Report of 16th meeting for MEDiterranean **I**nternational **A**coustic **S**urveys **(MEDIAS)**

in the framework of European Data Collection Framework (DCF)

Ljubljana, Slovenia and ZOOM (Hybrid meeting)

18-20 April 2023

Steering Committee Report

Contents

1. Introduction

The MEDIAS (MEDiterranean International Acoustic Surveys) Steering Committee met in Ljubljana, Slovenia, on 18-20 April 2023, hosted by ZZRS 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. Romania and Bulgaria). Two representatives from STECF, one representative of EC from DG-MARE, and one representative from RDBFIS & RDBFIS-II projects were invited to participate. In total, 34 participants attended the meeting including 20 in-person attendees and 14 virtual participants (see list of participants in Annex I and Institute's acronyms in Annex II).

The agenda of the 16th hybrid MEDIAS Coordination Meeting (see Annex III) was adopted by all participants.

In accordance to the Agenda adopted, the main aims of the 16th MEDIAS Coordination Meeting were:

- to present the outcomes related to the MEDIAS activities carried out in 2022;
- 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 peculiar / common types of echograms from different areas;
- to discuss the issues faced in the Northern Alboran Sea survey and propose solutions;
- to work on MEDIAS regional database structure;
- to make progress on the standardization of zooplankton sampling
- to agree on the method to produce standardized maps at the Mediterranean scale;
- to establish the ToRs and plan 17th MEDIAS meeting in 2024.

Following the agenda, during the first day activities and outcomes related to the 2022 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 Romania and Bulgaria in the Black Sea.

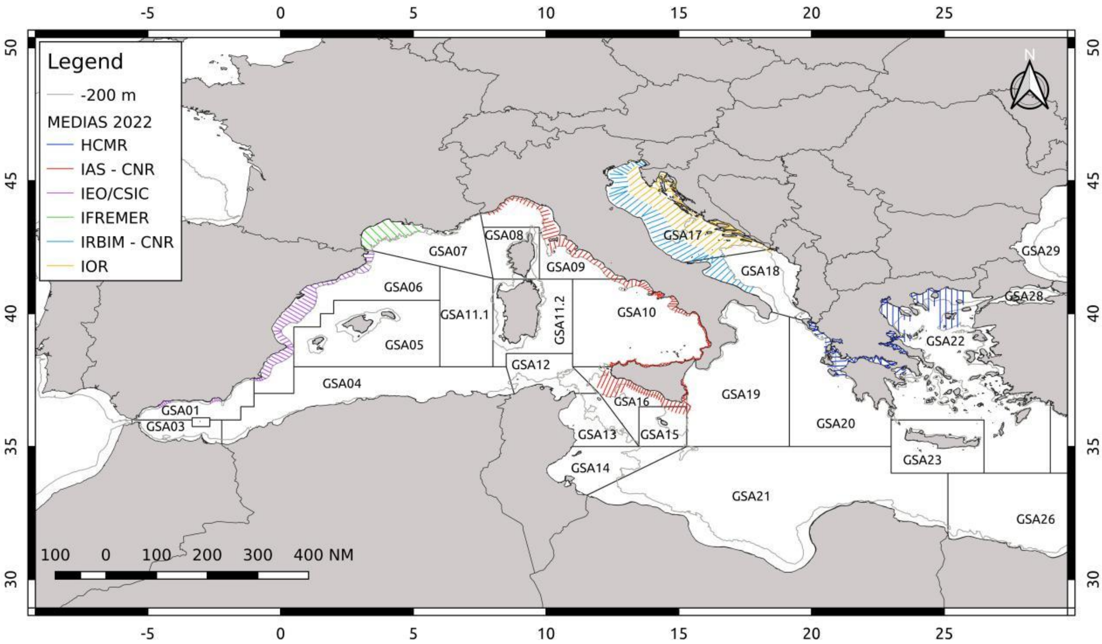


Figure 1.1. Acoustic surveys performed in the MEDIAS framework during 2022.

2. Results of the surveys carried out in 2022 in the framework of the Mediterranean International Acoustic Surveys (MEDIAS)

2.1. MEDIAS 2022 in Iberian coast (ESP): GSA 1 - Northern Alboran Sea and GSA 6 - Northern Spain (Magdalena Iglesias, Ana Ventero, Pilar Córdoba, José Carlos Rodríguez, IEO-CSIC)

a) General information on the survey

MEDIAS 2022 acoustic survey was carried out in the Mediterranean Spanish waters (GSA06, Northern Spain and GSA01, Northern Alboran Sea) from 8th July to 10th August 2022 (34 days) on board the R/V "Miguel Oliver" (70 m long, 2 x 1000 kW). Target species were European anchovy (*Engraulis encrasicolus*) and European sardine (*Sardina pilchardus*).

b) Type of echosounders and frequencies in use

The equipment was composed by an EK80 (SIMRAD) scientific echosounder equipped with five frequencies (18, 38, 70, 120 and 200 kHz); three pelagic trawls (9-18 m vertical opening and 20 mm codend), equipped with an FS70 (SIMRAD) netsonder and a MARPORT catch sensor placed on the top of the trawl codend. Moreover, two CTD (Seabird 19 plus) were used to collect temperature, salinity, fluorescence and dissolved oxygen data from the water column.

c) Calibration results

The acoustic system was calibrated at the beginning of the survey using the standard sphere method (Demer *et al*., 2015) (Table 2.1.1). Elementary Sampling Distance Unit (EDSU) was 1 nmi, minimum bottom depth 30 m, pulse duration 1 ms for all frequencies and ping rate was set to maximum.

Table 2.1.1. Calibration results in MEDIAS 2022.

Frequency (kHz)	**18**	**38**	**70**	**120**	**200**
Echo-sounder type	EK80 (Simrad)				
Transducer type	ES18	ES38-7	ES70-7C	ES120-7C	ES200-7C
Transducer Serial number.	2068	453	142	354	297
Research Vessel	Miguel Oliver				
Date	09/07/2022				
Place	Bahía de Palma				
Bottom depth (m)	40				
Temperature at sphere depth (°C)	23.7851				
Salinity at sphere depth (psu)	37.6881				
TS of sphere (dB)	-42.35	-42.33	-41.67	-39.98	-38.81
Pulse duration (ms)	1024				
Ping rate	0.5				
RMS beam	0.14	0.05	0.12	0.2	0.35
Transducer Gain (dB)	22.93	26.35	27.35	26.99	25.92
Sa corr (dB)	0.01	-0.01	-0.07	-0.06	-0.09
Beam width atwarth (°)	10.29	6.62	6.47	5.67	5.34
Beam width along (°)	10.34	6.69	6.50	5.87	5.86
Athwart offset (°)	-0.03	0.00	-0.11	-0.01	-0.08
Along offset (°)	0.03	-0.07	-0.27	-0.32	-0.42

d) Survey design

Acoustic data were collected during daytime (6:00 am - 8:00 pm) 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 and 4 nmi in GSA01. Vessel speed during acoustic survey was 10 knots. Elementary Sampling Distance Unit (EDSU) was 1 nmi, minimum bottom depth 30 m, pulse duration 1 ms for all frequencies and ping rate was set to maximum.

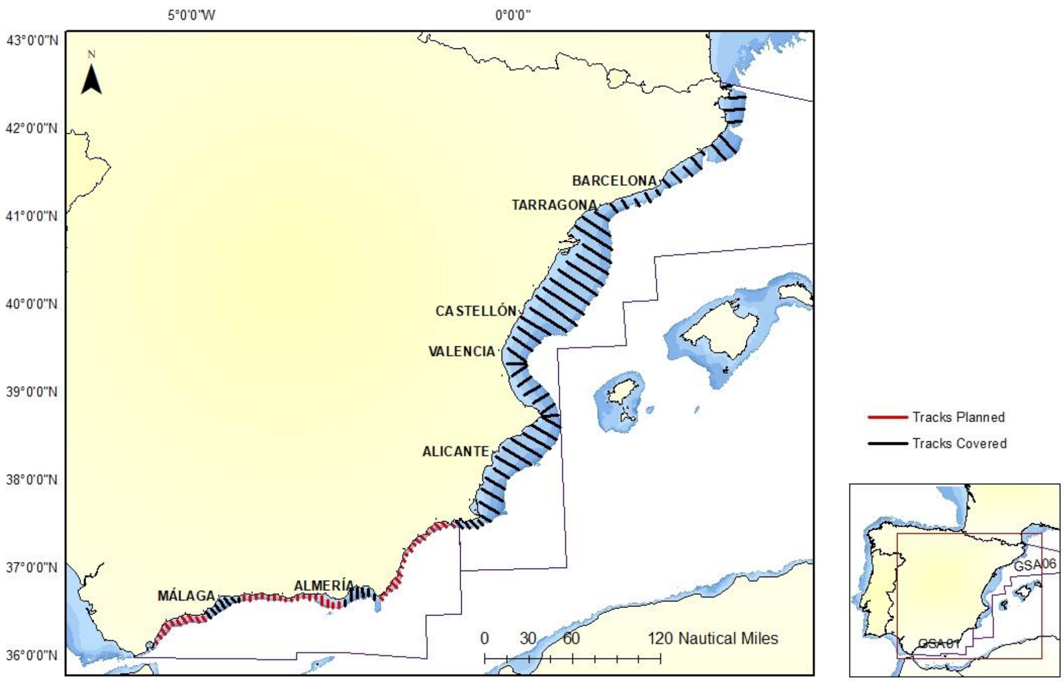


Figure 2.1.1. Acoustic survey design (65 transects, in black); 52 in GSA06 and 13 in GSA01. MEDIAS 2022.

Acoustic data were collected over 698 nautical miles (nmi) corresponding only to the transects from GSA06 (Fig. 2.1.1) and processed. In GSA01 only the Bays of Almeria and Málaga (13 tracks) were covered due to the lack of time. Propulsion problems in the research vessel caused the loss of 8 days of survey. The GSA01 has not yet been processed.

e) Fish sampling

Forty-one (41) pelagic hauls were carried out in GSA06 and fourteen (14) in GSA01 for the scrutinizing of the echograms (Fig. 2.1.2).

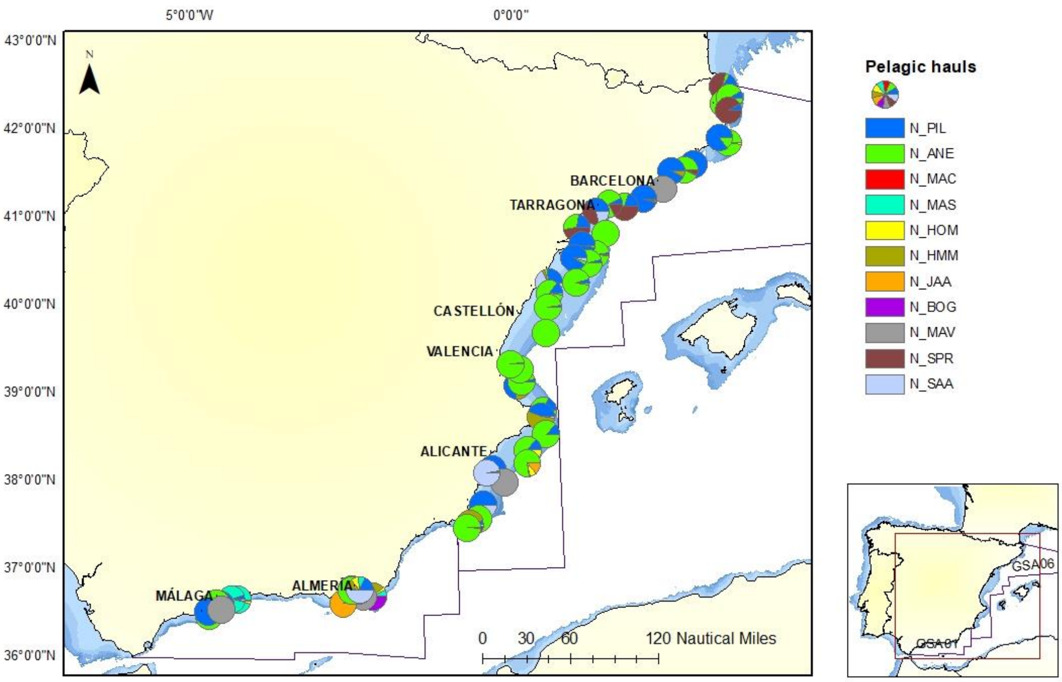


Figure 2.1.2. Pelagic hauls (56) composition carried out during the Spanish acoustic survey MEDIAS 2022.

f) Oceanographic parameters

In total, 126 CTD stations were performed in GSA06 and 24 in GSA01 (Fig. 2.1.3).

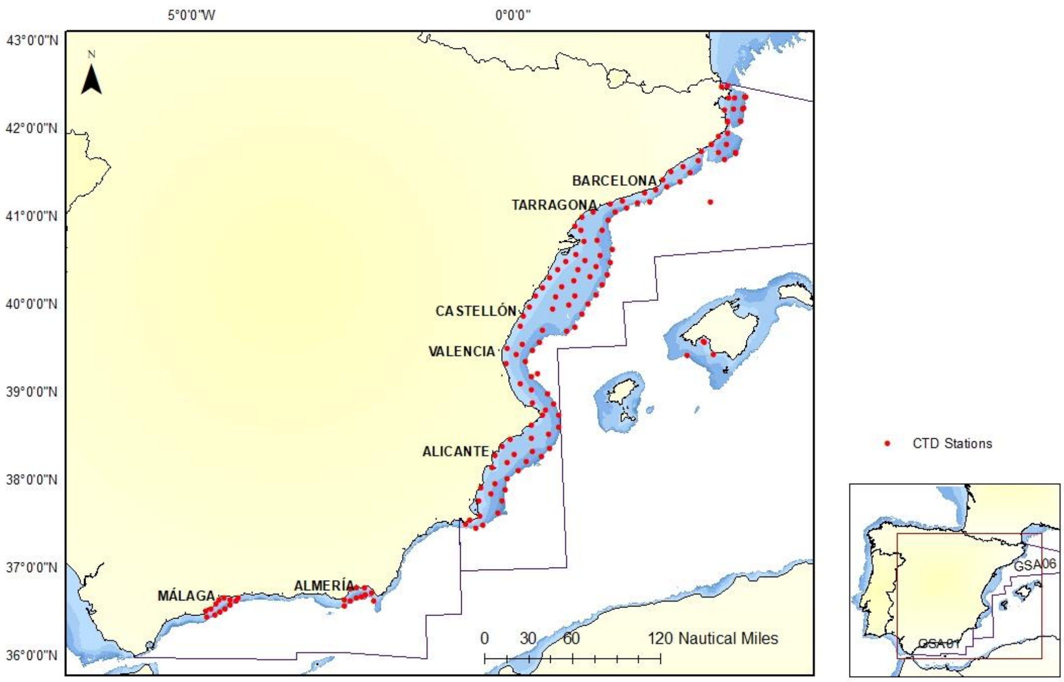


Figure 2.1.3. CTD stations (150) carried out during the Spanish acoustic survey MEDIAS 2022.

g) Biomass estimations of target species

Biomass (tons) of sardine (*Sardina pilchardus*) (Fig. 2.1.4) were estimated by GSA: 41000 tons (CV 11) in GSA06.

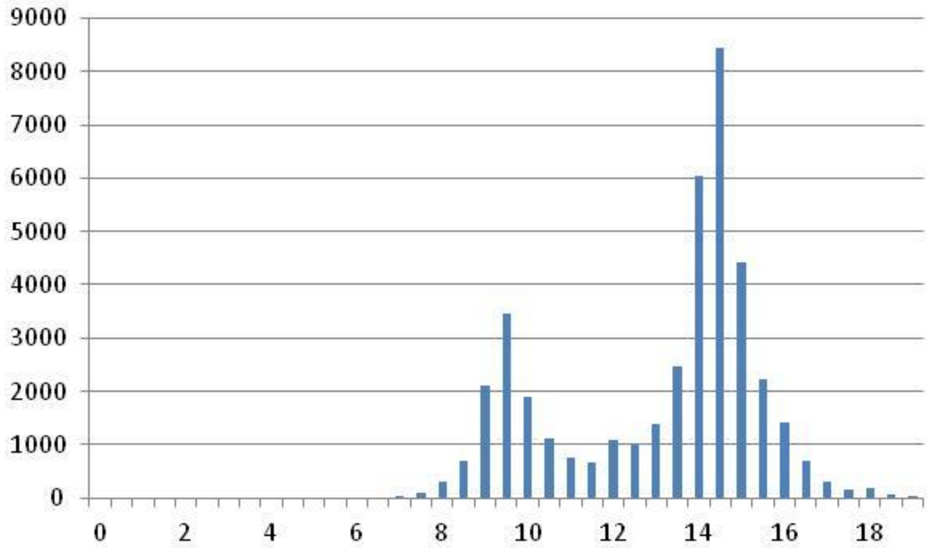


Figure 2.1.4. Sardine (PIL, FAO code) biomass in tons by length (LFD) in GSA06. MEDIAS 2022.

Biomass of anchovy (*Engraulis encrasicolus*) (Fig. 2.1.5) was estimated by GSA: 69646 tons (CV 11) in GSA06. Anchovy length frequency distribution was bimodal.

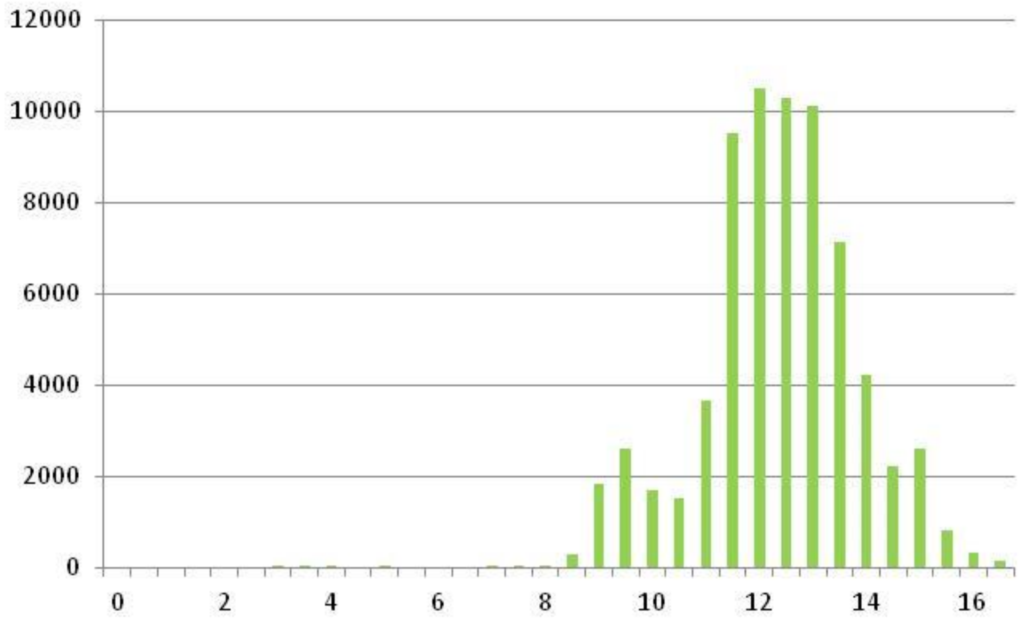


Figure 2.1.5. Anchovy (ANE) biomass in tons by length (LFD) in GSA06. MEDIAS 2022.

Age length key (ALK) for sardine in GSA06, MEDIAS 2022, was composed by 5 years classes (0-4). The number of otoliths readings was 1117 (individuals) (Fig. 2.1.6.a). In GSA01, the number of sardine otoliths readings was low (307), the number of age classes were 5 (0-4) (Fig.2.1.6.b).

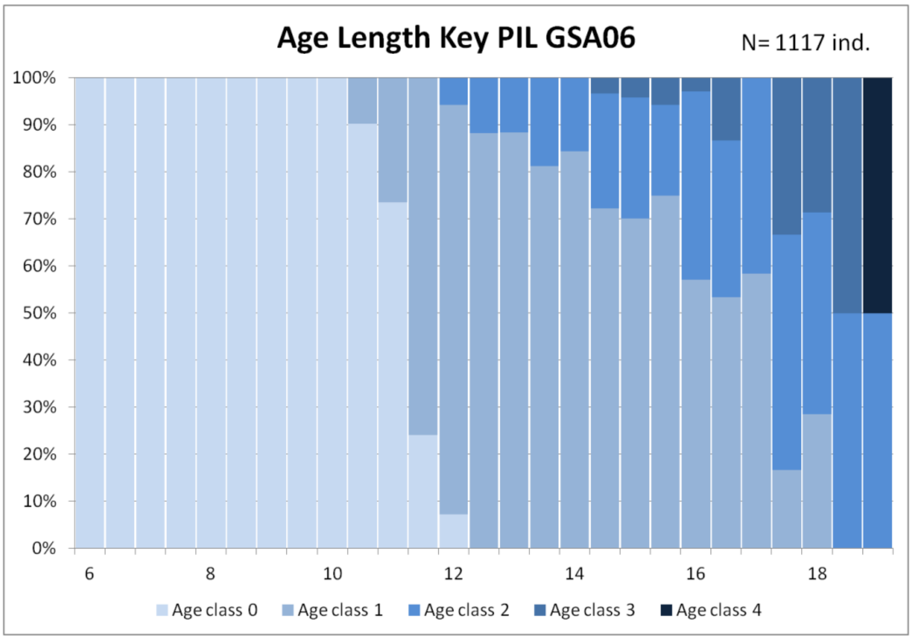


Figure 2.1.6.a. Sardine ALK GSA06, MEDIAS 2022.

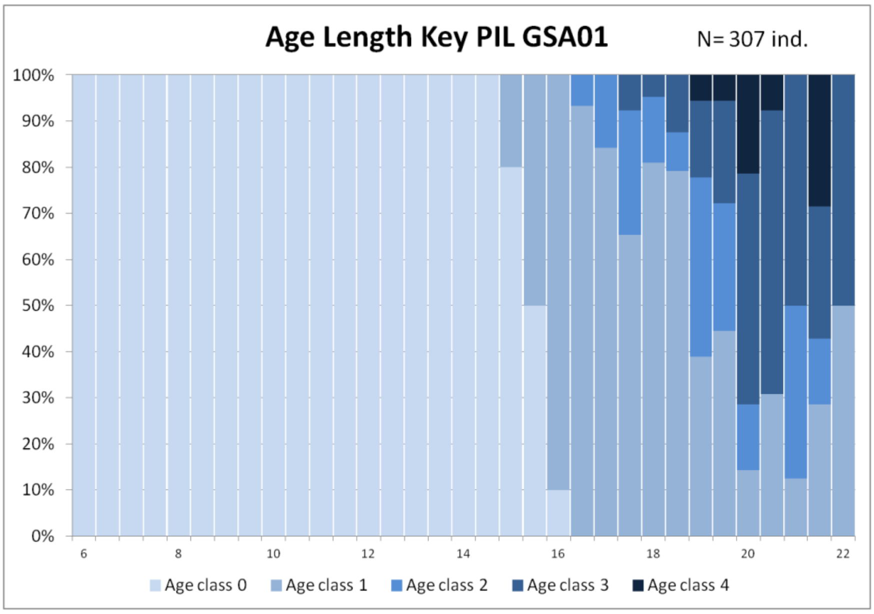


Figure 2.1.6.b. Sardine ALK GSA01, MEDIAS 2022.

Anchovy ALK in GSA06, MEDIAS 2022, was represented by 3 year classes (0-2) (981 pair of otoliths) (Fig. 2.1.7.a), and only 2 year classes (0-1) were detected in GSA01, with a lower number of otoliths readings (114) (Fig 2.1.7.b).

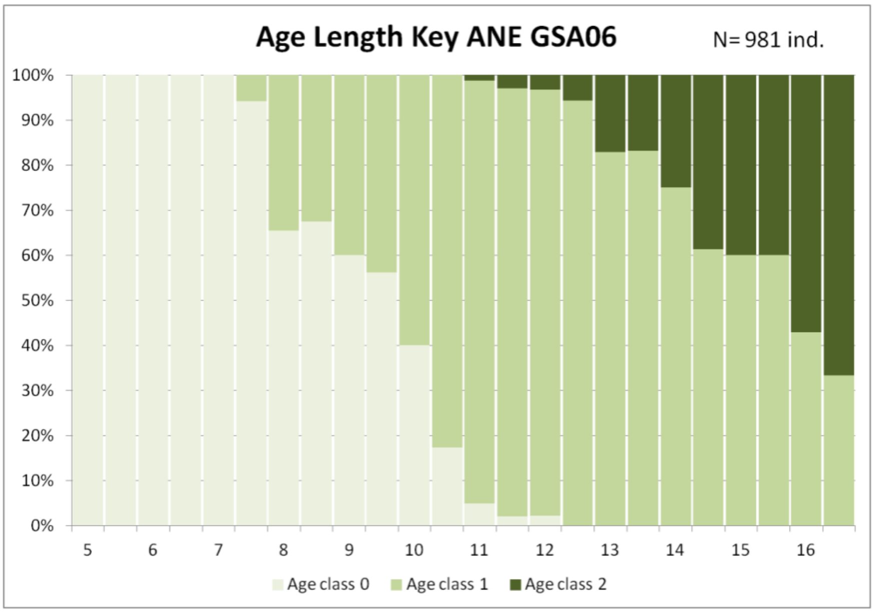


Figure 2.1.7.a. Anchovy ALK GSA06, MEDIAS 2022.

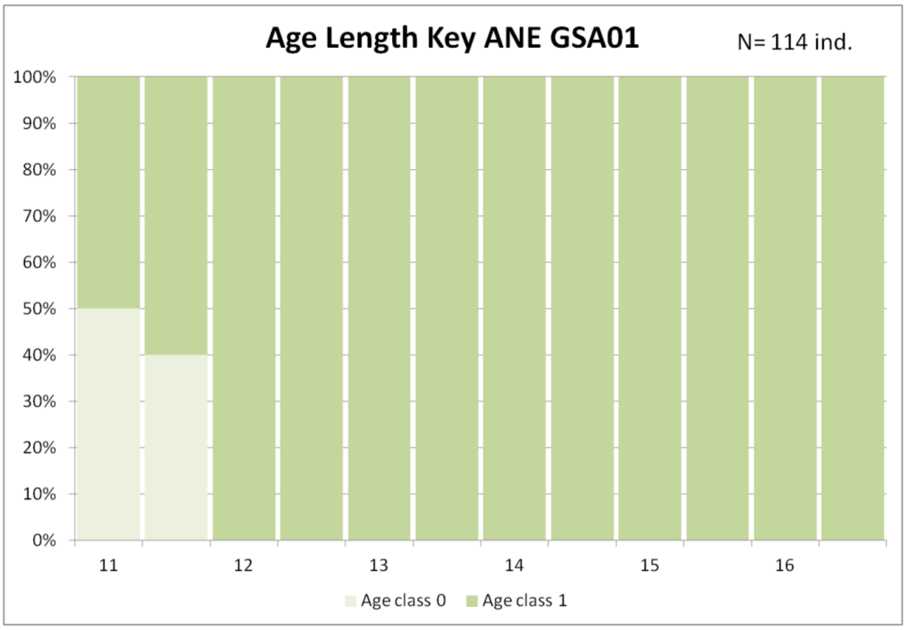


Figure 2.1.7.b. Anchovy ALK GSA01, MEDIAS 2022.

h) Abundance indices of target species

Spatial distribution of sardine and anchovy in GSA 06 in 2022 (Figure 2.1.8 & 2.1.9) was mainly coastal for sardine, and covering all the continental shelf depth for anchovy in both areas.

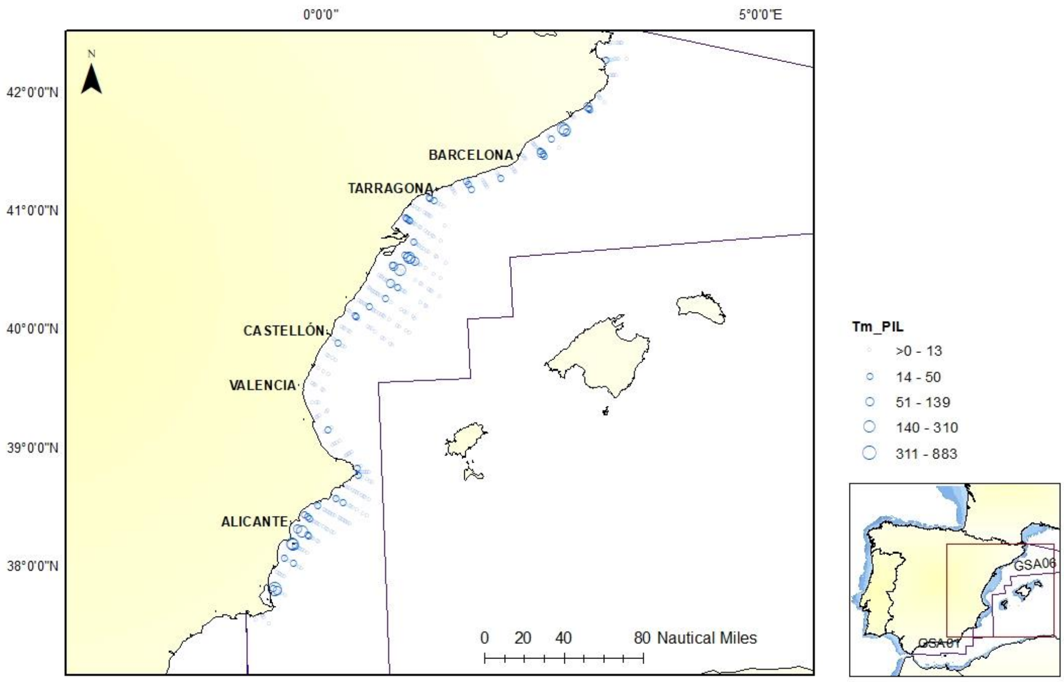


Figure 2.1.8. Sardine (PIL) spatial distribution in GSA06 in MEDIAS 2022.

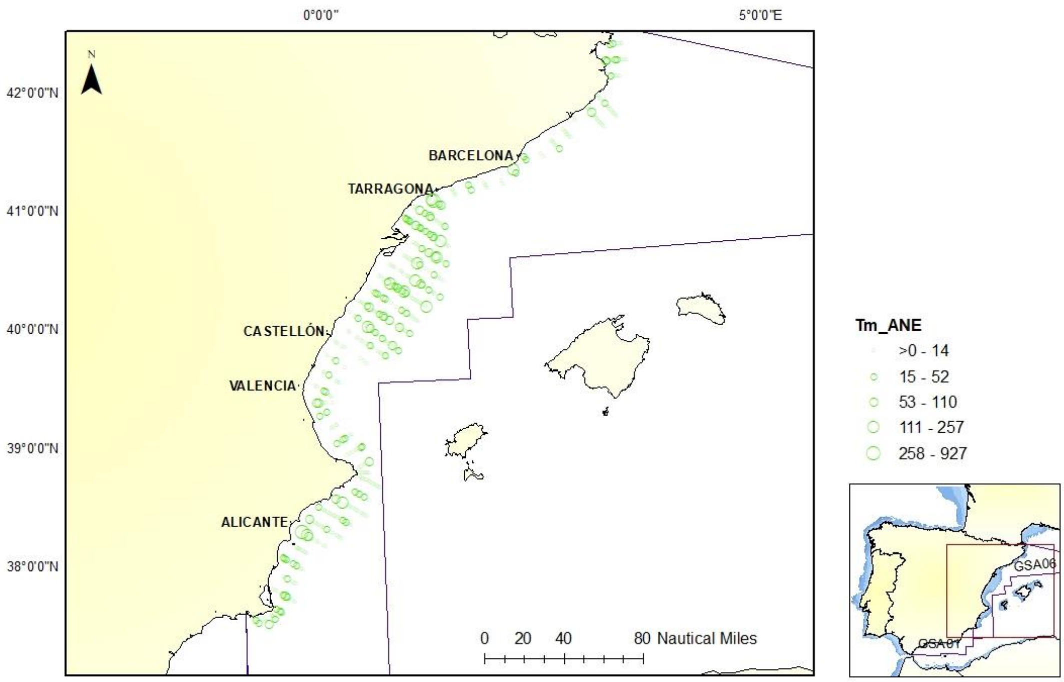


Figure 2.1.9. Anchovy (ANE) spatial distribution in GSA06 in MEDIAS 2022.

2.2. MEDIAS 2022 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 20 to July 31 2022. (lasted 39 days at sea, but only 15 days of effective work due to an epidemic of covid on board and 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 1024 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 analyse acoustic data.

c) Calibration results

The acoustic system was calibrated on May 06 2022. Calibration results are shown in Table 2.2.1.

Table 2.2.1. Calibration results in MEDIAS 2022.

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				
Date	06/05/22				
Place	Toulon - Baie de la Garonne				
Temperature (°C) at sphere depth	17.2				
Salinity (psu) at sphere depth	38				
TS of sphere (dB)	-42.4	-41.5	-39.6	-39	-44
Bottom depth (m)	16.49	15.91	16.49	16.49	16.22
Pulse duration (s)	1.024	1.024	1.024	1.024	1.024
Ping rate	0.4	0.4	0.4	0.4	0.4
Rms beam	0.03	0.10	0.06	0.10	0.15
resulting gain (dB)	26.38	26.24	25.35	26.17	27.76
Sa corr (dB)	-0.55	-0.28	-0.28	-0.26	-0.20
Beam width atwarth°	6.91	6.48	7.40	6.63	6.99
Beam width along°	6.88	6.49	7.38	6.62	7.10
Atwarth offset°	-0.01	-0.05	0.00	-0.03	0.08
Along offset°	0.04	0.00	0.08	-0.10	0.05

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 2022 total nautical miles effectively used for acoustic analysis (minus pelagic trawls tracks and linking transects) were 261.

