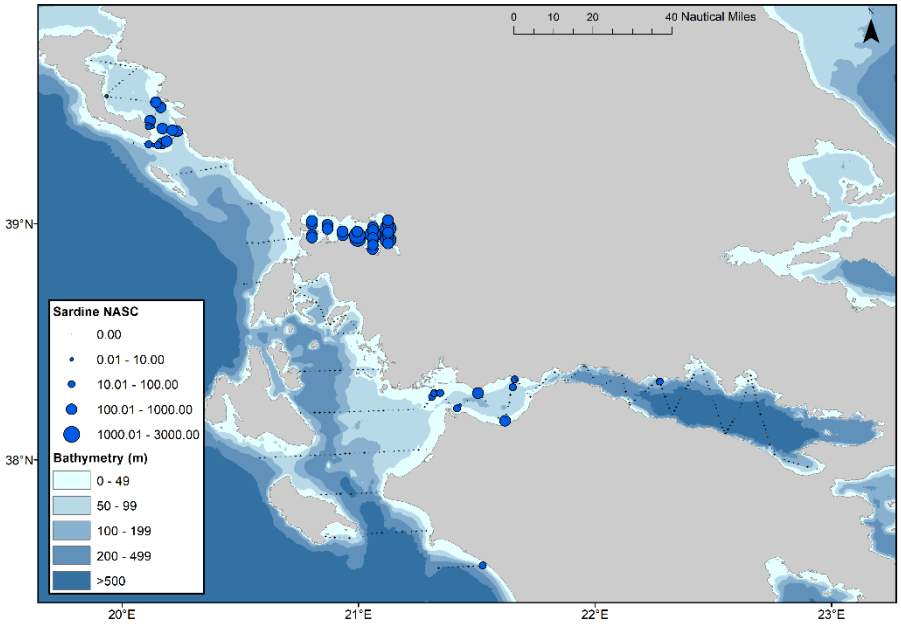


Figure 2.8.18. The distribution of sardine NASC (m^2/nm^2) per EDSU in eastern Ionian Sea (GSA 20) during September - October 2023.

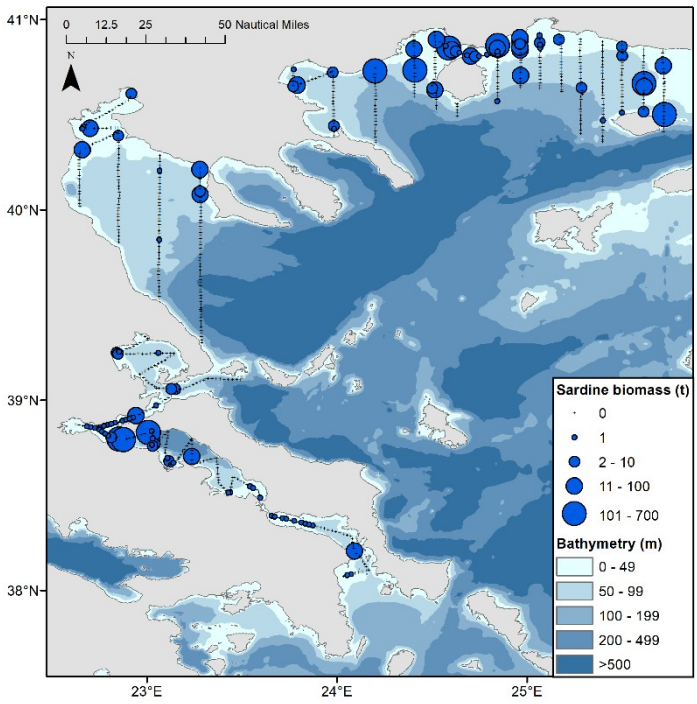


Figure 2.8.19. The distribution of sardine biomass (t) per EDSU in northern Aegean Sea (GSA 22) during August - September 2023.

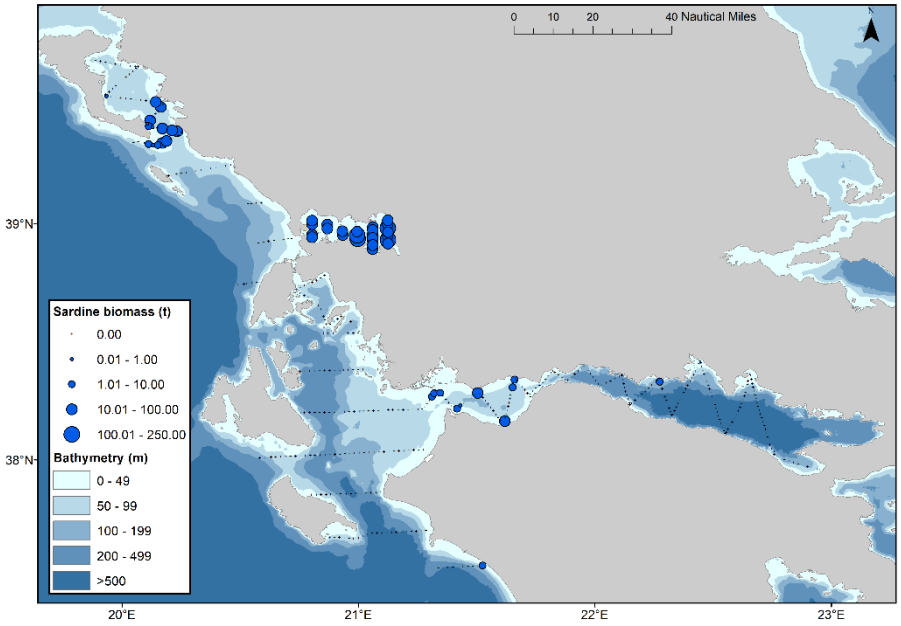


Figure 2.8.20. The distribution of sardine biomass (t) per EDSU in eastern Ionian Sea (GSA 20) during September - October 2023.

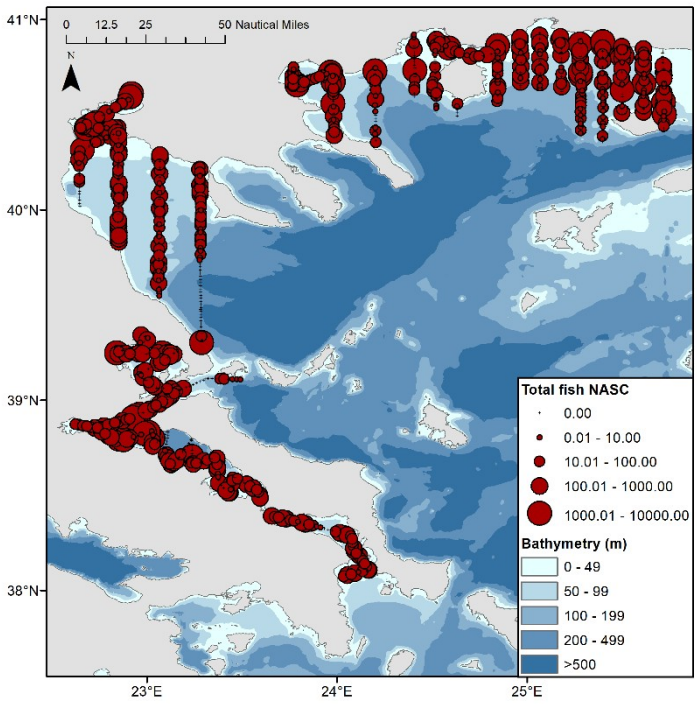


Figure 2.8.21. The distribution of total fish NASC (m^2/nm^2) per EDSU in northern Aegean Sea (GSA 22) during August - September 2023.

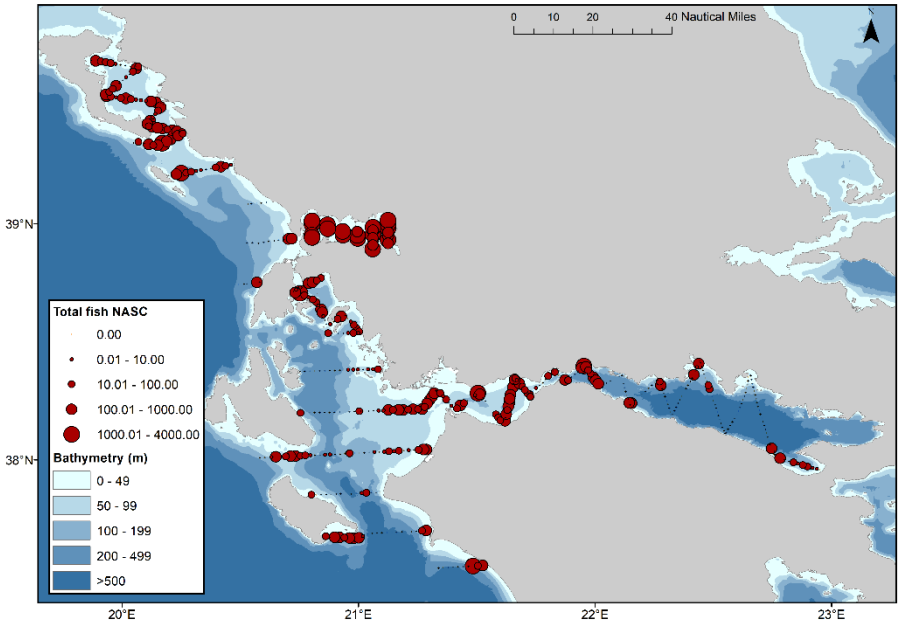


Figure 2.8.22. The distribution of total fish NASC (m^2/nm^2) per EDSU in eastern Ionian Sea (GSA 20) during September - October 2023.

2.9. Pilot acoustic survey in Cyprus 2023 GSA25: (I. Thasitis DFMR, A. Machias, K. Tsagarakis, Z. Kapelonis, M.M. Pyrounaki, S. Somarakis, E. Schismenou, K. Markakis, E. Andriotis, O. Anadoli, M. Giannoulaki, HCMR)

a) General information on the survey

Pilot acoustic survey in Cyprus covered 1450 nm^2 of national waters during March 2023 with the fishery Research Vessel PHILIA (26 m length, 2× 340 HP).

b) Type of echosounders and frequencies in use

The split beam echo sounder used was SIMRAD EK80, operating at frequencies of 38, 120, 200 and 333 kHz. No threshold limit was applied to the raw data. The threshold for processing for the assessment (38 kHz) was set to -70 dB. The pulse duration is 1.024 ms. The surveying acoustic vessel maintained a speed of 8 knots. Echoview software was used to visualize and analyze the acoustic data.

c) Calibration results

The acoustic system was calibrated at the beginning of the pilot acoustic survey 2023 in Cyprus.

Table 2.9.1. Calibration results of the Pilot Acoustic Survey in Cyprus 2023.

	38 kHZ (ES38-7)	**120 kHz (ES120-7c)**	**200 kHz (ES200-7c)**	**333 kHz (ES333-7c)**
Target	Copper (Cu) 60 mm	Copper (Cu) 23 mm	Copper (Cu) 13.7 mm	Tungsten (Wc-Co) 22 mm
Beam Angle [deg]	7	7	7	7
Gain (adj., final) [dB]	0.81, 26.31	0.59, 27.96	1.27, 28.58	0.83, 24.72
Sa correction [dB]	-0.10	-0.04	-0.09	-0.04
Offset alongship [deg]	0.01	-0.07	-0.07	-0.26
Offset athwartship [deg]	-0.06	-0.02	0.01	-0.26
Beamwidth alongship [deg]	7.88	6.43	6.51	6.33
Beamwidth athwartship [deg]	8.02	6.29	6.56	6.03
Depth [m]	14.5	14.7	14.7	14.7
RMS TS error [dB]	0.08	0.11	0.10	0.31

d) Survey design

Acoustic data were collected from 54 transects in GSA 25. The transects were parallel, perpendicular to the coastline and 10 nm apart from the 10m isobath to 500m isobaths (Fig. 2.9.1). Total nautical miles effectively used for acoustic analysis in GSA 25 were 319.

e) Fish sampling

Acoustic recording was conducted during daytime and trawl hauls during daytime/ night time. Thirteen (13) pelagic hauls were carried out in GSA 25 four (4) demersal hauls. However, they ended up with zero catch (Fig. 2). The pelagic net used has headline length of 28m, a sideline dimension of 55m and codend mesh size of 8mm.

f) Oceanographic parameters

53 hydrological stations have been conducted in GSA 25 in 2023, using a SBE 19plus CTD, which measures conductivity, temperature, pressure, salinity and fluorescence.

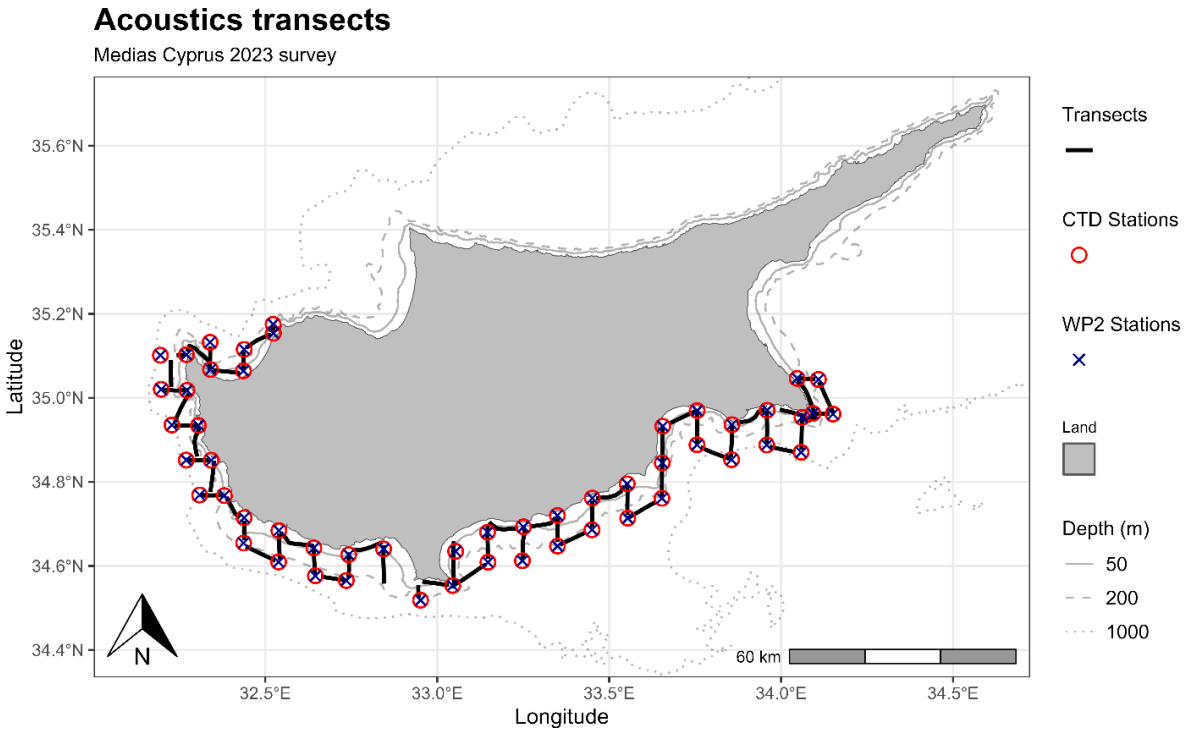


Figure 2.9.1. Acoustic transects sampled in the Pilot Acoustic Survey in Cyprus (GSA 25) in March-April 2023. The position of CTD stations and WP2 ichthyoplankton stations sampled are also shown.

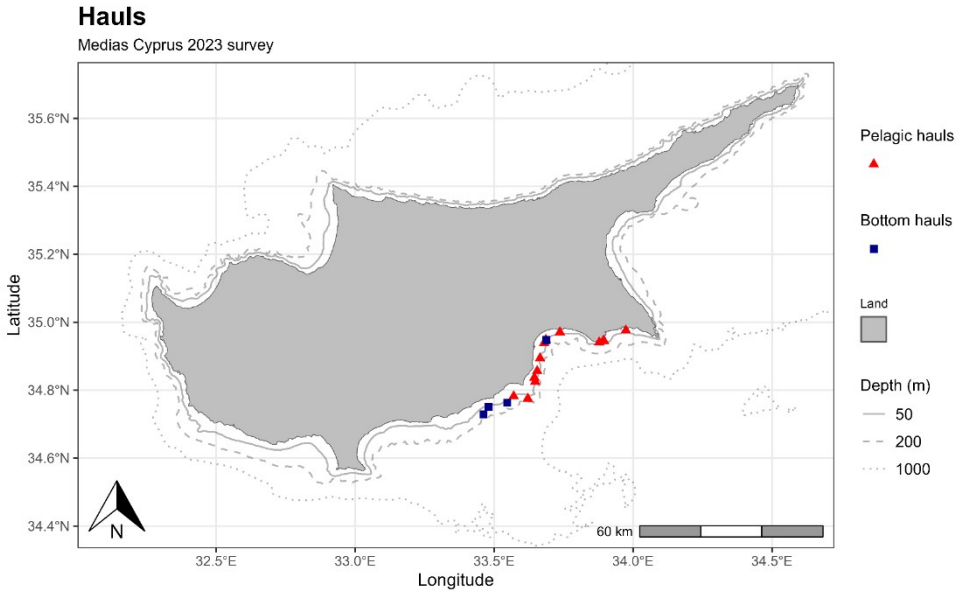


Figure 2.9.2. Positions of hauls carried out within the Pilot Acoustic Survey in Cyprus in March-April 2023.

g) Biomass estimations of target species

As the biological sampling was not successful during the Pilot Acoustic Survey in Cyprus in March April 2023, there was no fish biomass estimation. Instead, total fish echo abundance was split into mesopelagic fish echo abundance, benthopelagic fish echo abundance and mixed pelagic fish echo abundance based on echo traces position in the water column, bathymetry and experts' knowledge.

h) Abundance of fish assemblages

Spatial distributions of fish echo abundance in terms of NASC (m^2/nm^2) in GSA 25, are given in Fig 2.9.3 - 2.9.4.

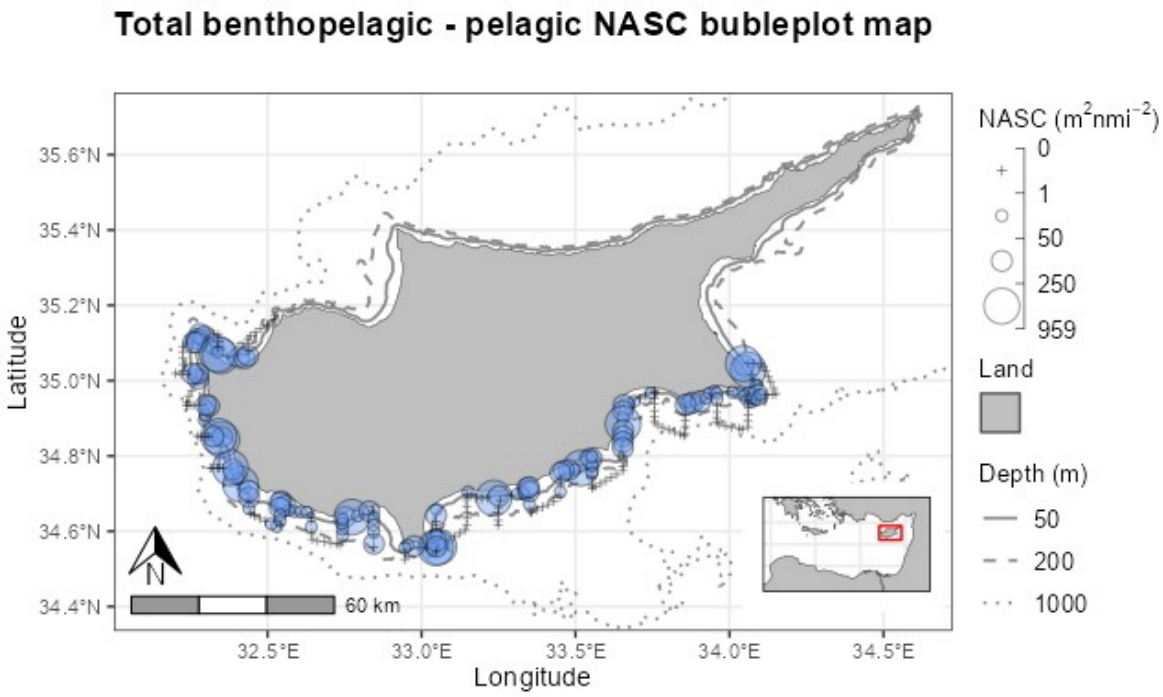


Figure 2.9.3. The distribution of total benthopelagic- pelagic fish NASC (m^2/nm^2) per EDSU in GSA 25 during March – April 2023.

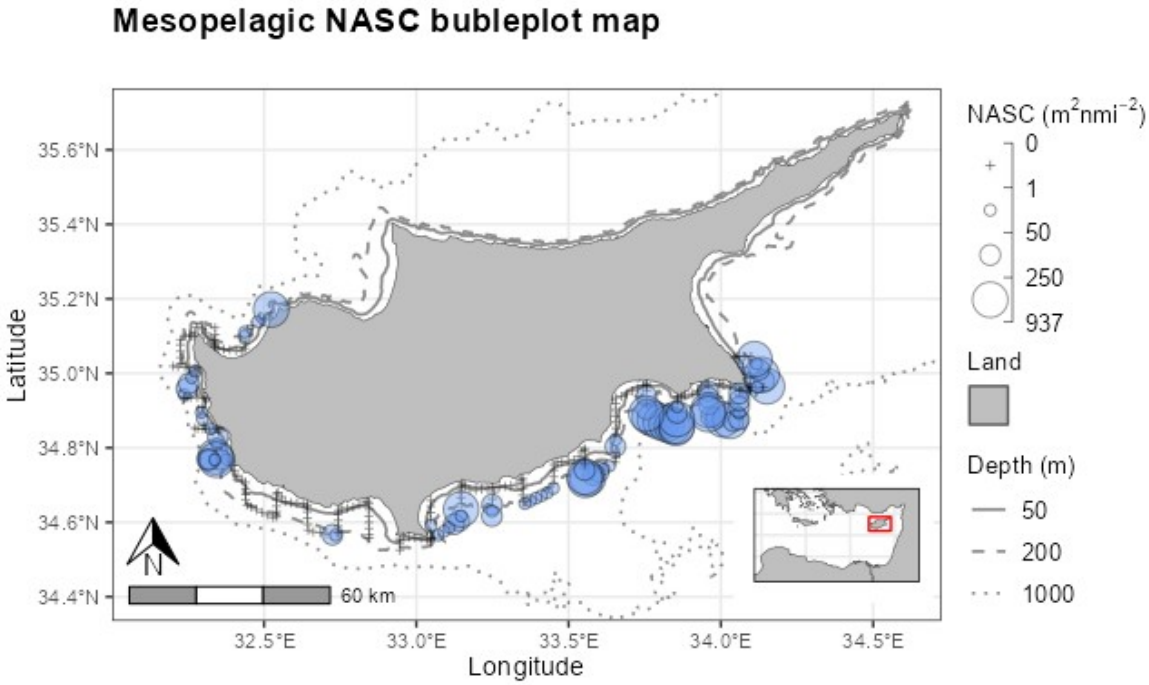


Figure 2.9.4. The distribution of mesopelagic fish NASC (m^2/nm^2) per EDSU in GSA 25 during March - April 2023.

3. Results of pelagic trawl surveys in the Black Sea (GSA 29) in 2023

3.1. MEDIAS 2023 in the GSA 29 - Black Sea Bulgarian waters (Violin Raykov, Dimitar Dimitrov-Institute of Oceanology- Bulgarian academy of sciences)

a) General information on the survey

Pelagic trawl survey in the Black Sea (*PTSBS*) for sprat stock assessment are planned for June -July (spring season) and October - November (autumn season) applying the swept area method in the Bulgarian Black Sea area.