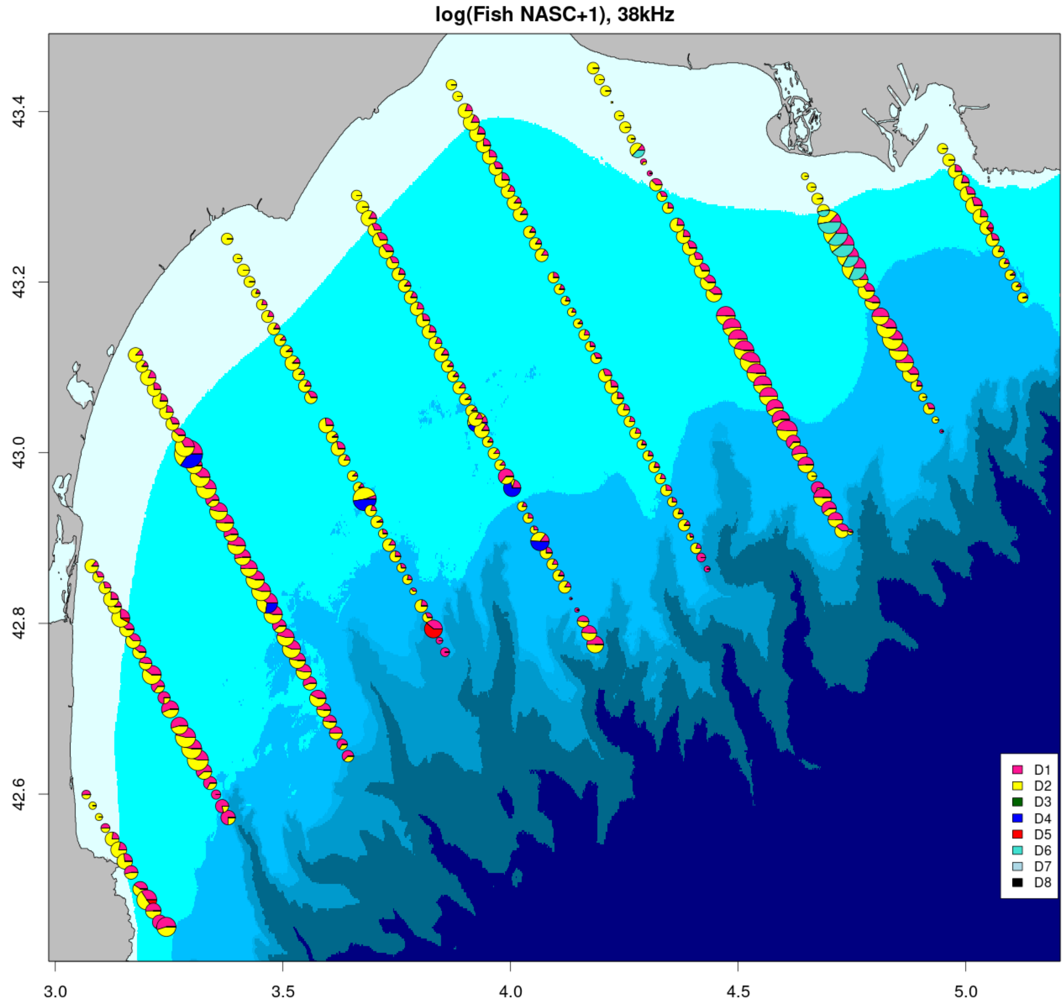


Figure 2.2.1. The survey design in GSA 7 (MEDIAS 2022). The size of the pie charts is proportional to the log(Fish NASC+1) while the colour shows the echotyping result.

e) Fish sampling

Echotraces are identified with a pelagic haul. Twenty-seven (27) pelagic hauls were then carried out in GSA 7 to be used for the scrutinizing of the echograms (Figure 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 day time. The pelagic net used has headline length of 83.2 m, a sideline dimension of 65.20 m and a codend mesh size of 18 mm.

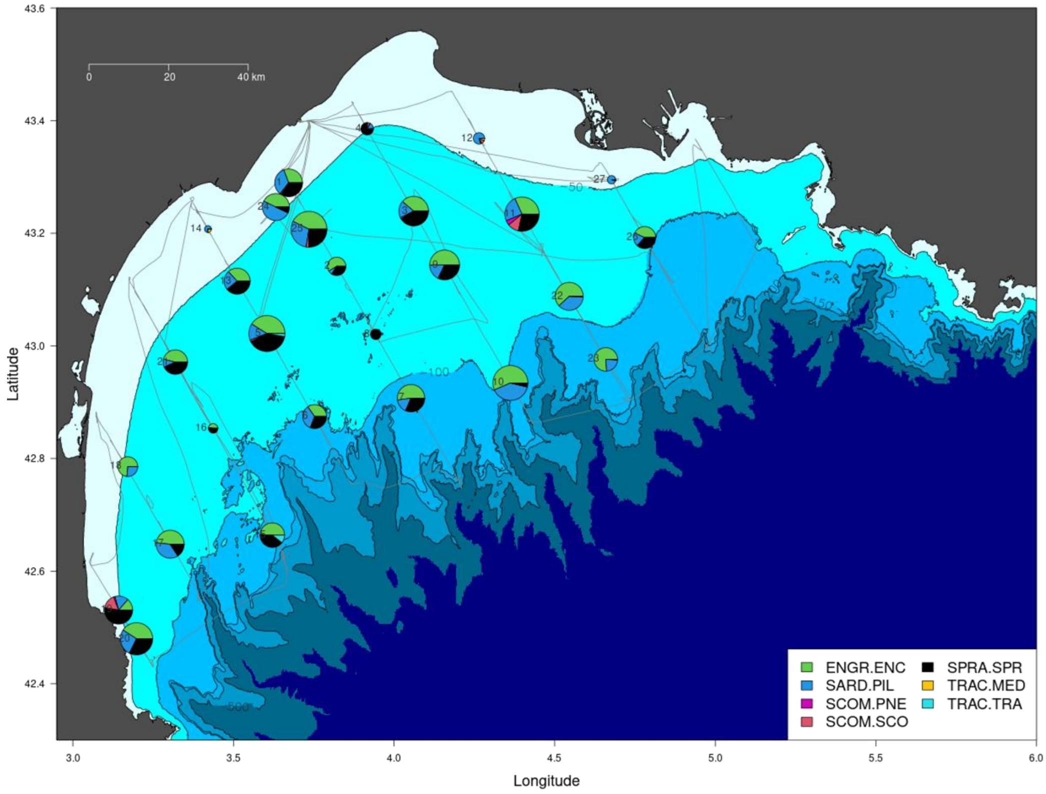


Figure 2.2.2. Catch compositions of pelagic hauls (27) carried out in GSA 7 during the French acoustic survey MEDIAS 2022.

f) Oceanographic parameters

34 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 (Figure 2.2.3). Zooplankton was sampled through WP2 vertical nets, while phytoplankton was sampled through Niskin bottles in subsurface.

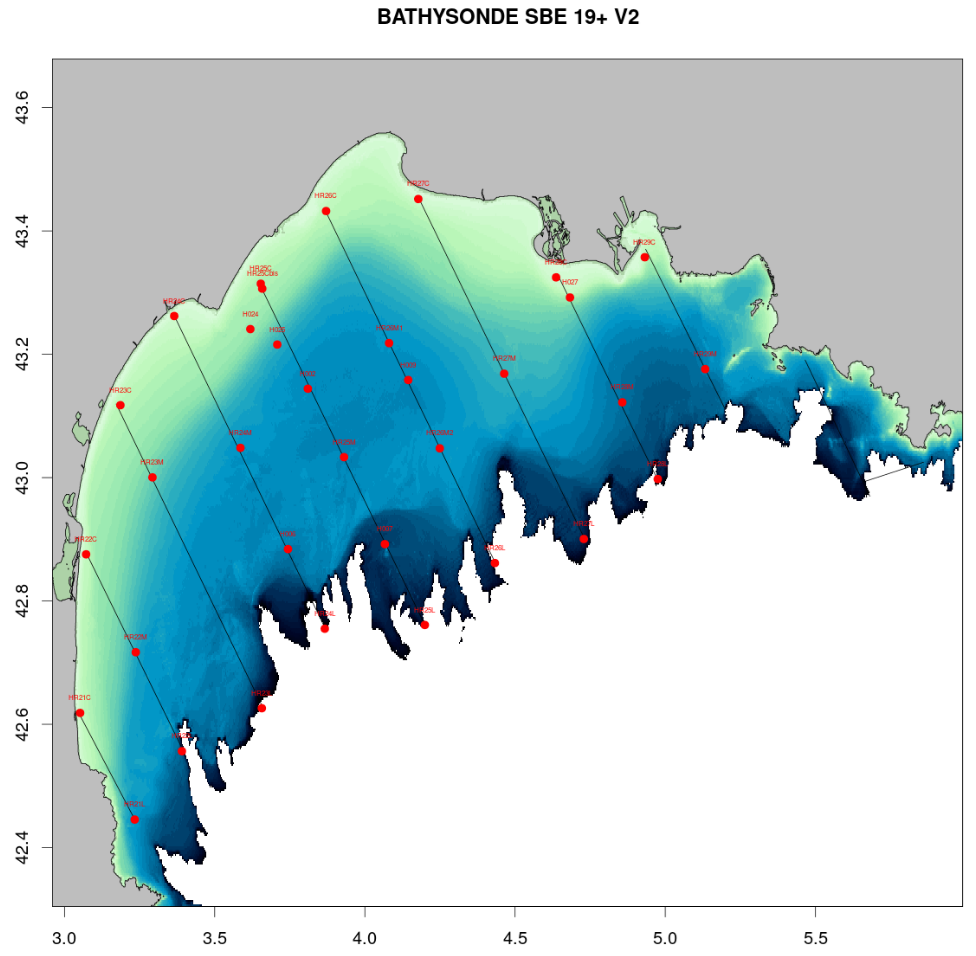


Figure 2.2.3. CTD stations (34) carried out during the French acoustic survey MEDIAS 2022.

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 64821 t and 73604 t in 2022. The CVs of geostatistical simulations were 14 and 9 % while the CV associated to Hauls / ESDUs associations were 24 % and 3 % for respectively sardine and anchovy.

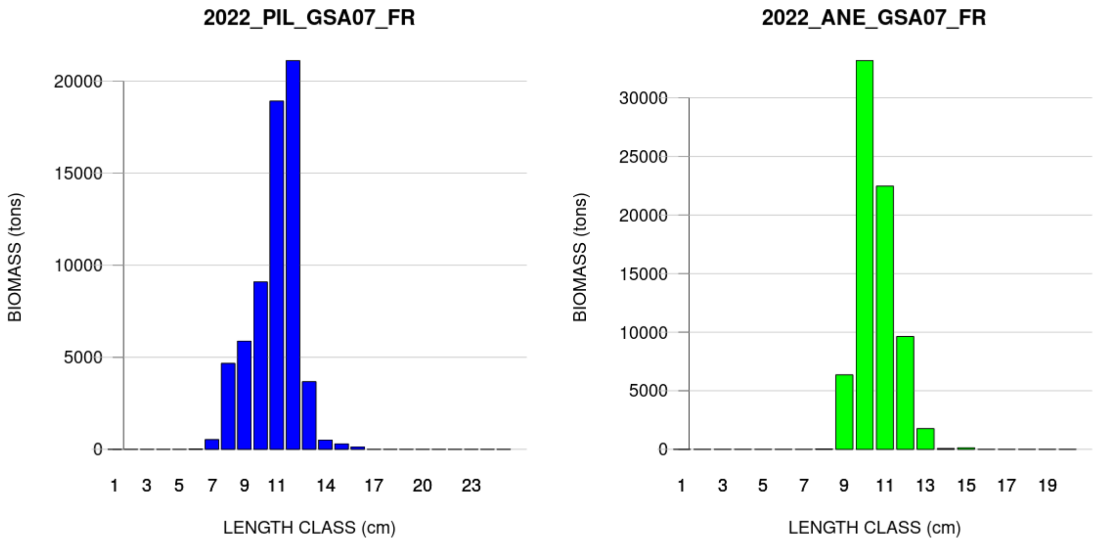


Figure 2.2.4. Biomass estimates per length classes for sardine and anchovy (MEDIAS 2022).

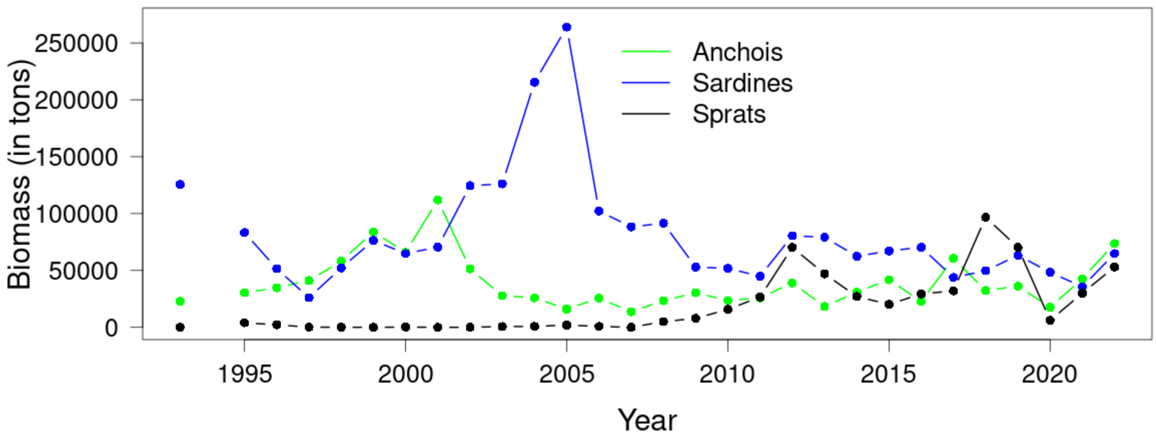


Figure 2.2.5. Long-term biomass estimates in GSA 7 for anchovy, sardine and sprat (DCF-MEDIAS estimates have started in 2009).

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

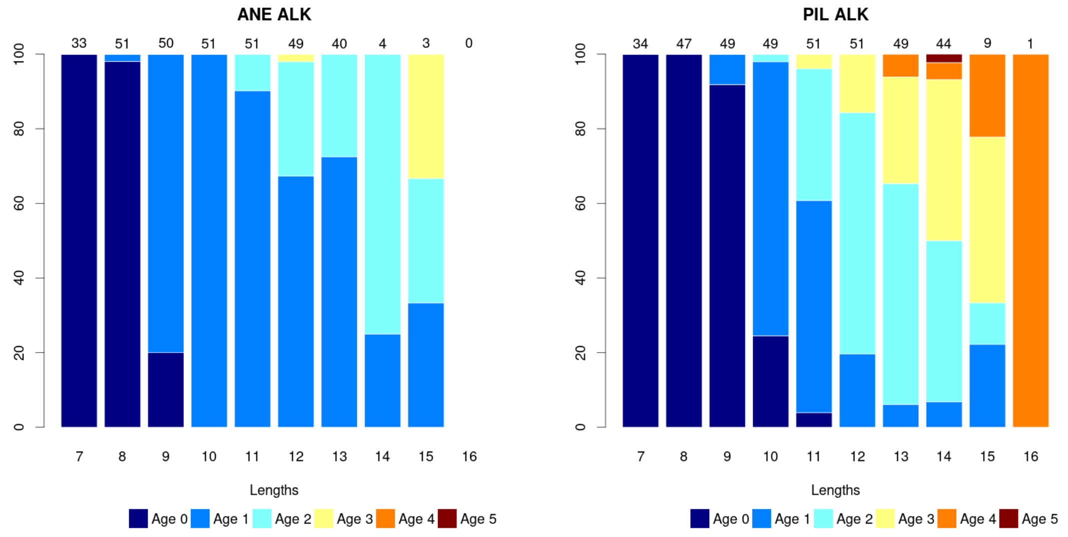


Figure 2.2.6. Age-length keys for sardine and anchovy in GSA 7 (MEDIAS 2022). The number of observations per size class are shown at the top of each bar in the barplot.

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

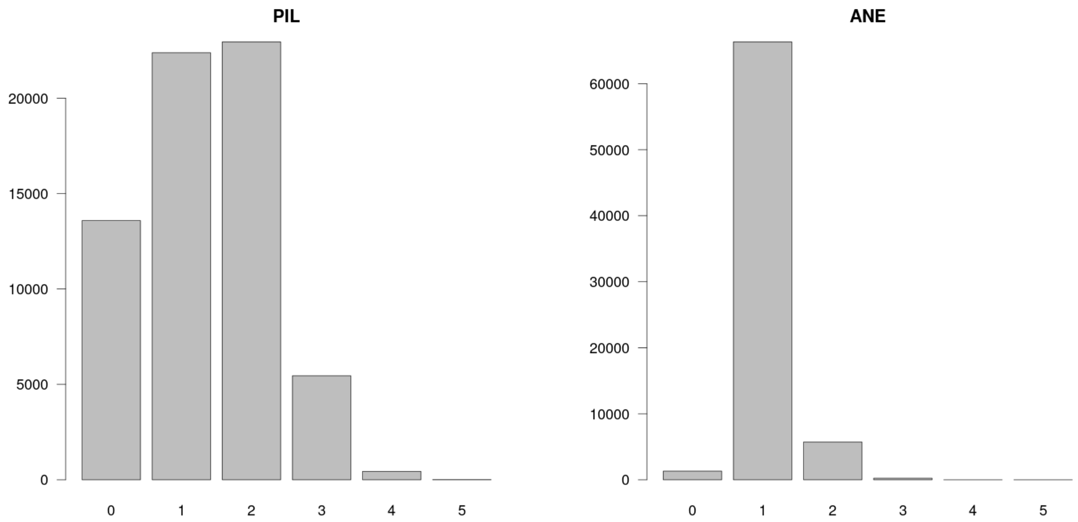


Figure 2.2.7. Biomass at age (in tons) estimates in MEDIAS 2022.

h) Abundance indices of target species

Spatial distributions of abundance indices of sardine and anchovy in GSA 7 during MEDIAS 2022 are shown in Figure 2.2.8.

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

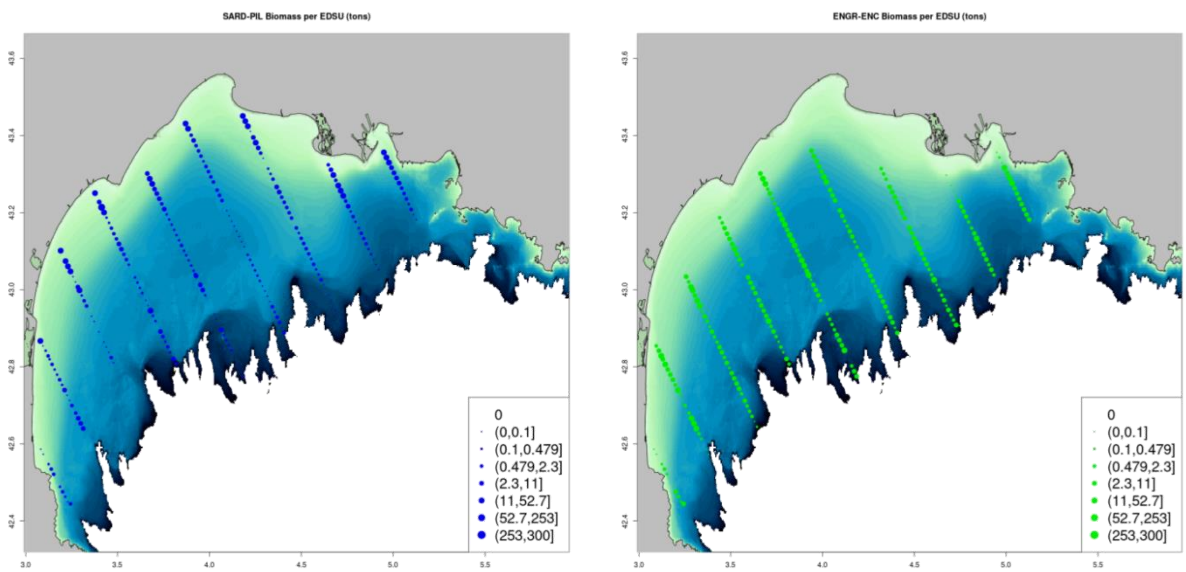


Figure 2.2.8. Spatial distributions of abundance indices of sardine (left) and anchovy (right) in GSA 7 during MEDIAS 2022.

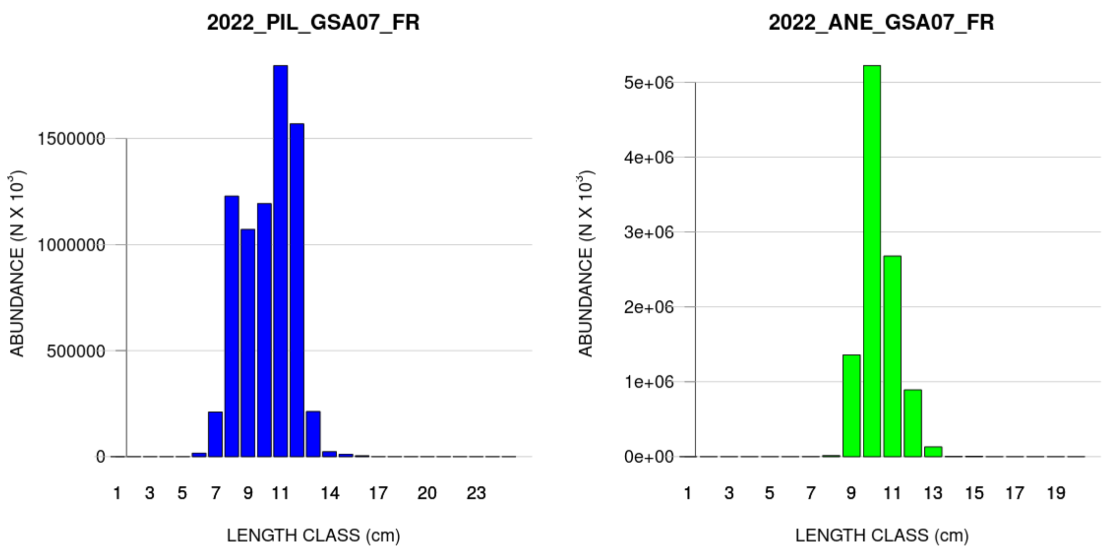


Figure 2.1.9. Abundance estimates per length classes for sardine and anchovy (MEDIAS 2022).

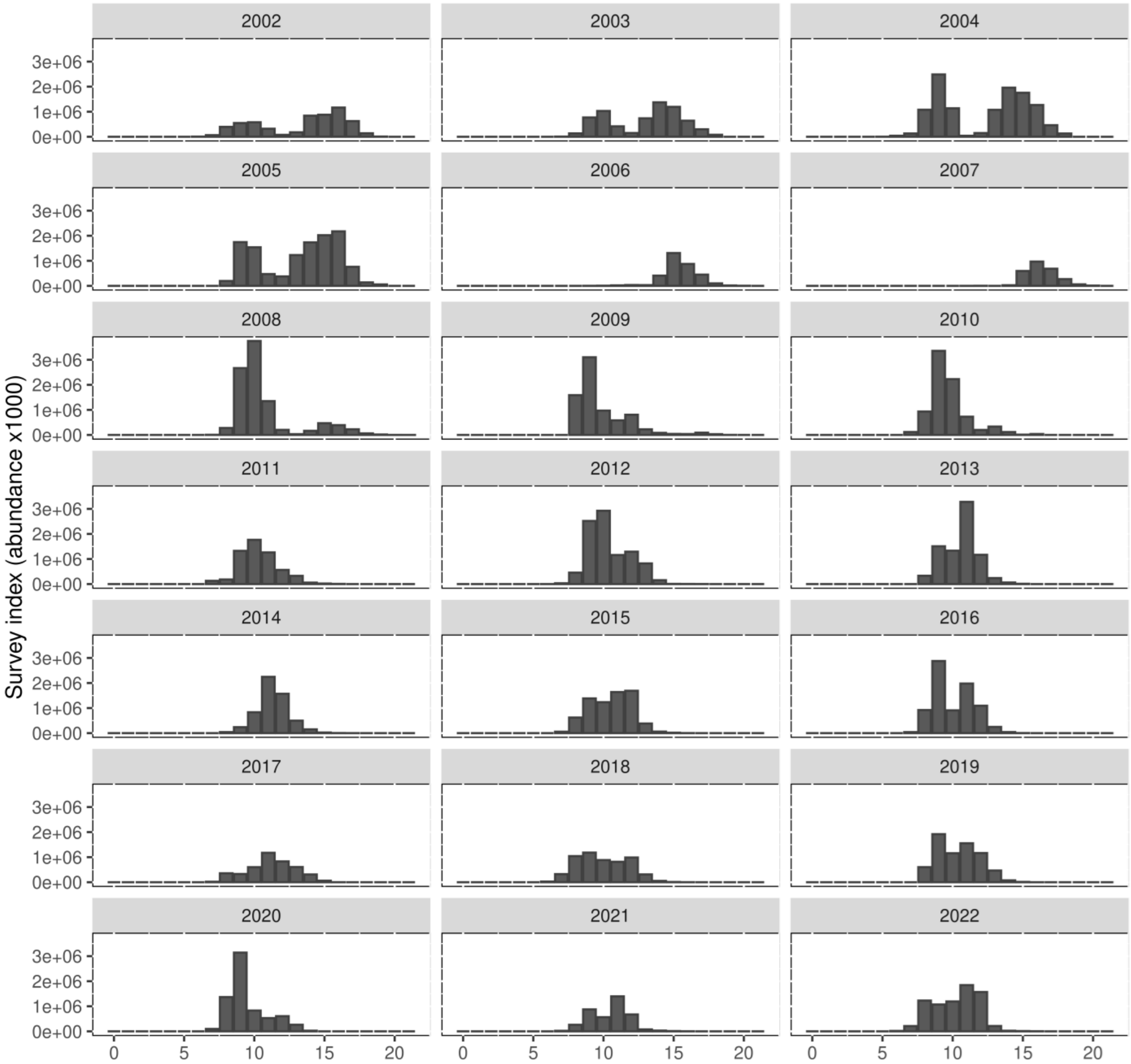


Figure 2.1.10. Length structured abundance estimates for sardine in GSA 07.

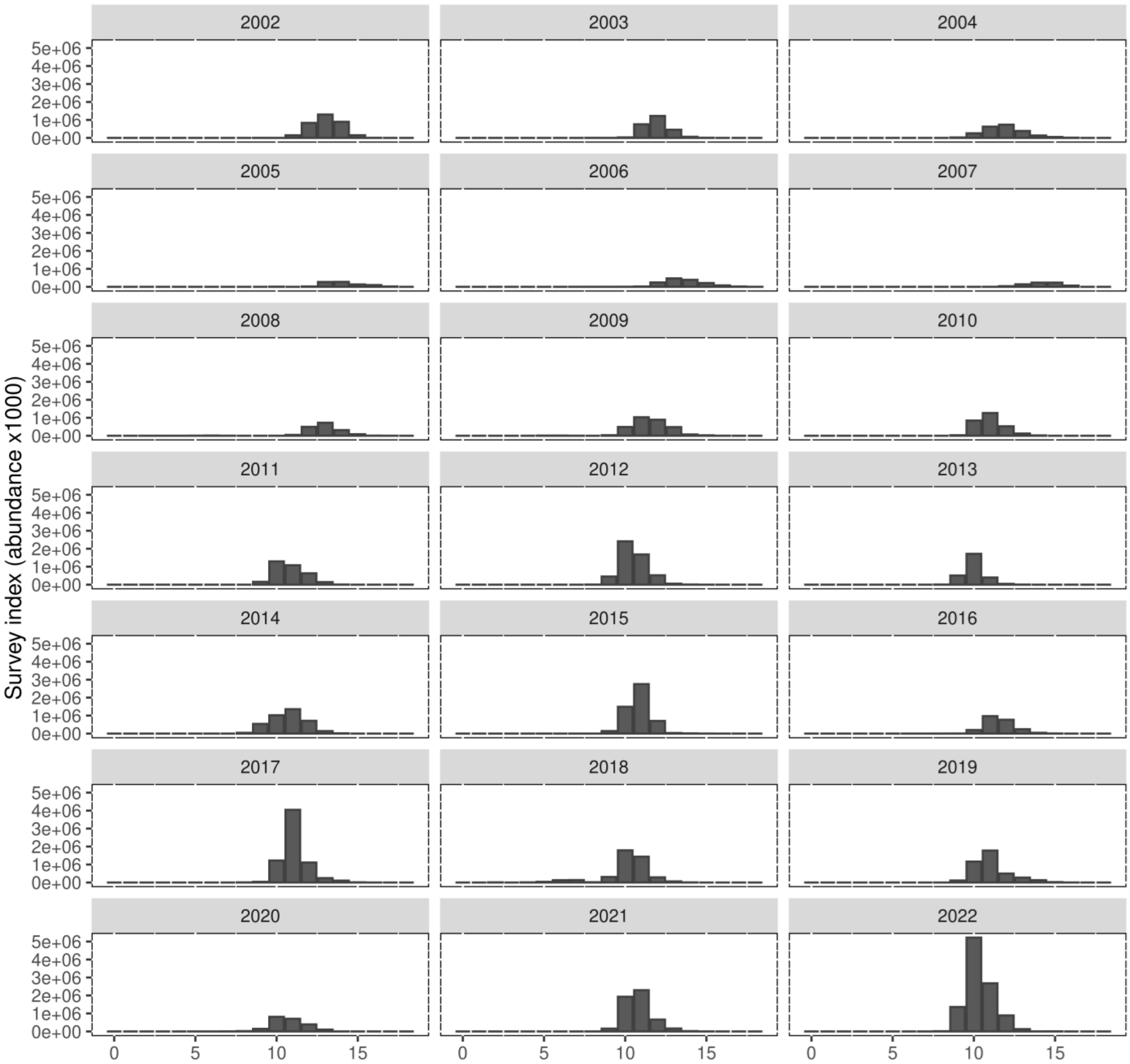


Figure 2.1.11. Length structured abundance estimates for anchovy in GSA 07.

Long-term age-structured estimates from acoustic surveys related to sardine and anchovy populations are shown in Figure 2.1.12 and Figure 2.1.13.

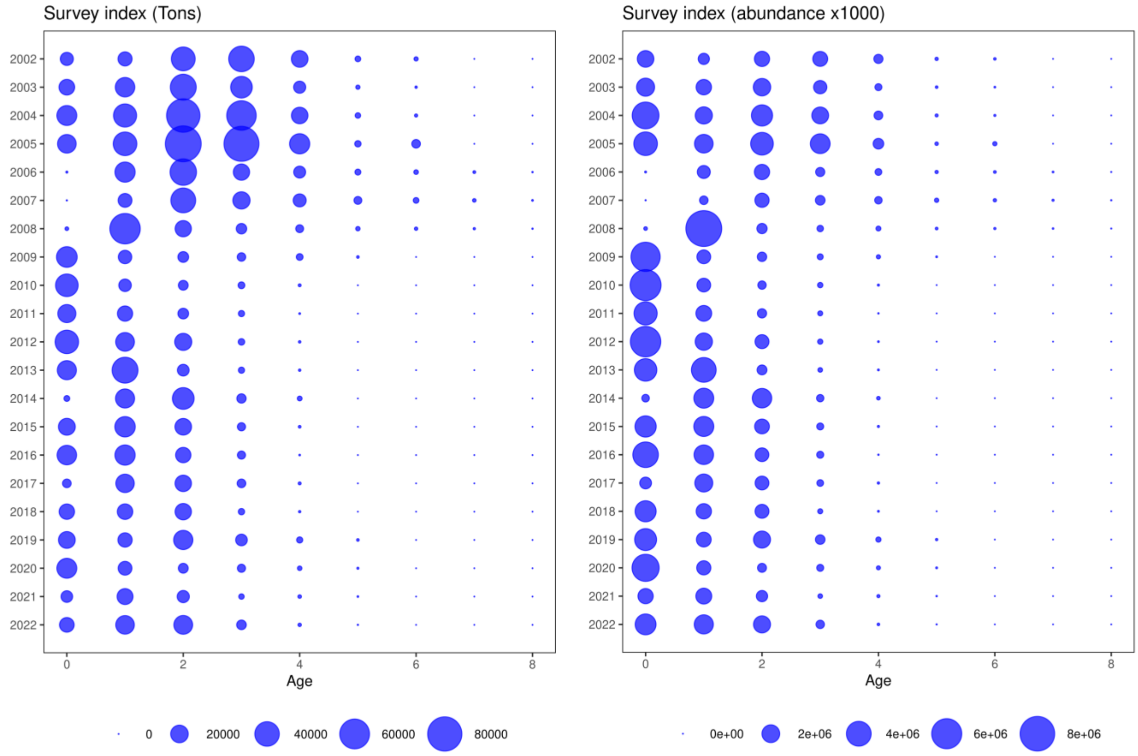


Figure 2.1.12. Age-structured acoustic estimates for sardine in GSA 7.