The Pelagic Trawl survey (PT) was accomplished on board of research vessel HaitHabu. The main characteristics of the ship are given bellow: IMO = 8862686; MMSI = 207139000; Call sign = LZHC; Flag = Bulgaria [BG]; AIS Vessel Type = Other; Gross Tonnage = 142; Length Overall x Breadth Extreme = 24.53m × 8m; Crew = 6.

The aim of the pelagic trawl survey in the Black Sea is the assessment of the biomass of sprat (*Sprattus sprattus*) stock. Furthermore, an analysis of the distribution and abundance of the other species caught as well as by-catch will be presented. Accordingly, this survey aims to:

- Estimating abundance indices (by number and biomass) of the main pelagic species of commercial interest distributed at a depth between 10 m and 100 m;

- Describing the demographic structure of species of interest to the fishery, together with spatial distribution patterns;

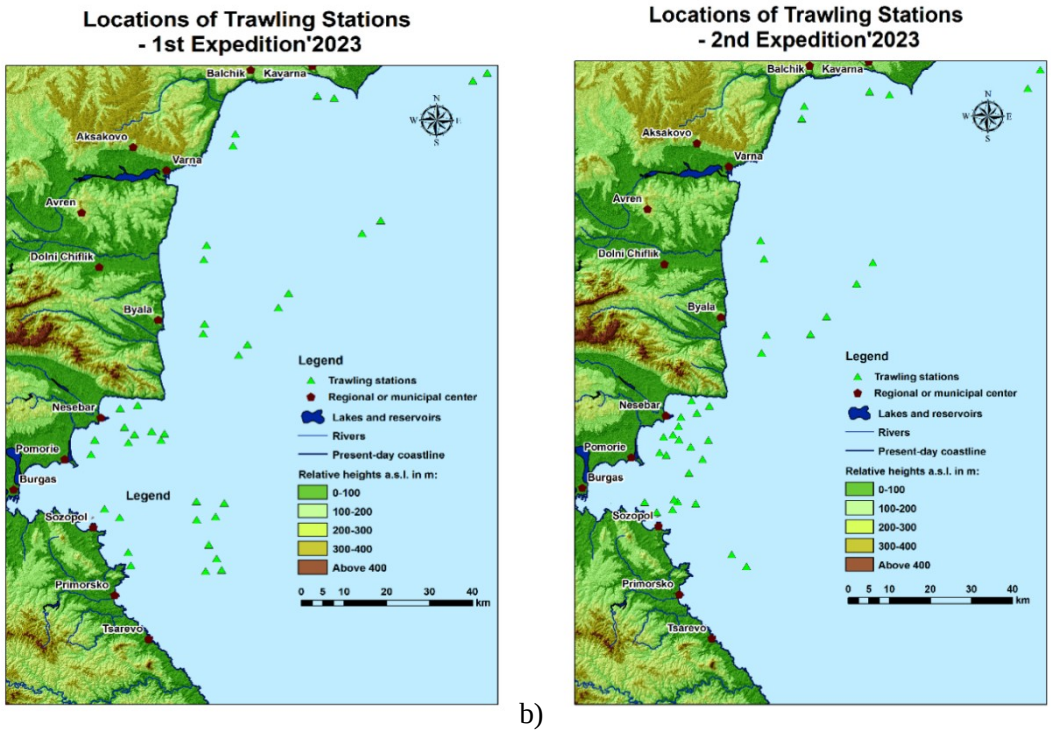
- Undertaking size and biological sampling, including extraction of parts to determine the age of the main species targeted by the fishery;

- Estimate maturity and feeding ecology of sprat and horse mackerel;

- Assessing the impact of fishing activity on the environment.

b) Survey design

To establish the abundance of the target species (*Sprattus sprattus*) and bycatch in front of the Bulgarian coast a standard methodology for stratified sampling was employed (Gulland, 1966). To address the research objectives the region was divided into 3 strata according to depth: Stratum 1 (15 - 30 m), Stratum 2 (35 – 50 m) and Stratum 3 (50 – 100m). The study area in Bulgarian waters was partitioned into 128 equal in size, not overlapping fields, situated at a depth between 16-92 m. At 37 of the fields chosen at random, sampling employing midwater trawling was carried out. Each field is a rectangle with sides 10' Lat × 10' Long and area around 125.16 km2 (measured by application of GIS), large enough for a standard lug extent in a meridian direction to fit within the field boundaries.



a) b)

Figure 3.1.1. Pelagic trawl planned distribution points. (a) Spring season and (b) autumn season. MEDIAS 2023.

c) Fish sampling

The dimensions of the pelagic trawl employed are as follows: type of pelagic trawl = 50/35 – 74 m; Length of the head rope = 40 m; Horizontal spread of trawl = 16 m; Vertical spread of trawl = 7 m; Mesh size of the net = 7x7 mm; Effective part of wingspread = 27 m; Pelagic doors = 3.5 m^2

The hauls were carried out during the day with single haul duration between 30 - 40 min; depending on hydro-meteorological conditions at average trawl speed 2.7 knots. Each survey includes 30 mid-water trawl hauls for 10 days.

The main aim of the survey is to obtain the abundance index for sprat, whiting, picked dogfish and horse mackerel, red mullet, anchovy exploited stock. During the surveys, the collected information include length (TL), weight, sex composition and maturity. Otoliths for age determination are collected and discards are investigated.

The methodology of pelagic survey is available in the following links: http://www.io-bas.bg/publications/manuals/Raykov_best_guidline_RAYKOV_Corr_last.pdf; http://www.io-bas.bg/publications/manuals/Methodology%20for%20pelagic%20research%20in%20the%20Bulgarian%20Black%20Sea%20waters_IO_BAS.pdf

Collected information from the sprat survey: the data recorded for each haul includes: depth, measured by the vessel's echo sounder; GPS coordinates of start/end haul points; haul duration; abundance of the target species; weight of total catch; absolute and standard length,

individual weight of the separate specimens; otoliths collection for age determination; sex identification and the species composition of the by-catch.

d) Biomass estimations of target species in summer survey

Pelagic trawl spring surveys: in summer 2023.

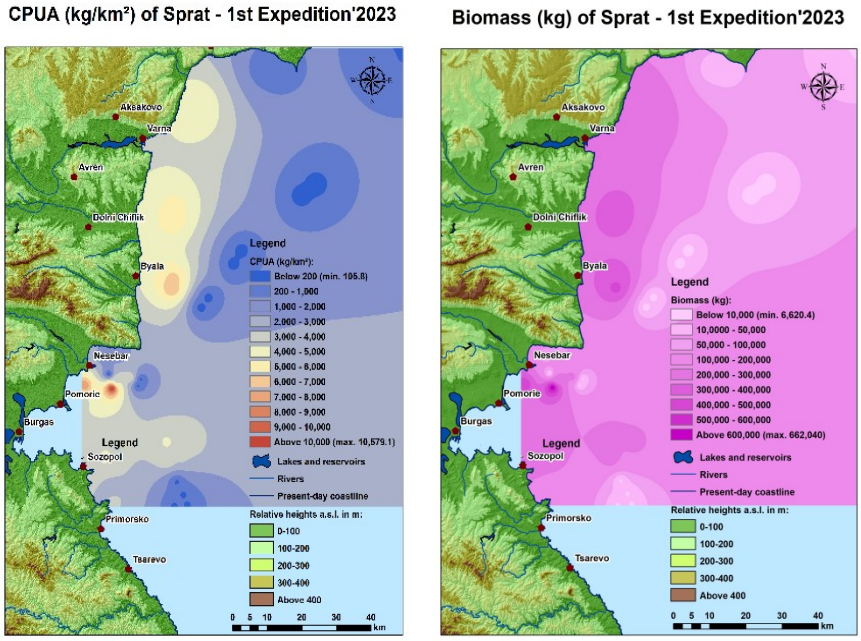


Figure.3.1.2. Catch per unit area (CPUA kg.km^{-2}) and sprat biomass from the deep layers of the study areas in July, 2023.

Table 3.1.1. Area method in July 2023, calculated average sprat catch per unit area (CPUA, average), Biomass – weight in tonnes, surface in km^2 and number of fields per area.

Average CPUA	depths	Biomass	Surface km^2	N stations
2552.20	15–30 m	12496.55	2065.14	33
3364.15	30–50 m	7556.84	1814.82	29
3128.39	50–100 m	13223.86	4130.28	66
		33227.25	8010.24	128

The total studied area was 8010.24 km^{-2}, and the amount of total biomass of sprat in the Bulgarian waters of the Black Sea in July 2022 amounted to 33 227 tonnes.

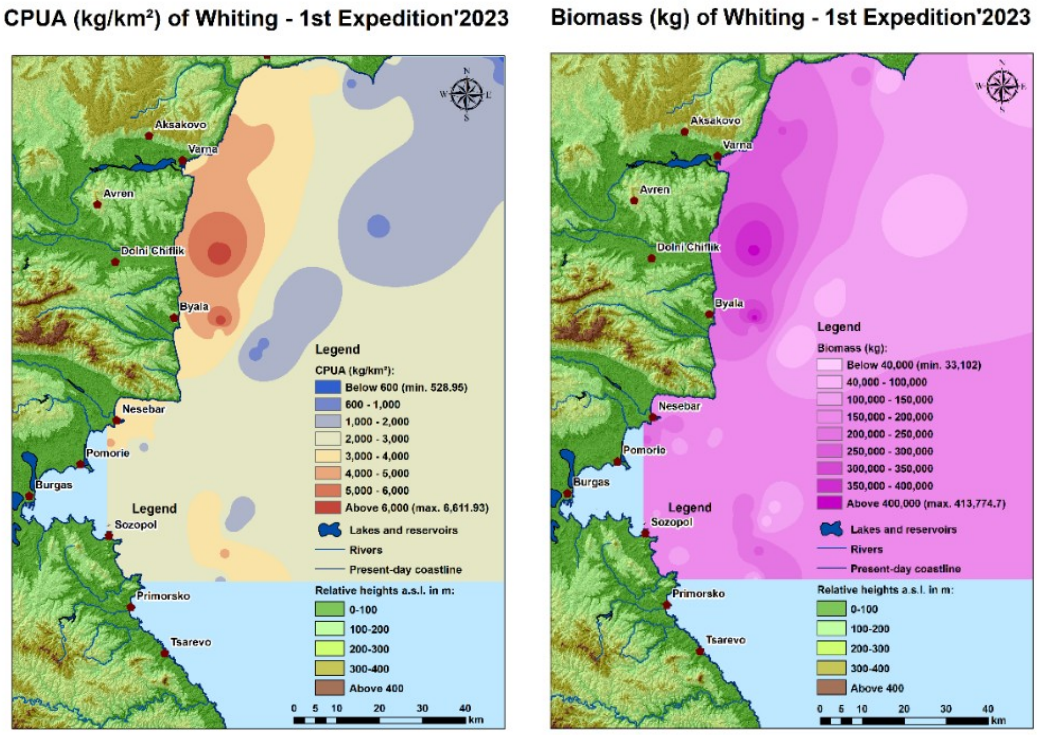


Figure.3.1.3. Whiting abundance and biomass at different depth layers in July 2023.

Table 3.1.2. The Area method in July, 2023 calculated average whiting catch per unit area (CPUA, average), biomass, weight in kg, **Surface in km²** and number of fields per area.

Average CPUA	Depths, m	Biomass	Surface km²	N stations
2750.56	15–30	5680.3	2065.14	33
2683.24	30–50	4869.6	1814.82	29
2716.9	50–75	11222	4130.28	66
		21771.5	8010.24	128

The total investigated area was 8010.24 km^{-2}, and the amount of total biomass of whiting 21771 tons.

The total surveyed area was 8010.24 km^{-2}, and the amount of total biomass of mullet was 2883.8 tons (Table 3.1.3, Fig. 3.1.4). The densest aggregations were observed in front of the town of Pasha Dere, in front of the resort of Albena, in front of the town of Balchik under the Kaliakra river and in the Nesebar Bay at depths of 30–50m, and west of Sozopol at depths of 50–100m. The species was recorded in 24 stations (out of a total of 38), with the highest density in the 30–50 m stratum.

We observed the densest clusters and biomass peak in the range 50–100m (1442 t); 15–30 m (874 t) and 30–50 m (568 t).

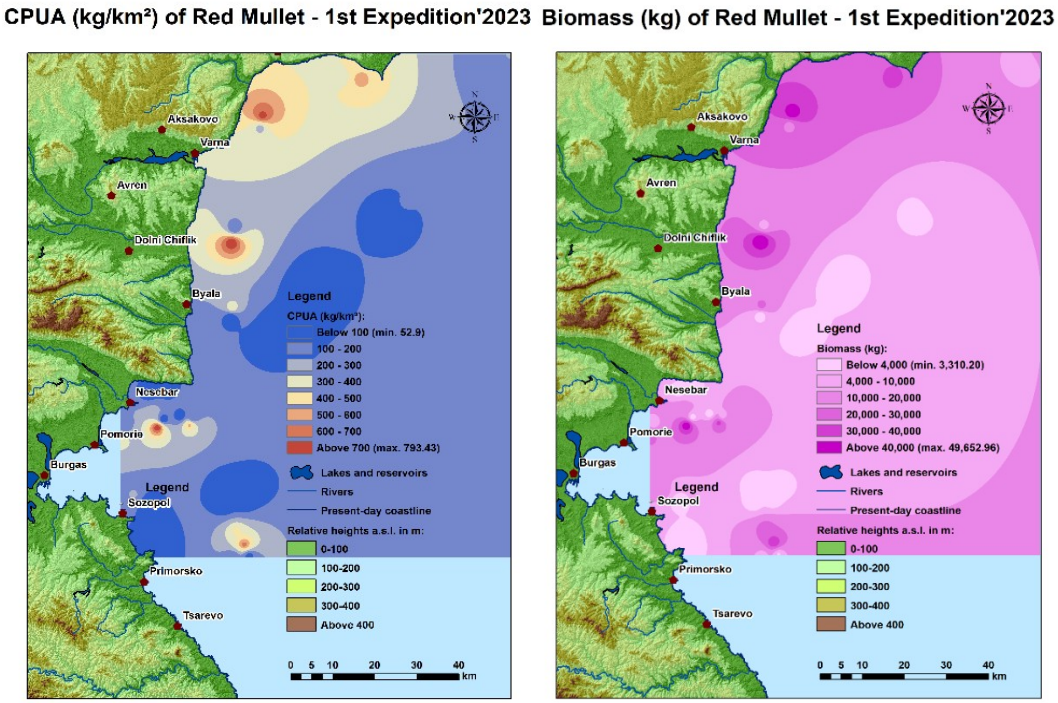
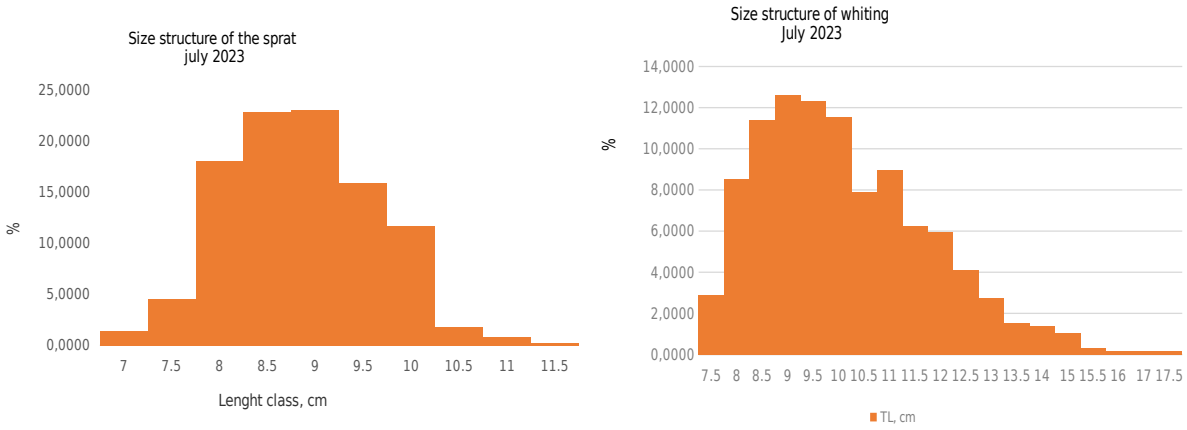


Figure.3.1.4. Red mullet abundance and biomass at different depth layers in July 2023.

Table 3.1.3. Swept area method for stock survey in July 2023 – average values of catch per unit area (CPUA), biomass (kg), Ax – area and number of fields.

CPUA average	Strata (m)	Biomass (kg)	Surface km^2	No. of stations
423.16	15–30	873.89	2065.14	33
312.97	30–50	567.97	1814.82	29
349.11	50–100	1441.92	4130.28	66
		2883.8	8010.24	128



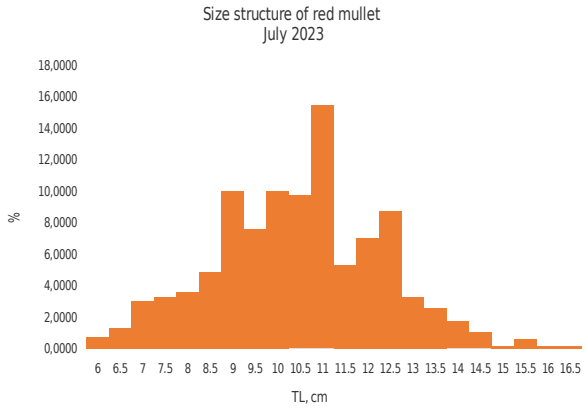


Figure.3.1.5. Size structure of sprat, whiting and red mullet, July 2023.

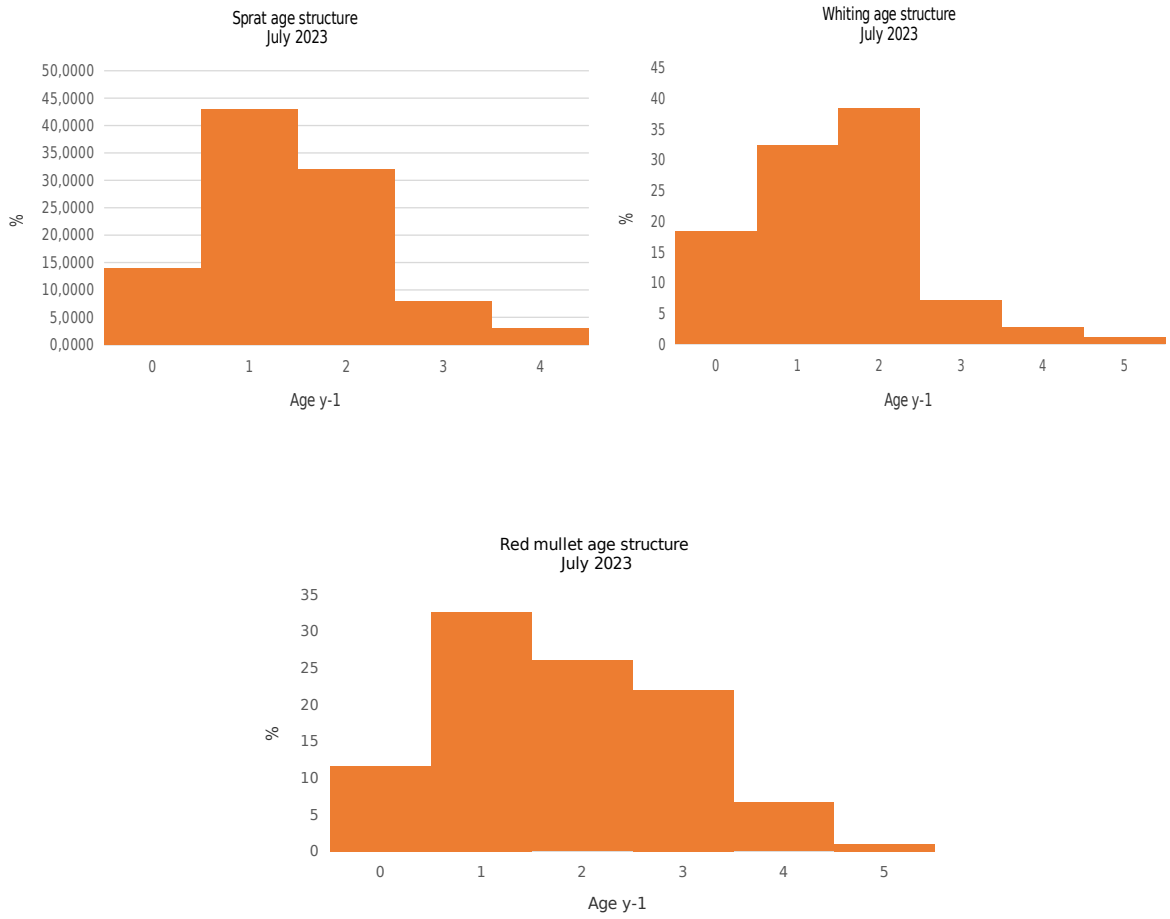
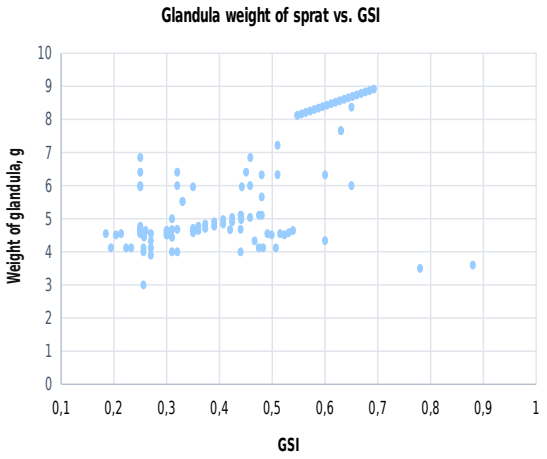


Figure.3.1.6. Age structure of sprat, whiting and red mullet, July 2023.

The size classes of 8.0–8.5 cm dominated the sprat catches, as the highest size classes were represented with low percentage. In July 2023, the 8.5 cm size class had the largest percentage of representation in catches, followed by the 8 cm size class. These trends are also observed in previous periods (2007–2015) (Raykov et al., 2007–2023). Regarding the presentation of the size classes in the total biomass – classes 8.0–8.5–9.0 cm was predominant

(Fig 3.1.5). In Figure 3.1.6 the distribution of biomass by age groups is presented. In July 2023, age groups 1-1+ y^{-1} and 2-2 + y^{-1} had a significantly larger prevalence in catches compared to the other age groups.

Figure 3.1.7. Biomass and abundance by lengths and age of sprat, red mullet and whiting July 2023.