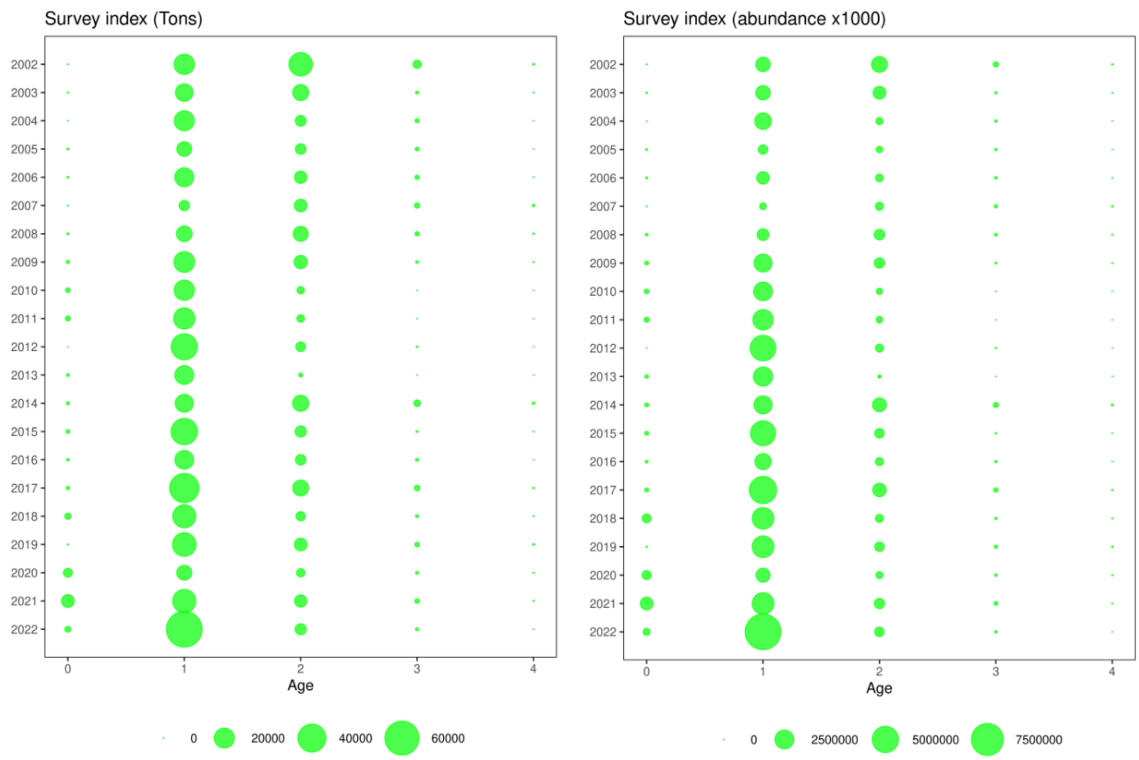


Figure 2.1.13. Age-structured acoustic estimates for anchovy in GSA 7.

2.3. MEDIAS 2022 in GSA 9 and GSA 10 (ITA) – Tyrrhenian Sea and Ligurian Sea (Angelo Bonanno, Gualtiero Basilone, Marco Barra, Simona Genovese & Rosalia Ferreri, CNR-IAS)

a) General information on the survey

MEDIAS 2022 in GSA 9 and GSA 10 took place from August 12 to 9 September (lasts 29 days at sea) and covered the continental shelf in the Ligurian and Tyrrhenian seas (6512 nm^2) with the fishery Research Vessel "G. Dallaporta" (35.7 m length, 1086 HP).

b) Type of echosounders and frequencies in use

The split beam echo sounder used was SIMRAD EK60, with the 38, 70, 120 and 200 kHz frequencies. The threshold for acquisition was –80 dB and that for processing for the assessment (38 kHz) was -60 dB. The pulse duration was 1024 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 Syracuse on 31 July 2022.

Table 2.3.1 Calibration results in MEDIAS 2022.

Transducer Frequency	**38 kHz**	**70 kHz**	**120 kHz**	**200 kHz**
Transducer model	ES38B	ES70-7C	ES120-7C	ES200-7C
Transducer serial no.	30789	271	480	365
Bottom depth (m)	15	15	15	15
Temperature at sphere depth	28.3°C	28.3°C	28.3°C	28.3°C
Salinity (PSU) at sphere depth	38.7	38.7	38.7	38.7
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	0.13	0.26	0.25	0.86
Transducer gain (dB)	24.77	25.48	24.24	22.36
Sa corr. (dB)	-0.6	-0.44	-0.48	-0.52
Athw. Beam angle (deg)	7	6.27	6.05	8.37
Along Beam angle (deg)	6.87	6.32	6.31	7.32
Athw. Offset Beam angle (deg)	0.08	0.13	-0.24	0.01
Along Offset Beam angles (deg)	0	-0.1	0.07	-0.05

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 number of nautical miles effectively used for acoustic analysis (minus pelagic trawls tracks and linking transects) was 1449.

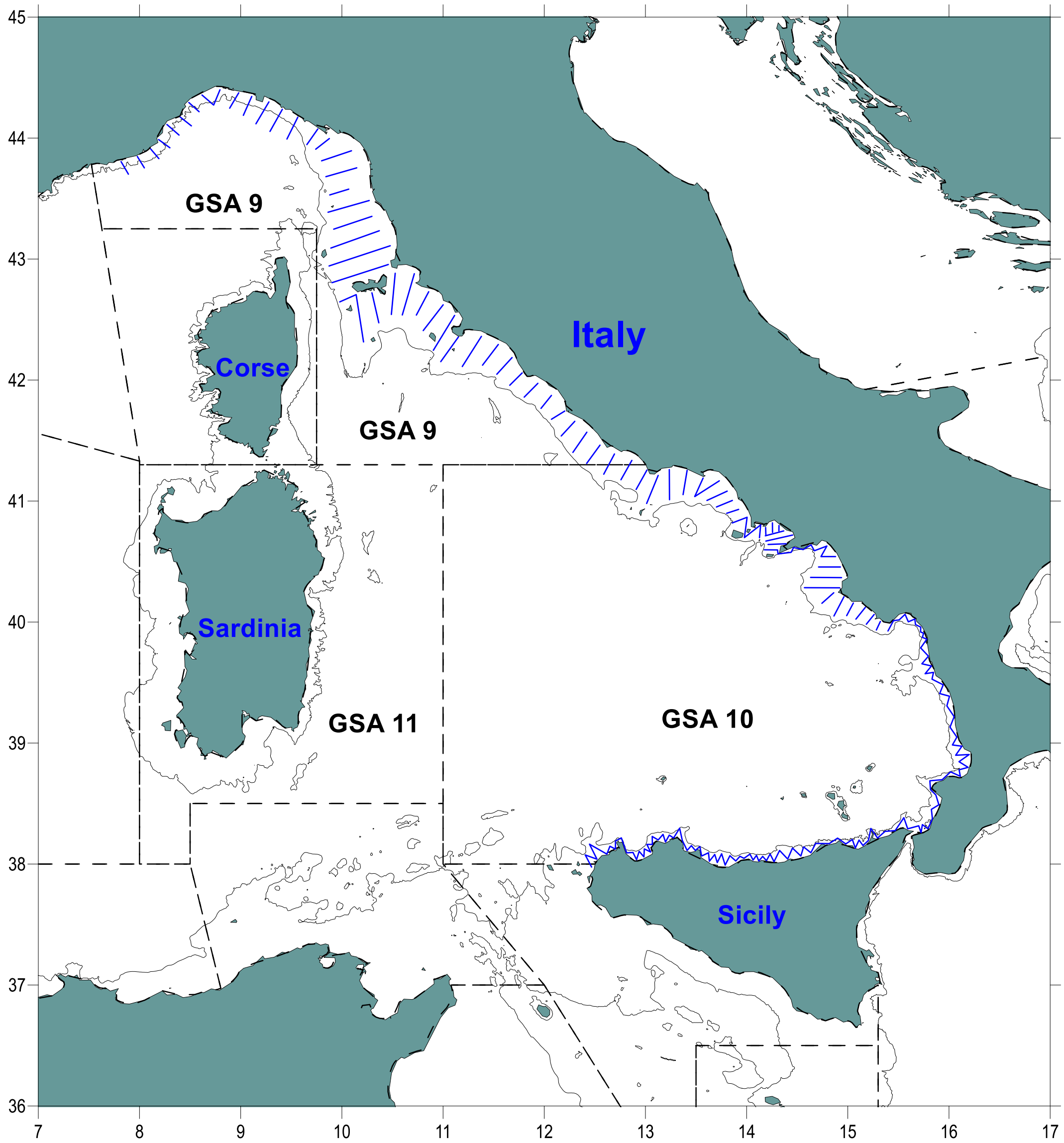


Figure 2.3.1. Acoustic survey design. MEDIAS 2022 in GSAs 9 and 10.

e) <u>Fish sampling</u>

Pelagic fishes are identified with a pelagic haul. In summer 2022, twenty-one (21) and twenty-two (22) pelagic hauls were carried out respectively in GSA 9 and GSA 10 to be used for echograms scrutinizing (Fig. 2.3.2). Trawl hauls were performed during day time.

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.

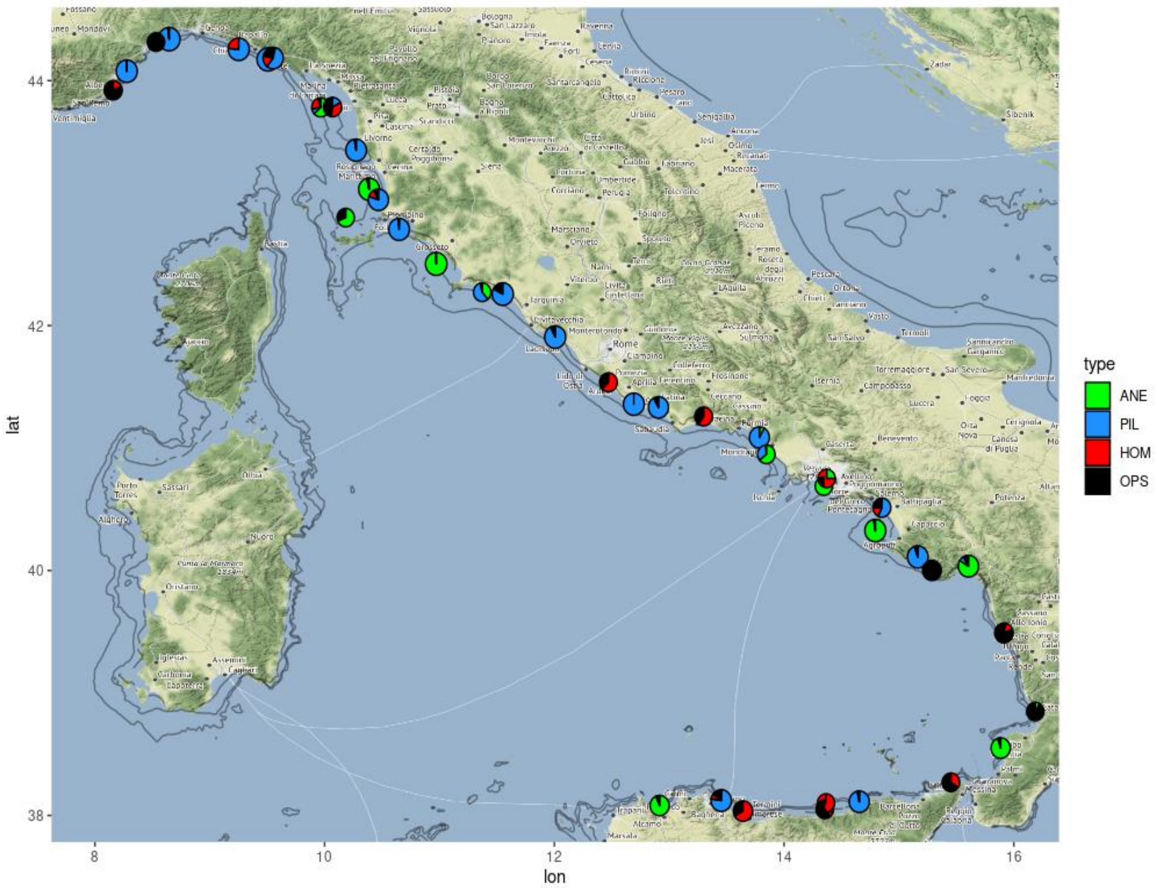


Figure 2.3.2. Map with pie charts reporting percentages in weight of anchovy, sardine and other species for hauls carried out during the acoustic survey in GSAs 9 and 10. MEDIAS 2022.

f) <u>Oceanographic parameters</u>

During the survey in summer 2022, 91 and 175 hydrological stations have been conducted in GSAs 9 and 10 respectively using a SBE 9/11plus CTD which measures conductivity, temperature, pressure, fluorescence, PAR (Photosynthetically active radiation), pH, oxygen and turbidity (Fig. 2.3.3).

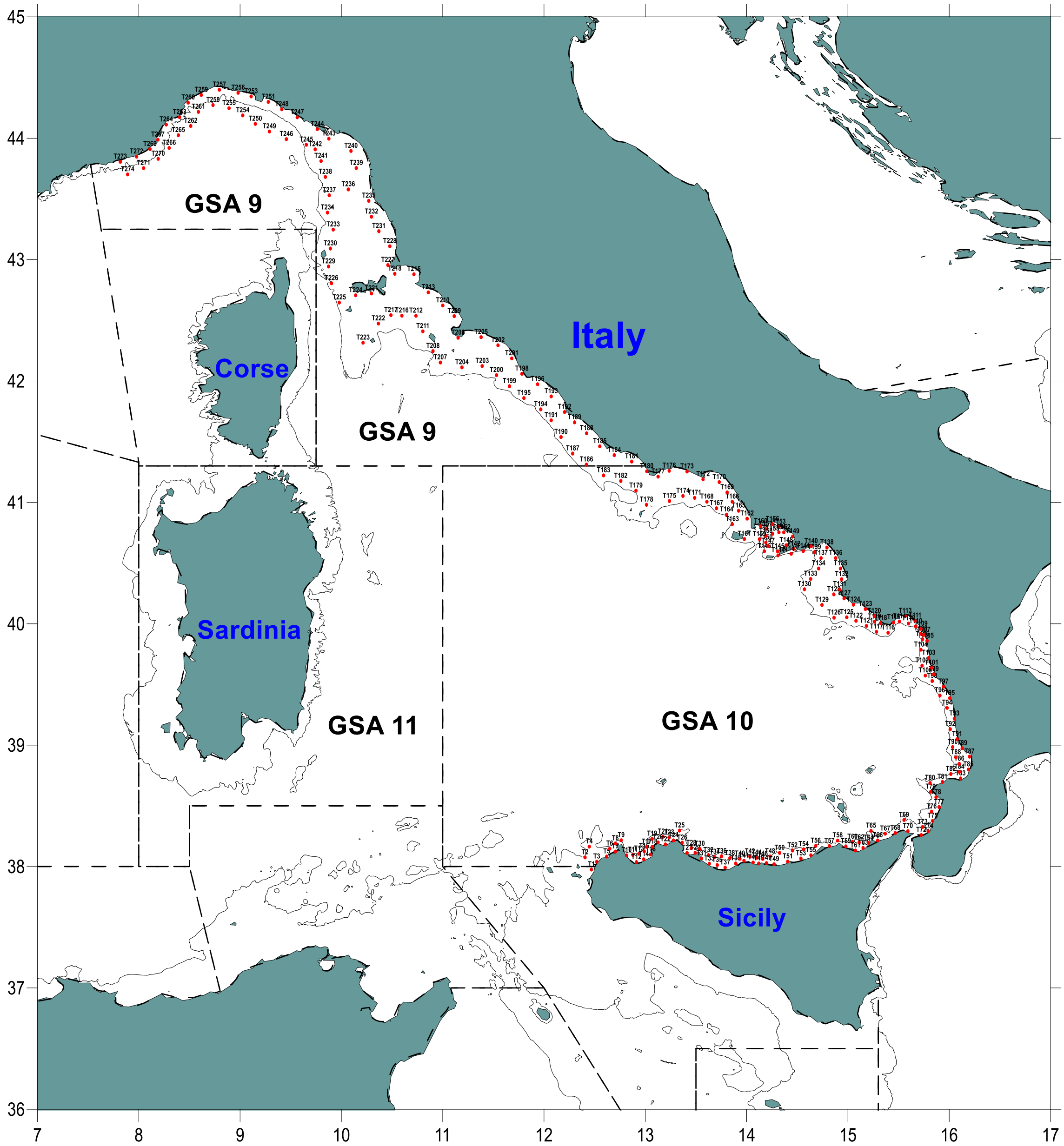


Figure 2.3.3. CTD stations performed during the echosurvey in GSAs 9 and 10. MEDIAS 2022.

g) <u>Biomass estimations of target species</u>

The biomass estimation of sardine and anchovy in GSAs 9 and 10, as well as the associated CVs of geostatistical simulations, are reported in the following table:

	GSA 9		GSA 10	
	Biomass (t)	CV	Biomass (t)	CV
Anchovy	14378.6	14	25761.4	16
Sardine	35081	14	8981.1	19

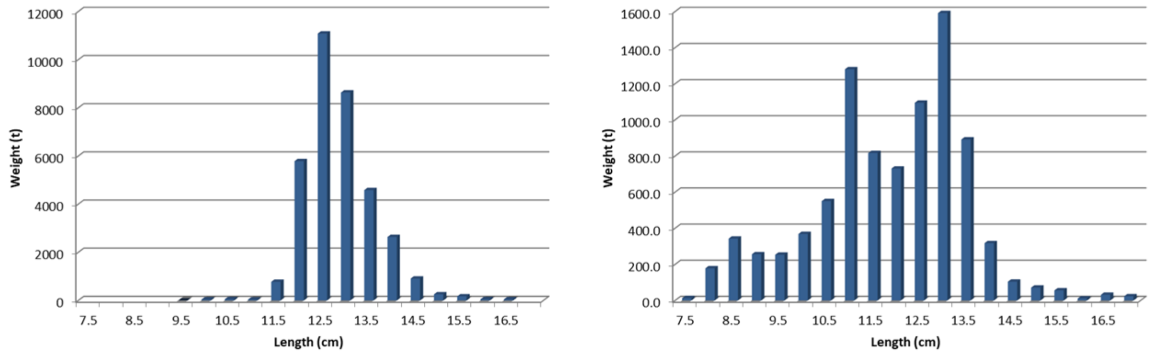


Figure 2.3.4. Sardine (PIL) biomass in tons by length (LFD) in GSAs 9 (left panel) and 10 (right panel). MEDIAS 2022.

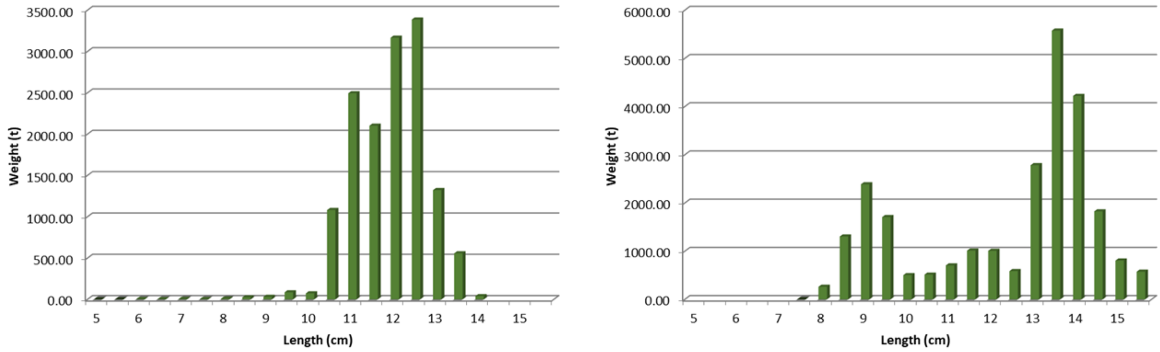


Figure 2.3.5. Anchovy (ANE) biomass in tons by length (LFD) in GSAs 9 (left panel) and 10 (right panel). MEDIAS 2022.

Age length key (ALK) for sardine in GSA 9, MEDIAS 2022, was composed by three year classes. The number of otoliths readings was 597 (no. individuals) (Fig. 2.3.6). In GSA 10, ALK was composed by three year classes; the number of otoliths readings was 518 (no. individuals).

Figure 2.3.6. Sardine ALK in GSAs 9 (left panel) and 10 (right panel), MEDIAS 2022.

Anchovy ALK in GSA 9, MEDIAS 2022, was represented by three year classes. The number of otoliths readings was 309 (no. individuals) (Fig. 2.3.7). In GSA 10, ALK was composed by four year classes; the number of otoliths readings was 387 (no. individuals).

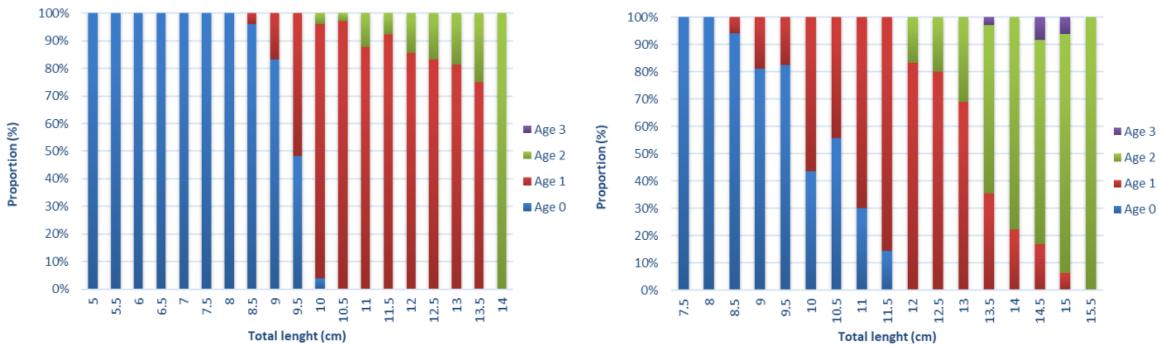


Figure 2.3.7. Anchovy ALK in GSAs 9 (left panel) and 10 (right panel), MEDIAS 2022.

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

Spatial distribution of sardine and anchovy in GSAs 9 and 10 in summer 2022 is shown in Figures 2.3.8 and 2.3.9.

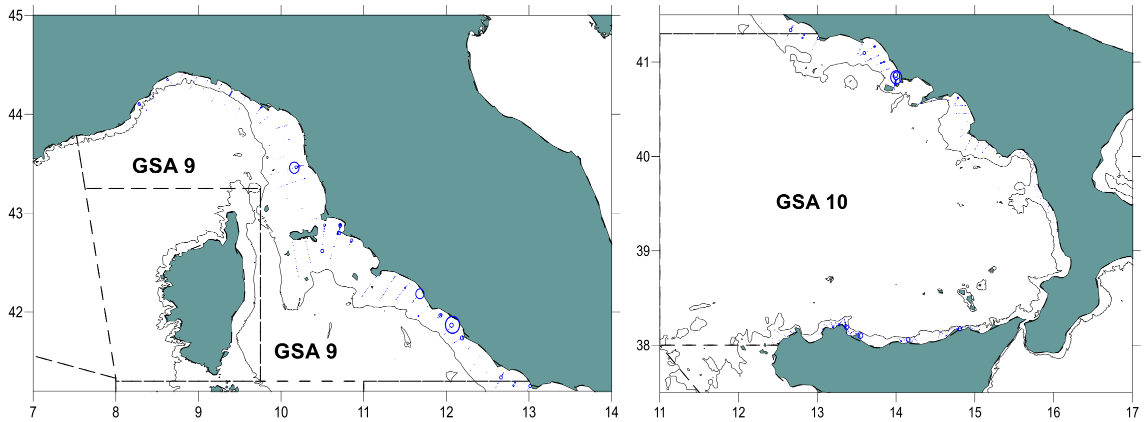


Figure 2.3.8. Sardine (PIL) spatial distribution in GSAs 9 and 10. MEDIAS 2022.

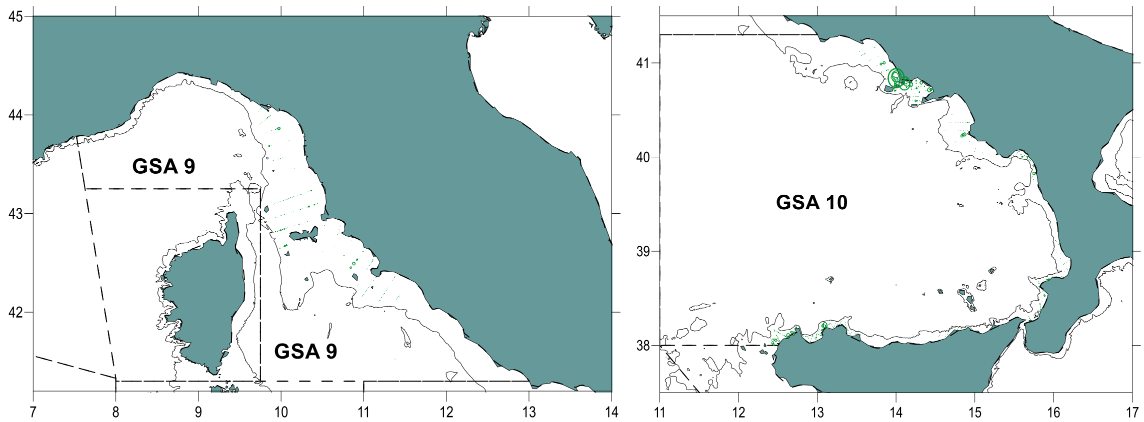


Figure 2.3.9. Anchovy (ANE) spatial distribution in GSAs 9 and 10. MEDIAS 2022.

Abundance of sardine (*Sardina pilchardus*) in GSAs 9 and 10 is reported in Fig. 2.3.10. Also during this survey, the main difference between the LFD in the two GSAs is the presence also of smaller specimens in GSA 10.

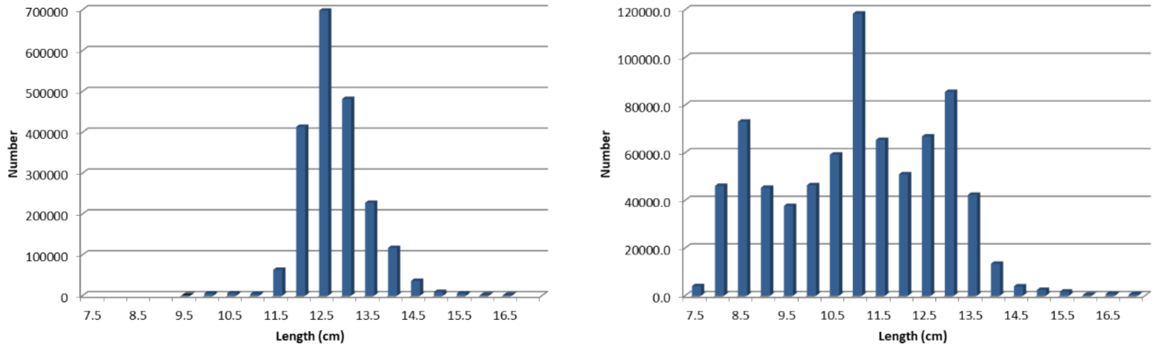


Figure 2.3.10. Sardine (PIL) abundance in numbers by length (LFD) in GSAs 9 (left panel) and 10 (right panel), MEDIAS 2022.

Abundance of anchovy (*Engraulis encrasicolus*) estimated in GSA 10 revealed a more complex LFD in comparison with GSA 9 with the presence of smaller and bigger specimens (Fig. 2.3.11).

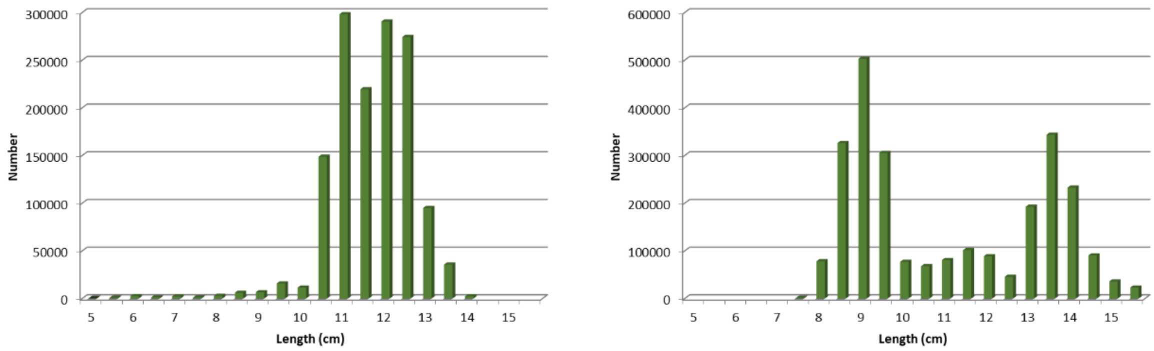


Figure 2.3.11. Anchovy (ANE) abundance in numbers by length (LFD) in GSAs 9 (left panel) and 10 (right panel), MEDIAS 2022.

2.4.MEDIAS 2022 in GSA 16 (ITA) – South of Sicily (Angelo Bonanno, Gualtiero Basilone, Marco Barra, Simona Genovese & Rosalia Ferreri, CNR-IAS)

a) <u>General information on the survey</u>

MEDIAS 2022 in GSA 16 took place from 31 July to 11 August (lasts 12 days at sea) and covered the continental shelf along the southern coast of Sicily (3981 nm^2) with the fishery Research Vessel "G. Dallaporta" (35.7 m length, 1086 HP).

b) <u>Type of echosounders and frequencies in use</u>

The split beam echo sounder used was SIMRAD EK60, with the 38, 70, 120 and 200 kHz frequencies. The threshold for acquisition was –80 dB and that for processing for the assessment

(38 KHz) was -60 dB. The pulse duration was 1024 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 31 July 2022. The calibration results are reported in the section belonging to the MEDIAS in GSAs 9 and 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 2022, total nautical miles effectively used for acoustic analysis (minus pelagic trawls tracks and linking transects) were 738.

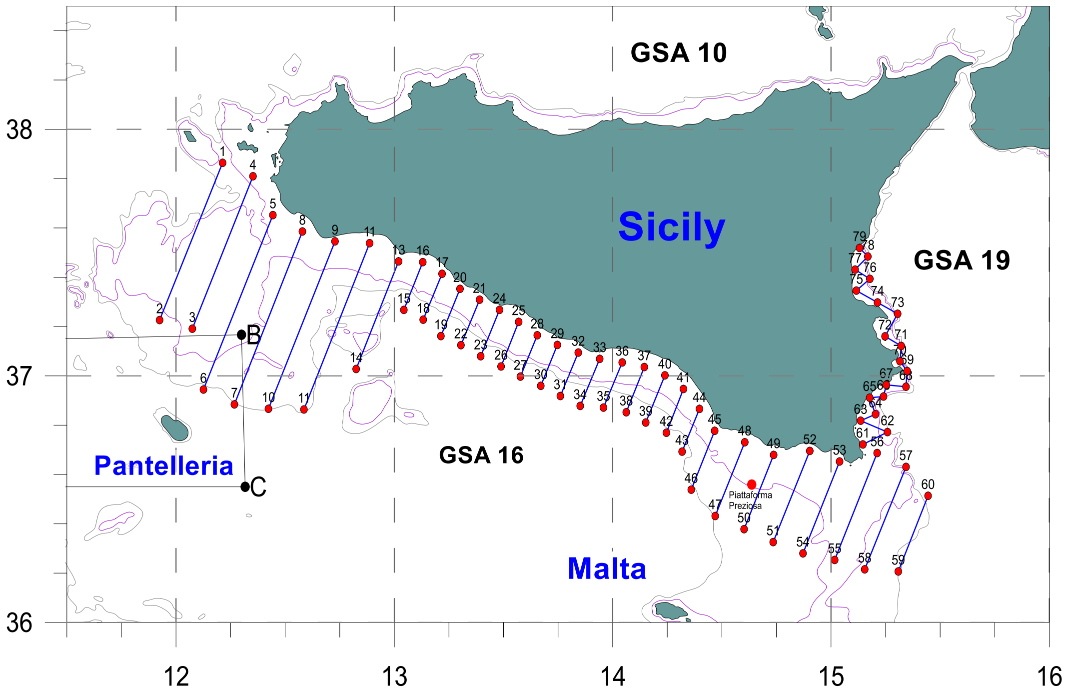


Figure 2.4.1. Acoustic survey design in GSA 16. MEDIAS 2022.

e) Fish sampling

Pelagic fishes are identified with a pelagic haul. In summer 2022, twenty-one (21) pelagic hauls were carried out in GSA 16 to be used for echograms scrutinizing (Fig. 2.4.2). Trawl hauls were performed during day time.
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.

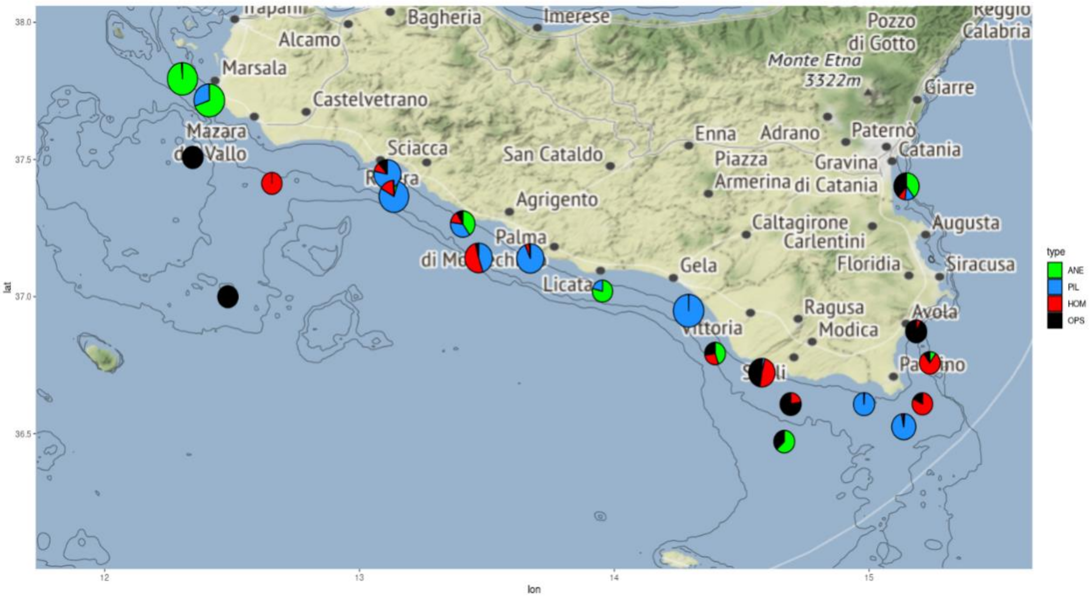


Figure 2.4.2. Map with pie charts reporting percentages in weight of anchovy, sardine and other species for hauls carried out during the acoustic survey MEDIAS 202 in GSA 16.

f) Oceanographic parameters

During the survey in summer 2022, 124 hydrological stations have been conducted in GSA 16 using a SBE 9/11plus CTD which measures conductivity, temperature, pressure, fluorescence, PAR (Photosynthetically active radiation), pH, oxygen and turbidity (Fig. 2.4.3).