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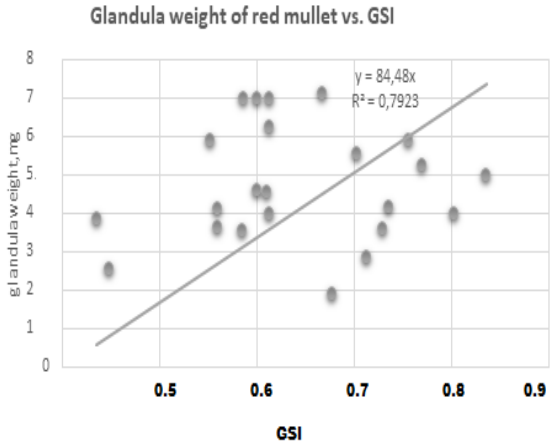

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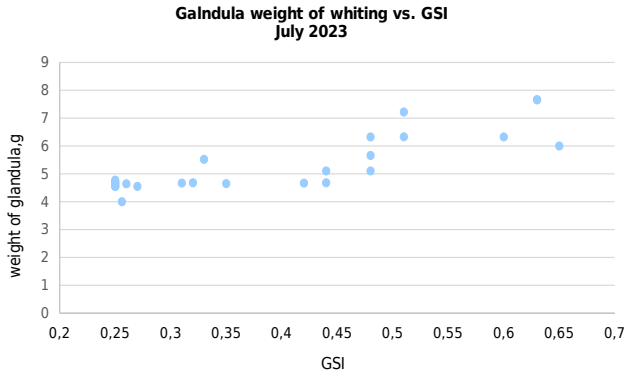
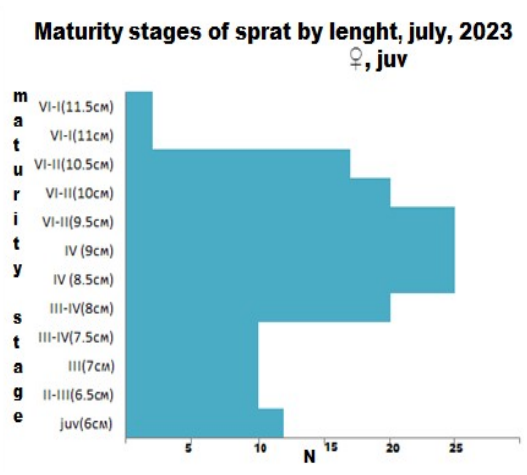


c)

Figure 3.1.8. Gonadosomatic index of a) sprat, b) red mullet, c) whiting during the studied period (GSI,% vs. glandule weight).



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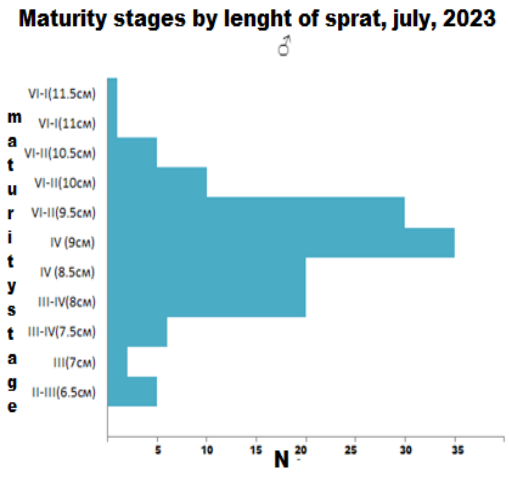

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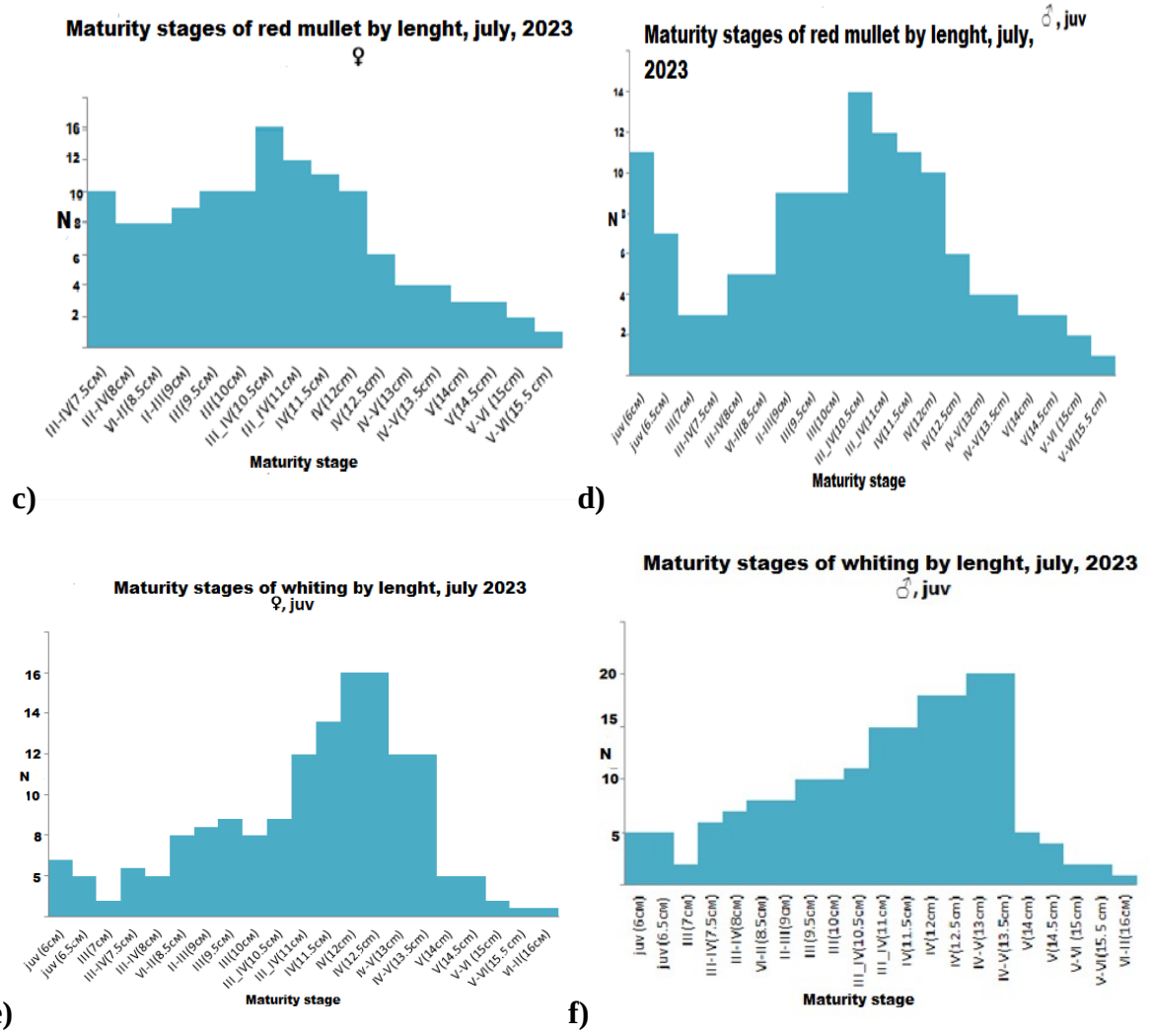


Figure 3.1.9. Sexual maturity of the studied species, analyzed by size classes (female – ♀, male – ♂ and young – juveniles) a) sprat ♀, juveniles b) sprat ♂ c) red mullet ♀, d) red mullet ♂, juveniles e) whiting ♀, juveniles f) whiting ♂, juveniles.

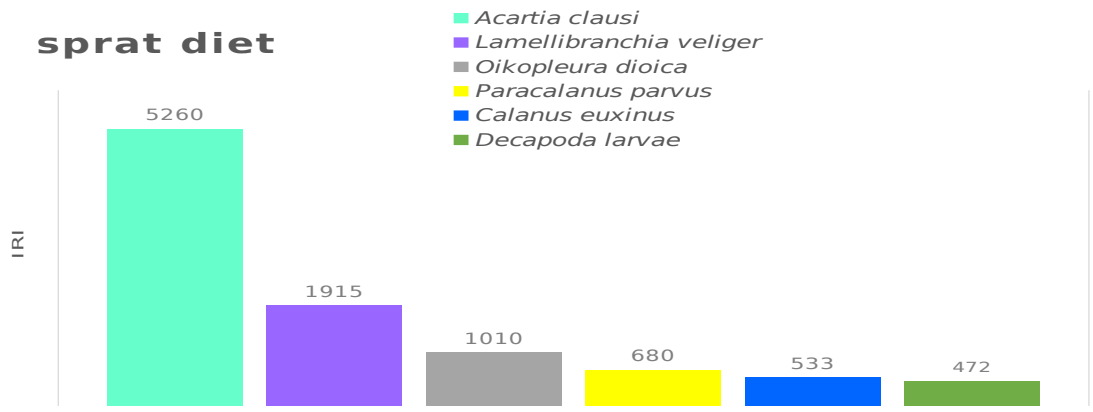


Figure 3.1.10. The mean values of the indices of relative importance (IRI) of the main mesozooplankton species in the sprat diet (VII. 2023).

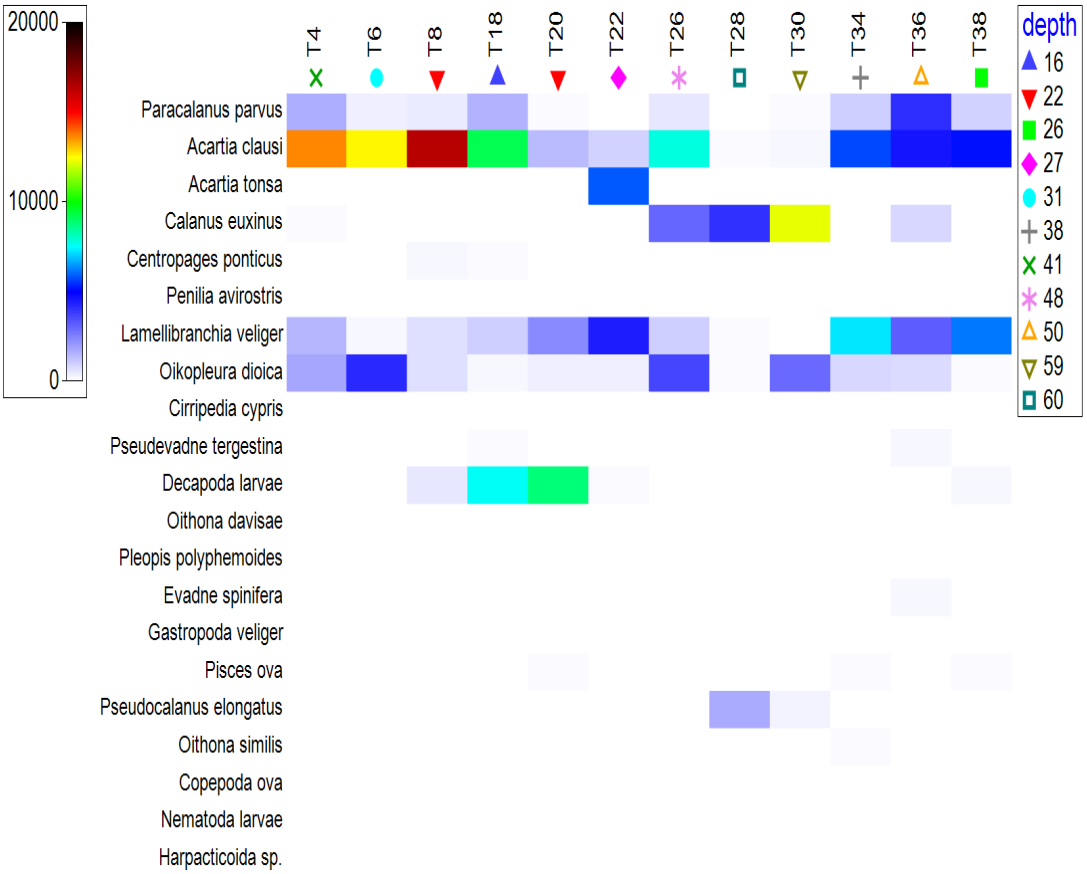


Figure 3.1.11. Sprat food composition (based on the index of relative importance of zooplankton species, IRI) and according to the depth of the studied areas.

e) Biomass estimations of target species in autumn survey

The catch per unit area (CPUA kg.km-2) was relatively high, with the formation of the sprat agglomerations. The densest agglomerations are observed in front of Sozopol, Primorsko, Kavarna, Balchik and Nessebar, and in the rest of the studied areas the species is spatially dispersed (Fig. 3.1.12)

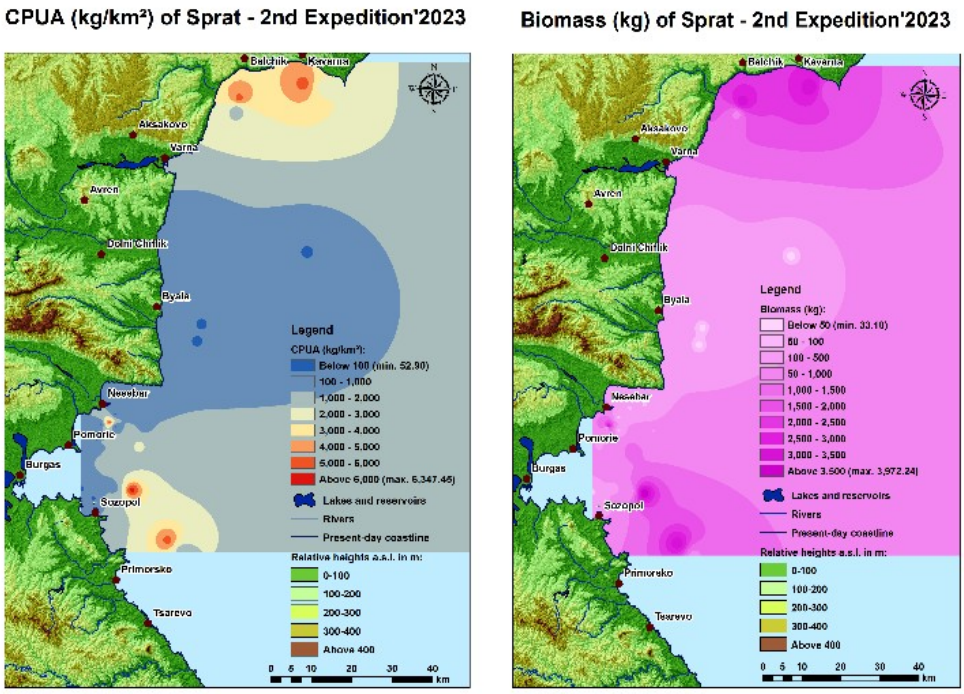


Figure 3.1.12. Catch per unit area (CPUA kg.km^2) and sprat biomass from the deep layers of the study areas in November, 2023

Table 3.1.4. Area method in November 2023, calculated average sprat catch per unit area (CPUA, average), biomass - weight (t), area in km^2 and number of fields per area

Average CPUA	Depths	Biomass	Surface km^2	No.stations
1303.15	15-30м	2691.18719	2065.14	33
1769.593	30-50м	3211.49349	1814.82	29
77.07623	50-100м	318.346429	4130.28	66
		6221.02711	8010.24	128

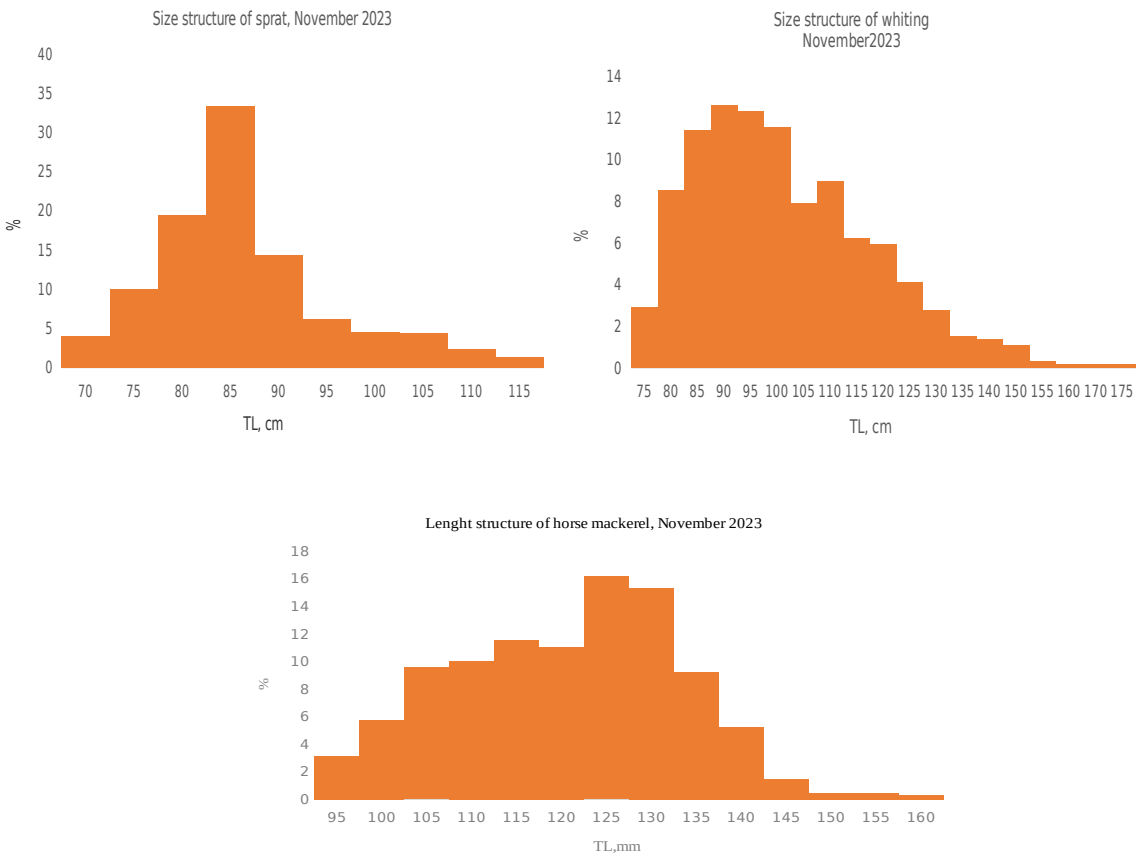


Figure 3.1.13. Length distribution of sprat, whiting and red mullet, November 2023.

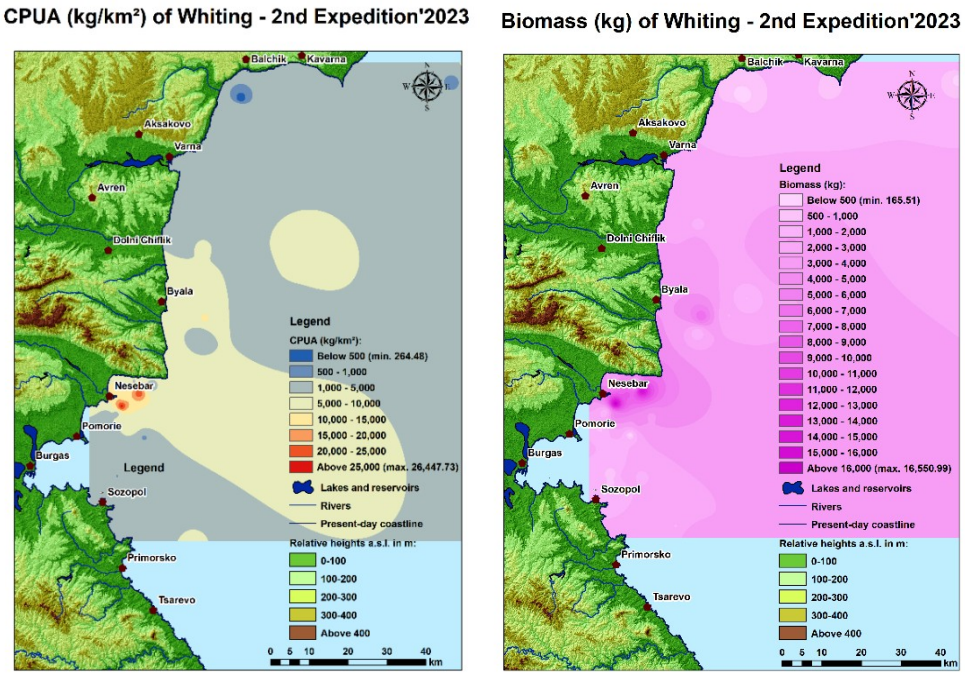


Figure 3.1.14. Abundance and Biomass of whiting, November 2023.

Whiting was represented in the composition of catches during the first part of the expedition conducted in November 2023 with the highest distribution density of the species recorded in the area of Nesebar, Elenite and Albena In a depth layer of 50–100 m, the highest CPUA values were recorded – 26447.73 kg.km^2, with an average value of 9918 kg.km^{-2}. In the depth layer 15–30 m, 6612 kg.km^{-2} (average 3339 kg.km^{-2}) and 30–50 m – 10579 kg.km^{-2} (average 3316 kg.km^{-2}), the species was recorded in all trawls.

The total investigated area was 8010.24 km^{-2}, and the amount of the total biomass of whiting was 53878 tons. The densest aggregations were observed in front of Nesebar Bay at depths of 50 – 60m, and in front of Byala at depths of 50–70m.

Table 3.1.5. The Area method in November 2023 calculated average Whiting catch per unit area (CPUA, average), biomass, weight in kg, surface in km^2 and number of fields per area.

Average CPUA	depths	Biomass	Surface km^2	N stations
3339.026	15-30	6895.55531	2065.14	33
3316.545	30-50	6018.93224	1814.82	29
9917.898	50-100	40963.6949	4130.28	66
		53878.1824	8010.24	128

The densest clusters and biomass peak of horse mackerel were observed in front of Byala, Obzor, and Irakli, followed by Pomorie within 15–30 m (1420 t); 30–50 m (863 t), and 50–100 m (250 t). The length – weight relationship for the horse mackerel was strong, showing a positive allometry with a high coefficient of determination (n = 3.114), R^2 = 0.99.

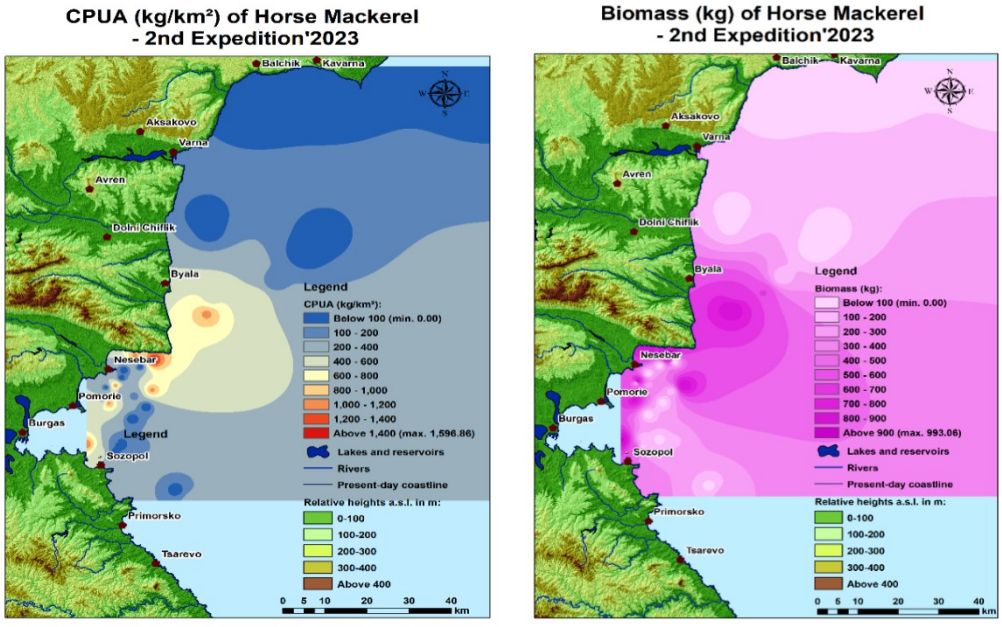
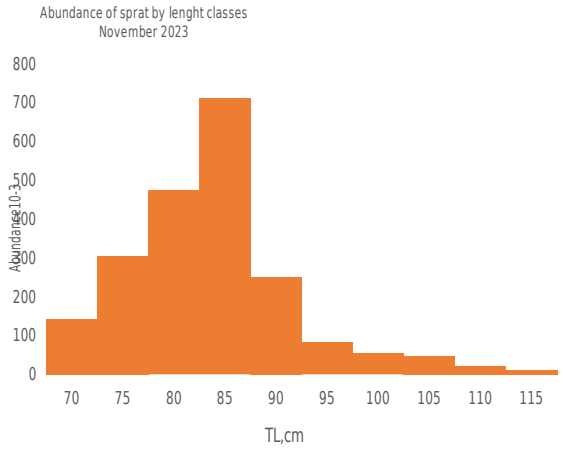
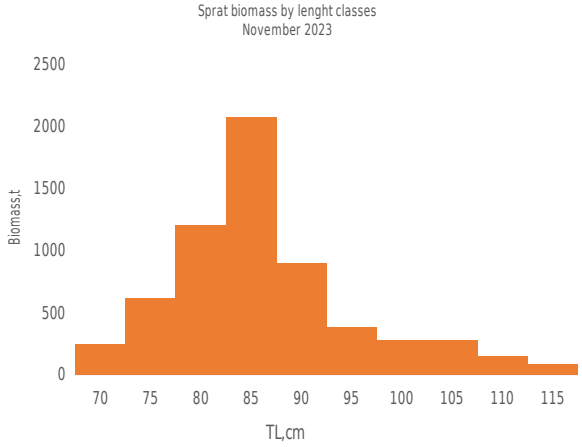


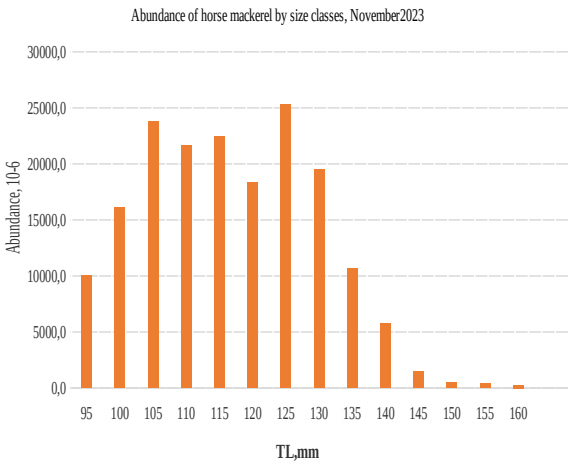
Figure 3.3.15. Horse mackerel biomass, November 2023.