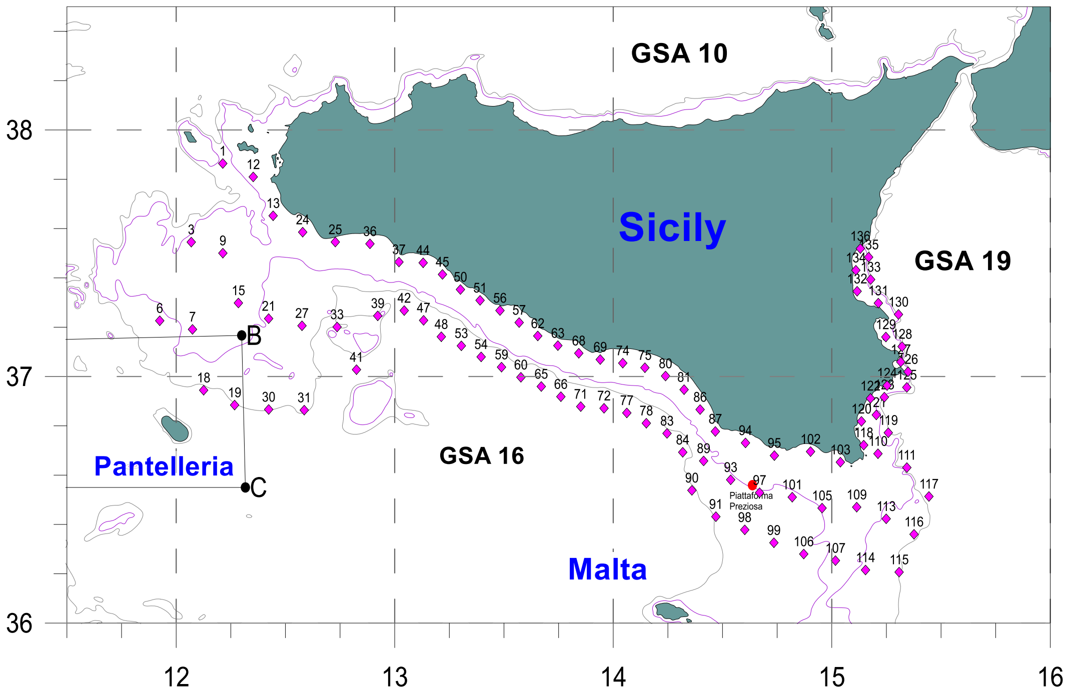


Figure 2.4.3. CTD stations performed during the echosurvey in GSA16. MEDIAS 2022.

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	12692.7	24
Sardine	18985.6	18

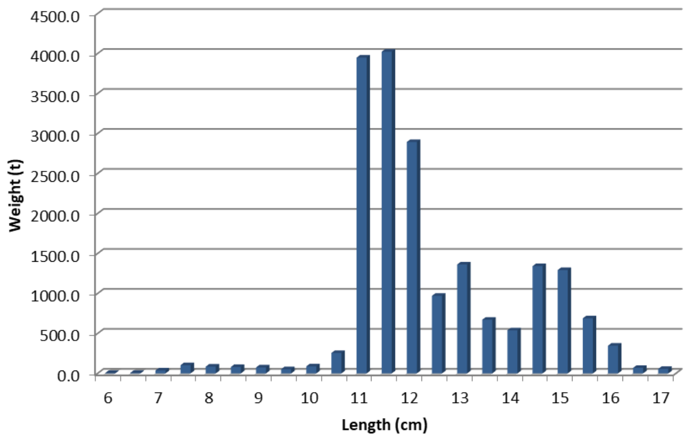


Figure 2.4.4. Sardine (PIL) biomass in tons by length (LFD) in GSA 16. MEDIAS 2022.

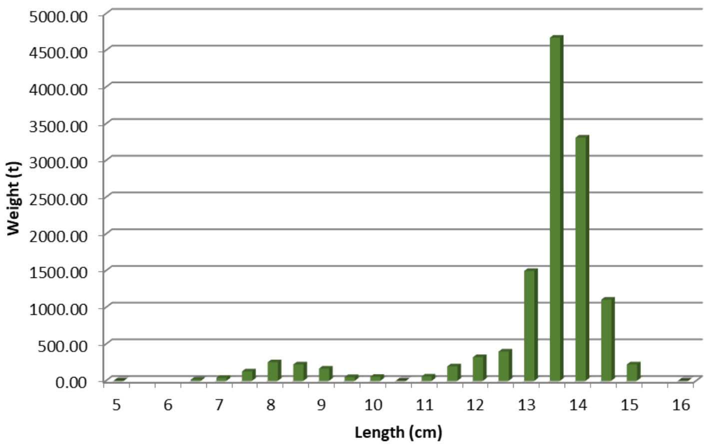


Figure 2.4.5. Anchovy (ANE) biomass in tons by length (LFD) in GSA 16. MEDIAS 2022.

Age length key (ALK) for sardine in GSA 16, MEDIAS 2022, was composed by three year classes. The number of otoliths readings was 633 (no. individuals) (Fig. 2.4.6).

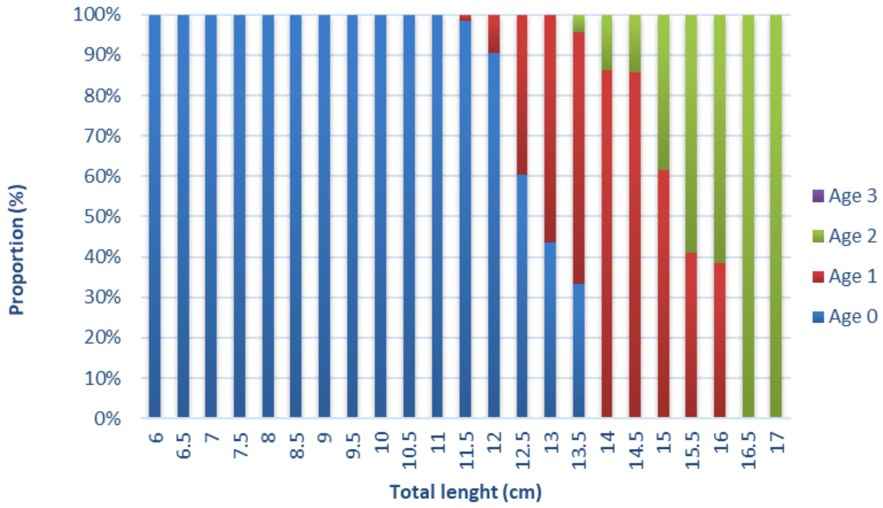


Figure 2.4.6. Sardine ALK in GSA 16. MEDIAS 2022.

Anchovy ALK in GSA 16, MEDIAS 2022, was represented by four year classes; the number of otoliths readings was 339 (no. individuals) (Fig. 2.4.7).

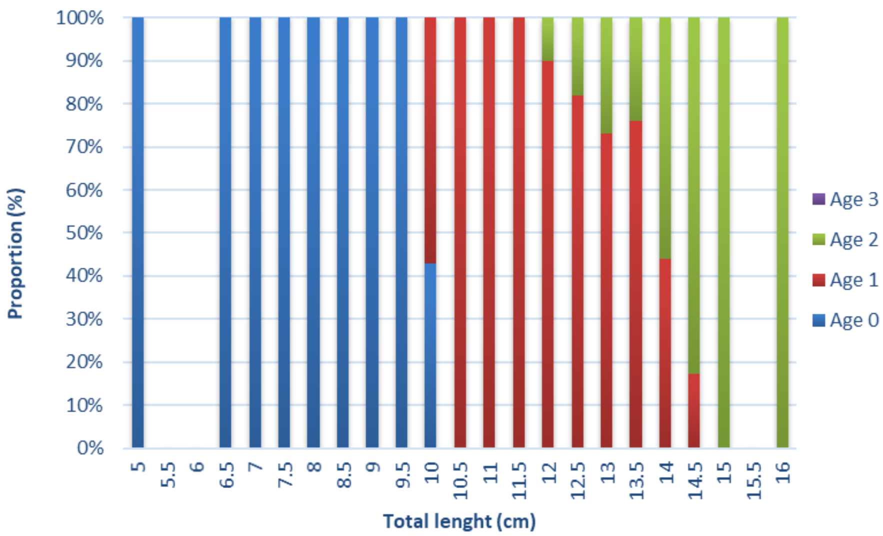


Figure 2.4.7. Anchovy ALK in GSA 16. MEDIAS 2022.

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

Spatial distribution of sardine and anchovy in GSA 16 in summer 2022 is shown in Figures 2.4.8 and 2.4.9.

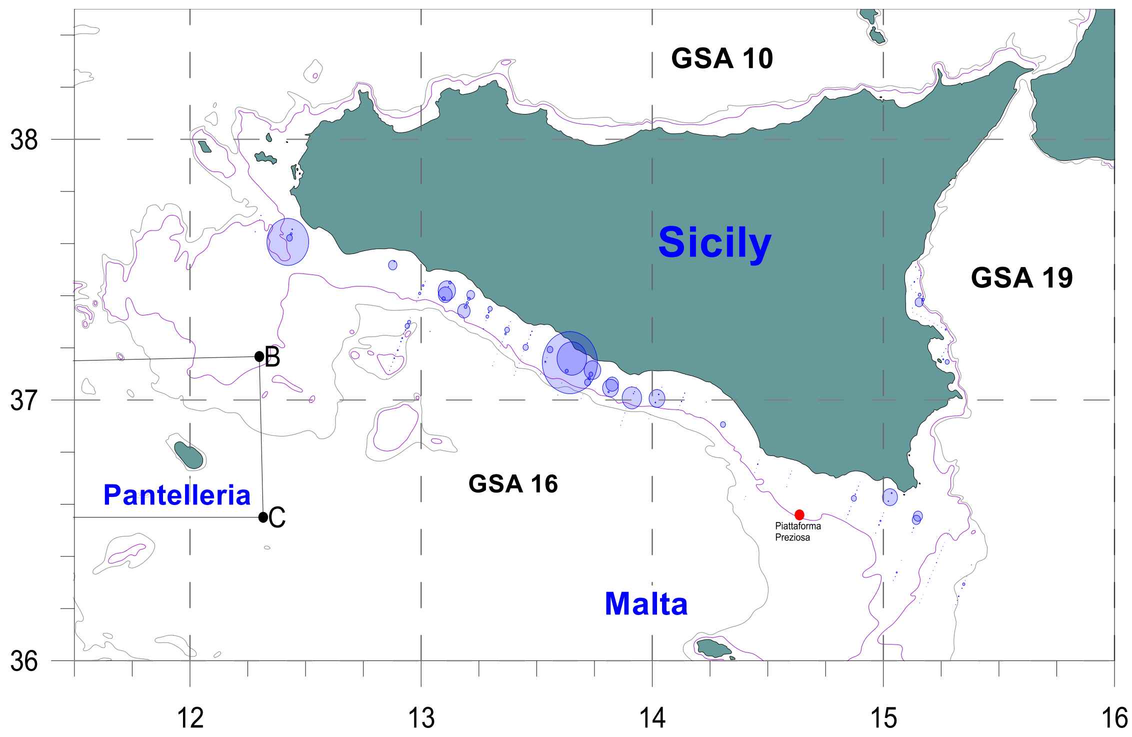


Figure 2.4.8. Sardine (PIL) spatial distribution in GSA 16. MEDIAS 2022.

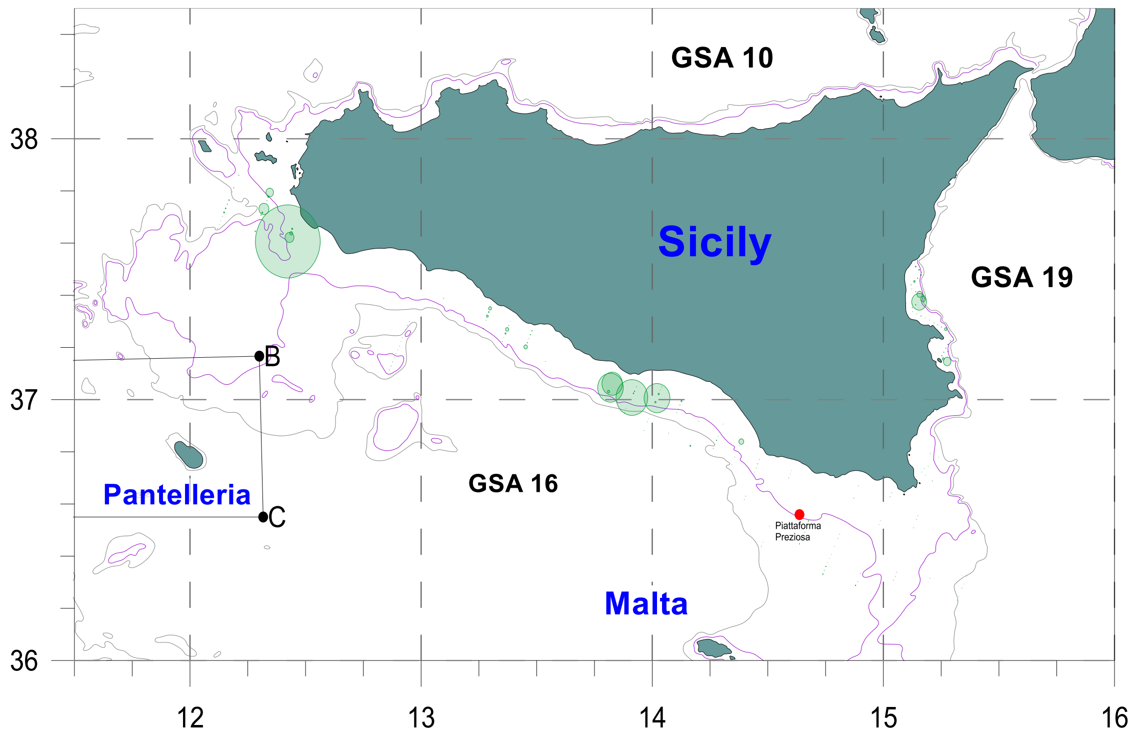


Figure 2.4.9. Anchovy (ANE) spatial distribution in GSA 16. MEDIAS 2022.

Abundance of sardine (*Sardina pilchardus*) in GSA 16 reported in Fig. 2.4.10. During this survey, the LFD is characterized by a main mode at 11.0 cm and two modes centred at 7.5 cm and 14.5 cm.

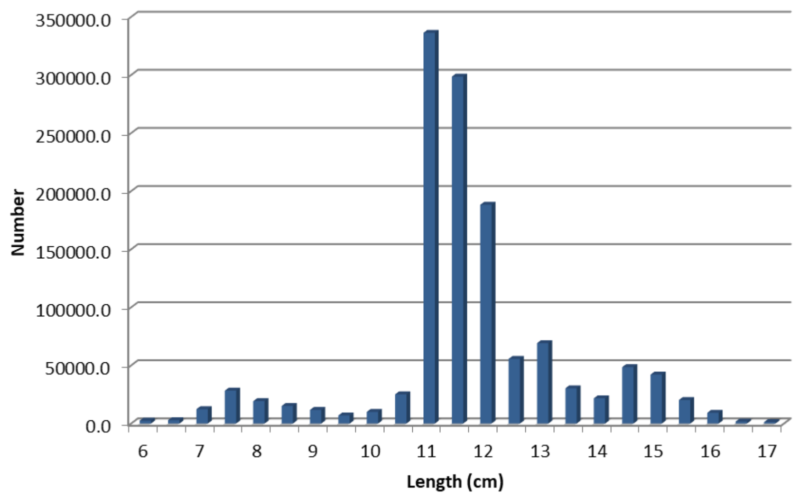


Figure 2.4.10. Sardine (PIL) abundance in numbers by length (LFD) in GSA 16, MEDIAS 2022.

Abundance of anchovy (*Engraulis encrasicolus*) estimated in GSA 16 revealed a bimodal structure for LFD with two modes centred at 8 cm and 13.5 cm (Fig. 2.4.11).

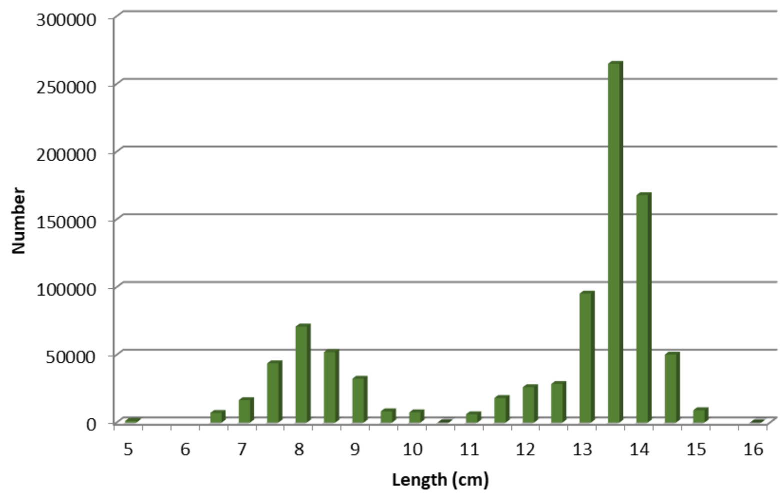


Figure 2.4.11. Anchovy (ANE) abundance in numbers by length (LFD) in GSA 16, MEDIAS 2022.

2.5. MEDIAS 2022 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 2022 was performed in two periods due to the combination of bad weather conditions and research vessel availability. First part of expedition was performed from 31.08.2022 to 28.09.2022. Second part continued from

23.10.2022 to 04.11.2022. For this purpose, in total, R/V BIOS DVA (length: 36m, engine power: 1200HP) was used for 42 days, in order to survey the area of 13.578 NMi2.

b) Type of echosounders and frequencies in use

R/V BIOS DVA is equipped with SIMRAD scientific echosounder system (EK80), including GPT (38 kHz) and WBT (120 kHz) 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 at the 1st day of the survey (31.08.2022) in the Kaštela Bay using the standard WC-sphere (38.1 mm) and EK80 software. Calibration results are shown in Table 2.5.1.

Table. 2.5.1 Calibration of 38 kHz scientific sounder system at R/V BIOS DVA (MEDIAS, 2022)

Frequency (kHz):	**38**
Transducer model:	ES38B
Serial number:	30825
Date:	31.08.2022
Latitude:	43°31.1757' N
Longitude:	16°42.3477' E
Bottom depth (m):	25
Temperature (C°):	21.6
Salinity (psu):	39
Sound speed (ms^{-1}):	1530.22
Beam Width Alongship:	6.87
Beam Width Athwartship:	6.92
Angle Offset Alongship:	0.00
Angle Offset Athwartship:	0.05
Transducer Gain (dB):	22.90
RMS value (dB):	0.0621
S_A Correction (dB):	-0.4536

Acoustic data calibration and processing has been done with Echoview software (Ver. 12), considering Elementary Sampling Distance Unit (EDSU) of 1 NM and data integration depth range up to to 200 m.

d) Survey design

Survey design in eastern part of GSA 17 (Fig. 2.5.1) 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. Number of nautical miles effectively processed for biomass estimation in 2022 was 1437 (Number of EDSU in the first leg of expedition was 654, and in second leg 783).

Figure. 2.5.1 Acoustic survey design in the eastern part of GSA 17 (red transects in inner sea, green and blue transects in open sea).

e) Fish sampling

55 samplings 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. In addition, fine mesh cod-end cover has been used in order to identify small acoustic targets (not used in fish LFDs). 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 10 – 13 m. Locations and species composition of samples obtained are shown in Figure 2.1.2.

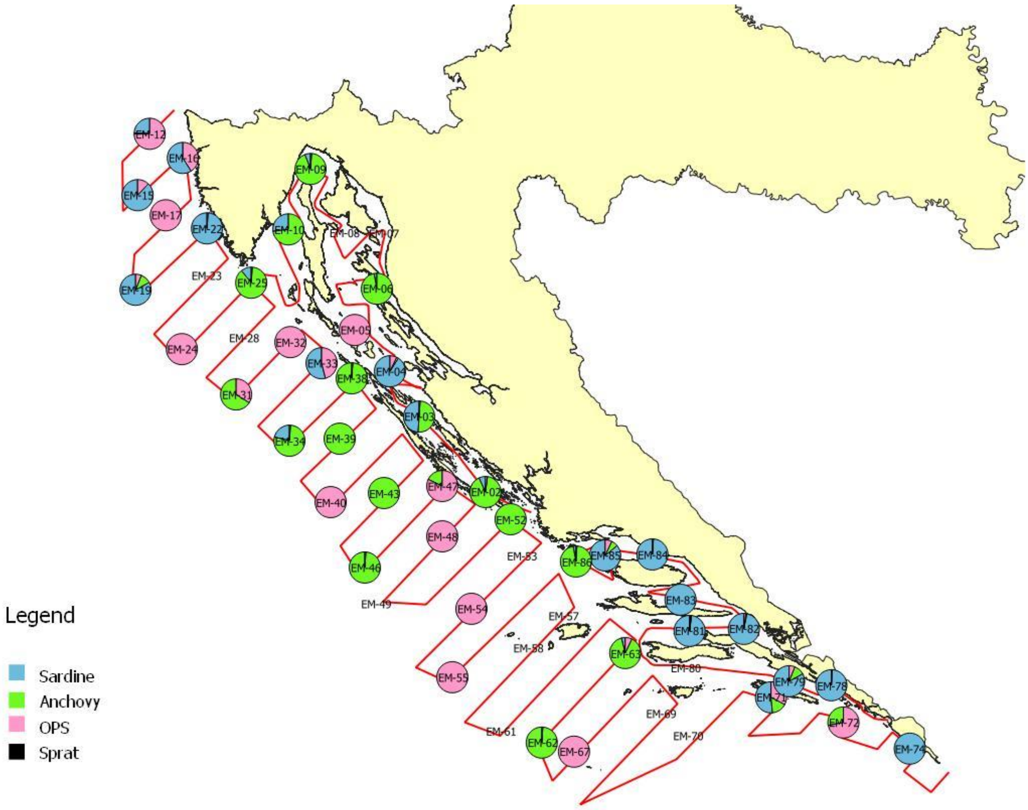


Figure 2.5.2 Pelagic hauls (55) composition (W%) carried out during the acoustic survey in the eastern part of GSA 17 (MEDIAS, 2022).

f) Oceanographic parameters

Oceanographic parameters (temperature and salinity) were measured by CTD probe at 87 different locations (Fig. 2.5.3). Based on measurements made, sound speeds were calculated and used to update echosounder during survey, as well as for surveyed area oceanographic description.

Figure 2.5.3 CTD stations (87) carried out during the acoustic survey in the eastern part of GSA 17 (MEDIAS, 2022).

g) Biomass estimations of target species

In the eastern part of GSA 17 were estimated 16 309 tons of anchovy (CV=11); 13 766 tons in the first leg of expedition and 2 543 tons in the second leg. Anchovy length frequency distribution was from 5 to 17 cm, mostly 12-13 cm. Also, 52 840 tons of sardine (CV=11) were estimated; 45 474 tons in the first leg of expedition and 7 366 tons in the second leg. Sardine length frequency distribution was from 8 to 17 cm, mostly 13-14cm. Biomass estimates per length classes are shown in the Figure 2.5.4. Time series of biomass estimated for anchovy and sardine are shown in Figure 2.5.5.a; and time series of average density are shown in Figure 2.5.5.b.

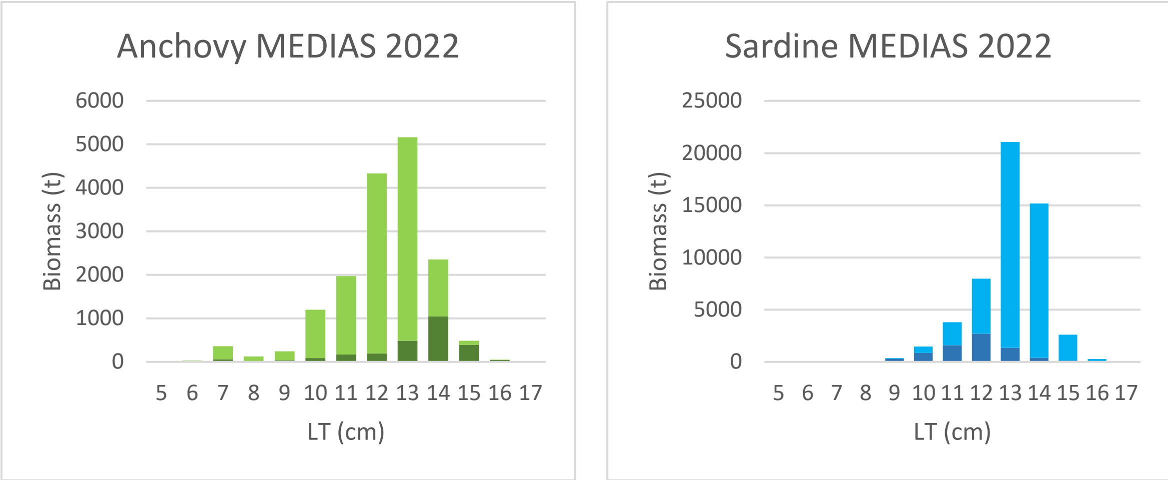


Figure 2.5.4 Biomass estimates per length classes in the eastern part of GSA 17 (MEDIAS, 2022). Two different shades of colours in 2022 indicate two parts of survey: the first leg of expedition (light shade) and the second leg of expedition (dark shade).

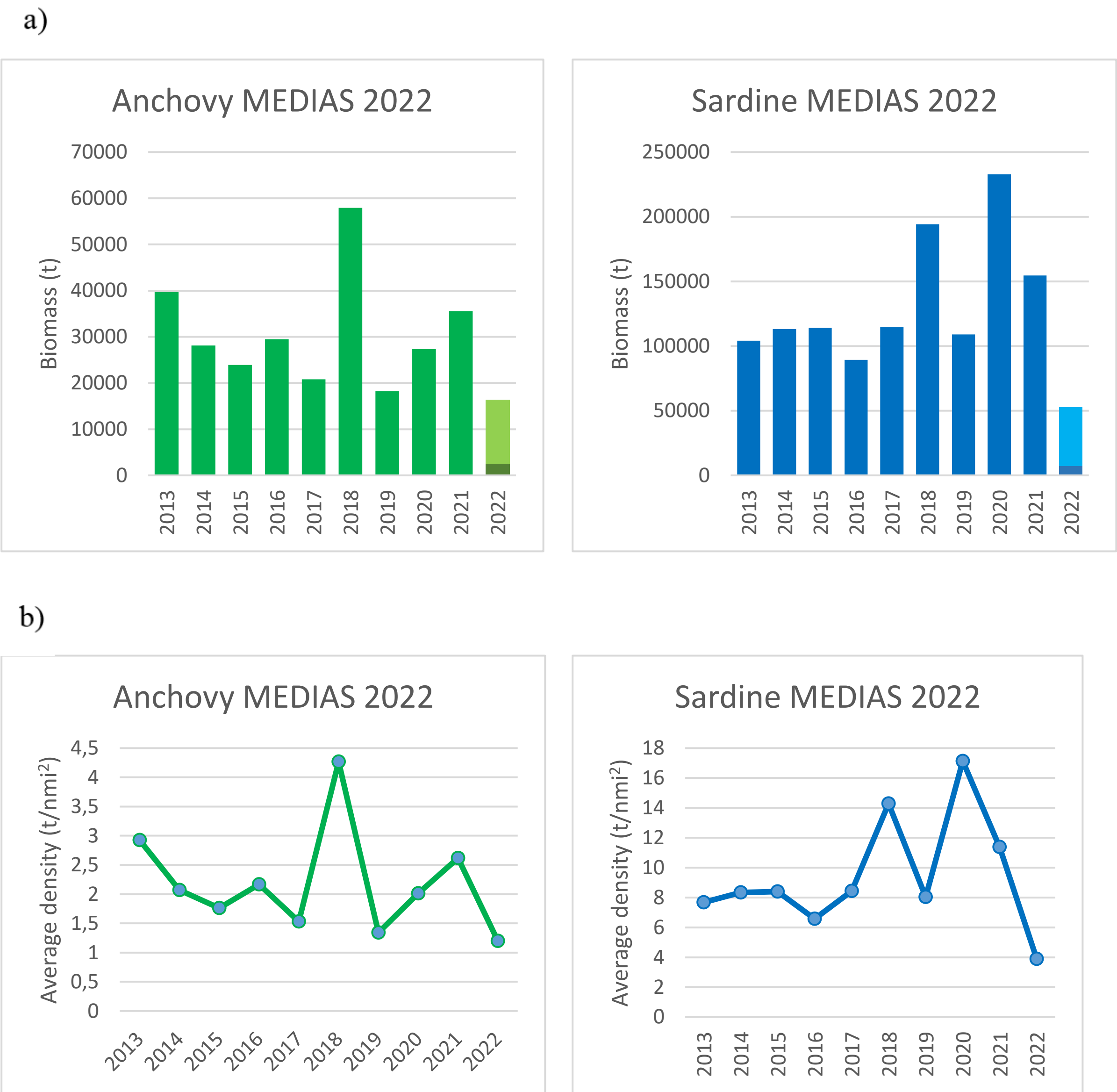
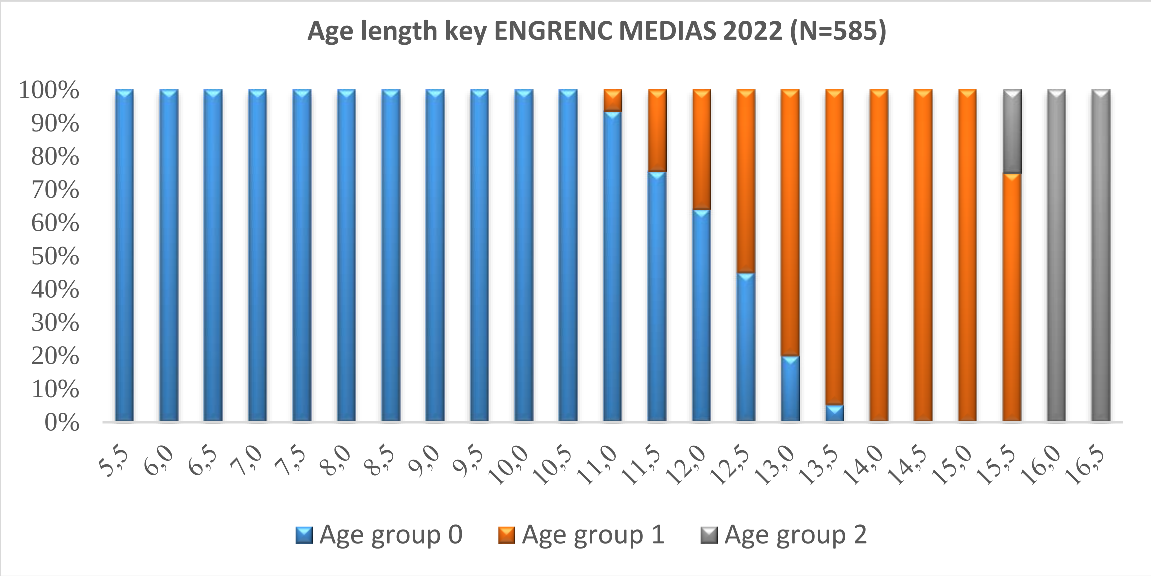


Figure 2.5.5 a) Time series of biomass estimation for anchovy and sardine in the eastern part of GSA17 (MEDIAS, 2022). Two different shades of colours in 2022 indicate two periods of survey: the first leg of expedition (light shade) and the second leg of expedition (dark shade). b) Time series of average density for anchovy and sardine in the eastern part of GSA17.

Age analyses, made in line with ICES WKARA2 report (2017) recommendations, resulted in survey specific ALKs for anchovy and sardine (Fig. 2.5.6). Results of analyses indicated that both anchovy’s and sardine's populations consisted of three age groups (0, 1 and 2). The number of otolith readings for anchovy and sardine was 585 and 609 respectfully. During MEDIAS 2022 survey, in terms of biomass, age group 1 was dominant in sardine’s population, while in anchovy's population age group 0 and 1 were more even, with the slight dominance of age group 1. Due to the very low biomass of fish from age group 2 for both species, that group is not visible in the figure (Fig. 2.5.7).