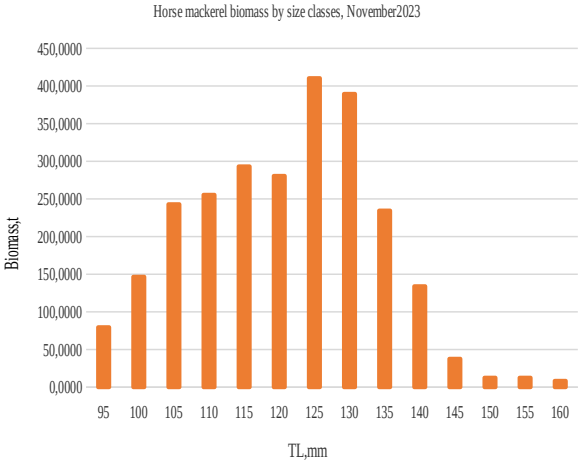
Table 3.1.6. Swept area method for stock survey in November 2023 – average values of Horse mackerel catch per unit area (CPUA), biomass (kg), area (km^2) and number of fields.

Average CPUA	Depth	Biomass (kg)	Surface	No. of stations
687.64	15-30	1420.07	2065.14	33
478.46	30-50	868.33	1814.82	29
90.68	50-100	249.68	4130.28	66
		2538.08	8010.24	128









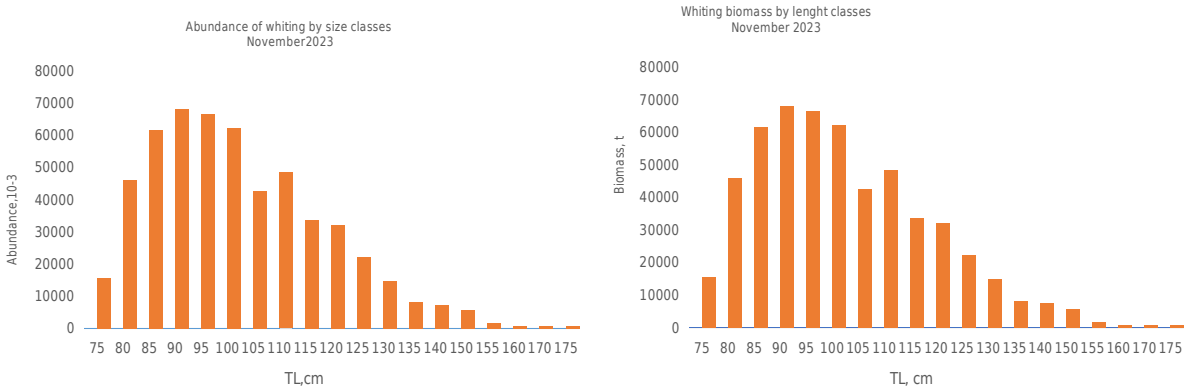
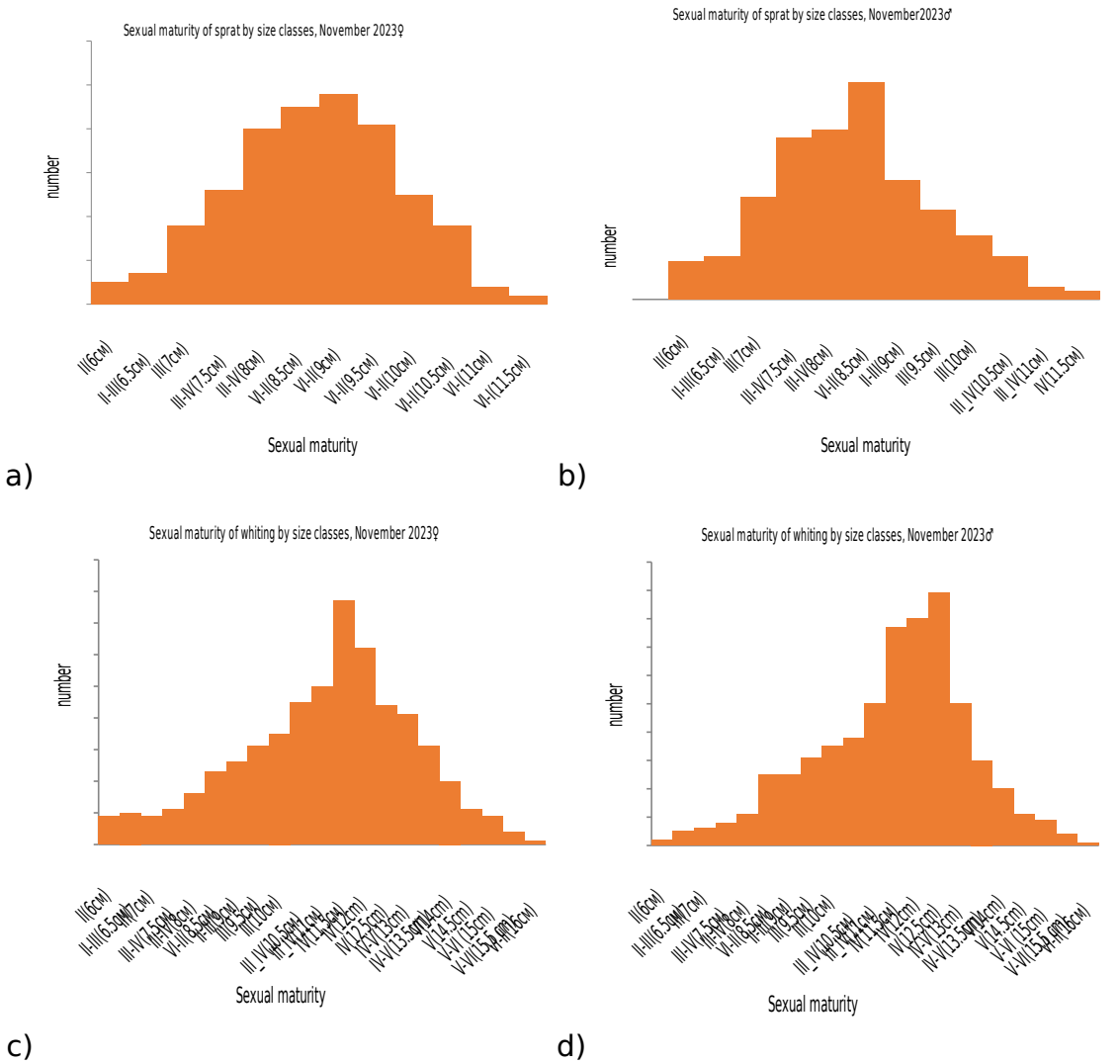
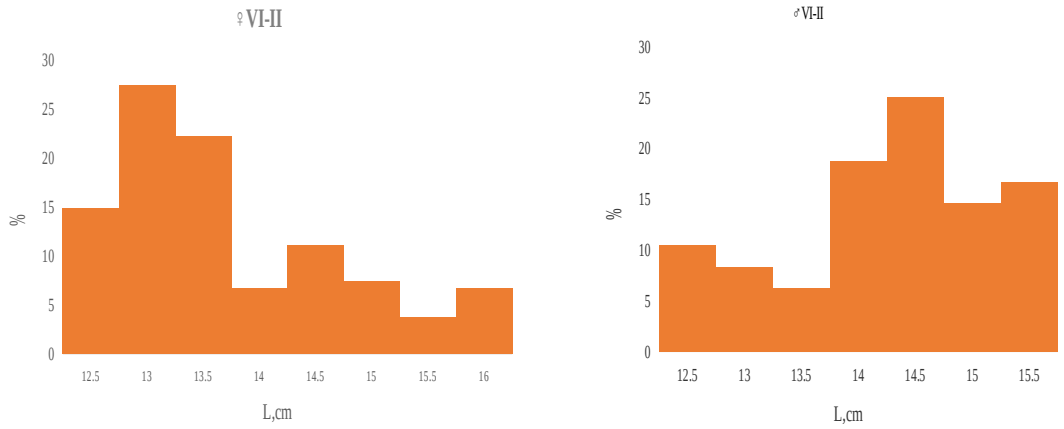


Figure 3.3.16. Abundance/ Biomass by length of sprat, horse mackerel and whiting, November 2023.





e) f)

Figure.3.1.17. Sexual maturity of the studied species, analyzed by size classes (females ♀, males ♂) a, b) sprat; c, d) whiting; e, f) horse mackerel.

The average value of the stomach fullness index (ISF) of sprat was 0.73 % BW ± 0.58 (SD), and for horse mackerel – 0.37 % ± 1.24 (SD) (Fig 3.1.18).

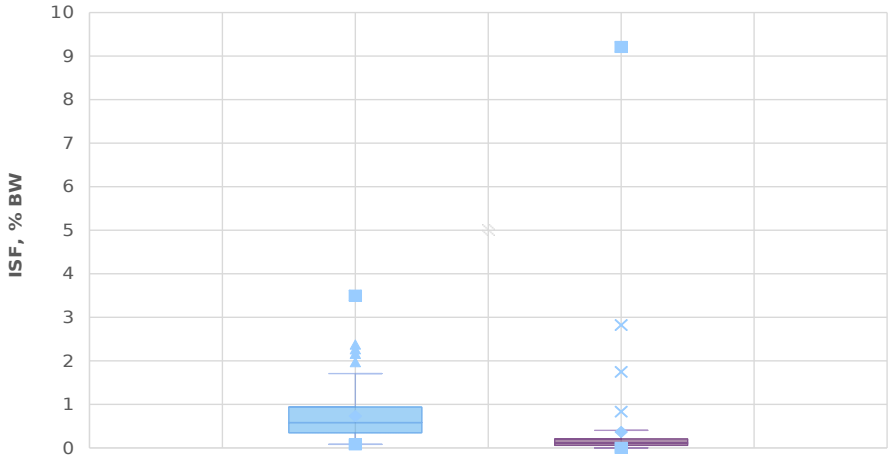


Figure 3.1.18. Box plot: Values of Index of Stomach Fullness ISF (% BW) by species in November 2023 (indicated: medians, range of values: 25–75 %, minimum and maximum values).

Accordingly, the multi-year average autumn value of ISF in the sprat was 0.91 % BW; while for horse mackerel, data in autumn 2021 showed a mean value of 0.35% BW ± 0.27 SD, and in autumn 2022 – 0.66 % BW ± 0.59 SD. The present study found a lower feeding intensity of sprat and horse mackerel compared to the autumn season of 2022. The analysis of the spatial distribution of ISF (% BW) showed a more intensive feeding of the sprat in the wide Burgas Bay and deeper water areas (Fig. 3.1.19). As far as the data on the feeding of the horse mackerel are only from the region of the Burgas Bay, we register pronounced variations of the feeding within this region

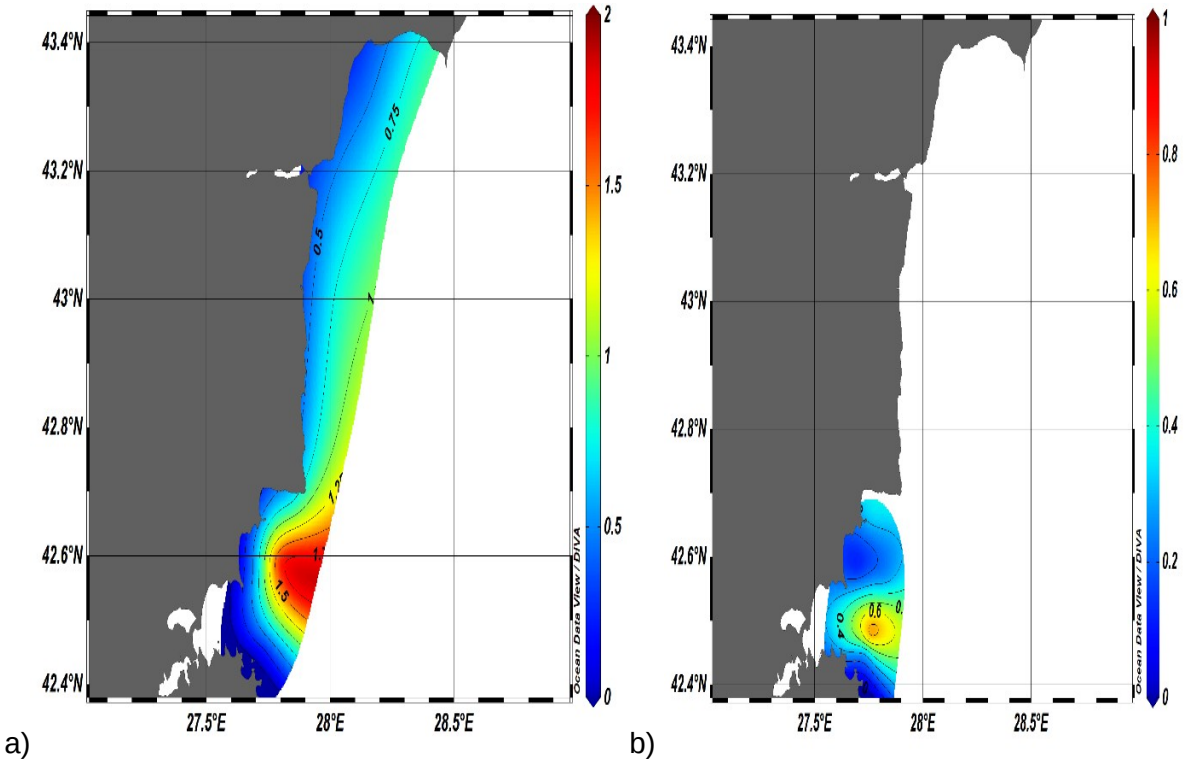


Figure 3.1.19. Spatial distribution of ISF (% BW) of sprat (a) and horse mackerel (b) in November 2023.

4. Review of issues discussed in other meetings held in relation to MEDIAS

MEDIAS Chair presented to Steering Committee an overview of some outcomes of past international meetings related to the activities of EU-MEDIAS as follows:

- Recommendation #5 of the RCM Med&BS meeting in 2023, dealing with the establishment of limit period of time for which the seasonality of the scientific surveys (e.g. MEDITS and MEDIAS) would not affect the information obtained. Internationally coordinated scientific surveys include specific time frameworks in which their activities should be carried out, in order to reduce the variability of the data collected. For instance, according to the MEDITS handbook, the period of the MEDITS survey should be centered around June (from May to July) and keep the sampling period consistent among years. In relation to the MEDIAS handbook, the period of the MEDIAS survey should in the summer and autumn season from June to October. June-July is the best period for MEDIAS survey for biological reasons, however depending on vessel availability the period could be extended to October.
- However, due to different reasons, the period can vary among GSAs and years and this could make that data obtained not useful for the purposes of its collection. In this sense, it is requested to mark a limit of time, before and after the mentioned months, for which it is considered that the seasonality would not significantly affect the results of the information obtained. Scientific survey Coordination Groups shall establish a

limit of time for which it is considered that the seasonality would not significantly affect the results.

- Recommendation #7 of the RCM Med&BS meeting in 2023, concerning the investigation of the possibility to collect acoustic data during the Pelagic Trawl Survey in the Black Sea (PTSBS). In order to have consistent and harmonized surveys for the assessment of pelagic species in the Black Sea the RCG recommends to the Black Sea Member States to ensure the availability and use of equipment according to MEDIAS protocol. In addition, Software and training could be provided by the MEDIAS scientific network. Bulgaria and Romania (both NC and experts), and MEDIAS Coordination Group shall investigate the possibility to ensure the use of equipment according to MEDIAS protocol (e.g. Simrad EK80).

- Recommendation #8 of the RCM Med&BS meeting in 2023, dealing with the inclusion of test studies in MS National Work Plans for egg and meso-zooplankton sampling and processing during MEDIAS surveys. According to the conclusions of MEDIAS steering committee in 2023 (Report of 16th meeting for MEDiterranean International Acoustic Surveys) MSs shall explore the potential for plankton and eggs sampling in parallel with acoustic sampling. To achieve this objective, they are encouraged to seek funding for a test study via the DCF to cover additional efforts.
- The reasons for this proposal are numerous. First, sampling of plankton scattering layers using plankton nets could facilitate echogram interpretation by providing a ground truth of some targets in the acoustic data, so that, during the acoustic processing, these targets could be discarded with a higher degree of certainty, while separating the small pelagic fish echoes from unwanted plankton echoes. The accuracy of this process could be further enhanced through the knowledge of the kind of planktonic organisms that are prevalent in a certain area.

- Plankton and eggs sampling are also important because of the potential relationships between acoustic surveys and anchovy stock assessments based on the daily egg production method. Finally, by knowing plankton abundance it is possible to have an index of productivity, and thus prey availability, that is important in the study of small pelagic fish abundance over the years and of their spatial distribution; this ecosystem indicator could also be important in the Marine Strategy Framework Directive.
- This proposal concerns the MEDIAS surveys that are held along the Iberian coast (GSA 1 and 6) carried out by IEO (Spain), Gulf of Lion (GSA 7) by IFREMER (France), Sicily Channel (GSA 16) by CNR-IAS (Italy), western Adriatic Sea (GSA 17 and 18) by CNR-IRBIM (Italy), eastern Adriatic Sea (GSA 17) by IOR (Croatia) and eastern Ionian Sea and Aegean Sea (GSA 20 and 22) by HCMR (Greece). The proposal also concerns the acoustic survey carried out by CNR-IAS (Italy) in the Tyrrhenian and Ligurian seas (GSAs 9 and 10), that are part of the MEDIAS since 2017. However, MSs should include in their NWPs only those GSAs in which the test study could be carried out, taking into account an adequate timing of the study.

- A proper number of stations (depending on transect length) could be performed along dedicated transects in order to collect information on meso-zooplankton and eggs with an appropriate resolution. A 3-year test study can be carried out for this purpose. Thus, a proper financial support is needed in order to plan and perform this kind of activities, including funding for the acquisition of equipment for sampling (i.e. WP2 plankton nets, flow meter, laboratory staff for the preservation) and for the analysis of the

samples (i.e. conventional counting under a microscope or using a ZooCAM a in-flow imaging system for fast onboard counting, sizing and classification of fish eggs and meso-zooplankton already used within the ICES WGACEGG working group). MSs interested in adding these additional data collection activities should ensure that the above justification is included in the "test study" section (text box 1a) in their National Work Plans.

5. Communication with DG-MARE

Venetia Kostopoulou (VK, DG MARE, Unit C3) presented the main areas of interest of the EU Data Collection Framework (DCF): (i) increased focus on quality; (ii) regional work plans that will allow a harmonised approach at sea basin level for the Member States involved, with the support of regional databases; (iii) collection of data that is multi-purpose and reusable, provided that rules on personal data protection are respected. She underlined the importance of integrating the elements of the regional work plans in the national work plans in the October 2024 submission to COM. She presented the relevant Regional Coordination Group (RCG) Med & BS recommendations (Rec), namely: Rec 5 on the sampling season for scientific surveys, where MEDIAS Group is requested to propose a limit beyond which the MEDIAS survey should not take place. VK stressed the importance of including the outcomes of MEDIAS discussions in the regional work plan; Rec 7 on acoustic data collection in the Black Sea. VK introduced the ongoing initiative coordinated by the BlackSea4Fish Project to establish a GFCM pelagic acoustic survey and shared the protocol with the MEDIAS group; Rec 8 on the test study for new sampling during MEDIAS and reminded of the possibility of its inclusion in the regional work plan. VK presented the Framework Contract Med & BS study RDBFIS[1] (Regional Database Fisheries Estimation System), that is working on further developing the regional database for the Med & BS and informed participants of the ongoing data call, where the majority of Med and BS Member States are currently uploading aggregated and detailed biological data, as well as MEDITS survey data, with a deadline of 31 May 2024. She invited the MEDIAS group to discuss the content, time series and tentative deadline of the data call on MEDIAS data. She also briefly referred to other ongoing Framework Contract Med & BS studies, such as Qualitrain[2], Mapafish-Med[3] and Spillover-Med[4]. VK presented the three data requests received that are asking for MEDIAS data. She invited the MEDIAS Group to consider making aggregated MEDIAS data publicly available – with the possibility of excluding the last 3 years of data – and presented the state of play in the North sea basins, where data are already publicly available. This request is in line with

[1] The aims of the current study are, among others, to provide a temporary solution for hosting and maintenance of RDBFIS, to work on fine-tuning and further development and to provide support and training, if needed, to the users. The coordinator is Stefanos Kavadas (HCMR) and the duration is 24 months (Start date: 01 April 2023, End date: 31 March 2025).

[2] Quality checking of Mediterranean & Black Sea data and training for Member State experts. The objectives of this project include, among others, technical work on quality checks and data checking in Med and Black Sea, as well as preparation, coordination and organisation of technical trainings and information sessions. The coordinator is Isabella Bitetto (COISPA) and the duration is 24 months (Start date: 14.12.2022, End date: 13.12.2024).

[3] Mapping of marine protected areas and their associated fishing activities: Mediterranean and Black Seas, which aims at providing and improving, for the Mediterranean and Black Seas, the basic scientific knowledge to characterize (i) the existing marine and protected areas (MPAs); (ii) the fishing activities present within MPAs and their surrounding areas; and to understand (iii) the response of the fishing activities to MPA implementation. The coordinator is Antonio Di Franco (Stazione Zoologica Anton Dohrn). The duration is 24 months.

[4] Assessing spillover from marine protected areas to adjacent fisheries: Mediterranean and Black Seas, which aims to assemble existing information and collect new one to provide an overview of the role that the MPAs may play for local fisheries through spillover effects in the Mediterranean and Black Sea. Overall, this study will lead to an improvement of the assessment and evaluation of MPA benefits to local fisheries. The coordinator is Antonio Di Franco (Stazione Zoologica Anton Dohrn). The duration is 30 months.