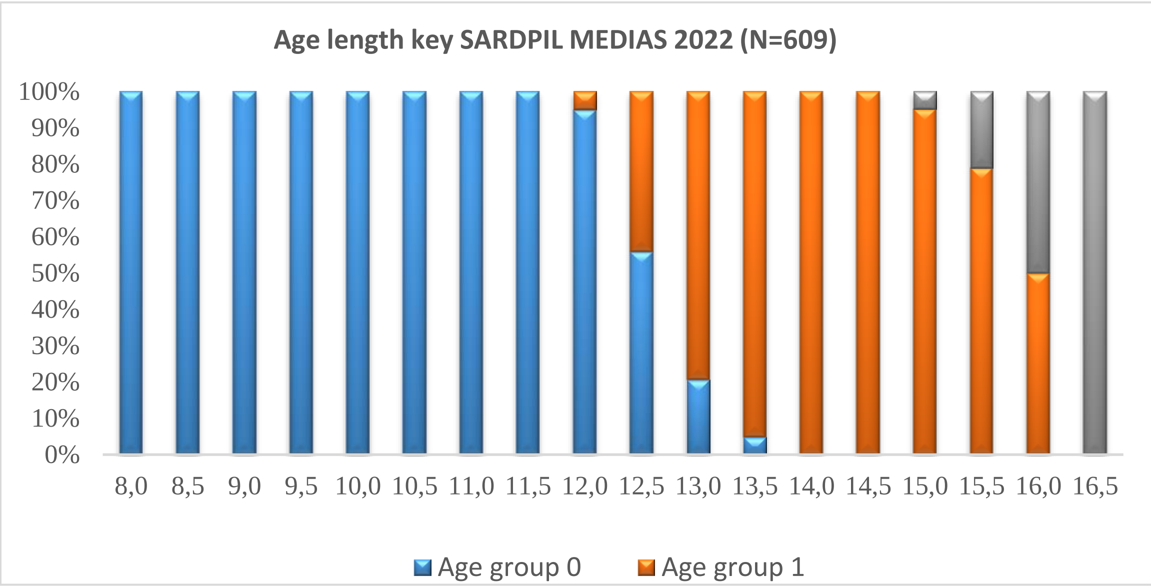
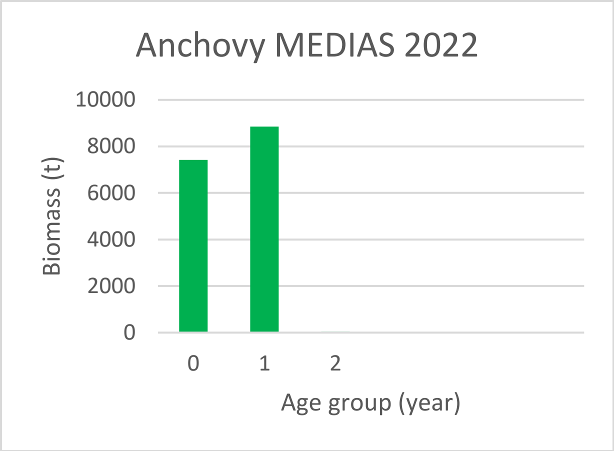


Figure 2.5.6 Age length keys (ALK) for anchovy (above) and sardine (below) in GSA17, MEDIAS 2022, were composed of three age groups (0, 1 and 2). The number of otolith readings was 585 for anchovy and 609 for sardine.



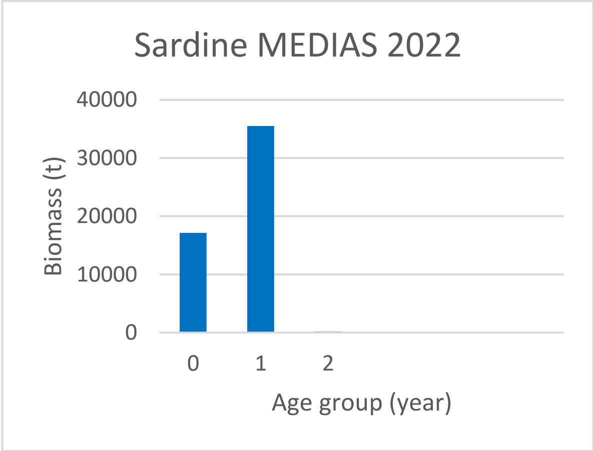


Figure 2.5.7 Biomass of anchovy and sardine estimates per age groups (MEDIAS, 2022).

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

Spatial distributions of sardine and anchovy in the eastern part of GSA17 are presented in terms of NASC per EDSU in Figures 2.5.8 and 2.5.9. Spatial distribution of anchovy shows biggest concentration of individuals near the coast and within channels between coast and islands (Fig. 2.5.8). 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. 2.5.9).

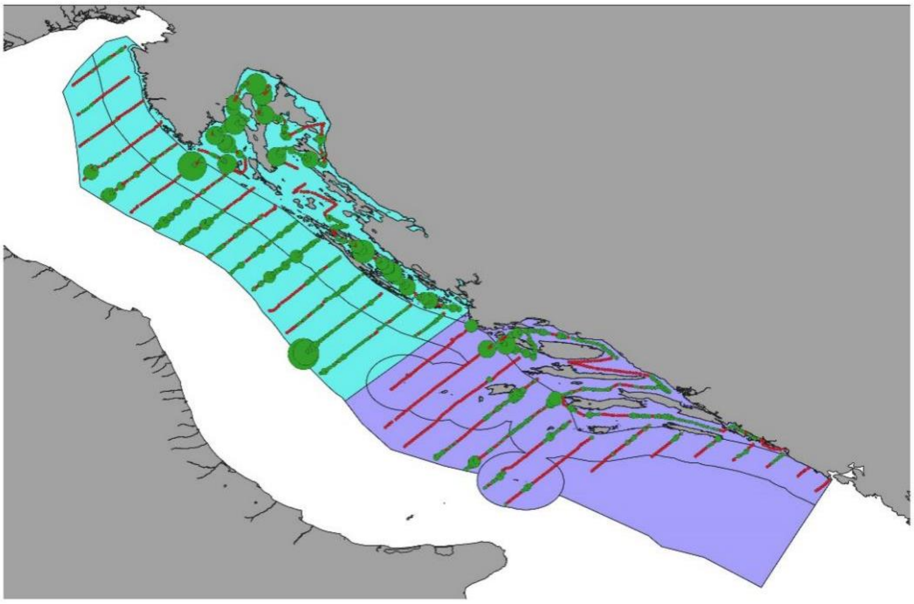


Figure 2.5.8 Anchovy spatial distribution in the eastern part of GSA17 (MEDIAS, 2022). The colour of background indicates two different periods of survey: September (light blue) and October (purple).

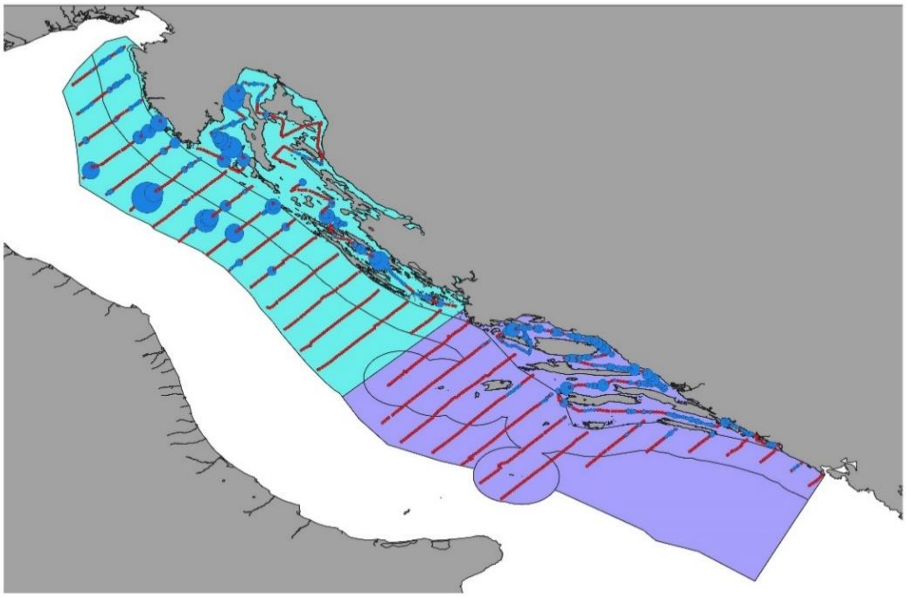


Figure 2.5.9 Sardine spatial distribution in the eastern part of GSA17 (MEDIAS, 2022). The colour of background indicates two different periods of survey: the first leg of the expedition (light blue) and the second leg of the expedition (purple).

Abundance ($x10^3$) per length for anchovy and sardine are shown in Figure 2.5.10. Graphical view of anchovy shows bimodal shape with two peaks: 7 cm and 12-13 cm, in contrast to the graphical view of sardine with only one peak at 13 cm.

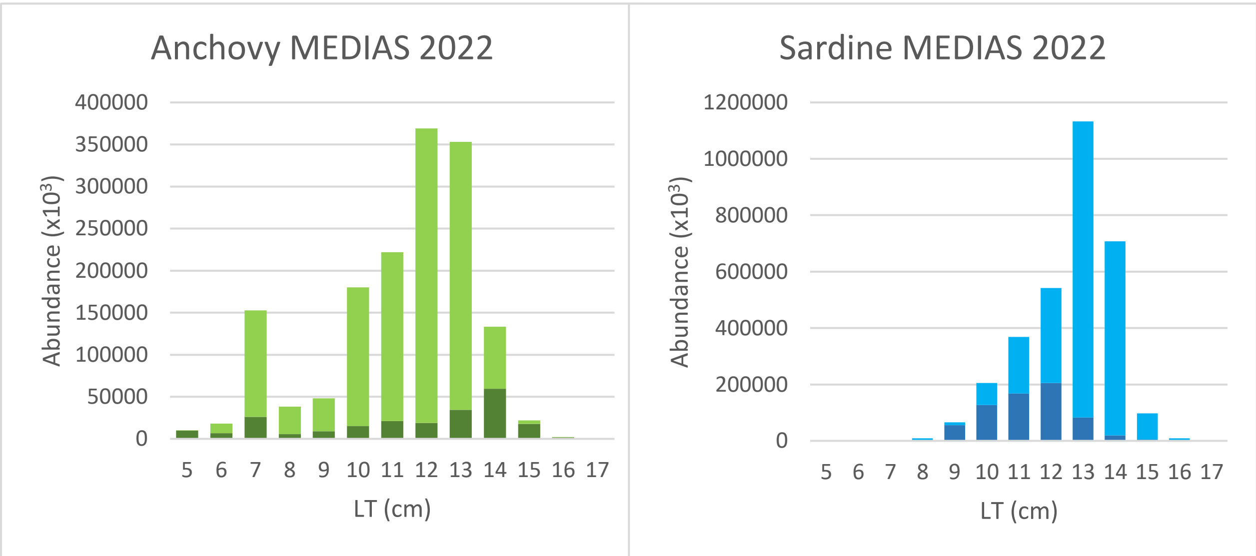


Figure 2.5.10 Abundance (x103) per length for anchovy and sardine in the eastern part of GSA 17 (MEDIAS, 2022). Two different shades of colours indicate two periods of survey: the first leg of the expedition (light shade) and the second leg of the expedition (dark shade).

2.6. MEDIAS 2022 in western GSA 17 and GSA 18 (Nord-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 2022 acoustic surveys were carried out in the period June 3 – July 22, 2022. They were conducted in the western GSA 17, including territorial waters of Slovenia, and western GSA 18, following MEDIAS protocol (MEDIAS Handbook, 2022), in the planned area of ~ 13,300 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). Slovenian researchers didn't take part in the cruise in Slovenia waters in 2022, since it was not possible due to restrictions on board for COVID-19 pandemic: maximum 7 scientists (instead of 11) could be present on-board R/V "G. Dallaporta".

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 1024 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 6th of June 2022 at 38, 70, 120 and 200 kHz, using the standard sphere method.

Table 2.6.1. Calibration results in MEDIAS 2022.

Transducer Frequency	**38 kHz**	**70 kHz**	**120 kHz**	**200 kHz**
Echo-sounder type	ES38B	ES70-7C	ES120-7C	ES200-7C
Transducer serial no.	30789	271	924	365
Vessel	R/V Dallaporta			
Date	06/06/2022			
Time (GMT)	8:51 - 9:28			
Place	Ancona			
Latitude	43° 38.0’			
Longitude	13° 42.9’			

Bottom depth (m)	30			
Temperature (°C) at sphere depth	14.7			
Salinity (psu) at sphere depth	39.0			
Speed of sound (m s^{-1})	1510.32			
TS of tungsten (Wc-Co) 38.1 mm sphere (dB)	-42.4	-41.6	-39.6	-38.9
Pulse duration (s)	1.024	1.024	1.024	1.024
Range to sphere (m)	16.5	16.5	16.0	16.5
Ping rate	Max	Max	Max	Max
Default TS transducer gain (dB)	25.28	27.33	26.98	26.06
Iteration no.	1703	1799	2057	2290
Time	10:51 – 10:58	10:38 – 10:47	11:05 – 11:13	11:19 – 11:28
RMS beam	0.077	0.172	0.092	0.142
Calibrated TS transducer gain (dB)	25.12	26.99	26.97	24.27
Sa corr. (dB)	-0.565	-0.128	-0.071	-0.128
Atwarth Beam angle (deg)	7.13	6.71	6.57	7.94
Along Beam angle (deg)	6.89	6.38	6.38	7.51
Atwarth Offset Beam angle (deg)	-0.02	0.04	-0.03	-0.49
Along Offset Beam angles (deg)	0.04	-0.03	-0.11	-0.17

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.

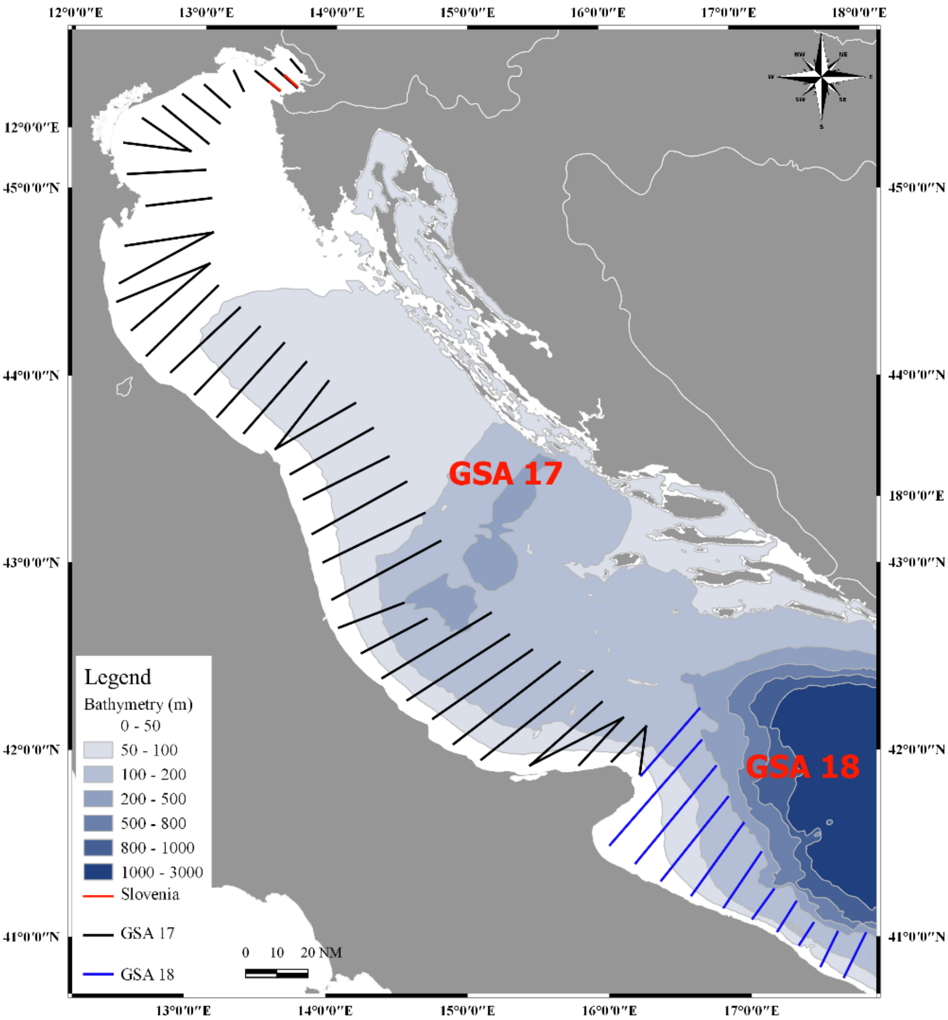


Figure 2.6.1. Acoustic survey design in western part of GSA 17 and GSA 18. MEDIAS 2022.

Survey period of the MEDIAS 2022 acoustic survey in western GSA 17 was from June 3 to July 3, 2022; area coverage was 100% over a total area of 10,636 nmi^2 and 39 transects. The number of nautical miles effectively processed for biomass estimation was 1072.

MEDIAS 2022 acoustic survey in western GSA 18 was done in the period from July 4 to July 22, 2022; area coverage was 100% over a total area of 2,510 nmi^2 and 11 transects. The number of nautical miles effectively processed for biomass estimation was 260.

e) Fish sampling

A midwater sampling trawl "Volante" with the following characteristics was used during the surveys: 18 mm codend mesh size, about 10 m vertical opening and 12 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 2022, 29 pelagic hauls were done in GSA 17 (Fig. 2.6.2.a) and 9 pelagic hauls in GSA 18 (Fig. 2.6.2.b). 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 smaris, Scomber colias, Sardinella aurita, Boops boops, Aphia minuta,* Sarda sarda.

Other species found in some catches were: *Loligo volgaris, Illex coindetii, Alloteuthis media, Aequorea Aequorea, and Rhizostoma pulmo.*

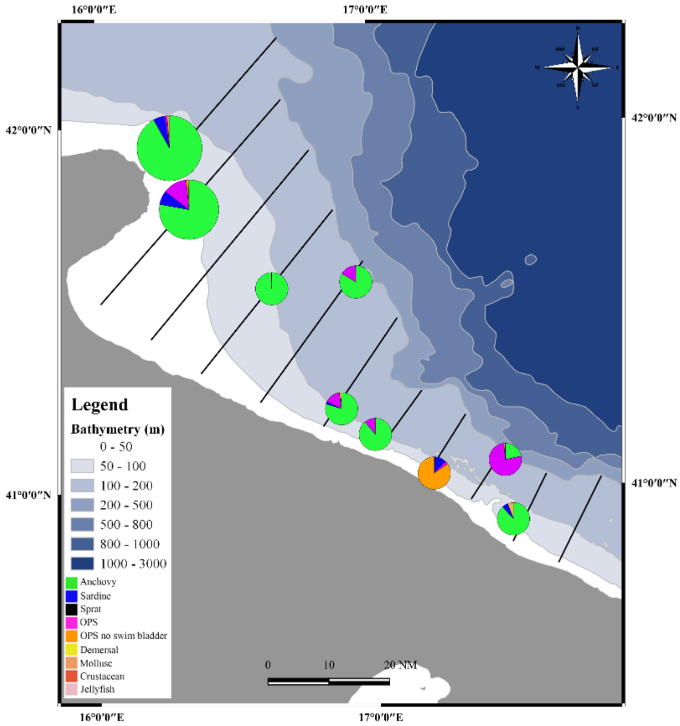


Figure 2.6.2.a. Pelagic hauls composition (29) carried out during the acoustic survey in western GSA 17. MEDIAS 2022.

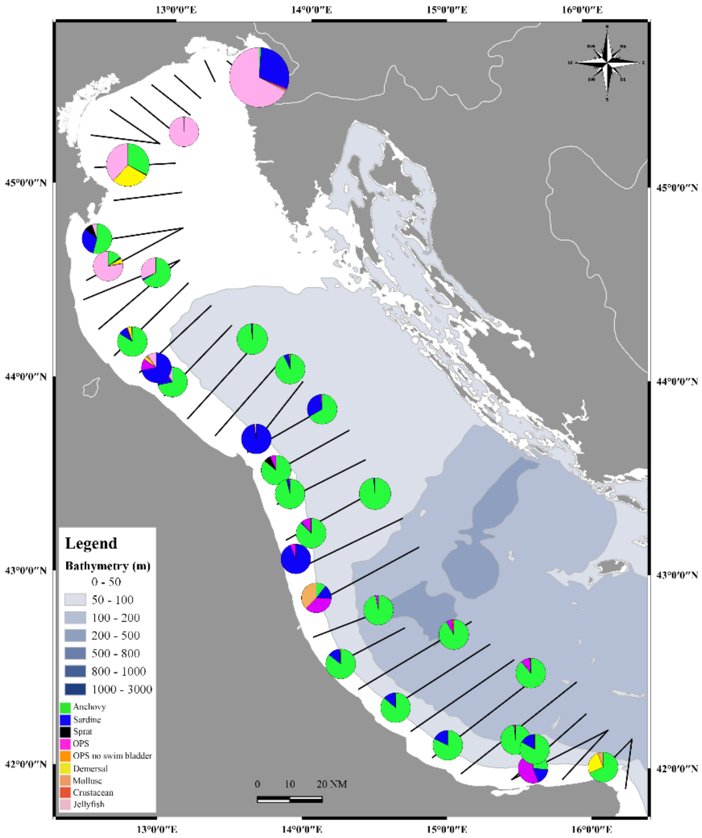


Figure 2.6.2.b. Pelagic hauls composition (9) carried out during the acoustic survey in western GSA 18. MEDIAS 2022.

f) <u>Oceanographic parameters</u>

In total, 60 CTD stations were performed in GSA 17 (Fig. 2.6.3.a) and 17 CTD stations in GSA 18 (Fig. 2.6.3.b), 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 46 mesozooplancton stations were done in GSA 17 and 12 in GSA 18 using a WP2 vertical net.

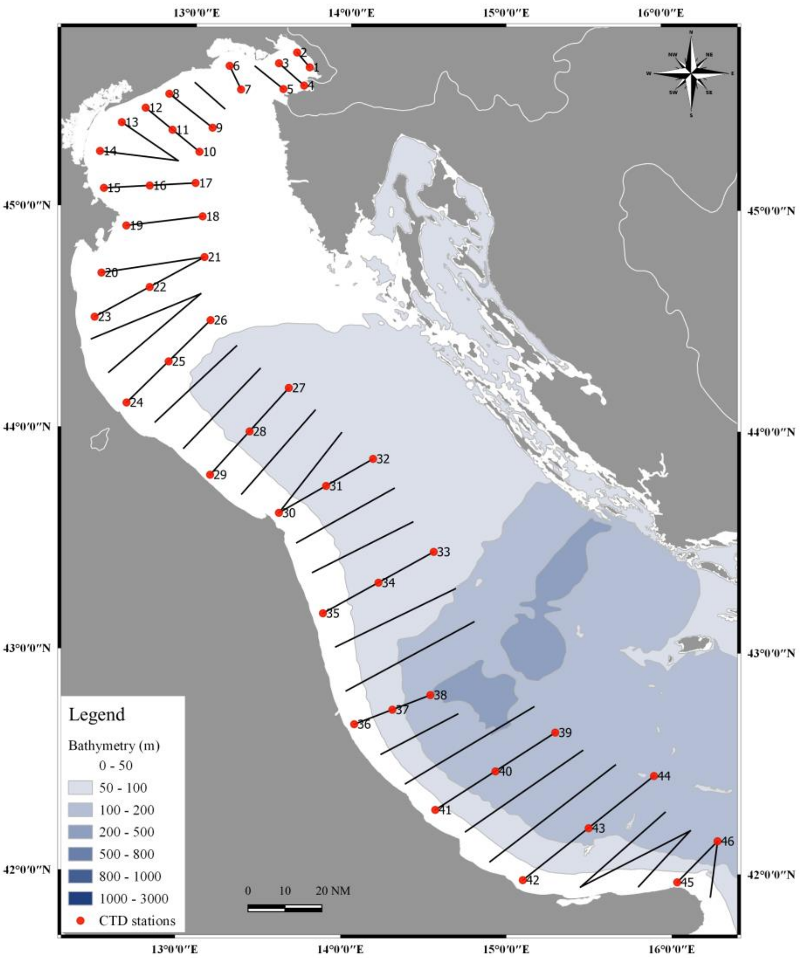


Figure 2.6.3.a. Planned CTD stations carried out during the acoustic survey in in western part of GSA 17 MEDIAS 2022.

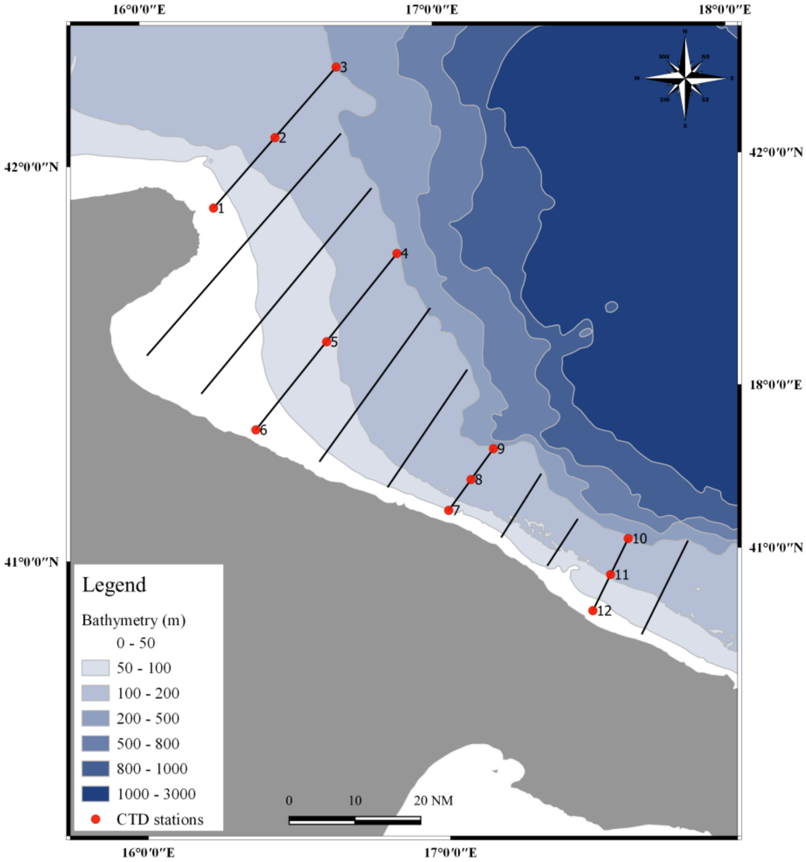


Figure 2.6.3.b. Planned CTD stations carried out during the acoustic survey in western part of GSA 18 MEDIAS 2022.

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

Biomass of sardine (S*ardina pilchardus*) (Fig. 2.6.4 and Fig. 2.6.5.a) and anchovy (*Engraulis encrasicolus*) (Fig. 2.6.5) and related (geostatistical simulations) CVs in 2022 in western GSA 17 were reported in the following table:

Year	Sardine	CV	Anchovy	CV	Sampled Area
2022	70,542 t	10%	193,678 t	10%	10,636 nmi^2

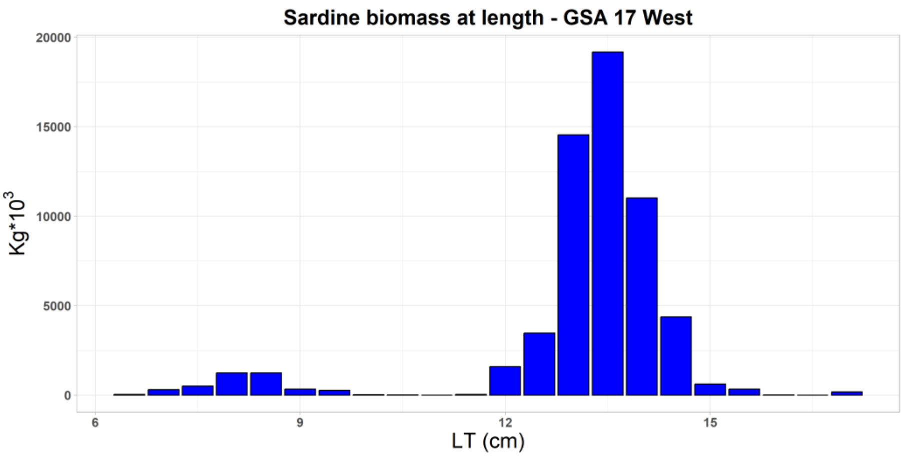


Figure 2.6.4. Sardine (PIL) biomass in tons by length (LFD) in western GSA 17. MEDIAS 2022.

For sardine, biomass per length class is bimodal (7-10 cm; 12-14.5 cm) with low recruitment.

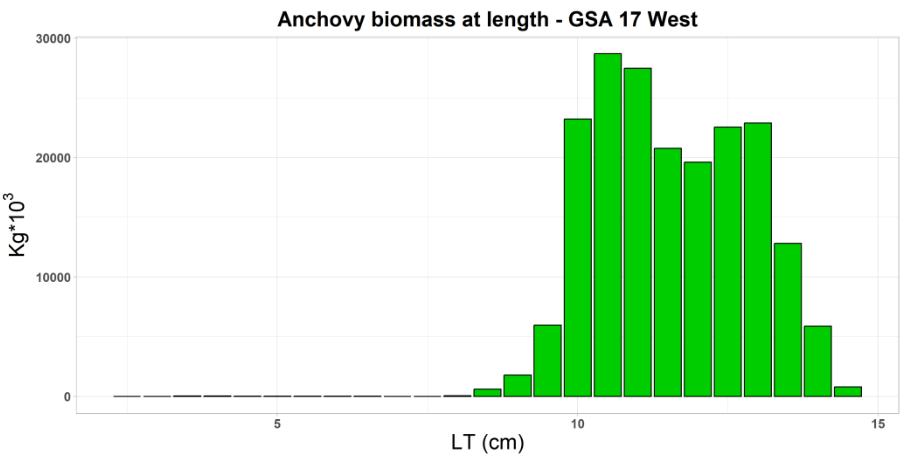


Figure 2.6.5.a. Anchovy (ANE) biomass in tons by length (LFD) in western GSA 17. MEDIAS 2022.

Anchovy biomass per length class showed a distribution concentrated in the range 9.5-14 cm. Recruitment was almost absent.

In 2022 we have a decrease in anchovy and sardine biomass in western GSA 17 MEDIAS (Fig. 2.6.5.b.).

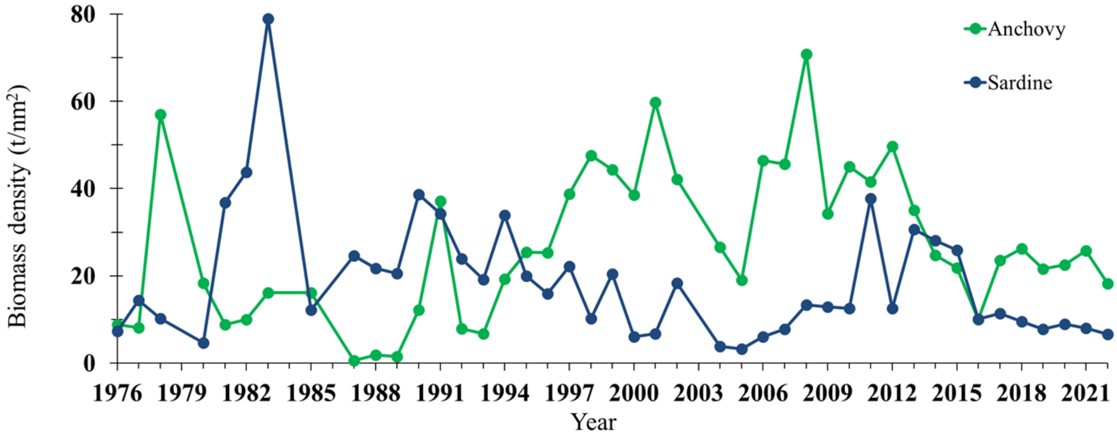


Figure 2.6.5.b. Historical trends in North-western Adriatic Sea 1976-2022.

Age length key (ALK) for sardine in western GSA 17, MEDIAS 2022, was composed by 3 years classes: age 0, age 1 and age 2. The number of otoliths readings was 441 for sardine (no. individuals) (Fig. 2.6.6).

Within GFCM context, a revision of sardine age readings criteria was finalized in 2023 after an intercalibration process among expert readers of the Adriatic Sea countries (Albania, Montenegro, Croatia, Italy, and Slovenia). Mr Pierluigi Carbonara, COISPA Institute, coordinated the entire process of otolith readings exchange through ICES SMARTdots platform. After the rereading, all the available ALKs were revised.

Then sardine biomass per age was estimated using the ALKs.

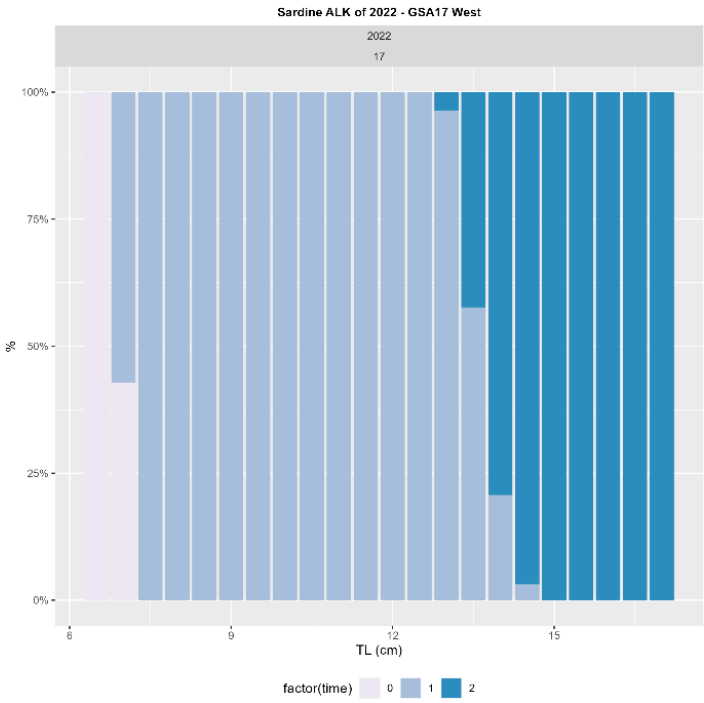


Figure 2.6.6. Sardine ALK western GSA17, MEDIAS 2022.

Anchovy ALK in western GSA 17, MEDIAS 2022, was represented by 3 years classes: age 0, age 1 and age 2. The number of otoliths readings was 624 for anchovy (no. individuals) (Fig. 2.6.7.a). Then anchovy biomass per age was estimated using the ALKs.