STECF opinion[5]. To this end, VK proposed to the MEDIAS Group to draft a stand-alone document addressed to end users on the specifics of MEDIAS survey design and the changes through time, that would facilitate interpretation of data. This initiative is already pursued by the MEDITS Coordination Group (for which more numerous data requests are received). The issue of public availability will be revisited at the upcoming RCG Med & BS meeting. VK informed participants of the new STECF and DCF websites.

6. Discussion on standardizing the MEDIAS surveys period

In the impossibility of defining a common period for all MEDIAS surveys, due to research vessel availability problems, the MEDIAS steering committee has decided to set an official period specific to each GSA, taking into account the historical period at which MEDIAS surveys were carried out. This will ensure the continuity of time series within the GSA level and keep the sampling period consistent among years. These periods (see table 6.1) have been added to the survey handbook and correspondence with RCG chairs will be initiated in order to propose a way of readjusting the DCF Regional Work Plan tables to enable information on surveys periods to be filled by GSA and not by MS. A buffer period of plus or minus one month is authorized in case of particular difficulties that may be encountered in certain years, while considering the month of October as an upper limit not to be exceeded. However, if the survey has to be brought forward or delayed by more than this buffer month outside the official period, a request must first be made to MEDIAS SC and the EC before launching the survey. Finally, the group reiterates that June-July is the best period from a biological perspective, but the proposed official periods are based above all on pragmatic, historical and operational considerations.

Table 6.1: Official period for MEDIAS surveys per GSA.

GSA	Official period
GSA1	6 7
GSA6	6 7
GSA7	6 7
GSA9	8 9

[5] STECF PLEN 21-02: *'7.7 Question on the use of data following data checks carried out in EWG 21-02'*, where STECF concluded that there is increasing interest in all sea basins for uses of scientific DCF data beyond the 'usual' end users dealing with stock assessment and management advice. STECF concluded that because fisheries data (both commercial and survey data) in the Med & BS area are currently less accessible than the corresponding ones in the ICES area, this increasing interest adds a significant workload to all interested parties, and makes data sharing for the Med & BS data a longer and more cumbersome process which negatively affects all interested parties (data requesters, MS, DG MARE, JRC). STECF stressed that the data collected under DCF calls are funded through public money; survey data, in particular, represent highly valuable information of generic scientific interest and without restrictions linked to commercial confidentiality. STECF fully supported that these scientific resources be made publicly available in the interests of all end-users and be freely used for further analyses provided the source is acknowledged and the obligations are met.

GSA10	7 8
GSA15	7 8
GSA16	7 8
GSA17 E	6 7
GSA 17 W	6 7
GSA 18	6 7
GSA 20	9 10
GSA 22	6 7
GSA 29 (summer)	6 7
GSA 29 (autumn)	10 11

7. Progress update on standardization of age reading and maturity estimates

Rosalia Ferreri, the leader of maturity analyses sub-group, presented preliminary results of picture exchange exercise. According to the agreed protocol, each laboratory would be able to provide up ten pictures for each sex and for each maturity stages (according to the ICES 2009 scale, as agreed by the MEDIAS SC). Pictures should be captured from both fresh and frozen samples of the main MEDIAS target species: *Engraulis encrasicolus* and *Sardina pilchardus*.

Currently, only results on fresh anchovy have been shared, particularly 133 picture: 79 females and 52 males. Individuals not staged by at least two operators (e.g., imaged not in focus) has been excluded (n=4). The sexual maturity estimates on fresh individuals turns out to be more certain and appropriate, since the images could be affected by light, colour counterfeit, as well as difficult in evaluate the turgidity. For these reasons, the estimate provided by the research team catching that fish has been considered the right one. The proportion of agreement (PA) among the “original estimates” and these ones carried out by other MEDIAS teams have been calculated for both sexes, for each maturity stages and overall. The PA is around 60% for both sexes combined and little higher for females (62%), while it decreases for males (53%). Evaluations of maturity stage reached good agreement levels, save for stage III. However, according to literature the stages III and V are macroscopically similar and several external factors can turn a stage III to appear as a stage V gonad, and particularly when identification has been carried out on images. Combining results

of individuals staged as III and V may be considered a reasonable compromise, for some specific application as distinguishing between mature and immature.

Next steps of MEDIAS maturity exchange program should include the sharing of remaining pictures. However, because of not all the MEDIAS teams contributed until now, it looks as a priority both identifying the referring people from each MS, as well as allowing them the possibility to collect photos for exchange. The group also recommends exploring the possibility of using SmartDots software for this exercise.

Walter Basilone informed the WG that an otolith reading exchange exercise has been carried out within the ICES WGBIOP and that the results of which will be made available by October 2024. He pointed out that the number of participants in this WG has increased, especially with new readers, and this has resulted in a drop in the agreement coefficient between age readers. In this context, MEDIAS SC proposed to explore the possibility of carrying out a Mediterranean-specific analysis based on this more global exercise by recovering the results of readers involved in the Mediterranean region and recalculating the agreement index based on a subset of the data. To this end, Walter Basilone will contact the WGBIOP chair to request access to the data needed for this analysis.

Lastly, the group updated the list of members of the maturity and age analysis sub-groups (table 7.1), noting the departure of Ilaria Costantini and her replacement by Samuele Menicucci (CNR-IRBIM) and the arrival of Miryam Fortuna (CNR-IAS), appointed as the new leader of the age reading sub-group.

Table 7.1. Two subgroups of MEDIAS experts on biological analyses (age & maturity). Subgroup coordinators are written in bold.

Institute	Subgroup 1: Age analyses	Subgroup 2: Maturity analyses
IEO/CSIC	Ana Ventero	Ana Ventero
IFREMER	Geoffrey Bled Defruit	Jean-Hervé Bourdeix
HCMR	Kostas Markakis	Stelios Somarakis and Evdoxia Schismenou
IOR	Denis Gašparević	Denis Gašparević
CNR-IRBIM	Samuele Menicucci	Ilaria Biagiotti
CNR-IAS	**Miryam Fortuna** and Walter Basilone	**Rosalia Ferreri**
FRIS	Petra Bratina	Petra Bratina

8. Work on MEDIAS regional database structure

The MEDIAS database structure was presented during the 16th MEDIAS Coordination Meeting (18-20/04/2023) and since then it has been developed in close collaboration with the MEDIAS chair (Tarek Hattab) and experts, based on the feedback they provided during the 1st MEDIAS WS (in May 2023) and the 2nd MEDIAS WS (in October 2023). The MEDIAS database is comprised of 3 modules: Acoustics, Pelagic Trawl and CTD; the corresponding tables in the relevant schemas were all inspected and adapted (wherever needed) by the group field by field. Pelagic trawl surveys carried out under DCF in Bulgarian and Romanian Black Sea waters were also included.

During the 17th MEDIAS coordination Meeting, the coordinator of RDBFIS, Stefanos Kavadas (SK), presented the MEDIAS database (and its integration within RDBFIS) and updated the participants on the current state of the system's modules and services. Navigation to the MEDIAS modules and the performance of trials with Greek data by importing .csv files, running syntax checks and inspecting the respective reports took place. The validation schemes for the acoustics and pelagic trawl modules were also presented and discussed within the group while they will also be uploaded in .pdf format in GoogleDrive for the group's best access and final check. Consistency checks were also performed providing as outcome the visualization of summary statistics by country in tabulation format, graphs or maps, thus allowing the MSs to check their data quality; this service is already developed and will be available in RDBFIS as soon as possible. SK also highlighted that the generation of the 3 tables submitted to Med&BS datacall: annual scientific survey biomass by length, annual scientific survey abundance by length, annual scientific survey abundance and biomass by age and sex are also available through the system. Moreover, the structure of the eggs and larvae database (schemas) has been prepared and the relevant entry forms have started to be developed. A dedicated workshop with the experts is foreseen to take place aiming to adapt the structure in order to meet contemporary needs. This service is expected to be finalized before the RCG 2024 meeting.

SK underlined that the contribution of the MEDIAS experts is of high importance and kindly requested the group to provide feedback on issues related to:

-Acoustics: Survey area (maximum and mean depth, shapefile, url), geographical stratum (available info), species list (updates);
-Pelagic trawl: Tech. specifications, Maturity stages (decision), More representative L-W a & b parameters;
-Suggestions on additional processing (data elaboration) routines and mapping facilities.

Finally, the pertinent MEDIAS Data-call has already been drafted by SK and it will also be shared with the MEDIAS group (via the GoogleDrive) in order for them to check its technical specifications and update it accordingly.

9. Discussion on the integration and standardization of acoustic observations in Black Sea surveys

MEDIAS SC has been informed of GFCM pelagic acoustic survey protocol adapted to the specific characteristics of the Black sea, and has proposed modifications to the latter, in particular the WG recommends using the 38 kHz frequency (i.e. since it gives a better response for bearing-gas fish) with a pulse duration of 1.024 ms (since a shorter pulse duration does not add any value to the echo-integration and especially for data acquired during the daytime , it is only of interest for certain types of experiment, such as TS measurements) and a day-time soundings (i.e. due to the environmental noise of plankton, which cannot be separated from the acoustic backscatter of fish during the night-time). The group also recommends that the Bulgarian and Romanian teams apply for funding to purchase a SIMRAD EK80 echosounder as part of the EMFAF call.

10. Presentation of statistical analysis of fish shoal descriptors

Following the presentations of the echotraces commonly observed in each GSA made at the previous coordination meeting, the WG decided to move on to more quantitative analyses this year by calculating fish school descriptors (e.g. morphometric, energetic, elongation, shape, perimeter, symmetry, spatial...etc), which were presented by the participants.

Four presentations were given, including selections of fish shoals from the western GSA 17 and 18 (Andrea De Felice) GSA 9, 10 and 16 (Angelo Bonanno), GSA 22 (Zacharias Kapelonis) and GSA7 (Tarek Hattab). The aim was to identify a set of descriptors common to both to Movies3D and Echoview analysis software and that would make it possible to deal with the great variability that can characterize such a datasets. Around 48 bench descriptors can be extracted from Echoview, of which several show multicollinearity, while a more limited number of descriptors (17 in all) can be extracted using Movies3D.

Following these presentations, the main questions raised concerned the choice of the most appropriate methodology to be used to select the fish schools before calculating the indicators, given that two methods were used, namely an expert-based approach (in GSA7) where shoals are visually selected based on the expert's experience, and a method based on the extraction of shoals in areas represented by monospecific trawls (comprising at least 80% monospecific catches). The choice between one method and another depends above all on the questions being addressed, bearing in mind that the primary aim of this analysis was to try to harmonize the way echograms are scrutinized. Angelo Bonanno's presentation also highlighted the great spatial and temporal variability in some descriptors by comparing the results of 3 years of data in 3 GSAs. Therefore, this variability should increase even more if all the data from all the GSAs are combined together in a single analysis. This suggests that it would be important to integrate environmental descriptors into the analysis because of their effect on the shape,

behaviour and position of fish shoals. These discussions will continue after the meeting by e-mail or specific meetings after a period of reflection where each team could take the time to think about the best possible option to continue these comparisons.

11. Discussion on the standardization of biomass estimates from EDSU values

The aim of these discussions was to make the process of estimating total biomass and abundances by study area from the EDSUs more transparent, for example by setting up a common R script to carry out this task that can be implemented as an algorithm inside RDBFIS. The rationale behind this initiative is to make it possible to re-estimate tuning index by considering sub-areas or larger areas than is currently done, thus offering greater flexibility for stock assessment needs. The procedure should also include a routine for detecting highly influential points that may have a strong leverage effect, and thus could be considered as outliers. What the WG has on hand at the moment, in addition to the classic method of multiplying the mean EDSUs value by the total surveyed area, is Marco Barra's script for geostatistical simulations to estimate the CV associated with the survey design, and which nevertheless makes it possible to simulate the total biomass per region. On the other hand, the EchoR package also offers an implementation of the mean EDSUs value method and also allows to apply this method by sub-region.

These discussions have highlighted the need to consider a specific method for zigzag VS parallel sampling design. In the case of zigzag sampling design, the coastline and bathymetric complexity lead in some cases to non-regular sampling scheme, resulting in a biased estimate of the mean EDSUs value. In such cases, an unbiased mean EDSUs value could be obtained by computing the weighted mean according to the Region Of Influence (ROI) of each EDSU. To this end, Marco Barra (CNR) will send to the group an R script enabling estimates to be made using a method based on Voronoi polygons in the case of zigzag sampling design. The WG will check this script before submitting it for integration into RDBFIS. The WG also recommends exploring an alternative approach using StoX software (Johnsen et al., 2019), and the VAST R package (Thorson, 2019), with the delta-generalized linear mixed model (delta-GLMM), which could also be used to make these estimates.

The MEDIAS SC invites the whole group to re-test the EchoR package for biomass and abundance estimates and contacting the IFREMER team with questions before the end of November 2024 if clarification of any issues is required.

Johnsen, E., Totland, A., Skålevik, Å., Holmin, A. J., Dingsør, G. E., Fuglebakk, E., & Handegard, N. O. 2019. StoX: An open source software for marine survey analyses. Methods in Ecology and Evolution, 10(9), 1523-1528.

Thorson, J. T. 2019. Guidance for decisions using the Vector Autoregressive Spatio-Temporal (VAST) package in stock, ecosystem, habitat and climate assessments. Fisheries Research, 210, 143-161.

12. Presentation of new standardized NASC maps at the Mediterranean scale (Marco Barra)

In accordance with the work plan delineated during the 16th MEDIAS meeting, the NASC maps for both anchovy and sardine were produced for the surveys conducted during the 2019–2022 period (Fig. 10.1 and 10.2).

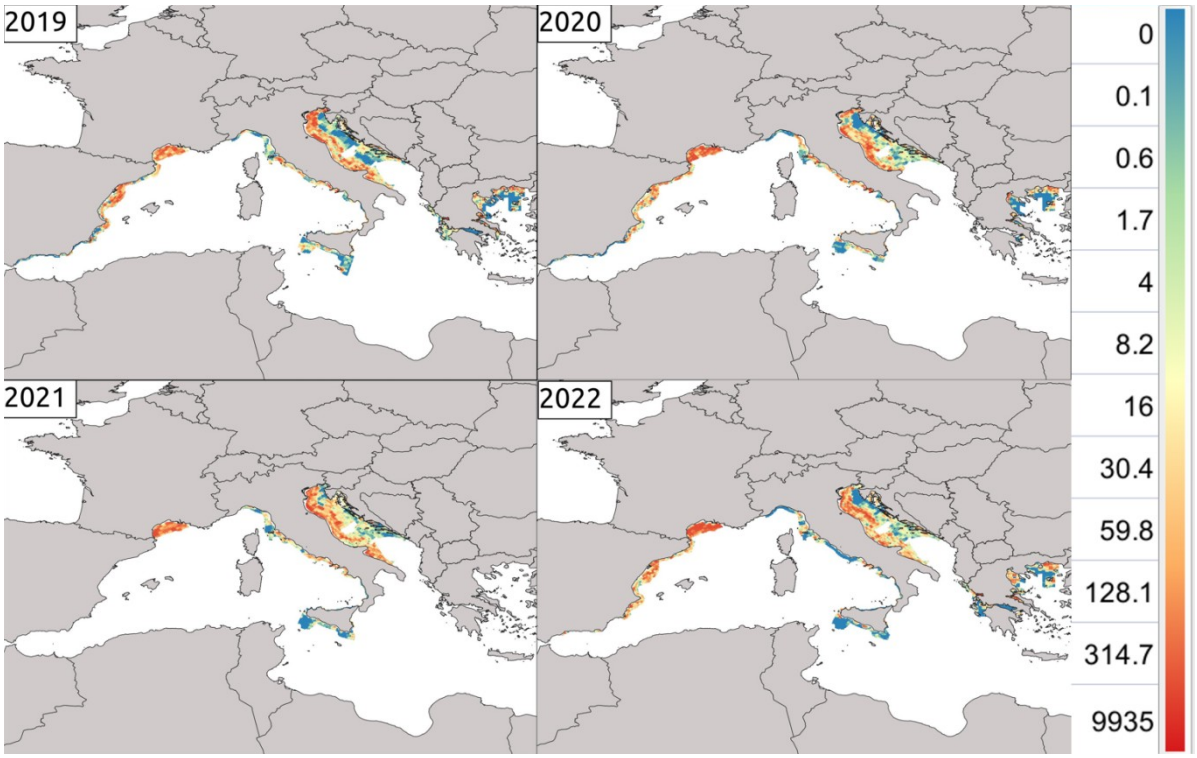


Figure 10.1. Anchovy Standardized NASC maps.

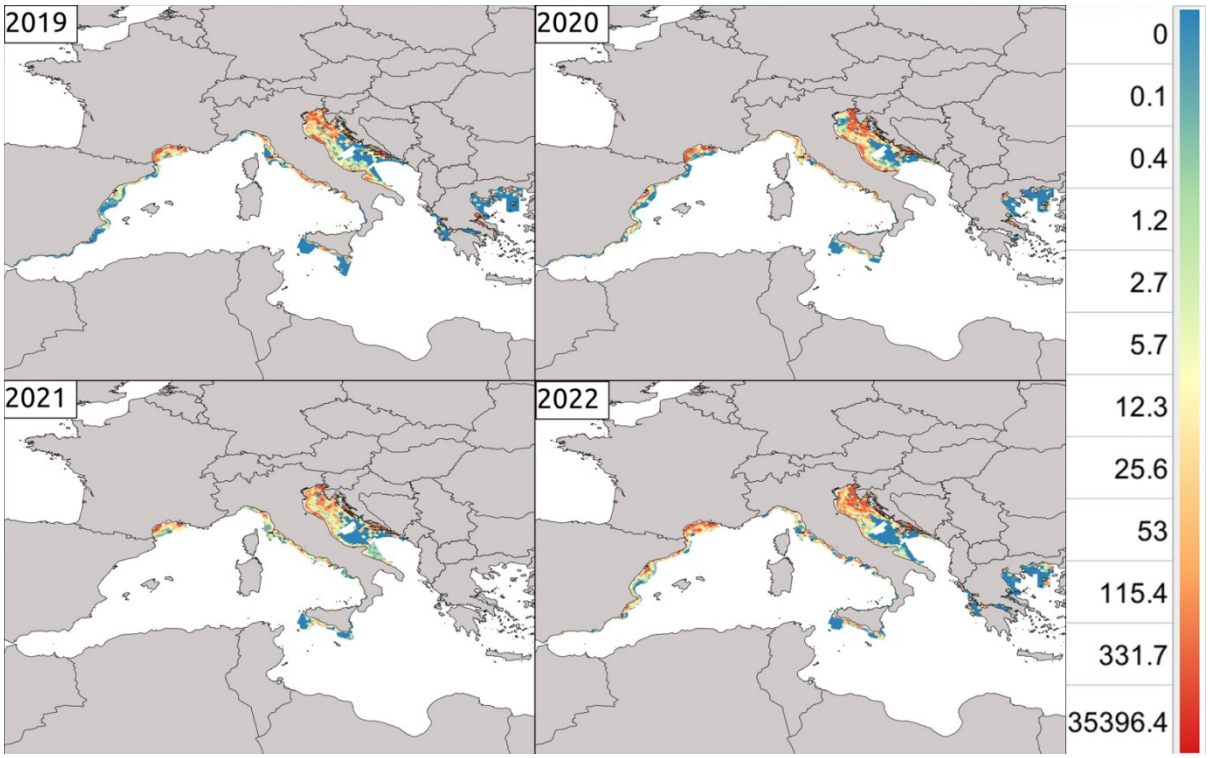


Figure 10.2. Sardine Standardized NASC maps.

An exploratory data analysis was conducted in order to ascertain the principal characteristics of each dataset. In accordance with the methodology established by the MEDIAS SC during the 16th MEDIAS meeting, NASC maps were generated using the IDW interpolation method (quadratic inverse distance weighting) with an interpolation grid characterized by a resolution of approximately 2 nmi and a limiting search radius to the nearest 10 points.

A new colour scale was defined for the entire dataset, thus allowing for a consistent visual comparison between the different GSA and years. In particular, despite the considerable differences in productivity between areas, the use of a quantile-based scale break enabled the visualization of local and regional patterns.

The results were presented and discussed in order to address the following issue:

- In some sectors, the interpolation grid resolution is not optimal in relation to the distance between islands and the coastline. Consequently, it was decided to increase the interpolation grid resolution in order to avoid such a problem.

- It should be noted that the survey coverage may vary over the course of the year. Consequently, zero values (previously treated as NaN) are explicitly highlighted in the maps in order to provide a clear view of the area covered by the survey.

In order to facilitate the merging of the files, it was also agreed that a common interchange format should be defined (Table 10.1). In addition to the data, the interpolation polygon should be provided in shapefile format.

Table 10.1. Basic information for sharing acoustic data.

Field	Type	Description
lon	real	EDSU longitude (decimal degree)
lat	real	EDSU latitude (decimal degree)
GSA	character	GSA code in the format "GSA01"
ANE_NASC	real	Anchovy NASC values
PIL_NASC	real	Sardine NASC values

The SC also proposed adding a disclaimer in the metadata of the regional maps to highlight the fact that the surveys were not carried out in exactly the same period and that the maps do not only continue a spatial gradient but also a temporal one which must be taken into account. To do this, the period for each survey will be added to the metadata.

Finally, the SC has also proposed to display the maps currently in SEXTANT in RDBFIS using a Web Map Service (WMS), which provides a simple HTTP interface for requesting geo-registered map images without multiplying data sources.

13. Discussion on standardization of zooplankton and eggs sampling

The chair reminded the group of the possibility of including test studies in MS National Work Plans for egg and meso-zooplankton sampling and processing during MEDIAS surveys and he re-explained the procedure for making this request. He also provided the WG with news of the efforts being made at IFREMER to make the ZooCAM available for sale to the scientific community, given the interest already shown by several MEDIAS teams in using this equipment. For the time being, the lack of a production line and after-sales service is a major limitation to the large-scale deployment of the instrument, something that cannot be done within IFREMER. The solution currently being investigated consists of an industrial transfer to a private company in the form of a license contract (i.e. right to manufacture and market a product). This industrial transfer is a process that may take some time, but the work of sourcing companies has already begun. The IFREMER team will continue to keep the WG informed of progress in this process.

14. Presentation of all the TS values used in the different surveys (for all pelagic species)

The WG reviewed the set of TS values used in the various GSAs for the different species for which biomass estimates are made. The aim is to make the different data post-processing steps more transparent. This also constitutes a first step towards the standardization of TS over the various surveys, starting as a priority with the anchovy TS. To this end, the WG decided to organise a specific meeting on this issue with a sub-group of representatives from each survey.

Table 14.1: Target strength (TS) values used by species and by GSA in MEDIAS surveys.