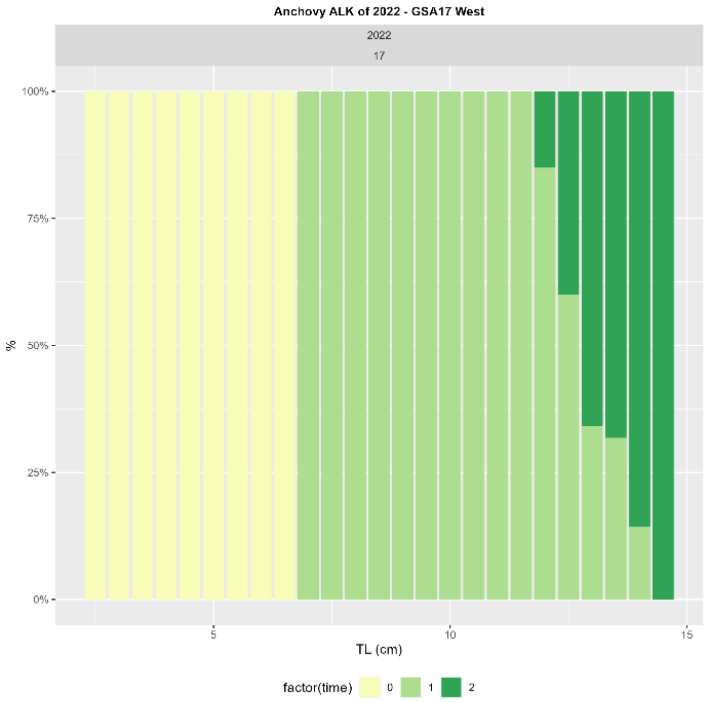


Figure 2.6.7.a. Anchovy ALK western GSA17, MEDIAS 2022.

Sardine and anchovy biomass per age were estimated (Fig. 2.6.7.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 is dominant.

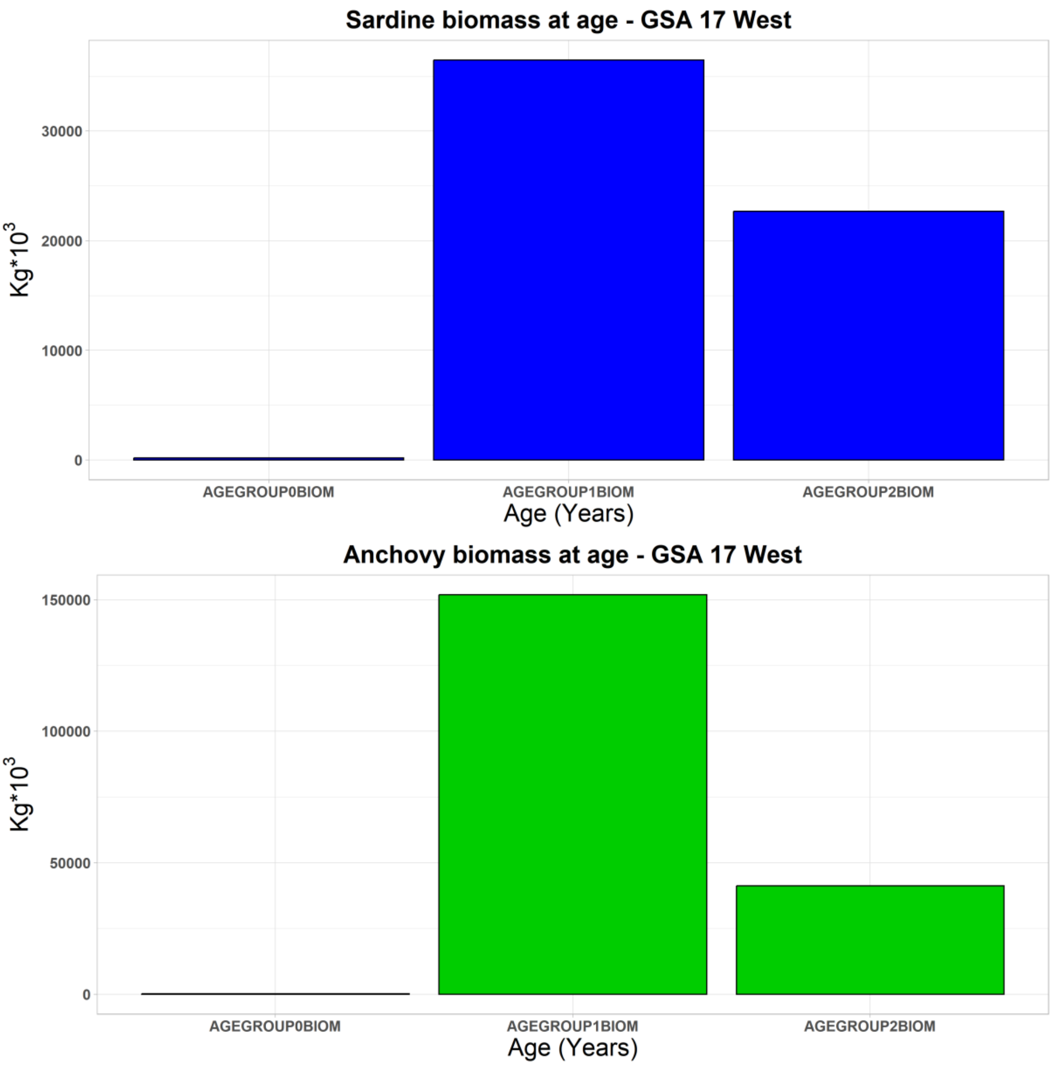


Figure 2.6.7.b. Sardine and anchovy biomass at age in western GSA 17 in 2022.

h) Abundance indices of target species: Western GSA 17

Spatial distribution of sardine and anchovy in western GSA 17 in June-July 2022 (Figure 2.6.8 and 2.6.9) 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.

Anchovy covers all the continental shelf in GSA 17 except for Trieste Gulf where its distribution is very low compared to the rest of the area. Anchovy is also present offshore.

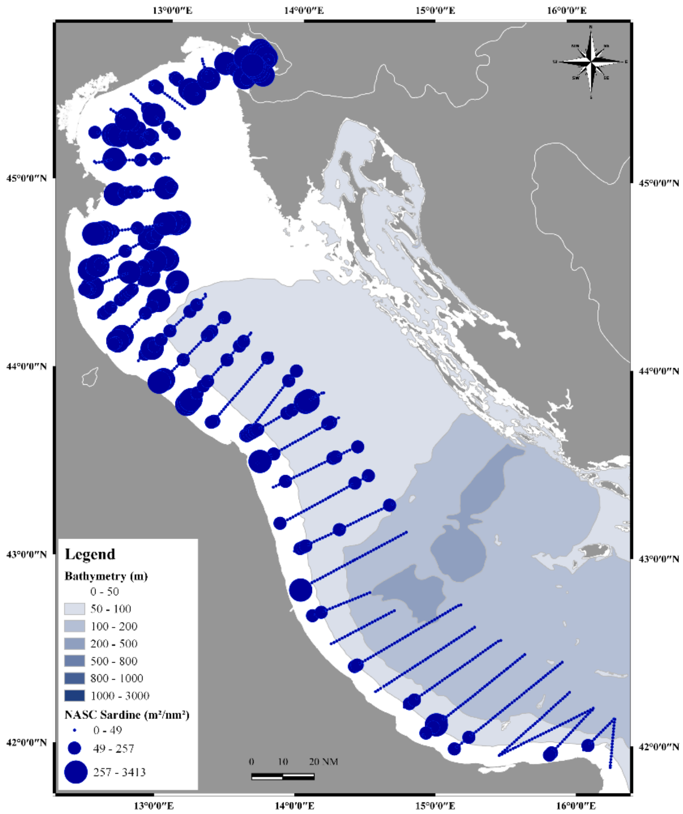


Figure 2.6.8. Sardine spatial distribution in western GSA 17 in June-July. MEDIAS 2022.

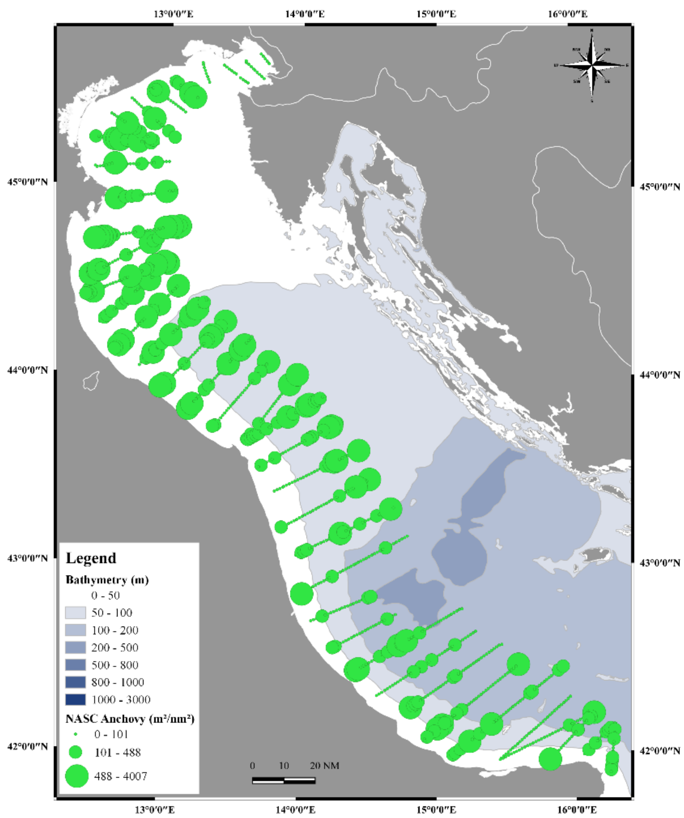


Figure 2.6.9. Anchovy spatial distribution in western GSA 17 in June-July. MEDIAS 2022.

i) <u>Biomass estimations of target species:</u> Western GSA 18

Biomass of sardine (*Sardina pilchardus*) (Fig. 2.6.10) and anchovy (*Engraulis encrasicolus*) (Fig. 2.6.11) and related (geostatistical simulations) CVs in 2022 in western GSA 18 were reported in the following table:

Year	Sardine	CV	Anchovy	CV	Sampled Area
2022	683 t	20%	14,144 t	15%	2,510 nmi2

For sardine, biomass per length classes (Fig. 2.6.10) is between 11.5 and 14.5 cm.

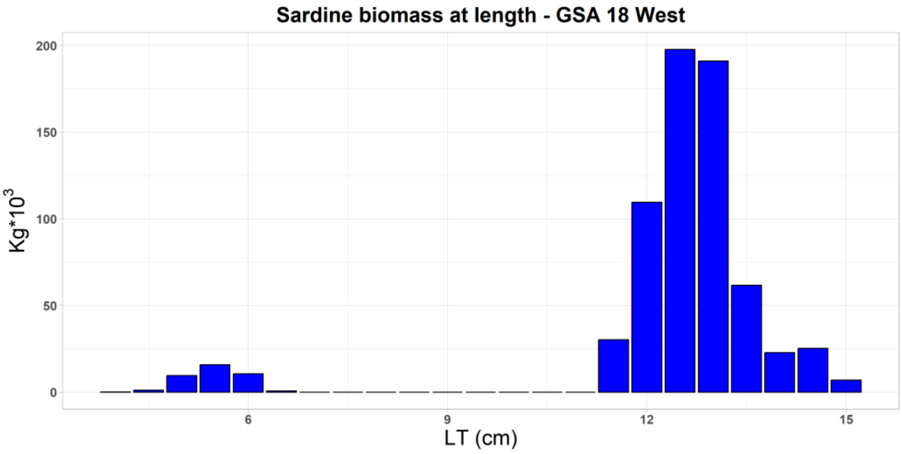


Figure 2.6.10. Sardine (PIL) biomass in tons by length (LFD) in western GSA 18. MEDIAS 2022.

Recruitment of anchovy was almost absent and absent for sardine. Anchovy length frequency distribution was mostly concentrated between 11 cm and 14 cm (Fig. 2.6.11).

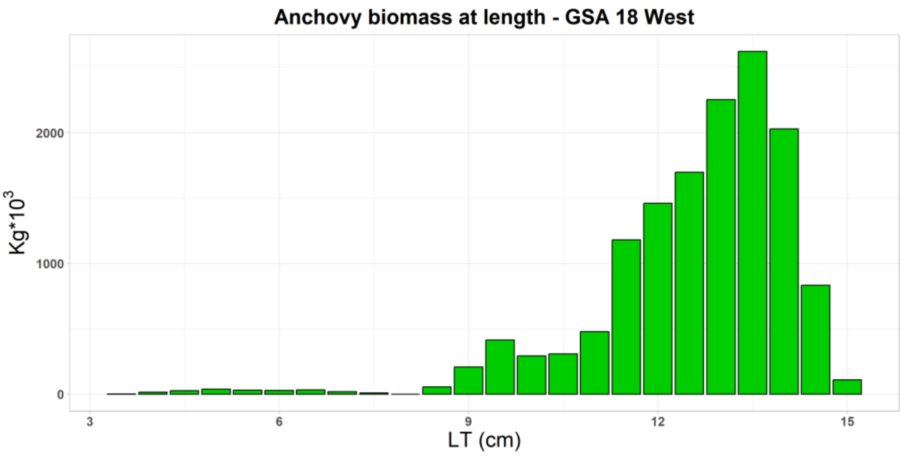


Figure 2.6.11. Anchovy (ANE) biomass in tons by length (LFD) in western GSA 18. MEDIAS 2022.

In 2022 in western GSA 18 MEDIAS there is a huge decline in sardine and anchovy biomass (Fig. 2.6.11.b). Particularly for sardine the value is very low.

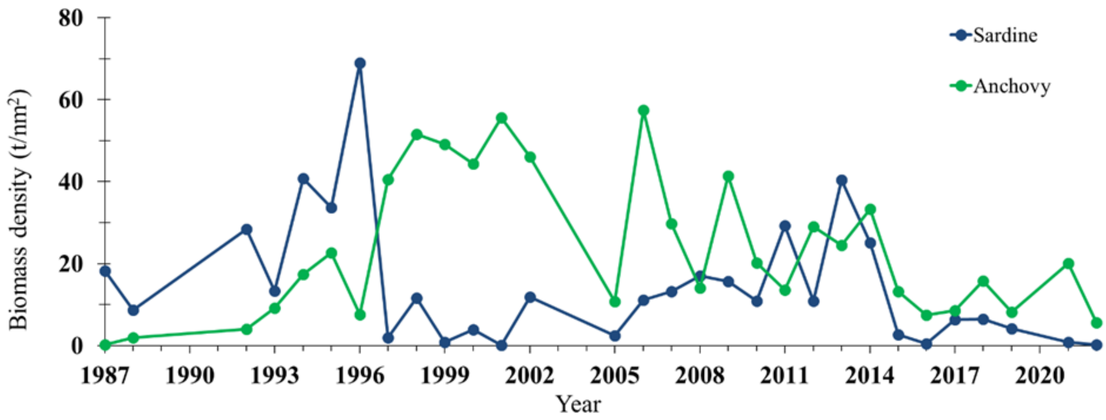


Figure 2.6.11.b. Historical trends in South-western Adriatic Sea 1987-2022.

Anchovy ALK in western GSA 18, MEDIAS 2022, was represented by 3 years classes: age 0, age 1 and age 2. The number of otoliths readings was 33 for sardine (no. individuals) (Fig. 2.6.12).

Within GFCM context, a revision of sardine age readings criteria was finalized in 2023 after an intercalibration process among expert readers of the Adriatic Sea countries (Albania, Montenegro, Croatia, Italy and Slovenia). Mr Pierluigi Carbonara, COISPA Institute, coordinated the entire process of otolith readings exchange through ICES SMARTdots platform. After the rereading, all the available ALKs were revised.

Then sardine biomass per age was estimated using the ALKs.

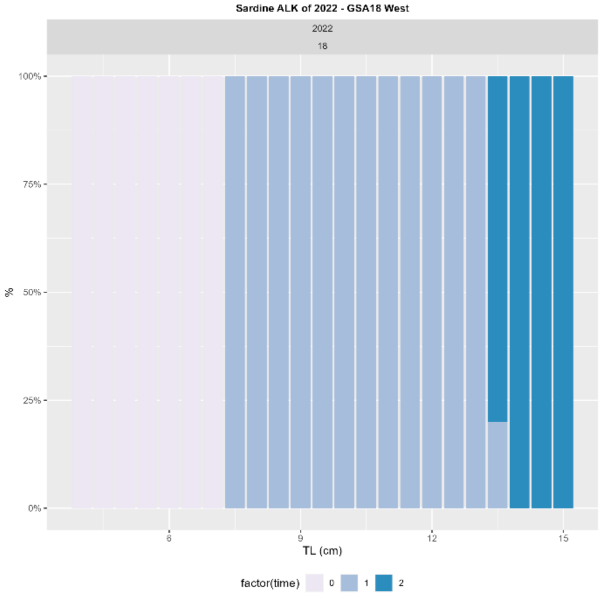


Figure 2.6.12. Sardine ALK western GSA18, MEDIAS 2022.

Age length keys (ALKs) for anchovy was composed by 3-year classes: age 0, age 1 and age 2.

The number of otoliths readings was 185 (individuals) for anchovy.

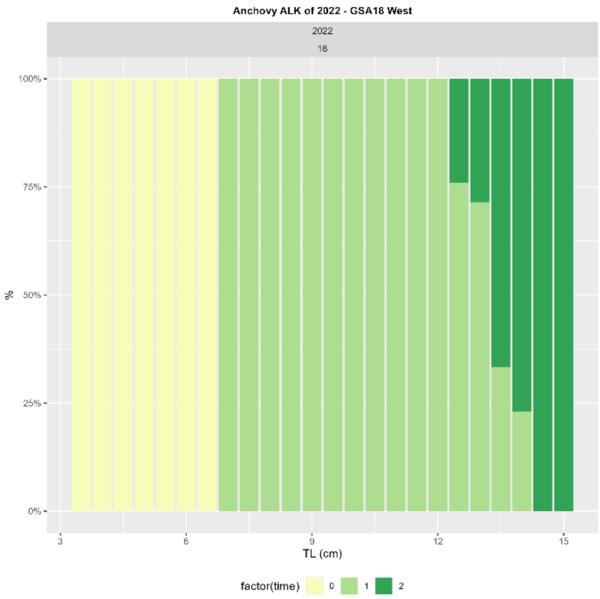


Figure 2.6.13. Anchovy ALK western GSA18, MEDIAS 2022.

Anchovy and sardine biomass per age were estimated (Fig. 2.6.13.b).

For sardine, biomass at age was dominated by age 1 group.

For anchovy, biomass per age groups were 3: 0, 1, 2. Age 1 and 2 are dominant.

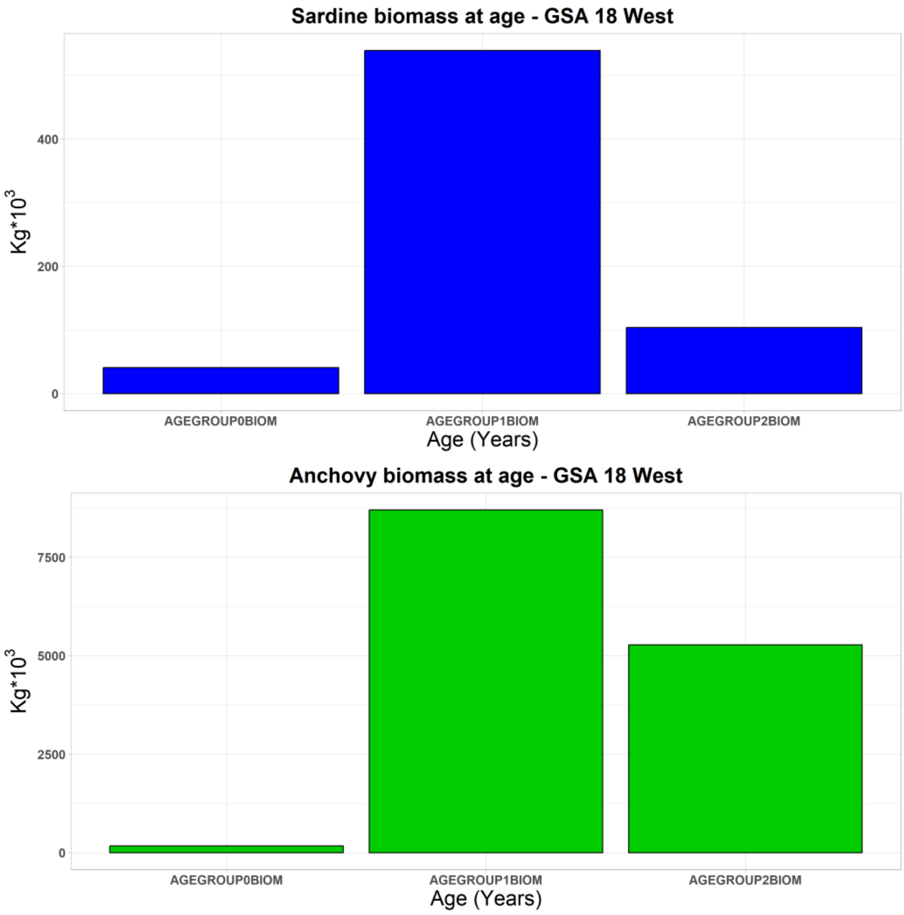


Figure 2.6.13.b. Anchovy and sardine biomass at age in western GSA 18 in 2022.

j) Abundance indices of target species: Western GSA 18

Spatial distribution of sardine and anchovy in western GSA 18 in July 2022 (Figure 2.6.14 and 2.6.15) was shown.

Sardine spatial distribution is concentrated between the coast and 100 m bathymetry in the southern part of the basin.

Anchovy covers all the continental shelf also in GSA 18.

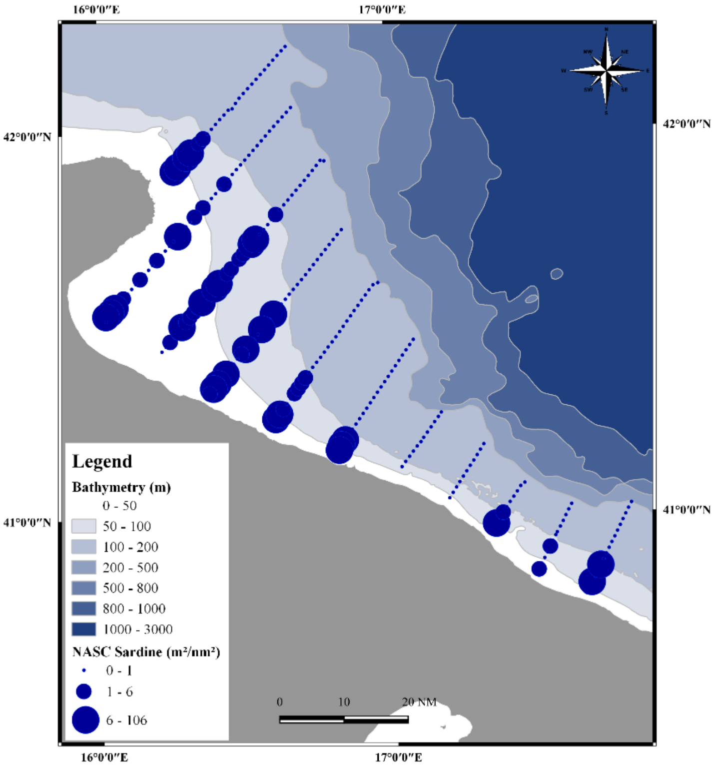


Figure 2.6.14. Sardine spatial distribution in western GSA 18 in in July. MEDIAS 2022.

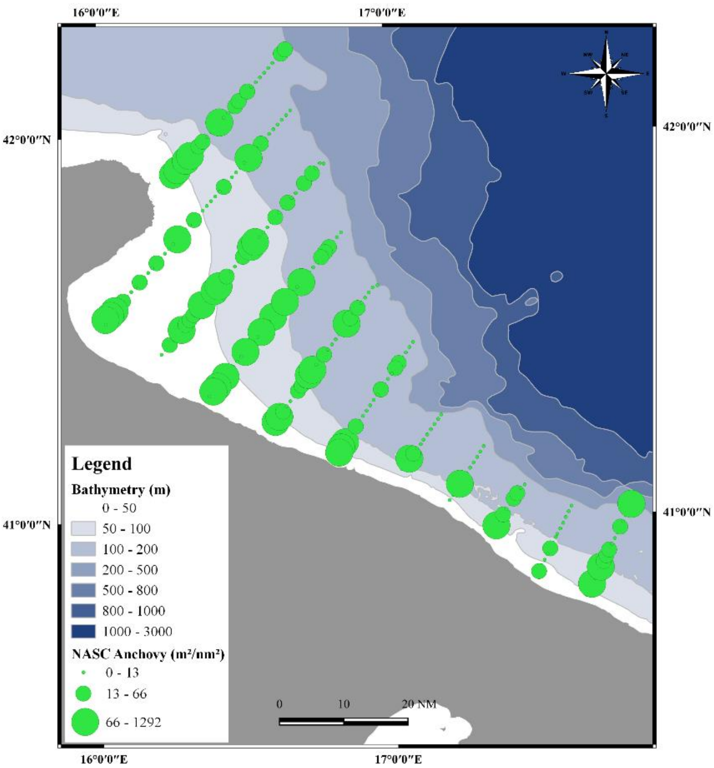


Figure 2.6.15. Anchovy spatial distribution in western GSA 18 in in July. MEDIAS 2022.

2.7. MEDIAS 2022 in GSAs 20 & 22 (Eastern Ionian and Aegean Seas, GRC). A. Machias, K. Tsagarakis, Z. Kapelonis, M.M. Pyrounaki, S. Somarakis, E. Schismenou, K. Markakis & M. Giannoulaki, HCMR)

a) <u>General information on the survey</u>

MEDIAS 2022 acoustic surveys covered 8115 nm^2 in northern Aegean Sea during June - July, and 3069 nm^2 in eastern Ionian Sea during September with the fishery Research Vessel PHILIA (26 m length, 2× 340 HP).

b) <u>Type of echosounders and frequencies in use</u>

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 1024 ms. The surveying acoustic vessel speed is 8 knots. The Echoview software was used to visualize and analyze acoustic data.

c) <u>Calibration results</u>

The acoustic system was calibrated at the beginning of the MEDIAS 2022 in northern Aegean Sea.

Table 2.7.1. Calibration results of the MEDIAS 2022.

	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]	0.93, 26.43	0.23, 27.23	1.56, 27.56	-1.2, 23.8
Sa correction [dB]	-0.23	-0.07	-0.16	-0.38
Offset alongship [deg]	0.01	-0.01	-0.22	-0.07
Offset athwartship [deg]	0.00	-0.10	-0.05	-0.23
Beamwidth alongship [deg]	7.56	6.21	7.16	6.21
Beamwidth athwartship [deg]	7.51	6.11	6.59	6.62
Depth [m]	7	7	7	7
RMS TS error [dB]	0.13	0.13	0.44	0.75

d) <u>Survey design</u>

Acoustic data were collected from 60 transects in GSA 22 and 46 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. 2.7.1 and Fig. 2.7.2). Total nautical miles effectively used for acoustic analysis were 1020 and 429 in GSA 22 and GSA 20, respectively.

e) <u>Fish sampling</u>

Echotraces are identified with pelagic hauls. Twenty-nine (29) pelagic hauls were carried out in GSA 22 and twenty-one (21) in GSA 20 to be used for the scrutinizing of the echograms (Fig. 2.7.3, Fig. 2.7.4). 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) <u>Oceanographic parameters</u>

129 hydrological stations have been conducted in GSA 22 and 80 hydrological stations in GSA 20 in 2022, using a SBE 19plus CTD, which measures conductivity, temperature, pressure, fluorescence, PAR (Photosynthetically active radiation), oxygen and turbidity (Fig. 2.7.1, Fig. 2.7.2).

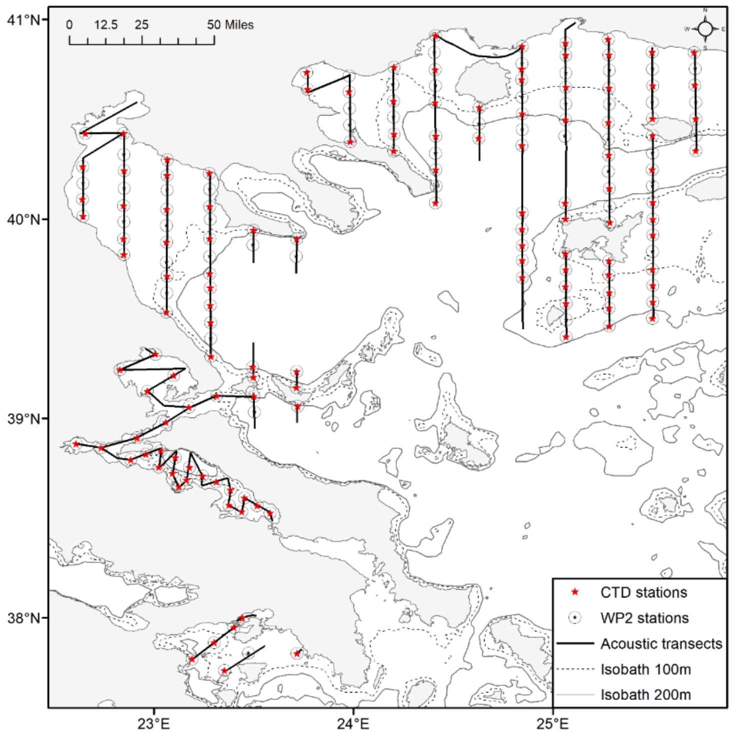


Figure 2.7.1. Acoustic transects sampled in the MEDIAS of the Hellenic part of northern Aegean Sea (GSA 22) in June-July 2022. The position of CTD stations and WP2 stations sampled are also shown.

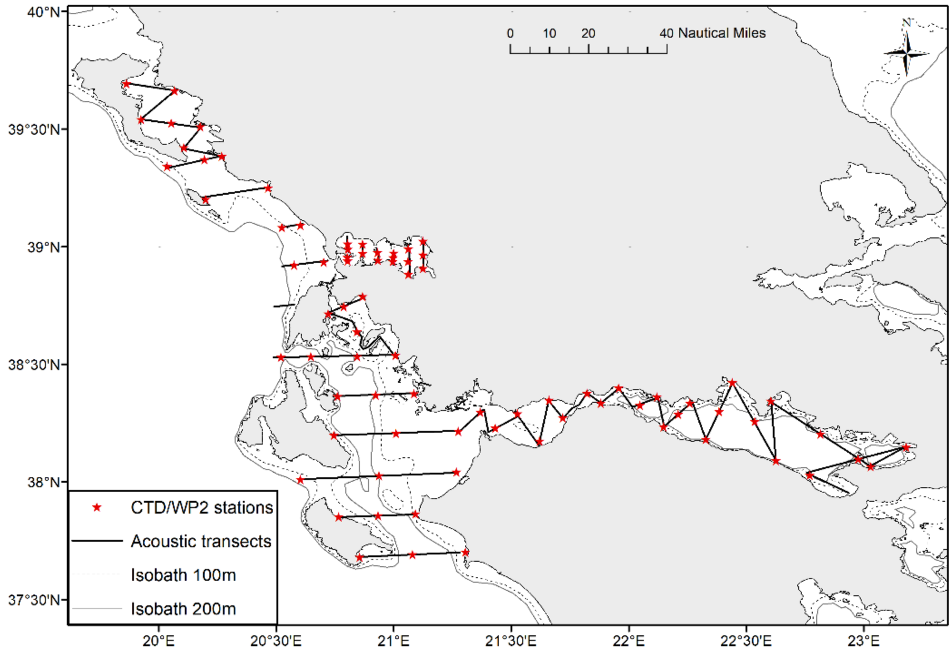


Figure 2.7.2. Acoustic transects sampled in the MEDIAS of the Hellenic part of eastern Ionian Sea (GSA 20) in September 2022. The position of CTD stations and WP2 stations sampled are also shown.

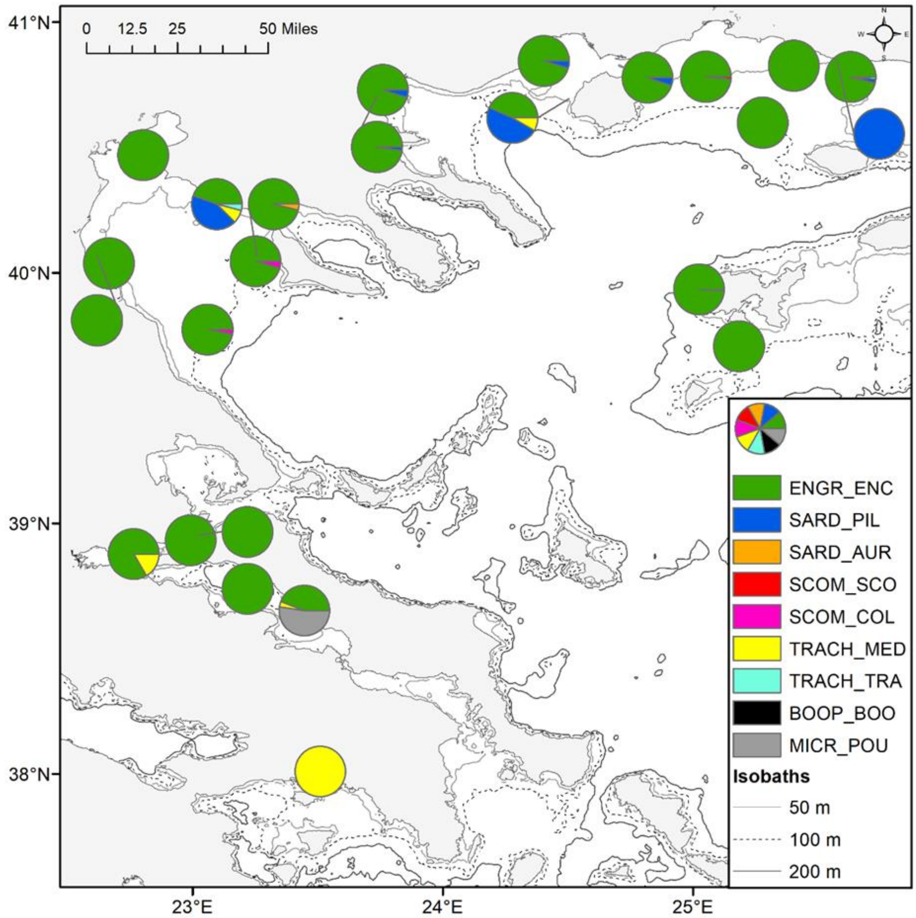


Figure 2.7.3. The catch compositions of the hauls (species kg/haul) weighted per hauling hour in northern Aegean Sea (GSA 22) during June-July 2022.