FAO code	Scientific name	GSA 1 & 6		GSA 7		GSA 9 10 & 16		GSA 17 & 18		GSA 20 & 22	
		TS	Reference	TS	Reference	TS	Reference	TS	Reference	TS	Reference
ANE	*Engraulis encrasicolus*	-72.6	Degnbol et al. (1985)	-71.20	ICES (1982)	75.2	Barange et al., 1996	-74.6	Azzali et al., 1997	-75.0	AcousMed final report 2012
ATB	*Atherina boyerii*									-67.4	Foote 1987
BOG	*Boops boops*	-67.0	Lillo et al., 1996	-67.0	Lillo et al., 1996	– 67.5	Foote *et al*., 1986	-67.0	Lillo et al., 1996	-67.0	Lillo et al., 1996
BPI	*Spicara maena*					– 71.2	Foote *et al*., 1986				
BVQ	*Bregmaceros nectabanus*									-67.4	Foote 1987
HMM	*Trachurus mediterraneus*	-68.7	Lillo *et al*., 1996	-68.70	Lillo *et al*., 1996	– 68.7	Lillo *et al*., 1996	-68.7	Lillo et al., 1996	-68.7	Lillo et al., 1996
HOM	*Trachurus trachurus*	-68.7	Lillo *et al*., 1996	-68.70	Lillo *et al*., 1996	– 68.7	Lillo *et al*., 1996	-68.7	Lillo et al., 1996	-68.7	Lillo et al., 1996

JAA	*Trachurus picturatus*	-68.7	Lillo *et al*., 1996	-68.70	Lillo *et al*., 1996	– 68.7	Lillo *et al*., 1996	-68.7	Lillo et al., 1996		
MAC	*Scomber scombrus*	-84.9	Edwards *et al*., 1984	-86.00	Misund and Betelstad (1996)	– 84.9	Edwards *et al*., 1984			86.0	Misund and Betelstad (1996)
PIC	*Spicara flexuosa*					– 71.2	Foote *et al*., 1986				
PIL	*Sardina pilchardus*	-72.6	MEDIAS Handbook	-71.20 and -72.6	ICES (1982) and MEDIAS Handbook	72.6	MEDIAS Handbook	-72.6	MEDIAS Handbook	-72.6	MEDIAS Handbook
SAA	*Sardinella aurita*			-71.20	ICES (1982)	– 71.2	Foote *et al*., 1986	-72.6	Lillo et al., 1996		
SPC	*Spicara smaris*					– 71.2	Foote *et al*., 1986			-67.0	
SPR	*Sprattus sprattus*	-72.6		-71.20	ICES (1982)			-71.7	Azzali et al., 1997		
VMA	*Scomber colias*	-68.7	Lillo *et al*., 1996	-70.00	Guttierez and MacLennan (1998)	– 68.7	Lillo *et al*., 1996	-68.7	Lillo et al., 1996	-70.0	Guttierez and MacLennan (1998)
WHB	*Micromesistius poutassou*	-67.4	Foote (1987)	-67.4	Foote (1987)					-67.4	Foote 1987

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15. Acoustic data processing in eastern part of GSA 17 - Northern Adriatic Sea (Tea Juretić)

The Croatian team presented the entire procedure for implementing their survey in the west of GSA 17. This presentation was given following a change in the team in charge of carrying out the survey, as well as their decision to revise the historical estimates. Additionally, it aimed to get feedback from the WG on optimizing on-board practices. The presentation covered details of the echosounders calibration procedure, the schedule for acoustic recordings, EK80 bug problems, crew issues, problems with the fishing gear and fishing operations, biological data collection procedure and post-processing with Echoview and post-Echoview analysis etc. Seven main recommendations were proposed following the presentation:

- It is not necessary to follow a predefined order to cover the acoustic transects, as this would result in a considerable loss of time in bad weather conditions. It is therefore preferable and more pragmatic to work in the sector where climatic conditions allow, without worrying too much about following an order that is spatially coherent.
- It was recommended to the Croatian team that environmental noise measurements could be taken, to better understand the influence of the ship noises on the recordings.
- Croatian team had a practice of imputing information from CTD after every station, which was not the same for the rest of the teams and it was recommended to keep the constant salinity and temperature values as input during calibration.
- The committee stressed out that recordings collected during trawling with speed of 4 knots were not to be used in assessment. The practices of fishing along the transect without re-recording the same area in the correct speed should be changed as well.
- Fishing during the night was suggested to improve catchability of larger fish and fish in open waters.
- Smaller biological sample for length and weight measurements was recommended, 100 individuals per species, compared to 500-700 in current methodology.
- Method of assessing abundance numbers for the GSA was discussed, where committee agreed it should be done by raising average density number to total area.

16. Accessibility issues in GSA7: development of a floating wind farms (Tarek Hattab)

The chair informed the WG of the planned construction of a floating wind farm in the Gulf of Lion, which will have an impact on the MEDIAS survey in the area because of the accessibility constraints it will create. This project, which will cover a total of 299 km2, will result in the inaccessibility of 7 nautical miles of the acoustic transects from 2024 onwards, a

further 6 nautical miles during the first phase of expansion and a further 20 nautical miles during the final phase of the project around 2030. So a total of 33 nautical miles will no longer be accessible, which is not insignificant compared to the ~ 270 nautical miles effectively processed for biomass estimation (Fig 16.1).

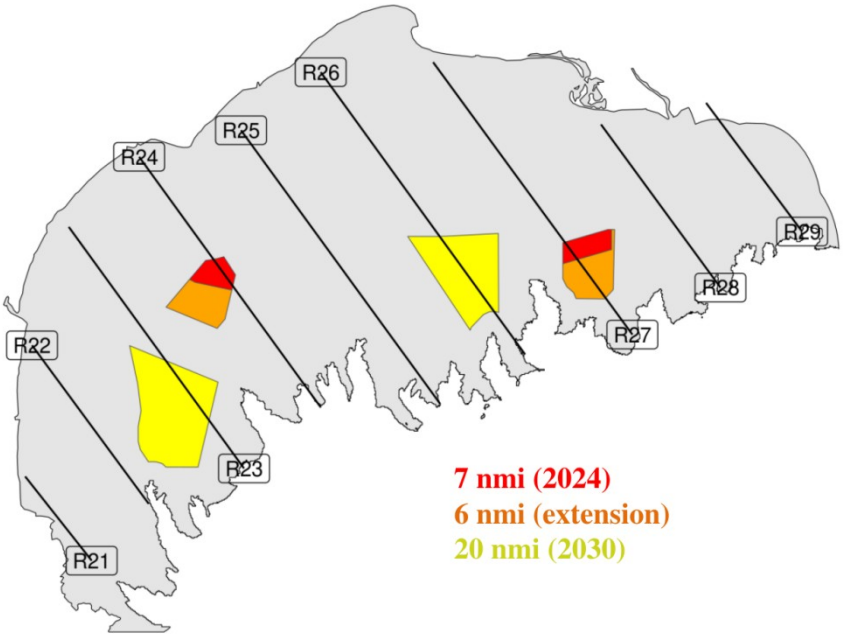

Figure 16.1. Geographical position of floating wind farm project areas in the Gulf of Lion.

The Chair also provided the WG with the results of simulations testing the effect of removing these nautical miles from historical estimates of biomass and total abundance in the study area. Although these simulations show a marginal effect (Fig 16.2), the WG recommended investigating different scenarios for modifying the sampling design (shifting transect positions and reducing inter-transect distance if necessary to reduce overlap with wind farm areas) to ensure good spatial coverage with no missing data along the transects.

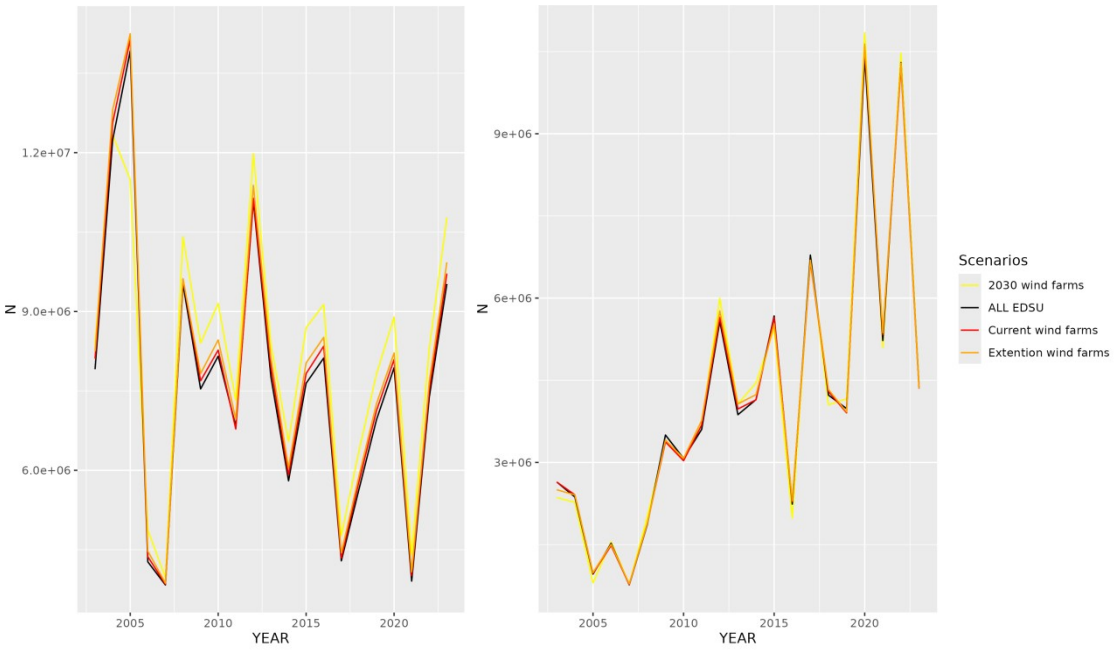

Figure 16.2. Effect of removing ESDUs located in the wind farm area on sardine (on the right) and anchovy (on the left) abundance estimates.

17. Spatial modelling of small pelagic fishes (Gualtiero Basilone)

A proposal for collaboration on the implementation of a spatial distribution model has been submitted to the WG as part of a PhD thesis supervised by Gualtiero Basilone. The aim of the PhD thesis is to predict the current spatial distribution of sardine and anchovy and then to make projection under several climate change scenarios over the 21st century using different emission scenarios (the IPCC Representative Concentration Pathways; RCPs). The discussions that followed focused on the importance of taking into account data from the southern limit of the geographical ranges of distribution, particularly when future projections are involved, in order to avoid obtaining truncated response curves and ending up with models that extrapolate the probability of presence outside the ranges of the environmental variables used for calibration. Furthermore, as this is a thesis, the WG also recommends focusing on what this work could bring new compared to previous work. Gualtiero Basilone stressed that all WG members are welcome to join in this work and that smaller sub-group meetings to coordinate this work will be held.

18. Update of MEDIAS Website

Marco Barra gave the WG a brief update on the development of the new MEDIAS website. The new site will be fully operational and he has already taken into consideration the proposals submitted at the previous coordination meetings. In order to start populating the website, he also invited the members of the WG to send him directly the information to be

included on the site, in particular photos, a list of publications, detailed information on the research vessel, information on research projects linked to the MEDIAS surveys.

19. Review and updates of MEDIAS Handbook

A ‘survey timing’ section has been added to the MEDIAS handbook, incorporating the information previously described in ‘6. Discussion on standardizing the MEDIAS surveys period’.

20. Terms of reference, venue and date for the next MEDIAS Steering Committee coordination meeting (2025)

MEDIAS SC discussed and accepted the Terms of References (ToR) for the next, 18th MEDIAS coordination meeting in 2025 (Annex IV).

The next meeting will take place from April 8 to 10, 2025. Kelly Camilleri and Jurgen Mifsud from MAFA have kindly agreed to organize the 18th MEDIAS SC in Malta.

21. Other issues

22. Conclusions and decisions of the 17th MEDIAS Steering Committee

1. With regard to the difficulties encountered in GSA1 with biological sampling, the MEDIAS SC recommends continuing the investigation of night trawling, given that the 2023 survey did not allow a sufficient number of stations to be completed. The group also recommends that comparisons be made between night and day trawling in order to quantify the differences that may exist between these two types of sampling strategy.

2. The WG recommends that MEDIAS time series presentations include the month of each year's surveys if there has been a change in the period in a given GSA.

3. In view of the new stock assessments recently carried out for GSA5, the group recommends adding this sub-area to the Spanish NWP in order to reinforce this new assessment. The Spanish team will study the question of the timing of this new survey during the next year, which could be carried out with another research vessel, while ensuring that the addition of this GSA does not affect the period of the GSA1 and 6 surveys.

4. In response to RCG Med&BS recommendation #5, the MEDIAS SC has set a specific period for each GSA which has been included in the MEDIAS handbook, based essentially on the historical periods of the surveys and the availability of research vessels. This will ensure the continuity of time series within the GSA level. A buffer period of plus or minus one month is authorized in case of particular difficulties that may be encountered in certain years.

However, if the survey has to be brought forward or delayed by more than this buffer month outside the official period, a request must first be made to MEDIAS SC and the EC before launching the survey.

5. The group addressed the issue of the provision of adjusted data following deviations from the protocol (e.g. change of period in a particular year, incomplete spatial coverage, etc.) which are not currently provided as part of the MED&BC data call. To ensure that estimates are made available to end-users, SC MEDIAS asks the DG MARE and the JRC team in charge of data-call to offer the possibility of uploading both adjusted and unadjusted data into the database, with the addition of a column specifying whether the data is protocol-compliant or an adjusted estimates. This means that it will be necessary to provide not just one row per species for a given year in the current data-call tables, but two rows if an adjustment has been made.

6. An initial result of the maturity stage photo exchange exercise was presented. This analysis needs to be completed with photos and readings still missing from the Greek and Croatian teams before the next coordination meeting. The group also recommends exploring the possibility of using SmartDots software for this exercise.

7. Following Ilaria Costantini's departure from the MEDIAS WG, Miryam Fortuna has been appointed as the new leader of the age reading subgroup.

8. The MEDIAS SC was informed that an otolith reading exchange exercise has been carried out within the WGBIOP and that the results of which will be made available by October 2024. In this context, MEDIAS SC proposed to explore the possibility of carrying out a Mediterranean-specific analysis based on this more global exercise.

9. The group acknowledges the effort made by the Greek team in extending the survey to the GSA 25 - Cyprus and encourages them to continue the investigation of the best way to cover this especially with regard to biological sampling and adapting the protocol to the particular characteristics of the area.

10. The MEDIAS SC has decided to organize a new workshop on the Regional RDBFIS database in the months following the coordination meeting, to address certain points that still need to be discussed. And on the question of the data call associated with the database, the WG recommends starting by providing data for the most recent years, and then progressively completing the historical time series. Finally, information on the contents and structure of the database will soon be shared in the form of a data-sharing point, enabling feedback from all the people involved in the MEDIAS coordination group.

11. MEDIAS SC has been informed of GFCM pelagic acoustic survey protocol adapted to the specific characteristics of the Black sea, and has proposed modifications to the latter, in particular the WG recommends using the 38 kHz frequency with a pulse duration of 1.024 ms and day-time soundings. The group also recommends that the Bulgarian and Romanian teams apply for funding to purchase a SIMRAD EK80 echosounder as part of the EMFAF call.

12. With regard to quantitative analysis of shoals, preliminary analyses have been carried out and have demonstrated what type of descriptors can be extracted with the two acoustic data processing software used within the group. These preliminary analyses highlighted the need to select descriptors that are robust to temporal and spatial sampling variability, and to standardize also the methodology used to extract the shoals (supervised extraction based on expert knowledge vs. use of monospecific trawls and the nearest EDSUs) depending on the objectives and questions addressed. These discussions will continue after the meeting in order to consider the best possible option.

13. Discussions on the standardization of biomass estimates from EDSU values have highlighted the need to consider a specific method for zigzag VS parallel sampling design. To this end, Marco Barra (CNR) will send to the group an R script enabling estimates to be made using Voronoi polygons in the case of not regular sampling design. The WG will check this script before submitting it for integration into RDBFIS. The WG also recommends exploring an alternative approach based on spatial delta-generalized linear models, which could also be used to make these estimates.

14. For regional NASC mapping, a data format was proposed to the group to simplify the merging of data from the various GSAs. The WG also agreed to send a shapefile representing the interpolation area to be considered in each GSA. It would also be necessary to update the maps metadata and, more importantly, to include the months in which the surveys were carried out in each area in order to avoid any possible misinterpretation of the maps which are currently publicly accessible in sextant. The possibility of integrating the sextant Web Map Service into RDBFIS was also suggested.

15. MEDIAS SC renewed its interest in the use of ZooCAM for fast counting and identification of staged fish eggs and zooplankton imaging and encouraged IFREMER's efforts to make this instrument available to the scientific community through an industrial transfer. The WG has also been informed of the possibility of adding test studies in MS NWP for eggs and meso-zooplankton sampling and processing during the MEDIAS surveys. MSs interested in adding these additional data collection activities should ensure that the justification from the RCG recommendation #8 from the 2023 report is included in the "test study" section (text box 1a) in their National Work Plans.

16. The WG collected the set of TS values used for all pelagic fish in the different GSAs, as a first step towards using common values and acknowledged the need to work further on this for all species. Thus, the MEDIAS SC agreed upon a working group to work further on the standardization of the TS of anchovy in priority.

17. The WG was informed of the difficulties encountered at GSA7 in relation with the development of floating wind farms in the area and the associated problems of area accessibility, and recommended that the French team explore possible scenarios for changing the sampling design to avoid the new inaccessible zones.

18. The MEDIAS SC invites the whole group to re-test the EchoR package for biomass and abundance estimates and contacting the IFREMER team with questions before the end of November 2024 if clarification of any issues is required.

19. With regard to availability of MEDIAS data, DG MARE proposed to make aggregated data (as provided in the DG MARE data call) publicly available, with the possibility of not disclosing/ sharing the last 3 years of data.

23. Closure of the meeting

The Chair thanked all experts for their participation in the 17th meeting of the MEDIAS Steering Committee and particularly to Angelo Bonanno (CNR-IAS) for hosting the meeting, the efficient organization and technical support of this hybrid meeting. The 17th MEDIAS Steering Committee was closed on 11 April 2024 at 13:00.

24. ANNEXES

Annex I: List of participants (2024)

Person	E-mail	Organisation	Attendance
Ana Ventero	ana.ventero@ieo.csic.es	IEO-CSIC	In-person
Andrea De Felice	andrea.defelice@cnr.it	CNR IRBIM	Online
Angelo Bonanno	angelo.bonanno@cnr.it	CNR-IAS	In-person
Antonio Palermino	antonio.palermino@irbim.cnr.it	CNR IRBIM	In-person
Athanassios Machias	amachias@hcmr.gr	HCMR	Online
Chato Osio Giacomo	Giacomo-Chato.OSIO@ec.europa.eu	EC	Online
Dimitar Dimitrov	dimpetdim@yahoo.com	IO-BAS	In-person
Giovanni Giacalone	giovanni.giacalone@ias.cnr.it	CNR-IAS	In-person
Gloria Blaya	gloria.blaya@ieo.csic.es	IEO-CSIC	Online
Gualtiero Basilone	gualtiero.basilone@cnr.it	CNR-IAS	In-person
Ignazio Fontana	ignazio.fontana@ias.cnr.it	CNR-IAS	In-person
Ilaria Biagiotti	ilaria.biagiotti@cnr.it	CNR IRBIM	Online
Iole Leonori	iole.leonori@cnr.it	CNR IRBIM	In-person
Jan Potočnik Erzin	jan.potocnik.erzin@gmail.com	FRIS	In-person
Jean-Hervé Bourdeix	Jean.Herve.Bourdeix@ifremer.fr	IFREMER	In-person
José Carlos Rodriguez	josecarlos.rodriguez@ieo.csic.es	IEO-CSIC	Online
Kelly Camilleri	kelly.camilleri.1@gov.mt	MAFA	Online
Magdalena Iglesias	magdalena.iglesias@ieo.csic.es	IEO-CSIC	In-person
Marco Barra	marco.barra@cnr.it	CNR-ISMAR	In-person
Maria Myrto Pyrounaki	pirounaki@hcmr.gr	HCMR	In-person
Marianna Giannoulaki	marianna@hcmr.gr	HCMR	In-person
Marija Boban	marebo@izor.hr	IZOR	In-person

Martina Zilioli	zilioli.m@irea.cnr.it	CNR IREA (RDFIS project)	Online
Michelle Mizzi	michelle.mizzi.1@gov.mt	MAFA	Online
Miriam Troyano	miriam.troyano@ieo.csic.es	IEO-CSIC	Online
Pilar Córdoba	pilar.cordoba@ieo.csic.es	IEO-CSIC	Online
Rosalia Ferreri	rosalia.ferreri@iamc.cnr.it	CNR-IAS	In-person
Samuele Menicucci	samuele.menicucci@irbim.cnr.it	CNR IRBIM	In-person
Simona Genovese	simona.genovese@cnr.it	CNR-IAS	In-person
Stefanos Kavadas	stefanos@hcmr.gr	HCMR (RDFIS project)	Online
Tarek Hattab	tarek.hattab@ifremer.fr	IFREMER	In-person
Tea Juretić	juretic@izor.hr	IZOR	In-person
Vanja Čikeš Keč	vanja.kec@gmail.com	IZOR	In-person
Venetia Kostopoulou	venetia.kostopoulou@ec.europa.eu	EC	Online
Violin Raykov	vio_raykov@abv.bg	IO-BAS	In-person
Zacharias Kapelonis	zkapelonis@hcmr.gr	HCMR	Online

Annex II: Institutions Acronyms

IEO/CSIC: Centro Oceanográfico de Illes Balears (COB-IEO), CSIC, 07015, Palma, Spain

CNR-IAS: Consiglio Nazionale delle Ricerche. Istituto per lo Studio degli Impatti Antropici e Sostenibilità in Ambiente Marino. Capo Granitola, Italy

CNR-IRBIM: Consiglio Nazionale delle Ricerche. Istituto per le Risorse Biologiche e le Biotecnologie Marine. Ancona, Italy

FRIS: Fisheries Research Institute of Slovenia. Ljubljana, Slovenia

HCMR: Hellenic Center of Marine Research, Greece

IFREMER: Institut Français de Recherche pour l'exploitation de la Mer, France

IO-BAS: Institute of Oceanology - Bulgarian Academy of Sciences. Bulgaria

IOR: Institute of Oceanography and Fisheries. Split, Croatia

NIMRD: National Institute for Marine Research and Development "GRIGORE ANTIPA". Romania

MAFA: Ministry for Agriculture, Fisheries and Animal rights, Malta

STECF: Scientific, Technical and Economic committee for Fisheries.