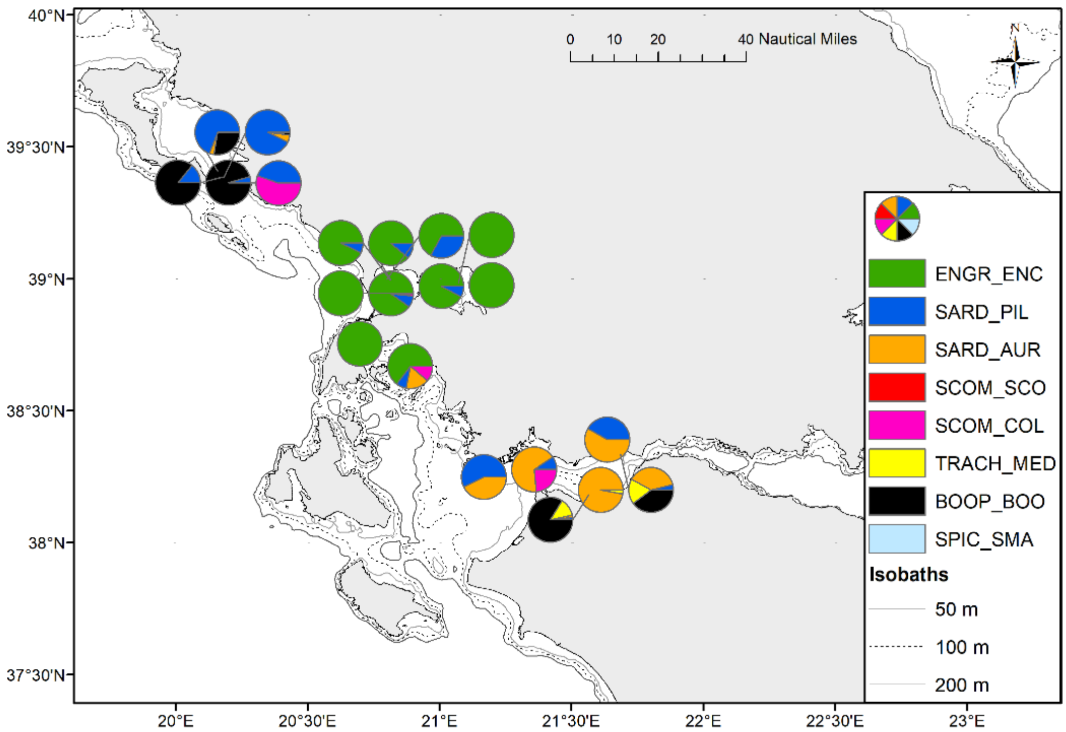


Figure 2.7.4. The catch compositions of the hauls (species kg/haul) weighted per hauling hour in eastern Ionian Sea (GSA 20) during September 2022.

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 2.7.2. The historical trend of anchovy and sardine in GSAs 22 and 20 are shown in figure 2.7.5 and figure 2.7.6.

Table 2.7.2. Estimates of biomass and CV for sardine and anchovy in GSAs 20 and 22 in 2022.

	GSA 22		GSA 20	
	Biomass (t)	**CV**	**Biomass (t)**	**CV**
Anchovy	88887	11%	37578	15%
Sardine	11985	25%	7285	25%

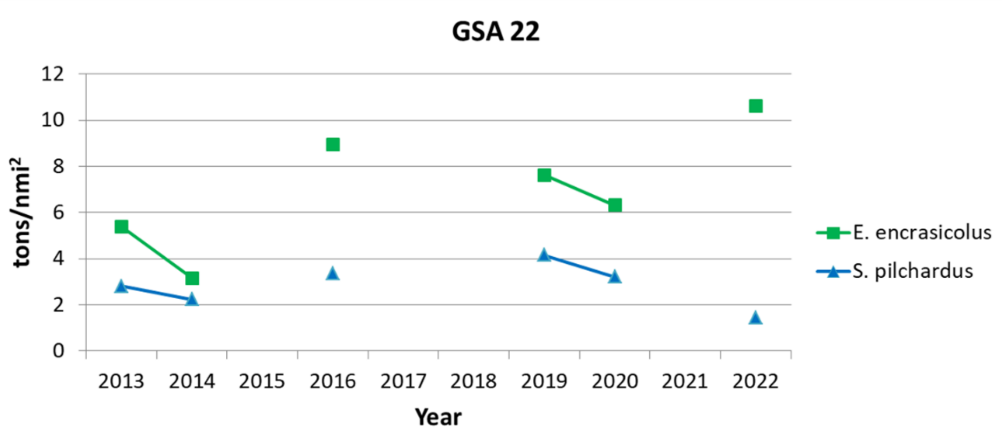


Figure 2.7.5. Historical trends in GSA 22 (northern Aegean Sea) in 2022.

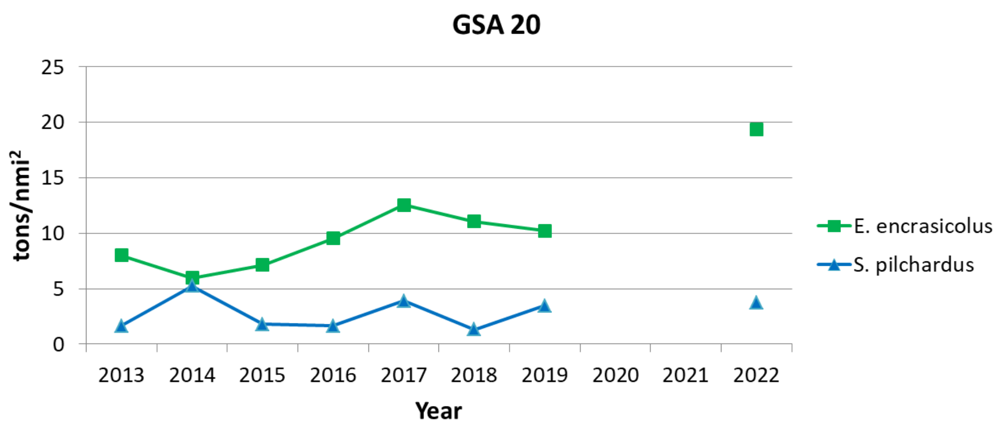


Figure 2.7.6. Historical trends in GSA 20 (eastern Ionian Sea) in 2022.

Biomass per length class for the two species are shown in figures 2.7.7 and 2.7.8 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. 2.7.9 and 2.7.10). Subsequently, biomass per age class for the two species are shown in figures 2.7.11 and 2.7.12 for GSA 22 and GSA 20, respectively.

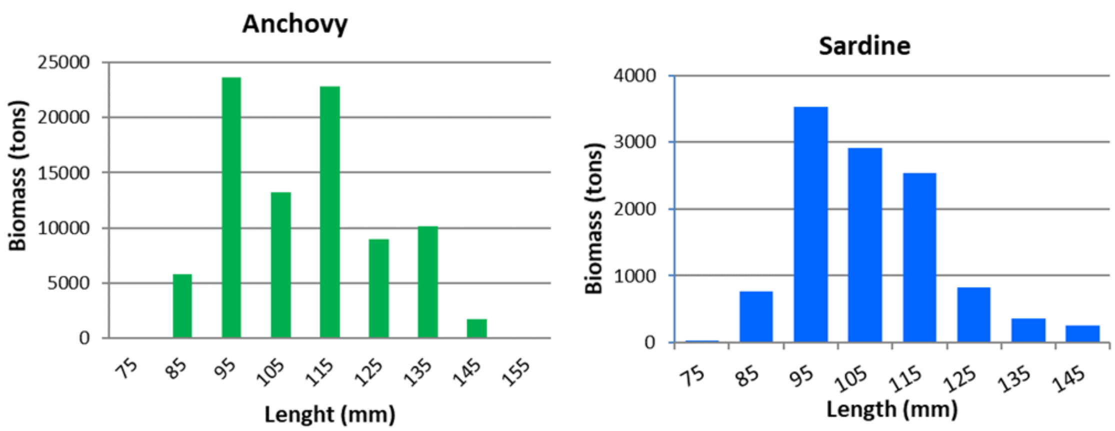


Figure 2.7.7. The anchovy and sardine biomasses (in tons) per length class in northern Aegean Sea (GSA 22) during June-July 2022.

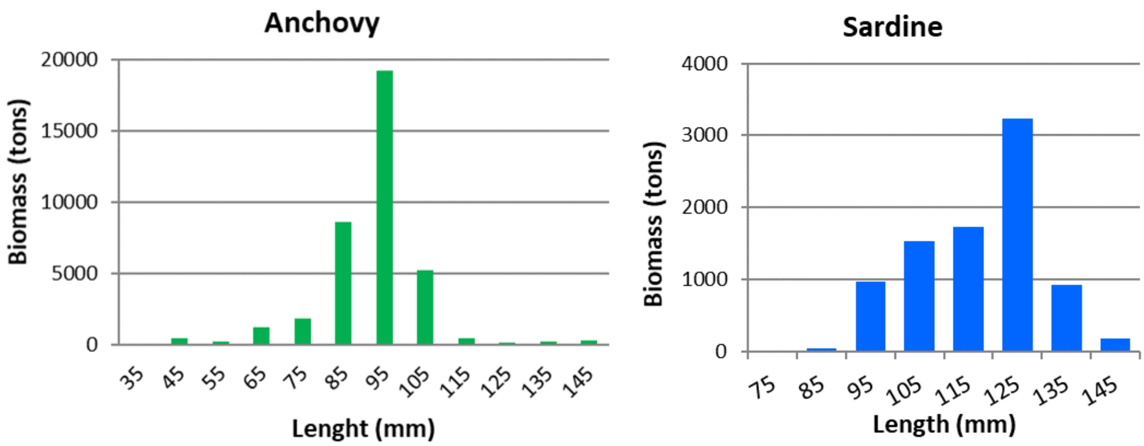


Figure 2.7.8. The anchovy and sardine biomasses (in tons) per length class in eastern Ionian Sea (GSA 20) during September 2022.

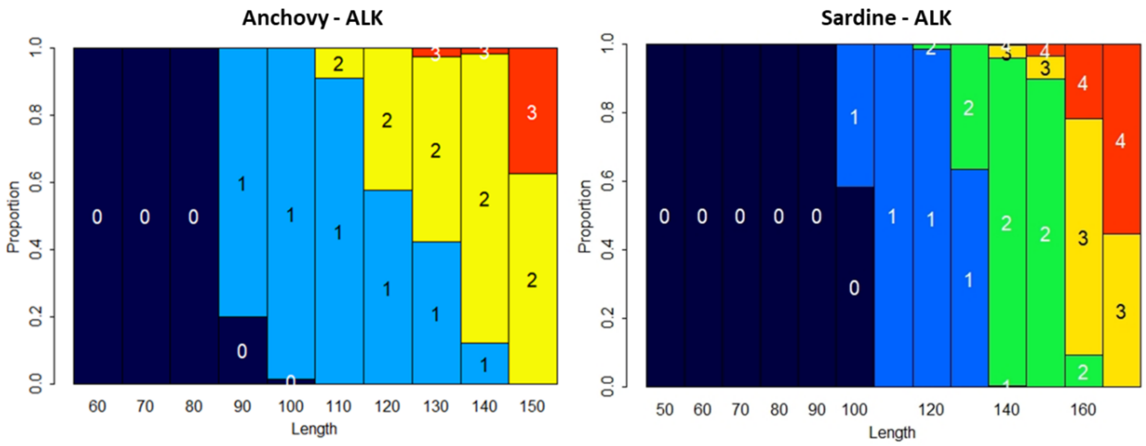


Figure 2.7.9. Age-length key assessed for anchovy and sardine in GSA 22 during June-July 2022.

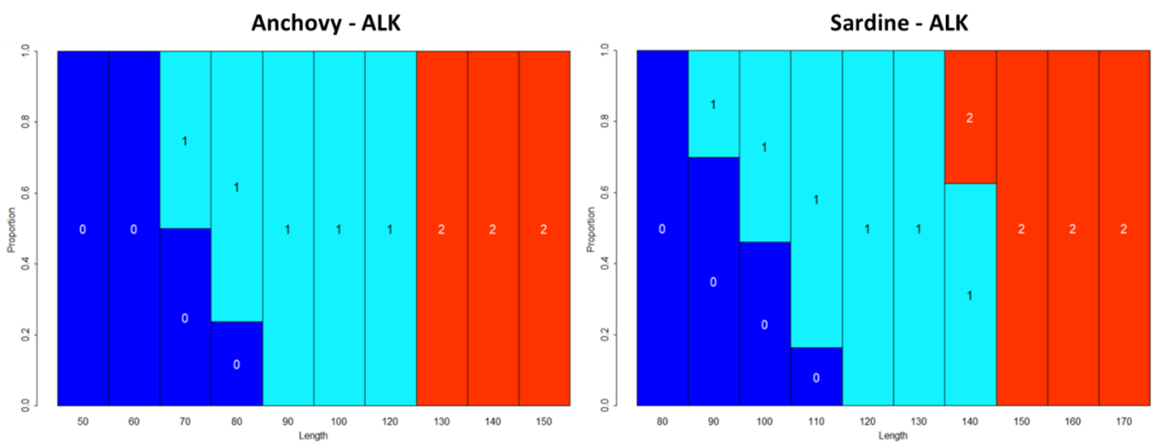


Figure 2.7.10. Age-length key assessed for anchovy and sardine in GSA 20 during September 2022.

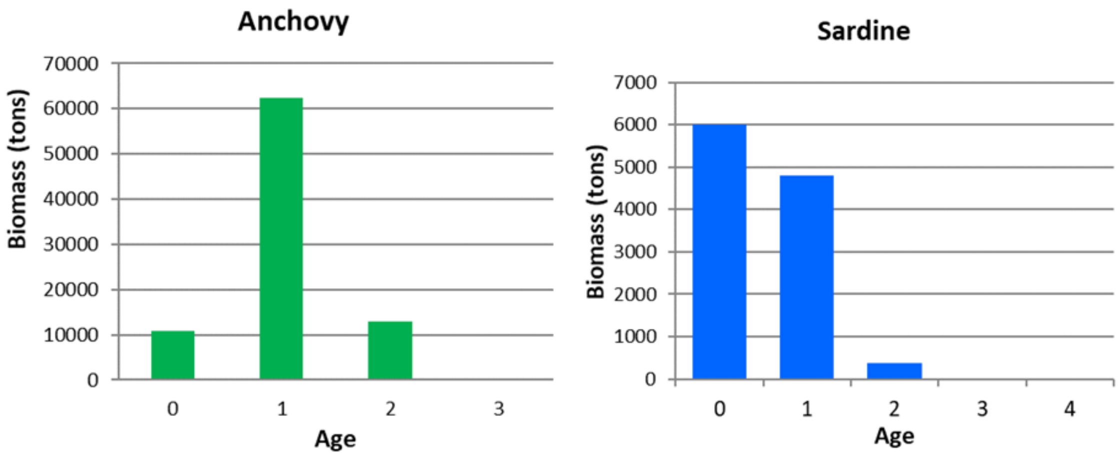


Figure 2.7.11. Anchovy and sardine biomasses (in tons) per age class in northern Aegean Sea (GSA 22) during June-July 2022.

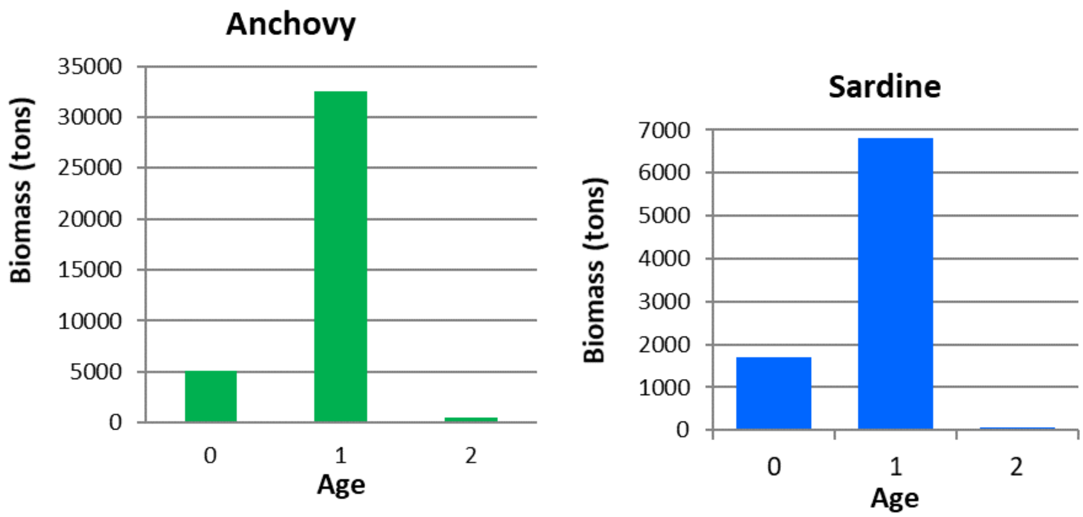


Figure 2.7.12. Anchovy and sardine biomasses (in tons) per age class in eastern Ionian Sea (GSA 20) during September 2022.

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 figures 2.7.13 - 2.7.20. The spatial distribution of total fish NASC (m^2/nm^2) is given in figures 2.7.21 and 2.7.22.

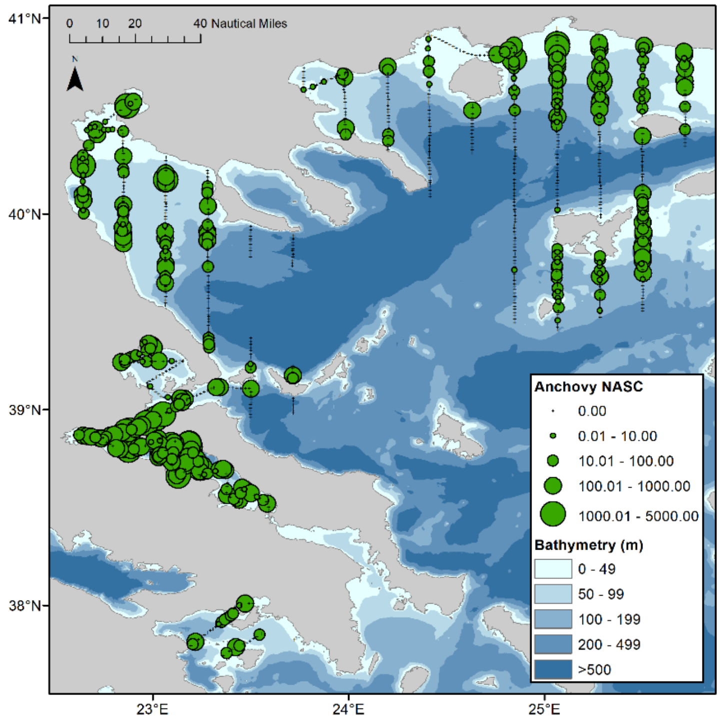


Figure 2.7.13. The distribution of anchovy NASC (m^2/nm^2) per EDSU in northern Aegean Sea (GSA 22) during June-July 2022.

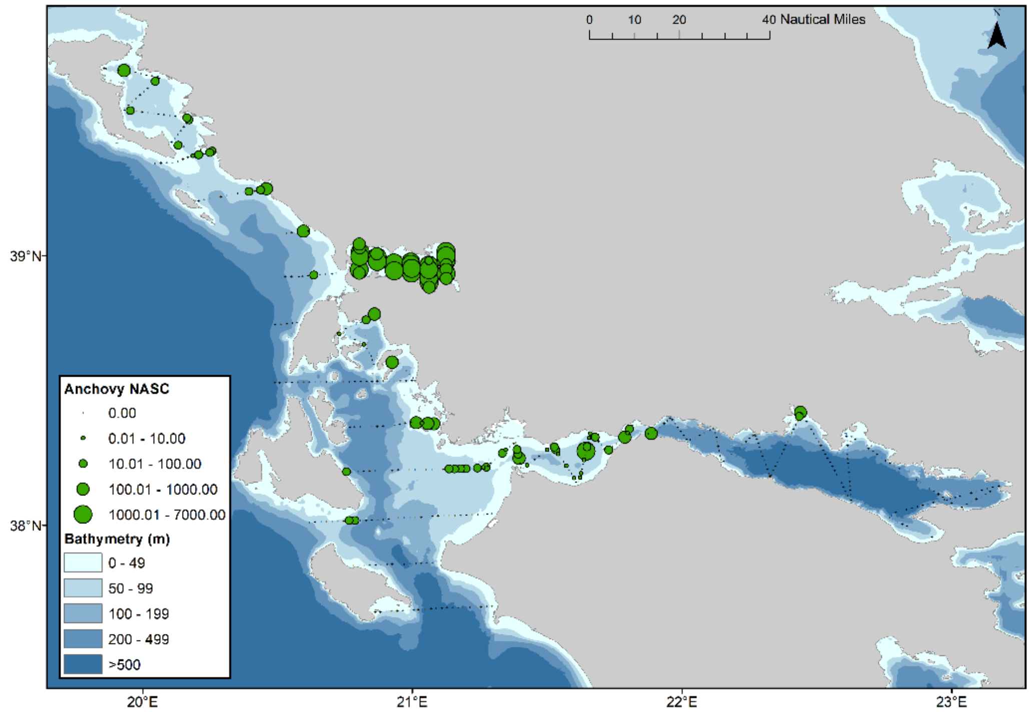


Figure 2.7.14. The distribution of anchovy NASC (m^2/nm^2) per EDSU in eastern Ionian Sea (GSA 20) during September 2022.

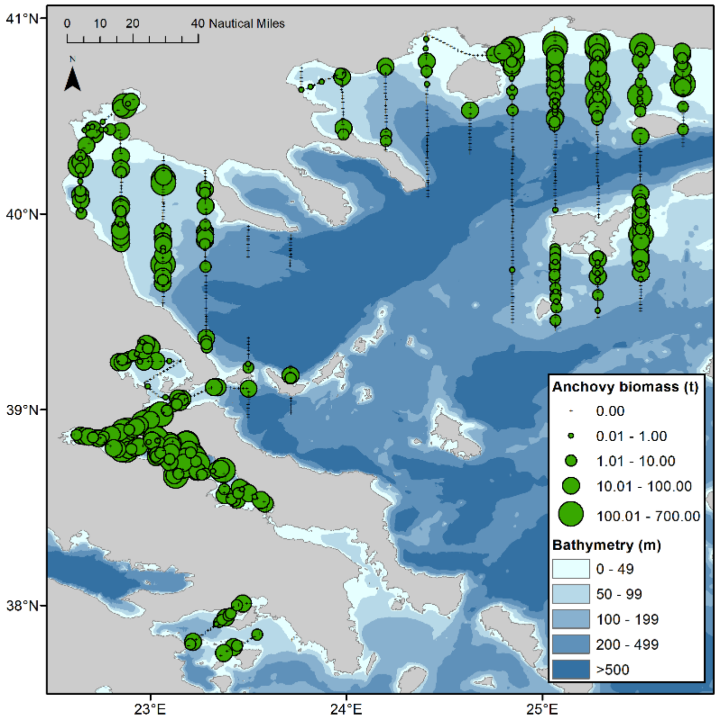


Figure 2.7.15. The distribution of anchovy biomass (t) per EDSU in northern Aegean Sea (GSA 22) during June-July 2022.

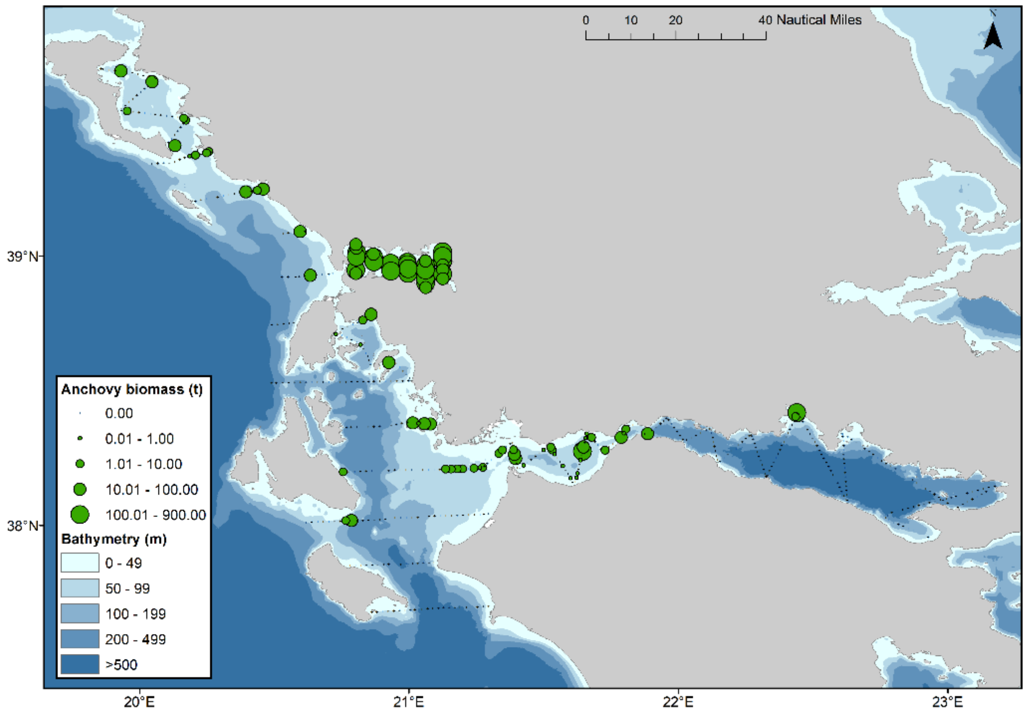


Figure 2.7.16. The distribution of anchovy biomass (t) per EDSU in eastern Ionian Sea (GSA 20) during September 2022.

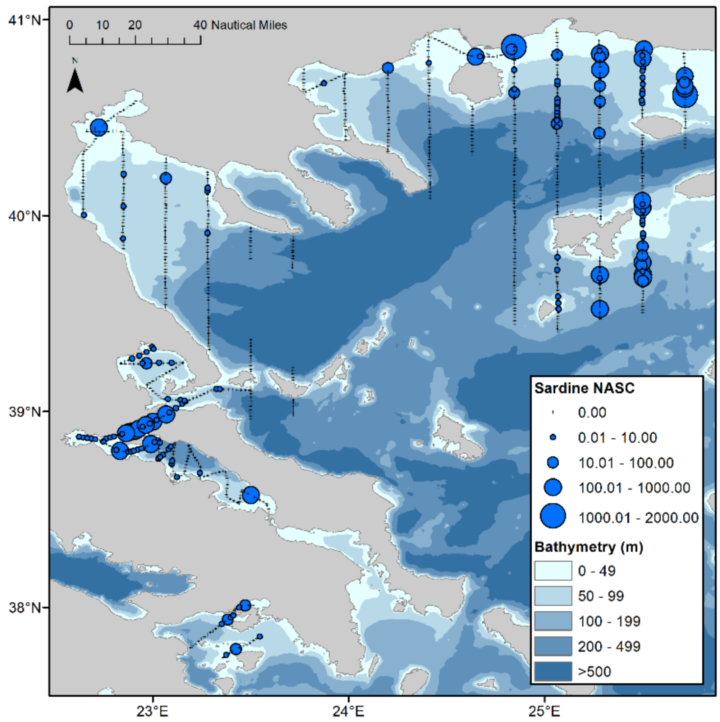


Figure 2.7.17. The distribution of sardine NASC (m^2/nm^2) per EDSU in northern Aegean Sea (GSA 22) during June-July 2022.

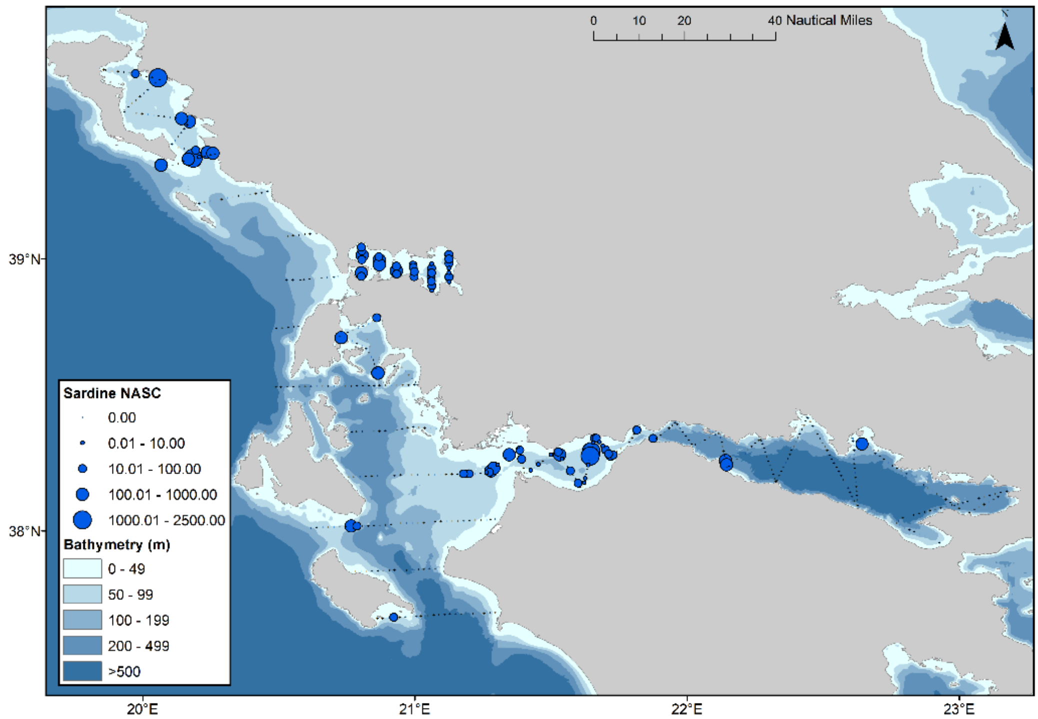


Figure 2.7.18. The distribution of sardine NASC (m^2/nm^2) per EDSU in eastern Ionian Sea (GSA 20) during September 2022.

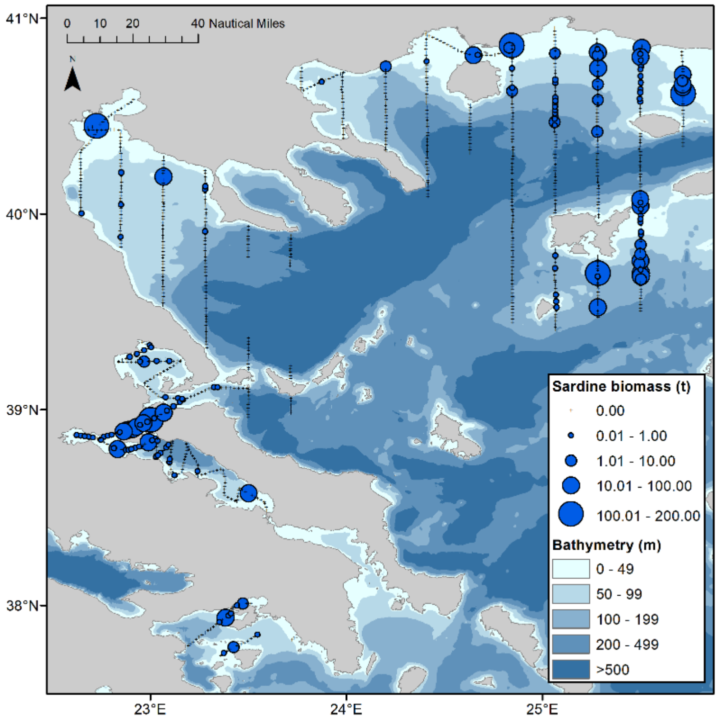


Figure 2.7.19. The distribution of sardine biomass (t) per EDSU in northern Aegean Sea (GSA 22) during June-July 2022.

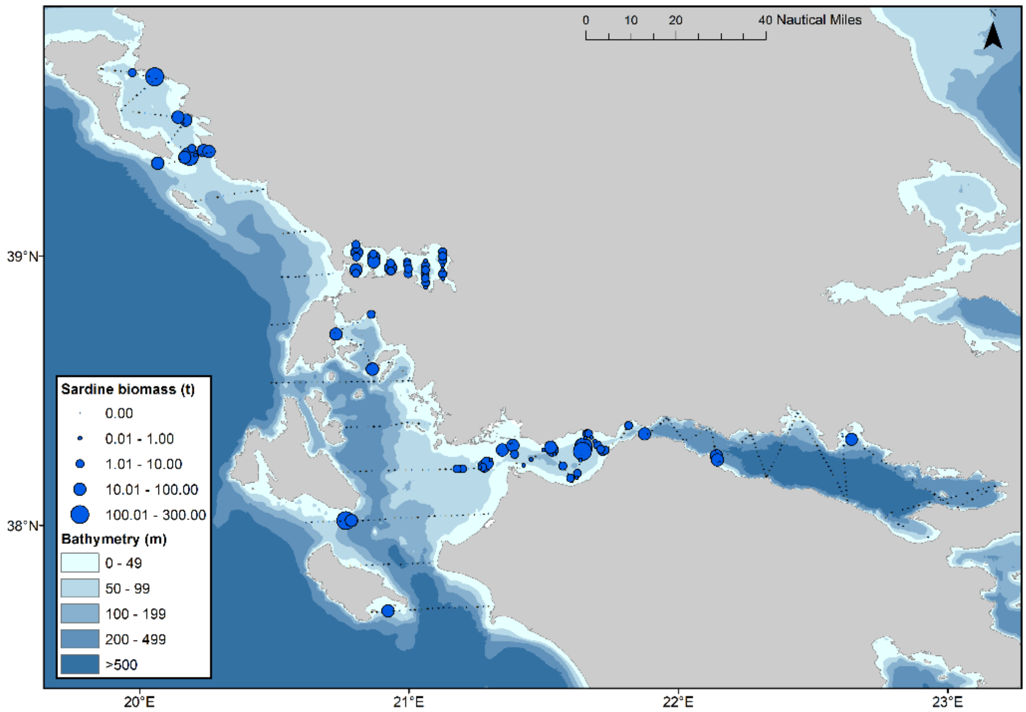


Figure 2.7.20. The distribution of sardine biomass (t) per EDSU in eastern Ionian Sea (GSA 20) during September 2022.