Annex III: Agenda of 17th MEDIAS Coordination meeting

17th MEDIAS Coordination Meeting

Palermo and ZOOM (Hybrid meeting)

April 9-11 2024

Meeting Agenda

Venue

Best Western Ai Cavalieri hotel

Address: Via Sant'Oliva 8 - 90141 - Palermo (PA), Italy

Tuesday 09/04/2024

09:00 – 09:30	Connection testing; Opening of the meeting & participants introduction; Adoption of the agenda.
09:30 – 10:00	Presentation of the 2023 acoustic surveys in GSA 1 - Northern Alboran Sea and GSA 6 - Northern Spain (IEO/CSIC) - Magdalena Iglesias, Ana Ventero, Pilar Córdoba, José Carlos Rodríguez, Miriam Troyano, Gloria Blaya.
10:00 – 10:30	Presentation of the 2023 acoustic surveys in the GSA 7 - Gulf of Lion (IFREMER) - Tarek Hattab and Jean-Hervé Bourdeix
10:30 – 11:00	Presentation of the 2023 acoustic survey in GSA 10 – Tyrrhenian Sea (CNR-IAS and CNR-ISMAR) - Angelo Bonanno, Marco Barra, Simona Genovese, Gualtiero Basilone and Rosalia Ferreri
11:00 – 11:30	Coffee break
11:30 – 12:00	Presentation of the 2023 acoustic surveys in GSA 15 - Malta (MAFA-ARM) - Kelly Camilleri, Mizzi Michelle and Mifsud Jurgen
12:00 – 12:30	Presentation of the 2023 acoustic surveys in GSA 16 - South Sicily (CNR-IAS and CNR-ISMAR) - Angelo Bonanno, Marco Barra, Simona Genovese, Gualtiero Basilone and Rosalia Ferreri
12:30 – 13:00	Presentation of the 2023 acoustic survey in the eastern part of GSA 17 - Northern Adriatic Sea (IZOR) - Vanja Čikeš Keč, Marija Boban and Tea Juretic

13:00 – 14:30 Lunch break

14:30 – 15:00 Presentation of the 2023 acoustic surveys in the western part of GSA 17 - Northern Adriatic and GSA 18 - Southern Adriatic (CNR IRBIM) - Iole Leonori, Andrea De Felice, Ilaria Biagiotti, Giovanni Canduci, Ilaria Costantini, Antonio Palermino and Samuele Menicucci

15:00 – 15:30 Presentation of the 2023 acoustic surveys in GSA 20 - Eastern Ionian Sea and GSA 22 - Aegean Sea (HCMR) – Maria Myrto Pyrounaki, Zacharias Kapelonis, Konstantinos Tsagarakis, Athanassios Machias, Konstantinos Markakis, Evdoxia Schismenou, Stylianos Somarakis and Marianna Giannoulaki

15:30 – 16:00 Presentation of the 2023 acoustic surveys in GSA 25 - Cyprus (HCMR)

16:00 – 16:30 Coffee break

16:30 – 17:00 Presentation of the 2023 surveys in the GSA 29 - Black Sea: Bulgarian survey (IO-BAS) - Dimitar Dimitrov and Violin Raykov

17:00 – 17:30 Presentation of the 2023 surveys in the GSA 29 - Black Sea: Romanian survey (NIMRD) - George Tiganov

17:30 – 18:00 General Discussion (on surveys presented)

Wednesday 10/04/2024

09:00 – 09:15 DG-MARE - Commission's views and suggestions (Venetia Kostopoulou, DG-MARE)

09:15 – 09:30 Review of issues discussed in other meetings held in relation to MEDIAS (RCG Med&BS Recommendation) (Tarek Hattab)

09:30 – 10:00 Discussion on standardizing the MEDIAS surveys period

10:00 – 11:00 Progress update on standardization of age reading and maturity estimates (Rossella Ferreri)

11:00 – 11:30 Coffee break

11:30 – 12:30 Work on MEDIAS regional database structure (Stefanos Kavadas, RDBFIS-II project)

12:30 –13:00 Discussion on the integration and standardization of acoustic observations in Black Sea surveys

13:00 – 14:30 Lunch break

14:30 – 15:00 Presentation of statistical analysis of fish shoal descriptors

15:50 –15:15 Discussion on the standardization of biomass estimates from EDSU values

15:15 – 15:45 Presentation of new standardized NASC maps at the Mediterranean scale (Marco Barra)

15:45 – 16:00 Discussion on standardization of zooplankton and eggs sampling

16:00 – 16:30 Coffe break

16:30 – 16:45 Presentation of all the TS values used in the different surveys (for all pelagic species)

16:45 – 17:15 Acoustic data processing in eastern part of GSA 17 - Northern Adriatic Sea (Vanja Čikeš Keč)

17:15 –17.30 Adjusting and optimizing biological sampling for the needs of MEDIAS based on area peculiarities

17:30 –17:45 Accessibility issues in GSA7: development of a floating wind farms (Tarek Hattab)

17:45 - 18:00 Spatial modelling of small pelagic fishes (Gualtiero Basilone)

Thursday 11/04/2024

09:00 – 10:00 General discussion and revision of the common MEDIAS protocol

10.00 – 10:30 Update of MEDIAS Website

10:30 – 11:00 Update of MEDIAS Handbook

11:00 – 11:30 Coffee break

11:30 – 12:15 Drafting and adoption of meeting conclusions

12:15 – 12:30 Terms of reference for the next meeting (2025); dates and venue of next meeting

12:30 – 13:00 Other issues

13:00 – 14:30 Lunch break

14:30 – 16.00 Drafting report

16:00 Closure of the meeting

Annex IV: Terms of Reference for the MEDIAS SC meeting in 2025

General:

- To present and harmonize the ongoing acoustic surveys in the Mediterranean Sea and Black Sea
- To provide information for management decisions if requested
- To provide input for stock assessment purposes concerning the stocks which are managed internationally
- To provide information for Good Environmental Status in the MSFD, if requested.

Specific:

- Update MEDIAS handbook and website if needed;
- Continuing the work on MEDIAS RDB related issues
- Present at the next meeting the results of the TS sub-group meeting
- Continuing the work on standardization of age reading and maturity estimates
- Present updates related to regional NASC mapping
- Explore the use of EchoR for data processing
- Drafts a document addressed to end users describing any changes in the sampling design through the years.

Annex V: MEDIAS HANDBOOK

(Version: April, 2024)

Common protocol for the MEDiterranean International Acoustic Survey (MEDIAS)

The geographical areas that are covered by the MEDIAS surveys and the respective days at sea per survey are presented in the following Table 1 and Figure 1. References can be found on MEDIAS website: http://www.medias-project.eu/medias/website/. More detailed information on MEDIAS, from current and historical perspective, are given in editorial written by Giannoulaki et al., 2021 and review paper written by Leonori et al., 2021 (see: https://doi.org/10.12681/mms.29068 and https://doi.org/10.12681/mms.26001).

Table 1. The size of the geographical area that is covered by each Institute in the Mediterranean Sea (acoustic surveys) and in the Black Sea (pelagic trawl surveys). NM = nautical miles.

Country	Institute	Geographical area	Size of area	Standard number of days
Greece	HCMR	Aegean Sea	9000 NM^2	40
Greece	HCMR	Eastern Ionian Sea	2800 NM^2	30
France	IFREMER	Gulf of Lion	3300 NM^2	33
Slovenia	CNR-IRBIM/FRIS	Adriatic Sea (Slovenia)	117 NM^2	1
Italy	CNR-IRBIM	Adriatic Sea (Italy)	13200 NM^2	40
Italy	CNR-IAS	Sicily Channel	4300 NM^2	16
Italy	CNR-IAS	Sardinia (east)*	3207 NM^2	**
Italy	CNR-IAS	Tyrrhenian and Ligurian Sea	6644 NM^2	30
Spain	CNIEO/CSIC	Iberian coast	8829 NM^2	33
Malta	MAFA	Malta (east)	1868 NM^2	4
Croatia	IOR	Adriatic Sea (Croatia)	13578 NM^2	35
Bulgaria	IO-BAS	Black Sea	3400 NM^2	20
Romania	NIMRD	Black Sea	4300 NM^2	20

* Official inclusion of this survey in DFC is pending

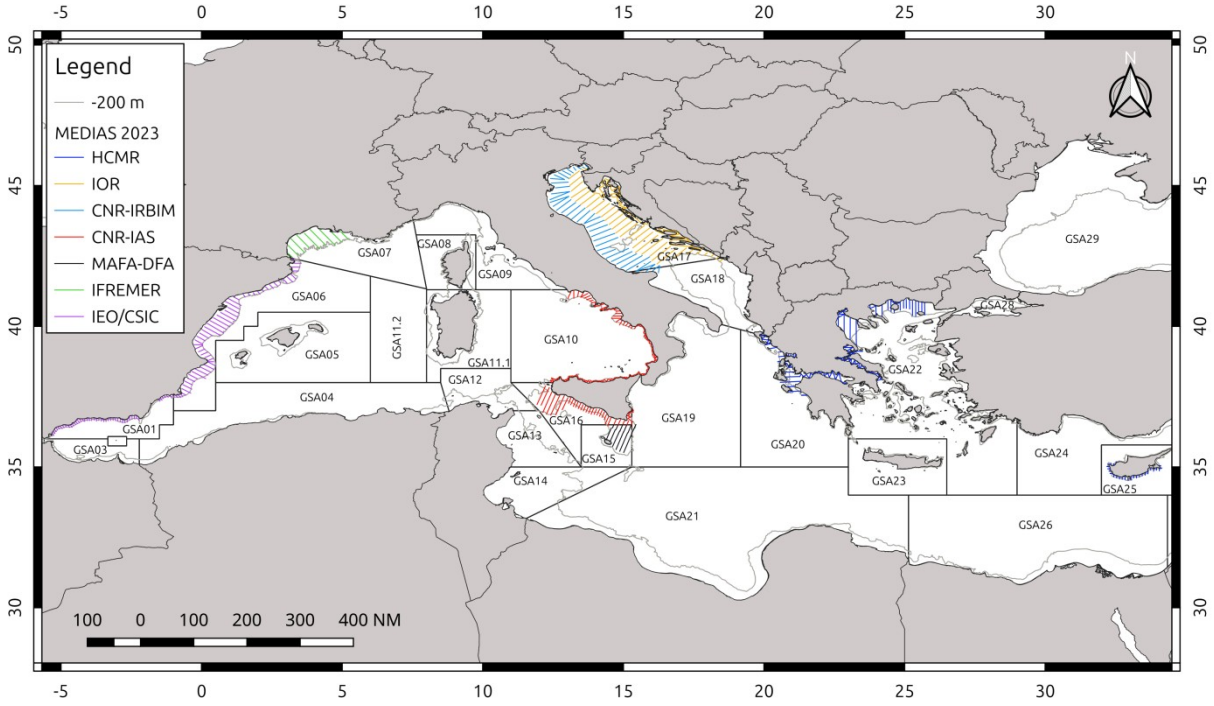

Figure 1. Surveys designs in the EU-MEDIAS.

Survey Identity

In the report of the DCF each Institute should report, the geographical area, the size of the area covered, the days at sea, as well as the period and dates in which the survey took place. In addition, the following vessel characteristics should be reported: Name of vessel, vessel length and vessel HP.

Echo sounder parameters

A variety of equipments with specific characteristics could be considered as adequate for the assessment of small pelagics. A split beam echo–sounder should be used for the echo–sampling. The angle beam, Athwart Beam Angle (in degrees), Along Beam Angle, and Ping rate of the echo–sounder should be reported. The frequency for assessment should be the 38 kHz, while the 18, 70, 120, 200 and 333 kHz can operate as complementary frequencies, depending on the research vessel used.

The pulse duration should be 1 ms; a pulse duration of 0.5 ms will be used only in case of Target Strength specific experiments. The threshold for assessment should be -70 to -60 dB depending on the survey and the ecosystem and should be reported. As the main objective is the optimum discrimination between fish and plankton, the background noise should be removed and in a next step, based on the available frequencies used in each survey, a frequency response-based mask should be developed to split the acoustic backscattering

between fish and plankton. Whenever this cannot apply, the threshold for assessment should be set at -70 to -60 dB, depending a) on noise level (-60 dB in case of high noise); b) the peculiarities of each area regarding school morphology and plankton density (-60 when plankton is dense, but -70 dB when small schools dominate the area); c) echo-sounder features; d) time of day that echo acquisition is carried out.

The ping rate should be set as fast as possible depending on depth, in order to assure good echo discrimination. At least one calibration of echo-sounder should be held per survey based on the procedure described in the manual of each echo-sounder and according to the principles described by Demer *et al.* (2015). The calibration parameters and the results of the acoustic equipment should be reported by survey according to the following Table 2. In principle, one calibration per survey is suggested.

Table 2. Calibration report

Calibration report
Frequency (kHz)
Echo-sounder type
Transducer serial no.
Vessel
Date
Place
Latitude
Longitude
Bottom depth (m)
Temperature (^{o}C) at sphere depth
Salinity (psu) at sphere depth
Speed of sound (ms^{-1})
TS of sphere (dB)
Pulse duration (s)
Equivalent 2-way beam angle (dB)
Default TS transducer gain
Iteration no.
Time
Range to sphere (m)
Ping rate
Calibrated TS transducer gain
Time (GMT)
RMS
sA correction

Survey timing

June-July is the best period for MEDIAS survey for biological reasons, however, in the impossibility of defining a common period for all MEDIAS surveys, due to research vessel availability problems, a specific official period has been established for each GSA, taking into account pragmatic, historical and operational considerations (table 3). This will ensure the continuity of time series within the GSA level and keep the sampling period consistent among years. A buffer period of plus or minus one month is authorized in case of particular difficulties that may be encountered in certain years, while considering the month of October as an upper limit not to be exceeded. However, if the survey has to be brought forward or delayed by more than this buffer month outside the official period, a request must first be made to MEDIAS SC and the EC before launching the survey.

Table 3. Official period for MEDIAS surveys per GSA

GSA	Official period
GSA1	6 7
GSA6	6 7
GSA7	6 7
GSA9	8 9
GSA10	7 8
GSA15	7 8
GSA16	7 8
GSA17 E	6 7
GSA 17 W	6 7
GSA 18	6 7
GSA 20	9 10
GSA 22	6 7
GSA 29 (summer)	6 7
GSA 29 (autumn)	10 11

Survey Design

The survey design for the acoustic sampling should consider the characteristics of the spatial structures of small pelagic fish in each area as well as the peculiarities in the topography of each area. Transects should be run along the greatest gradients in fish density, which is often related to gradients in bottom topography, meaning that transects will normally run perpendicular to the coastline/bathymetry. Inter-transect distance should be adjusted to achieve the minimization of the coefficient of variation of the acoustic estimates for the target species in each area but also take into account survey duration. In cases that topography is complex like in the case of semi-closed gulfs transect design could be decided otherwise. The survey design in each area should be reported. Based on some preliminary studies of the spatial structure characteristics of small pelagics in the Mediterranean Sea (WKACUGEO 2010; MEDIAS 2011) the inter-transect distance should not exceed 12 NM.

Specifically, within certain common workshops that were held in the framework of the AcousMed project (Anonymous, 2012) and past MEDIAS meetings, the existing survey design at different areas has been reviewed along with area peculiarities (e.g. size of the area, topography, survey duration). In the framework of these workshops, geostatistical analysis was applied on historical acoustic data under a common protocol and different survey designs were evaluated towards optimization, considering the spatial characteristics of small pelagic fish aggregations. The optimum inter-transect distance in each area has been identified and proposed. The results have been adopted at the 5th MEDIAS coordination meeting. However, in order to evaluate the survey performances in each area, a dedicated session with this specific Terms of Reference should be held when needed within the framework of the MEDIAS annual meetings.

Vessel speed during acoustic sampling should be adjusted depending on vessel noise as set by the ICES-WGFAST (WGFAST 2006). The working group agreed that vessel speed of 8-10 knots is adequate for a split beam echo sounder of 38 kHz. At higher speeds, problems might be encountered with engine noise or propeller cavitation.

It was strongly recommended that if species identification depends on the recognition of schools based on the echograms, the survey will have to take place only during day- time, being interrupted during periods in the 24-hour cycle when the schools disperse.

Otherwise, if available survey time does not permit this, echo sampling might be extended. In this case, echo allocation into species will not be based on school shape identification and justification should be given in the report that this does not affect the accuracy of the estimations. In the framework of the AcousMed project appropriate acoustic data from daytime and nighttime have been analyzed in order to determine the degree of error. Results from recent study (Bonanno et al, 2021) indicated that night estimates can be higher or lower compared to daytime estimates largely depending on the area peculiarities and especially the local plankton and fish densities. However, results showed that correction is possible and it is advisable when night sampling is inevitable.

Transects should be extended as close to the coast as possible in order to cover adequately the spatial distribution of sardine. The minimum distance from the shore largely depends on the size of the research vessel used. In any case, the Distance of acoustic sampling from the coast in respect to the Bottom depth should whenever this is possible reach the 10 m isobath. In each case the minimum bottom depth of each survey should be reported. The maximum echo-sounding depth should be 200 m and the minimum echo-sounding depth should be reported as it depends on the draught of the research vessel.

The Elementary Distance Sampling Unit (EDSU) for echo integration should be 1 nautical mile (NM), excluding "bad data". In the case of parallel transect designs, the acoustic energy in the inter-transect tracks will not be considered for assessment purposes. The working group concluded that the target species of the survey will be anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*).

The echo partitioning into species should be based on echogram visual scrutinization. This will be done either by direct allocation based on the identification of individual schools and/or allocation on account of representative fishing stations.

Target Strength (TS) equations: in the Mediterranean Sea, different species TS equations are currently applied depending on the area. The application of common TS equations should ideally derive from *in situ* estimations of TS, preferably based on acoustic data from the Mediterranean Sea. For this purpose, specific workshops were held in the framework of AcousMed project as well as DCF and MEDIAS coordination meetings but largely based on the analysis of available historical data. Based on these results, the 5^{th} MEDIAS coordination meeting agreed to apply for sardine the following TS-TL equation this point forward:

$$TS=20\log (TL)-72.6 \text{ dB}$$

where TS=Target Strength, TL=Total Length. The Steering Committee at its 14th annual meeting also agreed that in addition to use previous TS equation for sardine (with b20= -72.6 dB), IFREMER also will continue to use a b20=-71.2 dB in the Gulf of Lions, for compatibility reasons to the long time-series available, but in line with harmonization IFREMER will also provide estimates based on common TS that will be used for regional mapping purposes. Analysis results concerning anchovy indicated large differences between areas. For this purpose, MEDIAS partners concluded that further analysis using more data from all areas is needed and agreed not to propose a single TS equation and b_{20} value for anchovy. It was suggested that the work regarding anchovy TS should continue within the framework of specific MEDIAS workshops, using available data from additional areas, such as Croatia. Thus, it was agreed that for the time being, the historical Target Strength equations for anchovy will be maintained in each area and the applied TS equation should be reported.

Acoustic data processing for the assessment of the target species, Echoview or alternative Movies 3D software should be used for acoustic data analysis and the estimation of abundance. For compatibility reasons, raw data should be available into a common *.hac file format. Due to the large file size raw data will be stored within the responsibility of each

Institute. The common *hac format will be also available for the requirements of the Data Collection Framework (DCF) upon request.

A script in R to calculate geostatistical CV associated with biomass estimates from acoustic survey, based on Walline et al. (2007), has been created by Marco Barra (CNR) and tested by all MEDIAS groups. This procedure is considered mandatory to calculate geostatistical CV to be provided along with acoustic estimates.

Workflow for acoustic data processing

During the 6th MEDIAS meeting the Steering Committee agreed on a common workflow for acoustic data processing, which is structured in the following four steps:

a) Load and view data

b) The acoustic data acquired by echo-sounder during the survey are loaded in a software environment for visual exploration in terms of echograms and maps.

c) Calibrate

d) The results of calibration procedure, carried out on board the vessel, are installed in order to convert the raw acoustic data into absolute backscattering measurements. Such step includes also the installation of correct settings of transducers position referred to GPS antenna.

e) Remove background noise

f) Before analyzing the acoustic data any ambient noise present in the underwater environment has to be removed.

g) Detect and filter

The step includes the use of grids, lines, regions and mathematical operators for excluding from the collected acoustic data any backscattering signal not linked to the presence of fish and/or plankton.

<u>Specific aspects are:</u>

1. Intermittent noise removal;
2. Evaluate possible interferences that may produce artefacts in the echograms, and adopt a procedure for removing them;
3. Surface and seafloor exclusions;
4. Use lines for correctly separating the backscattering signals from surface and bottom;
5. Single targets estimation;

6. In case of organisms scattered in the water column, typical of night-time data acquisition, adopt the necessary procedure for separating fishes from planktonic organisms;
7. Schools estimation;
8. Use regions and/or mathematical operators for estimating backscattering signal due to fish aggregations.

Abundance indices

The following abundance indices should be estimated and reported in the DCF within the framework of MEDIAS:

The Total fish NASC per EDSU, as well as Point maps of total fish NASC should be available.

The target species of MEDIAS for assessment purposes will be anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*). The abundance indices estimated by all MEDIAS parties provided in the DCF report should include both NASC and Biomass estimations, for the whole area. Specifically, for the two target species abundance estimates provided in the report are: NASC/EDSU; Biomass/EDSU; Number of fish/EDSU; Number/age and per length class; Biomass/age and per length class. Point maps of anchovy and sardine in NASC/mile; Biomass/mile should also be available. In addition, abundance indices could be given for all pelagic species in the community which are important in each area.

The catch compositions of the hauls: pie-charts indicating percentage by weight per species and/or group of species should be available also.

Fish sampling

According to the standard methodology followed in acoustics, species allocation of the acoustic records is impossible if trawl information is not available. Fish sampling is required to collect representative samples of the fish population in order to identify echoes. The main objectives of trawling in an acoustic survey are a) to obtain a sample from the school or the layer that appears as an echo trace on the sounder for echo trace identification and allocation into species and b) to get biological information and evaluation of the size distribution of each species. Therefore, the trawling gear used is of no importance as long as it is suitable to catch a representative sample of the target-school or layer. In the framework of the AcousMed project available past data from different areas in the Mediterranean were analyzed based on a common protocol. Results showed no significant differences between day and night sampling (Machias et al., 2013). The coordination meeting based on these results concluded that

samples collected during both day and night in the same survey could be merged and used for the necessary estimations.

In addition, the sampling intensity of the hauls cannot be pre-determined because of the objectives of the acoustic survey *per se*. The sampling intensity in an acoustic survey depends on the size of the area covered, the frequency of occurrence of different echo traces on the sounder screen and the spatial characteristics of fish aggregations. In addition, the geographical coordinates or the sampling depth of the hauls cannot be pre-determined because pelagic species execute extended horizontal and vertical movements. Schools morphometry and energetic characteristics might change depending on the area, the time interval or even the fishing pressure. Therefore, the sampling strategy has to be adaptive depending on the school characteristics per area, time period and year.

Considering that, within a common protocol, the different research vessels used and the peculiarities of each area the following points have been agreed:

- A pelagic trawl will be used in all areas for biological sampling.
- Maximum codend mesh size should be equal to 24 mm (side of mesh equal to 12 mm). The codend and the trawl characteristics used in each area will be reported. If codend cover is used it should be reported and not to be used for LFD of target species.
- The vertical opening of the pelagic hauls along with the netsounder used should be reported.
- The duration of hauls should be no less than 30 min for unknown echoes and when multi-species scattered echoes are being fished.
- Vessel speed during fishing should be 3.5–4.5 knots.
- It is widely accepted that in the framework of an acoustic survey a standard total number of hauls cannot be set because this depends on the fish distribution and abundance found in each survey. However, in any case the hauls number must be adequate in order to a) ensure identification of echo traces; b) obtain a representative length structure of the population for each target species; c) obtain species composition and biological samples.
- Target species of the MEDIAS surveys are anchovy and sardine, but biological data for all species in the pelagic community (e.g. bogue, horse mackerels, sprat, etc.) regarding length frequency distribution and Length-Weight relationships should also be acquired.

Biological and oceanographic parameters

The following biological parameters should be estimated in each survey:

- The Length frequency distribution (0.5 cm) should be estimated from a representative sample for each fish species per haul. Total length will be measured for all species.

The Length–Weight relationship for all pelagic species will be estimated and reported. The size of each sample should be set at minimum the one described in the respective protocol of the Data Collection Framework (DCF).

- For the target species, anchovy and sardine, the mean Total Length at age should be estimated, as well as the Age-Length-Key used for the conversion of abundance indices to abundance-at-age. Data should be provided according to the DCF instructions.
- Otolith reading criteria for anchovy and sardine should be in accordance with ICES WKARA2 report (2017) and follow the recommendation of that meeting. In particular the 1st of January should be considered the birthdate for anchovy from an assessment point of view in relation to time-steps in the assessment. Mean TL at age should be reported.
- It is strongly recommended the use of ICES WKSPMAT report (2008) scale during the lab processing for classifying the reproductive phase for anchovy and sardine, particularly for identifying mature/immature which are very relevant to stock assessment purposes, in order to obtain the L_{50} estimation. This scale allows reaching a higher accuracy since it has been developed specifically for small pelagics (indeterminate spawners).
- Since the environmental parameters are very important for small pelagic fish, a minimum of 3 CTD stations should be held per transect or a grid of stations with density adequate to describe the oceanography of the surveyed area. Temperature and salinity are the hydrographic parameters that should be measured in the entire water column at each station.

Furthermore, the need for a common database has been concluded. The need for collaboration with the respective surveys in the Atlantic region (e.g. Bay of Biscay) has also been discussed and agreed. In the framework of this collaboration, information and experience will be exchanged.

Database

In the framework of the AcousMed project as well as a MEDIAS workshop, a common database design has been decided for all MEDIAS surveys (See: MEDIAS proposals in Annex VI). The 5th MEDIAS coordination meeting agreed to use this data base framework to store acoustic and biological data collected within the acoustic surveys in the Mediterranean Sea.

Ecosystem indices related to acoustic surveys

The abilities of currently applied MEDIAS surveys to contribute towards an ecosystem-based management approach in relation to the current and the future DCF requirements was extensively discussed by the MEDIAS partners. In the following Table 4 the ecosystem

indices that can derive from acoustic surveys (based on data regularly collected and analyzed) are reported.

Table 4. Ecosystem indices that could be derived from acoustic surveys.

	Spatial/ temporal strata	Spatial strata	GSA				
			Acoustic survey				
		Time periods	Season (Summer/Autumn depending on the area)				
	Taxonomic levels	Community	Pelagic fish (Species composition, occurrence in pelagic hauls)				
		Target Species	Adult	Anchovy			
				Sardine (for Mediterranean)			
				Sprat (for Black Sea)			
	Indices	Biodiversity	Species	Population size	Acoustic estimates	Total biomass & abundance estimates for target species	
						Estimation error (CV) (i.e. as agreed based on a common estimation procedure, see ToRs)	
				Population condition	Biomass & abundance estimate per size/age	Anchovy, Sardine, Sprat (Black Sea)	
					Recruitment index	Sardine (i.e. Number at Age 0 of the population based on summer surveys)	
				Habitats	Habitat	Hydrolo	Temperature (i.e. SST: average at 10m, estimated as the interpolated mean value for the whole area)

G o o					condition	gical condition	Salinity (i.e. SSS: average at 10m, estimated as the interpolated mean value for the whole area))
			Community	Fish Community condition	Community Synthesis	Total pelagic fish NASC	
					Species composition (i.e. percentage in terms of weight of pelagic trawls per hour)*		
			Age and size distribution	95% percentile of the population length distribution for the target species			
				Proportion of fish larger than L50 (length at first maturity estimated based on collected data or defined based on literature)			

Tables for DCF Data Call

The common templates (e. g. https://datacollection.jrc.ec.europa.eu/dc/medbs/templates), currently used for submission of MEDIAS results to Data Calls by MS, provided by JRC, are the following:

Abundance (in numbers per species per sex and length class)	xxx_Abundance
Biomass (biomass per species per sex and length class)	xxx_Biomass
Abundance biomass (abundance and biomass per species per sex and age class)	xxx_Abund_Biom

Common format for presentations at MEDIAS Coordination Meetings

- GSA number and general information on the GSA; map and general information on the acoustic survey
- Type of echosounder and frequencies in use
- Calibration results
- Survey design
- Number of nautical miles effectively processed for biomass estimation
- Biomass estimation results in tons by GSA and graphs in terms of biomass density (time series of average t/nm^2)

- Headline, footrope length of the pelagic net, sidelines dimensions, mesh size
- CTD stations map
- Biomass per length classes (0.5 cm) and per age classes in tons
- Graphs of Age Length Keys (in %, with total No. otoliths, by length classes)
- Maps of anchovy and sardine spatial distribution (proportional maps of NASC values - bubble plots)
- Map with pie charts reporting % in weight of anchovy, sardine and other species.

Other results of interest from acoustic surveys could be also reported but they are not mandatory.

Data accessibility

As the MEDIAS Steering Committee acknowledges the need for MEDIAS data and output accessibility it was agreed to:
1) MEDIAS data need to be available after March 31 of the next year (e.g. N+1 March 31, where N is year of the survey), and MS and end-users are recommended to respect this date (Recommendation No. 12 from RCM Med&BS meeting in 2016);

2) MEDIAS results per survey are presented in the Annual MEDIAS report which is freely available in the MEDIAS website;

3) Overall biomass and abundance estimates are available through the DCF Data Call;

4) Include annual distribution maps of NASC per species along with the respective metadata information in a GEOportal.

Detailed data per EDSU could be available to third parties through the GEOportal. The third party should send a request and present to the Steering Committee the type of data requested, the purpose for which data are needed and exchange ideas for collaboration.

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Summary table of the common protocol for the MEDiterranean International Acoustic Survey (MEDIAS).

Survey Identity	
Geographic area	Should be reported
GSA area	Should be reported
Size of Area to be covered (NM^2 / km^2)	Should be reported
Days at sea	Should be reported
Vessel	Should be reported
Vessel length	Should be reported
Vessel HP	Should be reported
Period of survey	Should be reported
Echo sounder parameters	
Echo sounder	Split beam
Frequency for assessment (kHz)	38

Complementary frequencies (kHz)	18, 70, 120, 200, 333 kHz depending on availability.
Pulse duration (ms)	0.5 or 1 ms, should be reported
Beam Angles (degrees) Athw. Beam Angle, Alog. Beam Angle	Should be reported
Ping rate	Maximum depending on depth
Calibration (No per survey)	A calibration report should be given One calibration per survey
Threshold for acquisition (dB)	-80
Threshold for assessment (dB)	-70 to -60 (reported)
Survey design	
Transects design	Perpendicular to the coastline/bathymetry, otherwise depending on topography The survey design according to the MEDIAS conclusion for each area and should be reported.
Inter-transect distance (NM)	Max <=12 NM. The inter-transect distance should be according to the MEDIAS conclusion for each area and should be reported
Time of day for acoustic sampling	Day time. Otherwise, in cases of time limitation and if echo allocation into species does not depend on school shape identification (in this case justification of the accuracy of results will be presented)
EDSU (nm)	1 NM
Distance from the coast according to the Bottom depth (min, m)	Bottom depth should whenever this is possible reach the 10 m isobath
Echo sounding depth (min, m)	Depending on the draught of RV. Should be reported
Echo sounding depth (max, m) recording.	200 m
Vessel speed	8-10 knots
Software for analysis	Movies and/or Echoview
File format	*.hac
Inter - transect	Acoustic energy in the inter-transect track will not be taken into account
Applied TS (dB)	Sardine: -72.6 dB, See also hand book Other species: Keep historical TS equations.

Echo partitioning into species	Echo trace classification based on echogram visual scrutinisation • Direct allocation and • allocation on account of representative fishing station
Abundance estimates	
Abundance indices estimated	Total fish NASC per EDSU Anchovy, Sardine NASC per EDSU Anchovy, Sardine Biomass per EDSU Anchovy, Sardine Numbers per EDSU Anchovy, Sardine Number/age and per length class Anchovy, Sardine Biomass/age and per length class
Maps and charts	Point maps of total fish NASC Point maps of target species in NASC/mile; biomass / mile. Catch compositions of the hauls, pies charts indicating biomass per species
Fish sampling	
Target species	Anchovy, Sardine
Other species	Biological data for all species in the pelagic community: Length-Weight relationships; Length distribution.

Fishing gear, codend mesh size	Pelagic trawl, Codend and trawl characteristics should be reported. Max Codend mesh size = 24 mm (side of mesh = 12 mm).
Vertical opening of the pelagic trawl	Should be reported
Netsounder used	Should be reported
Duration of haul	Minimum 30 min for unknown echoes
Time of sampling	Both daytime and night time biological samples from the same survey will be used.
Vessel speed during fishing	3.5 – 4.5 knots
Sampling intensity, no of hauls	The total number of hauls has to be adequate to: • ensure identification of echo traces; • obtain length structure of the population; • obtain species composition; • get biological samples.
Biological and oceanographic parameters	
Length	All species: Total length (TL), Length frequency distribution (0.5 cm)
Age readings, ALK	Sardine, Anchovy: Mean TL at age Sample sizes according to the new DCF.
Length - Weight	All pelagic species
Oceanographic. Parameter (CTD)	Minimum 3 CTD per transect or grid of stations with density adequate to describe the oceanography of the surveyed area. Minimum variables: T, S

Annex VI: MEDIAS group proposals

1) MEDIAS database

MEDIAS group is planning the development of a common database for all the partners involved in the project that would be highly beneficial concentrating the information on small pelagic stocks of different areas of the Mediterranean in the same structure with a standardized format. In order to proceed in this way a proper financial support is requested in order to buy hardware components and software adequate for this aim and contracts for the database technical developers.

The Common Database structure for acoustic surveys was adopted in the 5th MEDIAS meeting. General outline of a database for acoustic surveys is shown in Figure A1.

The major fields agreed are associated to:

a) input information related to export data from acoustic software (Figs. A2 & A3);
b) input information related to biological sampling and environmental data sampling (Figs. A4 & A5);
c) queries-calculations to fulfill DCF requirements (Fig. A6);
d) queries-calculations to facilitate abundance/biomass estimates (Fig. A6);
e) echosounder calibration report (Fig. A7);
f) data input validation and control checks;
g) up to date demands related to surveys and the Ecosystem Approach to Fisheries (Figs. A5 & A6).

Figure A1. General outline of a database for acoustic surveys.

Analytical info per database field are presented below.

Survey Identity
Geographic area
GSA area
Size of Area to be covered (NM^2 / km^2)
Size of Area effectively covered (NM^2 / km^2)
Vessel (Horse power, noise level, draft)
N° of hauls
N° of CTDs
Total number of EDSU processed
Dates of survey

Figure A2. Fields associated with the typical input info about the survey.

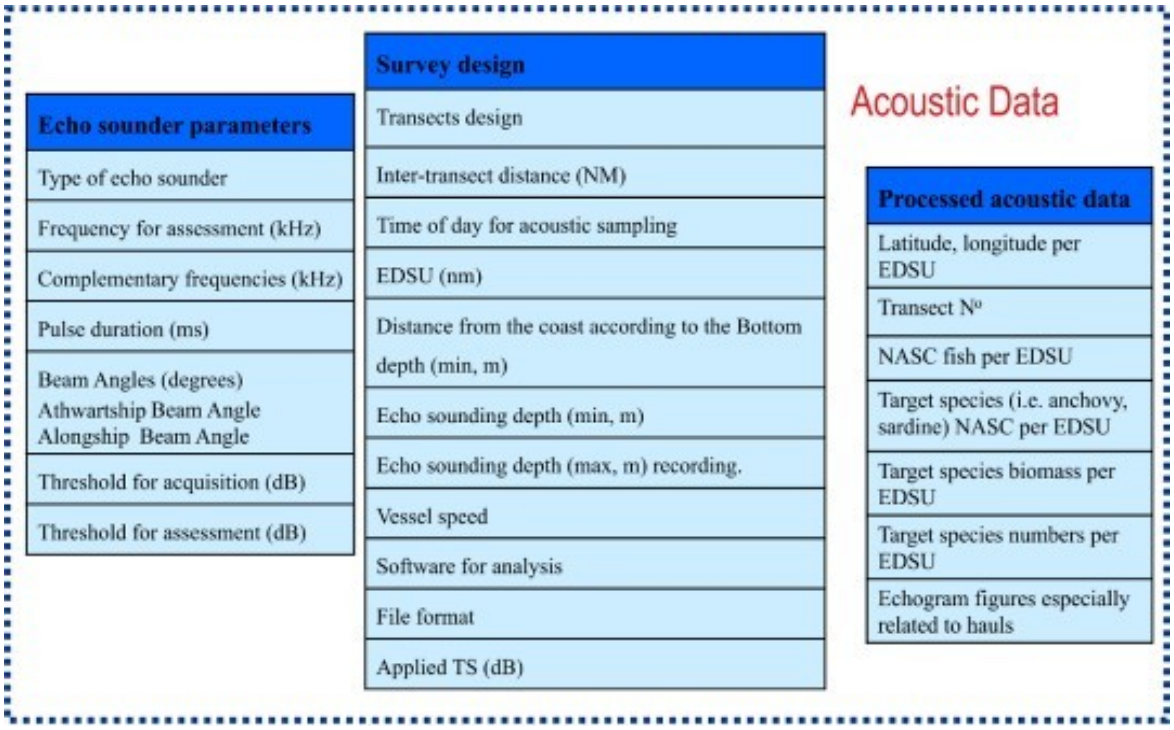

Figure A3. Fields associated with input info on Acoustic Data

Specific routines that are useful for a database dealing with acoustic survey data are outlined below:

1. Sub-area creation: query that allows the selection of a sub-area along with the underlined acoustic data (i.e. referring to whole transects or parts of transects) and the respective hauls based on certain criteria (e.g. depth, etc.), possibly through a GIS software that will be linked to the database;
2. Calculation of NASC average values and standard error in a sub-area;
3. Merge haul information in a sub-area: calculation of the mean size by species and the percentage in terms of weight and number of the species composition
4. Biomass estimation per species in a sub-area: using the average NASC value per species and composition information from hauls otherwise through direct allocation of NASC to species.

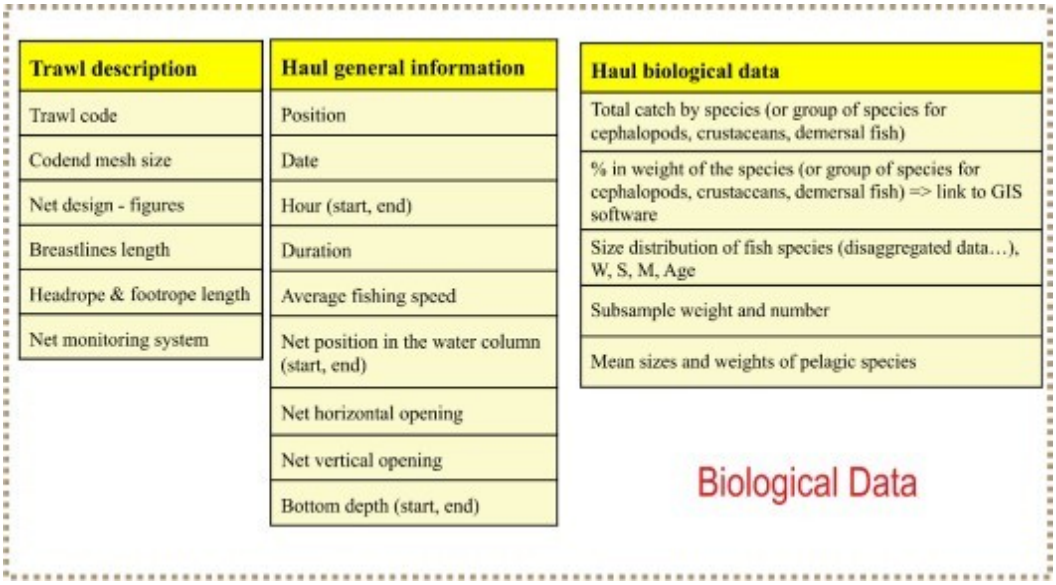

Figure A4. Fields associated with input info on Biological Data related to acoustic surveys

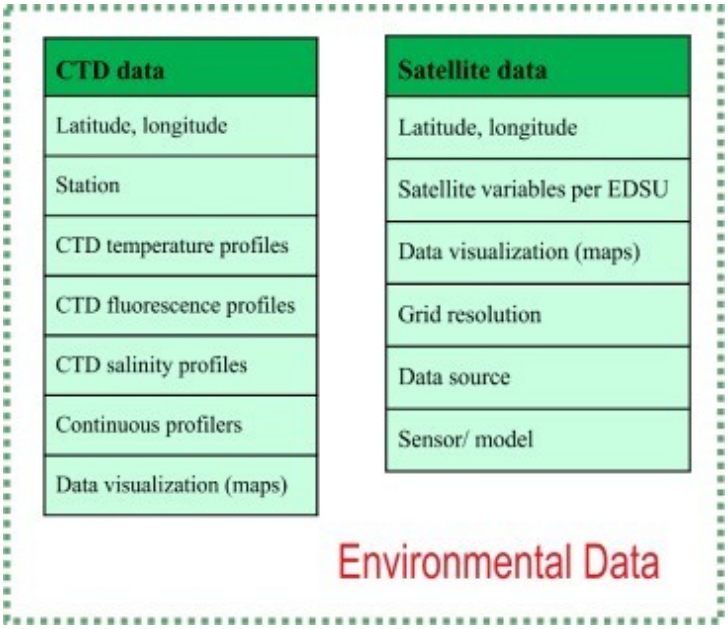

Figure A5. Fields associated with input info on Environmental Data related to acoustic surveys

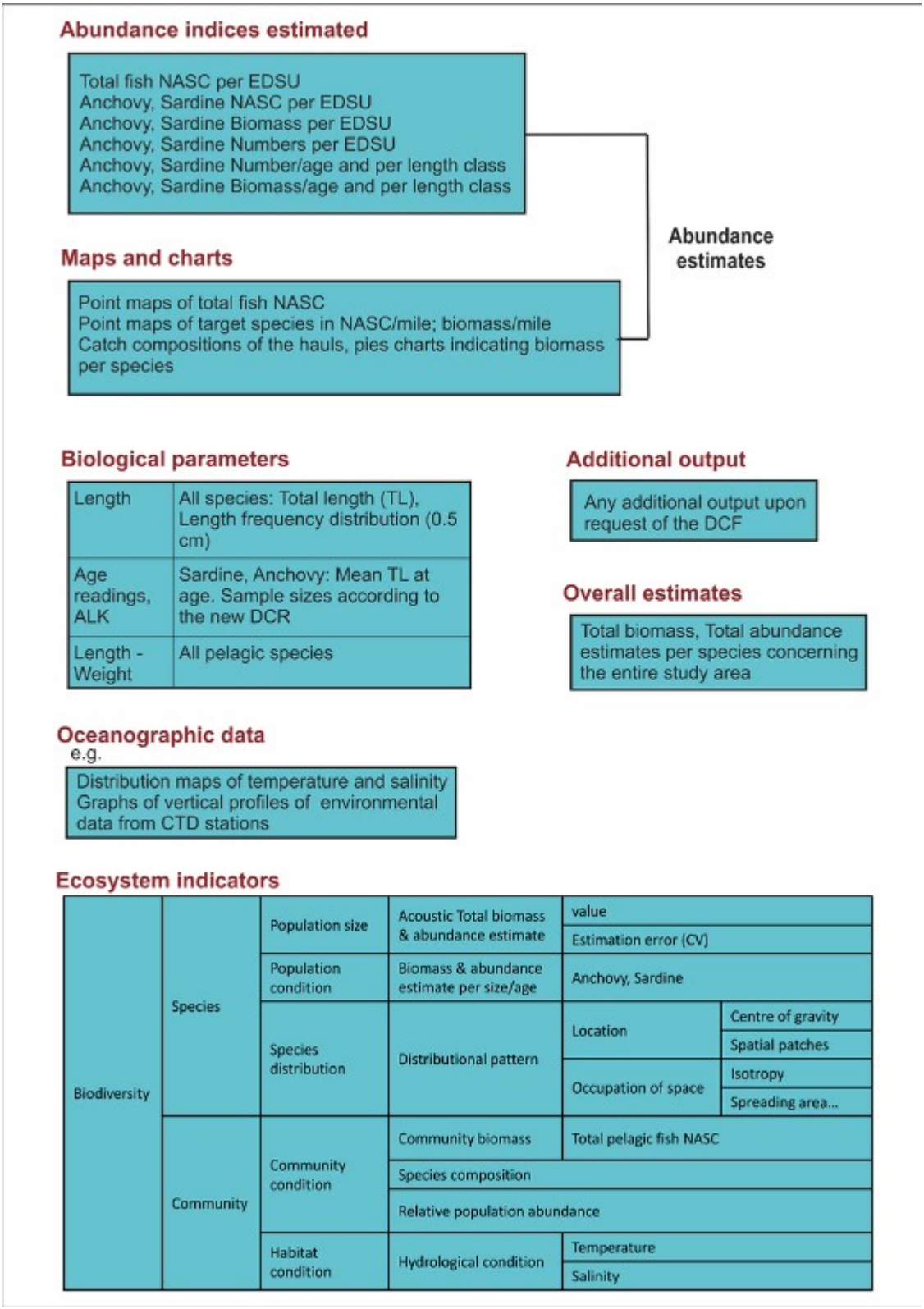

Figure A6. Fields associated with potential acoustic database output.

Calibration report

Frequency (kHz)	*	Speed of sound (ms^{-1})	*
Echosounder type	*	TS of sphere (dB)	*
Transducer serial no.	*	Pulse duration (s)	*
Vessel	C	Equivalent 2-way beam angle (dB)	*
Date	*	Default Sv transducer gain	*
Place	C	Iteration no.	C
Latitude	C	Time	*
Longitude	C	Range to sphere (m)	*
Bottom depth (m)	C	Ping rate	C
Temperature (^{o}C) at sphere depth	C	Calibrated Sv transducer gain	*
Salinity (psu) at sphere depth	C	Time (GMT)	*

*** Data you can find in the EK60 report sheet.**

Figure A7. Database Fields related to electro-acoustic calibration report.

2) Mesozooplankton sampling synoptic with acoustic survey

The MEDIAS Steering Committee discussed in many occasions about the importance to add a sampling on zooplankton to the already foreseen MEDIAS routine activities at sea, and finally agreed to propose that this research topic could be incorporated into the DCF for what concerns acoustic surveys. The reasons for this proposal are numerous. First of all, by knowing plankton abundance it is possible to have an index of productivity, and thus prey availability, that is important in the study of small pelagic fish abundance over the years and of their spatial distribution; this ecosystem indicator could also be important in the Marine Strategy Framework Directive.

Another important element is given by the fact that the sampling activity on plankton would produce a ground truth of some targets in the acoustic data, so that, during the acoustic processing, these targets could be discarded with a higher degree of certainty, while separating the small pelagic fish echoes from unwanted plankton echoes. The accuracy of this process could be further enhanced through the knowledge of the kind of planktonic organisms that are prevalent in a certain area, derived from sample collection by means of the plankton net, due to the fact that different planktonic organisms for anatomic and physiologic characteristics give different responses in multifrequency during the acoustic survey.

The analysis on plankton can also give information on the ichthyoplankton fraction; in this way a deeper knowledge on spawning (from collected eggs) and nursery areas (from collected larvae), at least for anchovy (*Engraulis encrasicolus*), given the survey period, could be gained. This fact would potentially allow the possibility to explore new management scenarios in the Mediterranean Sea, eventually based on local closures in correspondence of spawning and nursery areas.

The analysis on plankton can also give additional information on the pelagic ecosystem structure and function. The knowledge on zooplankton component in pelagic ecosystem is particularly important because it represent a link between the lowest trophic level (i.e. primary production - phytoplankton) and higher trophic levels (i.e. fish) in the marine food web. Such improved knowledge on marine ecosystem can be considered as necessary precondition in applying ecosystem-based management (EBM) in the future, in line with the new CFP.

This proposal concerns the MEDIAS surveys that are held along the Iberian coast (GSA 1 and 6) carried out by IEO (Spain), Gulf of Lion (GSA 7) by IFREMER (France), Sicily Channel (GSA 16) by CNR-IAS (Italy), western Adriatic Sea (GSA 17 and 18) by CNR-IRBIM (Italy), eastern Adriatic Sea (GSA 17) by IOR (Croatia) and eastern Ionian Sea and Aegean Sea (GSA 20 and 22) by HCMR (Greece). The proposal also concerns the acoustic survey carried out by CNR-IAS (Italy) in the Tyrrhenian and Ligurian seas (GSAs 9 and 10), that are part of the MEDIAS since 2017. All these surveys are conducted in the period June-September.

A proper number of stations (depending on transect length) could be performed along dedicated transects in order to collect information on mesozooplankton with an appropriate resolution.

A proper financial support is needed in order to plan and perform this kind of activity, both in the field and in the laboratory. Moreover, there is the need to buy specific staff such as plankton nets, bottles, laboratory staff for the preservation and the analysis of the samples, etc.

3) Intercalibration exercise

An intercalibration exercise involving all the MEDIAS groups is proposed. One of the MEDIAS study areas could be selected to host the intercalibration and all the involved research vessels, together with personnel and equipment in use during acoustic surveys should converge there. The procedure to conduct the intercalibration could be the one described in Simmonds and Mac Lennan (2005). Due to the fact that there are more than two vessels operating in MEDIAS surveys, the calibration should proceed in pair (two vessels at a time) conducting more trials.

Reference