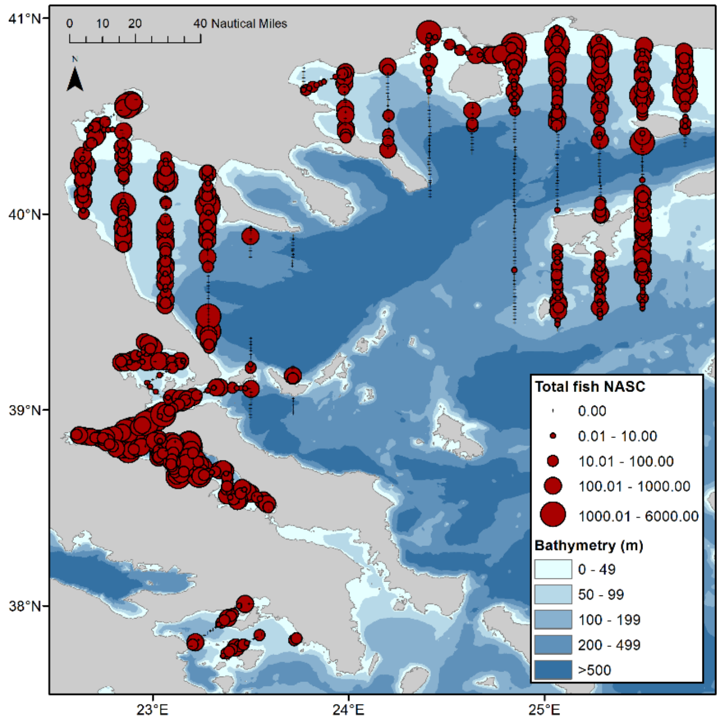


Figure 2.7.21. The distribution of total fish NASC (m^2/nm^2) per EDSU in northern Aegean Sea (GSA 22) during June-July 2022.

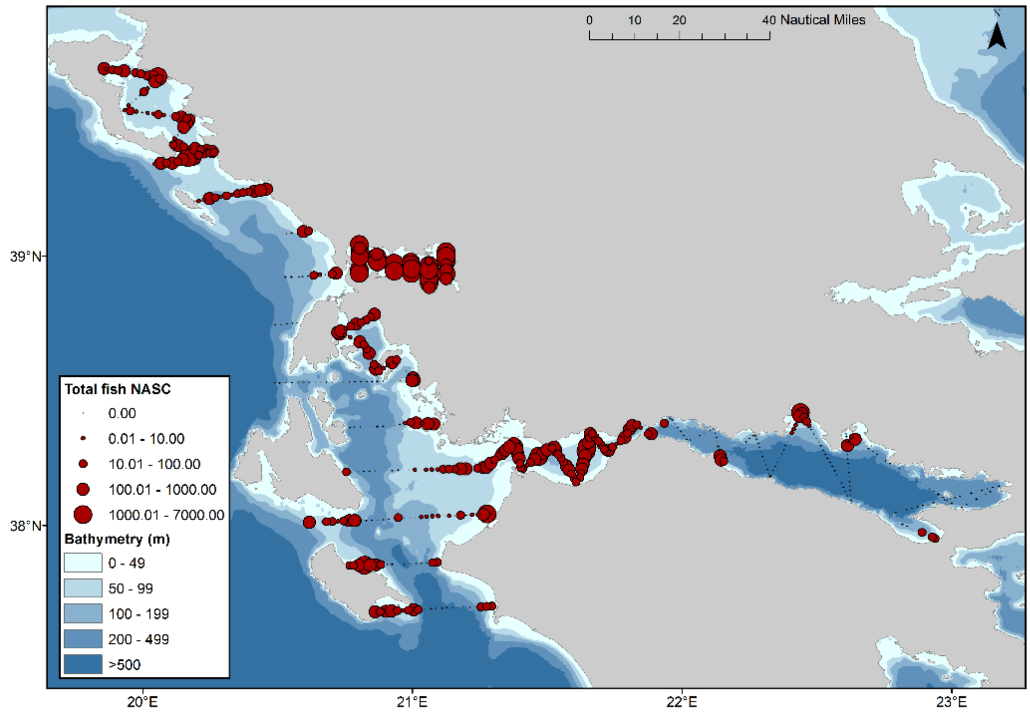


Figure 2.7.22. The distribution of total fish NASC (m^2/nm^2) per EDSU in eastern Ionian Sea (GSA 20) during September 2022.

3. Results of pelagic trawl surveys in the Black Sea (GSA 29) in 2022

3.1.MEDIAS 2022 in the GSA 29 - Black Sea (George Tiganov, Madalina Galatchi & Grigore Antipa, NIMRD)

a) General information on the survey

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

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;

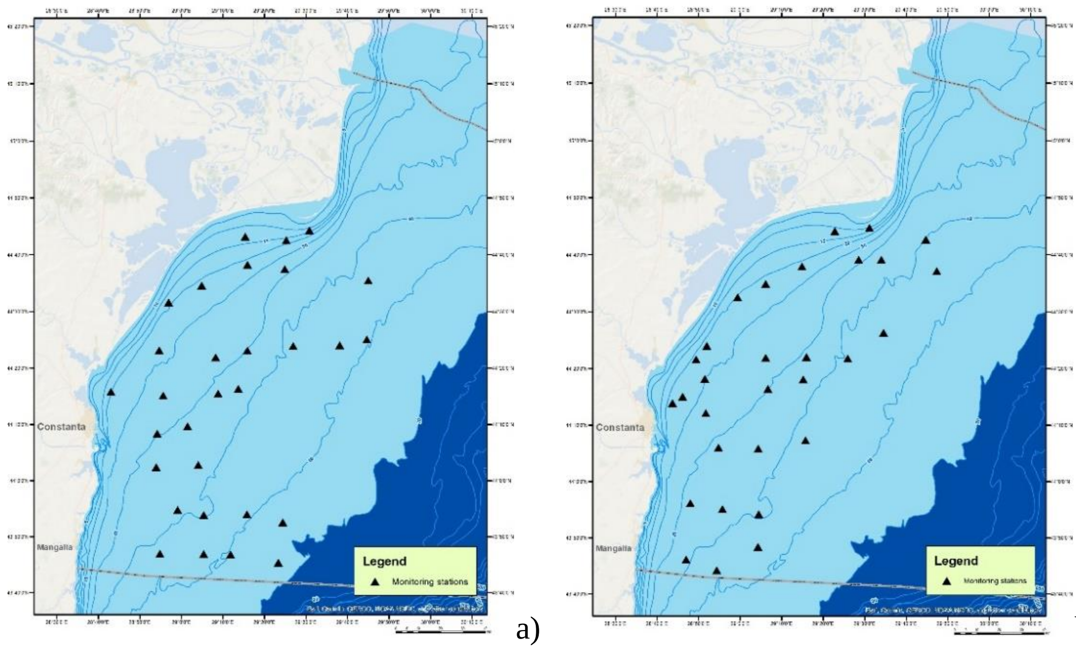
- Describing the demographic structure of species of interest to the fishery, together with spatial distribution patterns;

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

- Assessing the impact of fishing activity on the environment.

b) Survey design

To establish the abundance of the reference species in front of the Romanian coast a standard methodology for stratified sampling was used (Gulland, 1966;). To address the research objectives the region was divided into four strata according to depth – Stratum 1 (15 - 35 m) Stratum 2 (35 - 50 m), Stratum 3 (50 - 75 m). Each field is a rectangle with sides 10' Lat × 10' Long and area around 125.16 km^2 (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 2022.

c) Fish sampling

Each survey includes 30 mid-water trawl hauls for 8 days.

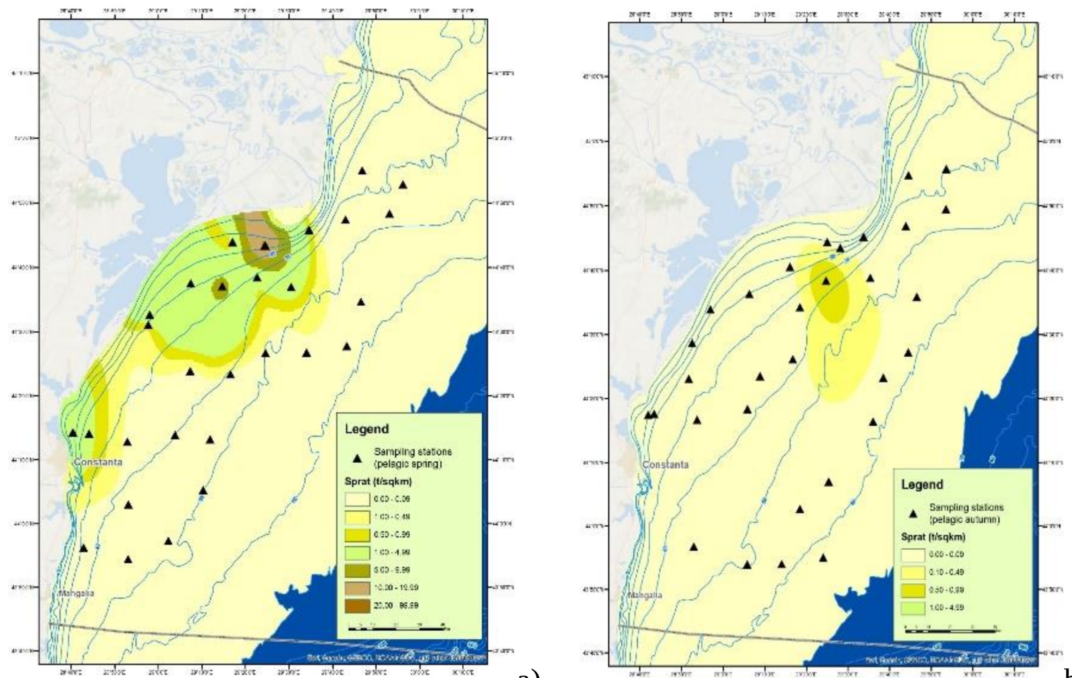
The main aim of the survey is to obtain the abundance index for sprat, whiting and picked dogfish exploited stock. During the surveys the collected information include length (TL), weight, sex composition and maturity. Otoliths for age determination are collected and discards are investigated. The methodology of pelagic survey is available in the following link: https://www.rmri.ro/Home/Downloads/Publications.Other/NAFA_Material%20and%20methods%20for%20survey%20in%20the%20Romanian%20Black%20Sea%20area.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*.

The results obtained are presented as maps and tables comprising data from turbot and sprat surveys, and additional information for the calculation of the catch per unit effort (CPUE/kg/hour) and the catch per unit area (CPUA/kg/km^2) in the swept fields are also provided. Collected data are stored in the NIMRD database, as well as in a module especially developed as a part of the Romanian NAFA (National Agency for Fishing and Aquaculture).

d) Biomass estimations of target species

Pelagic trawl spring surveys: in 2022, the calculated biomasses for the main pelagic fish species at the Romanian coast were: sprat (20,347.06 t; Fig. 3.1.2) and whiting (102.04 t). In the spring season, aggregated biomass of sprat was lower by about 50 % compared with the previous year. Due to the very small catches and the small number of specimens of picked dogfish caught, both in the spring season, the evaluation of the species in pelagic trawls was not performed.



a) b)

Figure 3.1.2. Distribution of sprat biomass in the spring (a) and autumn season (b), pelagic trawl survey, in 2022.

Pelagic trawl autumn surveys: in 2022, the calculated biomasses for the main pelagic fish species at the Romanian coast were: sprat (565.92 t / Fig. 3.1.2) and whiting (466.96 t). In the autumn season of 2022, the biomass of sprat was very low in comparison with the previous year. Due to the catches and the small number of captured dogfish specimens caught, in the autumn season, the assessment of the species in pelagic trawls was not performed.

<u>Pelagic spring survey</u>

Table 3.1.1. Evaluation of sprat biomass in the pelagic trawl survey, in the spring season of 2022 (Sprat / June 2022).

Depth range (m)	*0–30 m*	*30–50 m*	*50-70 m*	*Total*
Investigated area (Km^2)	2200	4050	2500	8750
Variation of the catches (t/Km^2)	0.759-21.984	0.000-1.999	0.000-0.000	0.000-21.984
Average catch (t/ Km^2)	4.732	0.131	0.000	1.621
Biomass of the fishing agglomerations (t)	11608.19	648.53	0.000	12256.72
Biomass extrapolated the Romanian shelf (t)				20347.06

Biomass (tons) and abundance (individuals) of sprat are presented in Fig 3.1.3.

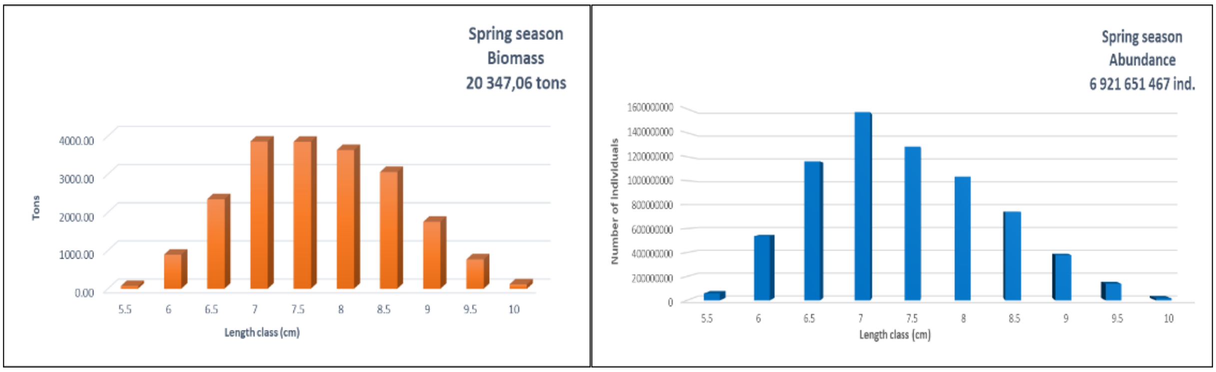


Figure 3.1.3. Sprat length frequency distributions in terms of biomass (left) and abundance (right) during spring pelagic survey.

Structure of biomass and abundance by age distribution are presented in Fig 3.1.4.

Figure 3.1.4. Sprat age structure in terms of biomass (left) and abundance (right) during spring survey.

Pelagic autumn survey

Table 3.1.2. Evaluation of sprat biomass in the pelagic trawl survey, in the autumn season of 2022 (*Sprat / October 2022).*

Depth range (m)	*0–30 m*	*30–50 m*	*50-70 m*	*Total*
Investigated area (Km^2)	1600	3400	3800	8800
Variation of the catches (t/Km^2)	0.000-0.014	0.000-	0.000	0.000-0.999
Average catch (t/ Km^2)	0.001	0.085	0.000	0.029
Biomass of the fishing	3.35	419.00	0.00	422.35
Biomass extrapolated the Romanian shelf (t)				565.92

Biomass (tons) and abundance (individuals) of sprat are presented in Fig 3.1.5.

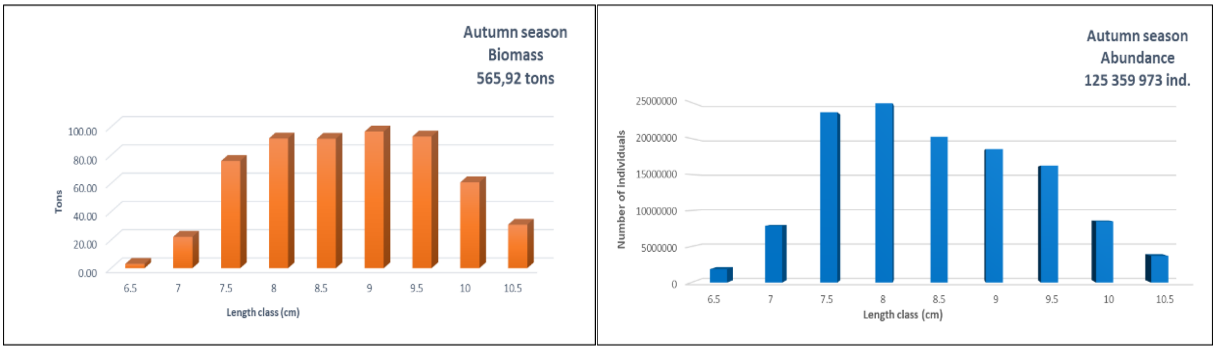


Figure 3.1.5. Sprat length frequency distributions in terms of biomass (left) and abundance (right) during autumn pelagic survey.

Structure of biomass and abundance by age distribution are presented in Fig 3.1.6.

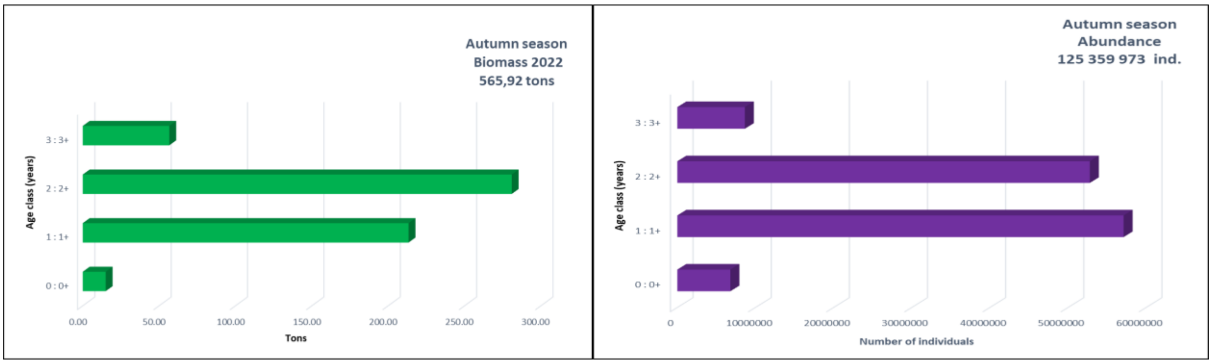


Figure 3.1.6. Sprat age structure in terms of biomass (left) and abundance (right) during autumn survey.

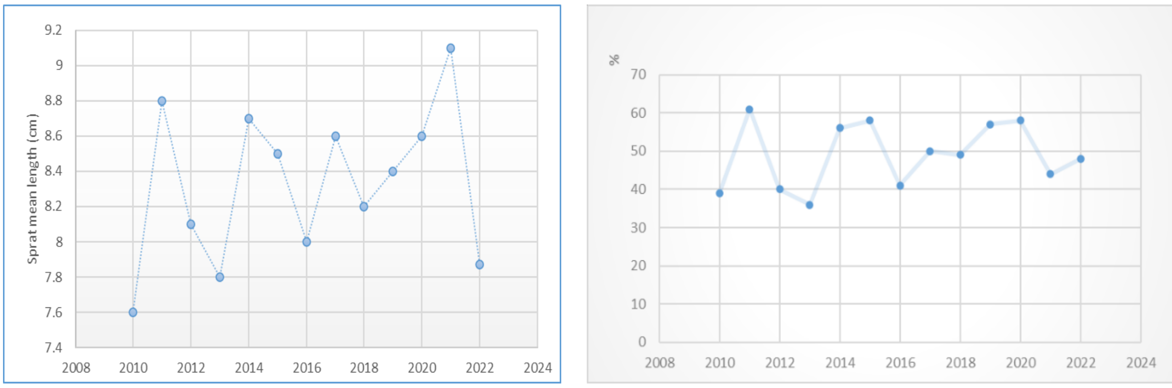


Figure 3.1.7. The average length (left) and percentage (right) of sprat specimens larger than the average size at first sexual maturation in the period 2010 – 2022.

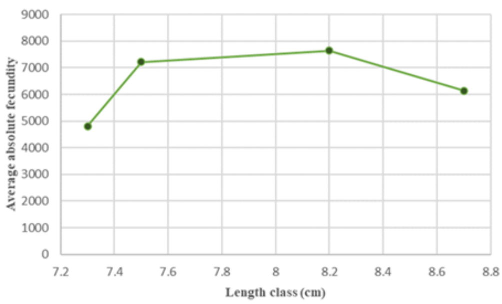


Figure 3.1.8. The average values of absolute fecundity of sprat in 2022.

3.2.MEDIAS 2022 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;

- Assessing the impact of fishing activity on the environment.

b) Survey design

To establish the abundance of the reference 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.

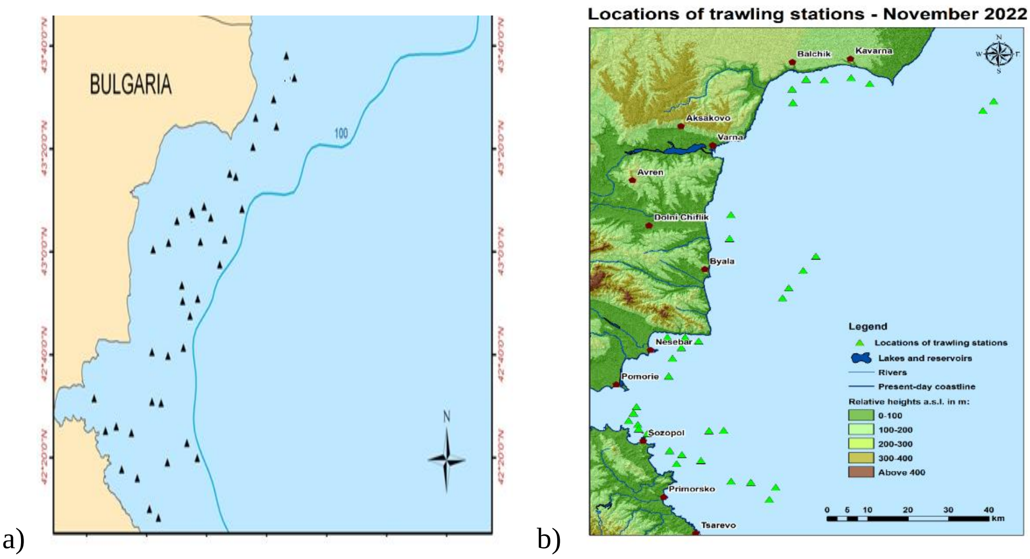


Figure 3.2.1. Pelagic trawl planned distribution points. (a) spring season and (b) autumn season. MEDIAS 2022.

<u>c) Fish sampling</u>

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 wing spread = 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.

<u>d) Biomass estimations of target species</u>

Pelagic trawl spring surveys: in summer 2022

The study area was 8010.24 km^{-2} and the total estimated sprat biomass was 43015 t.

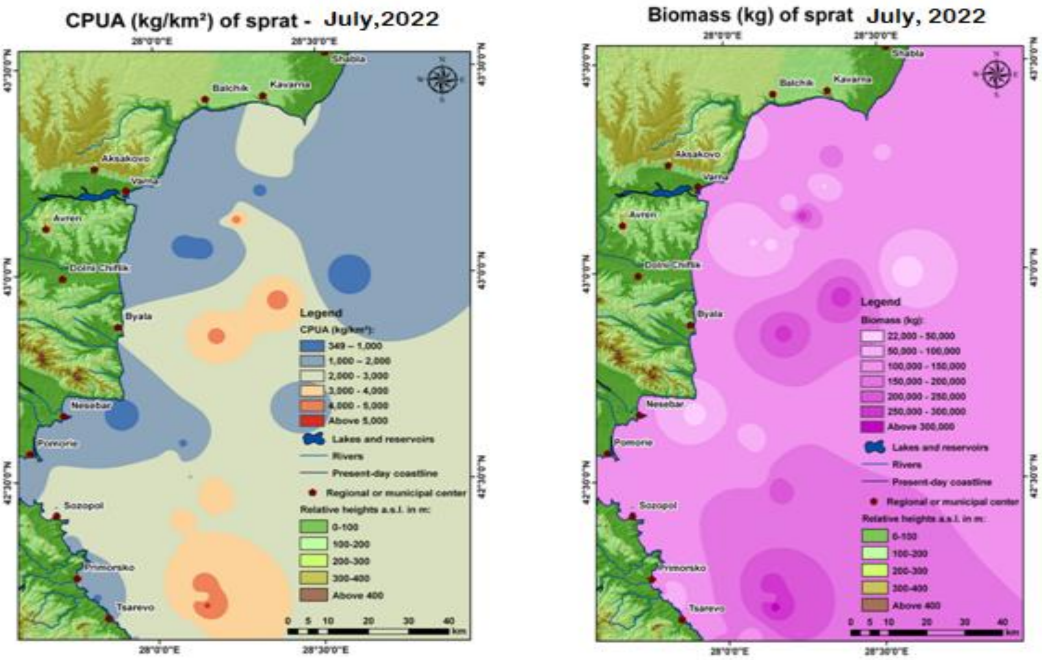


Figure.3.2.2. Sprat abundance and biomass in July 2022.

Table 3.2.1. July 2022, calculated average sprat abundance (CPUA, average), Biomass - weight in kg, Ah-area and number of fields per area

Average CPUA	Depths	Biomass	Surface km^{-2}	No. stations
7646.802049	15-30m	15791.717	2065.14	33
5802.071331	30-50m	10529.715	1814.82	29
4041.918026	50-100m	16694.253	4130.28	66
		43015.685	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 43015 tonnes.

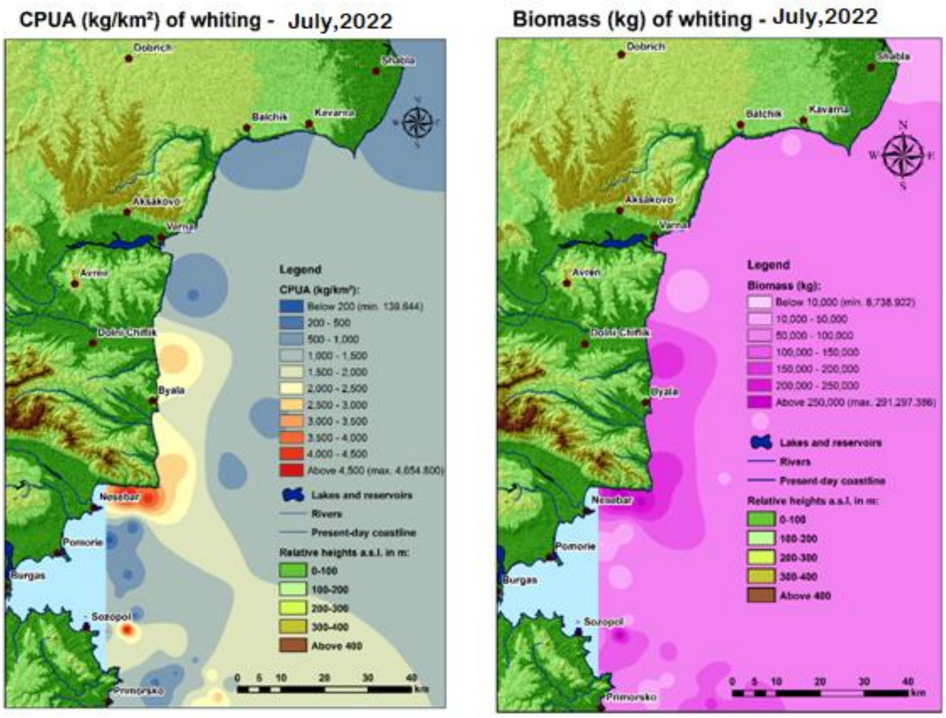


Figure.3.2.3. Whiting abundance and biomass at different depth layers in July 2022.

Table 3.2.2. The Area method in July, 2022 calculated average whiting catch per unit area (CPUA, average), biomass, weight in kg, surface km^{-2} and number of fields per area.

Average CPUA	Depths	Biomass	Surface Km^{-2}	No.stations
1817.958012	15-30	3754.3378	2065.14	33
3546.708703	30-50	6436.6379	1814.82	29
3883.090607	50-75	16038.251	4130.28	66
		26229.227	8010.24	128

The total investigated area was 8010.24 km^{-2}, and the amount of total biomass of whiting 26229.227 tons.

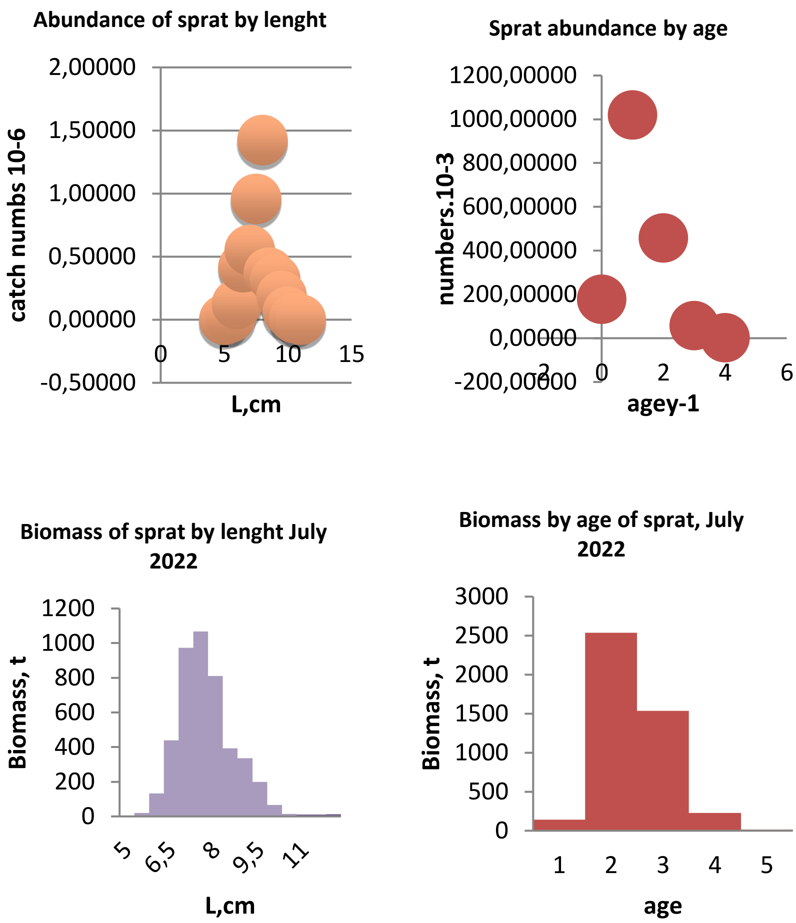


Figure 3.2.4. Biomass and abundance by lenghts and age of sprat, July 2022.

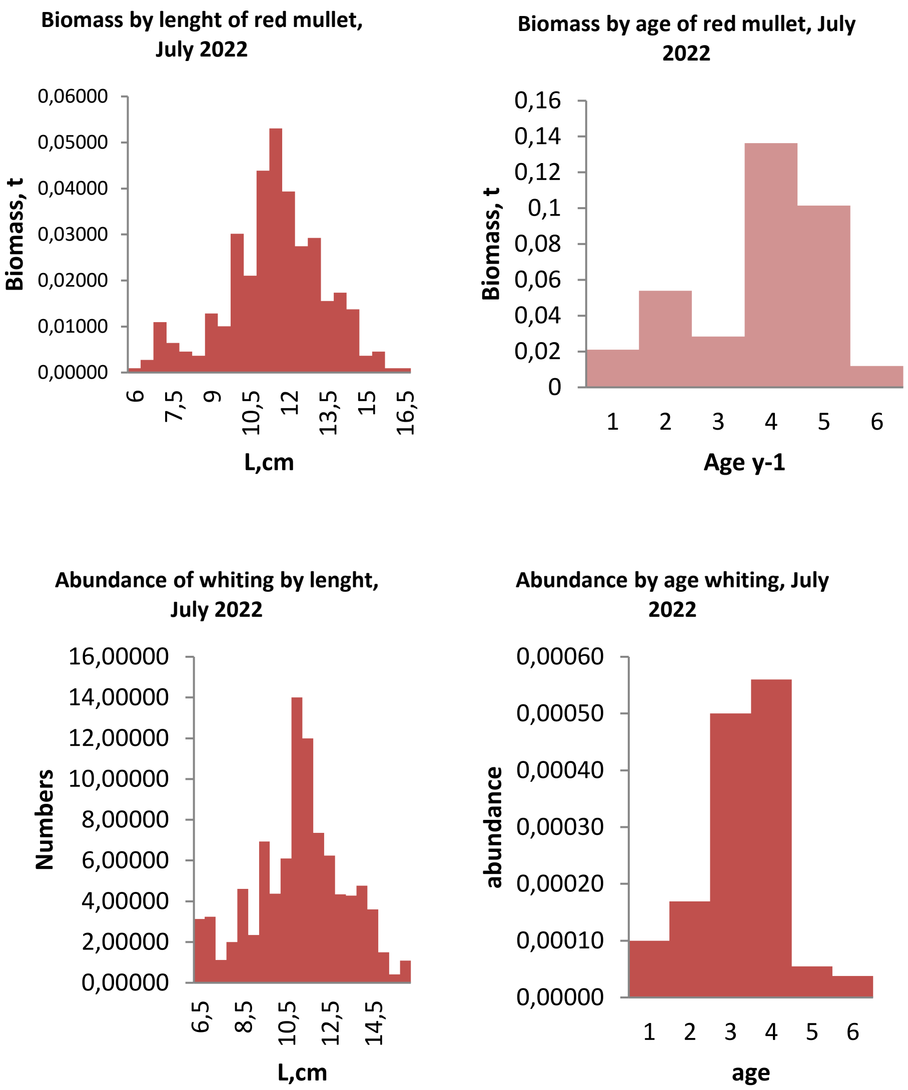
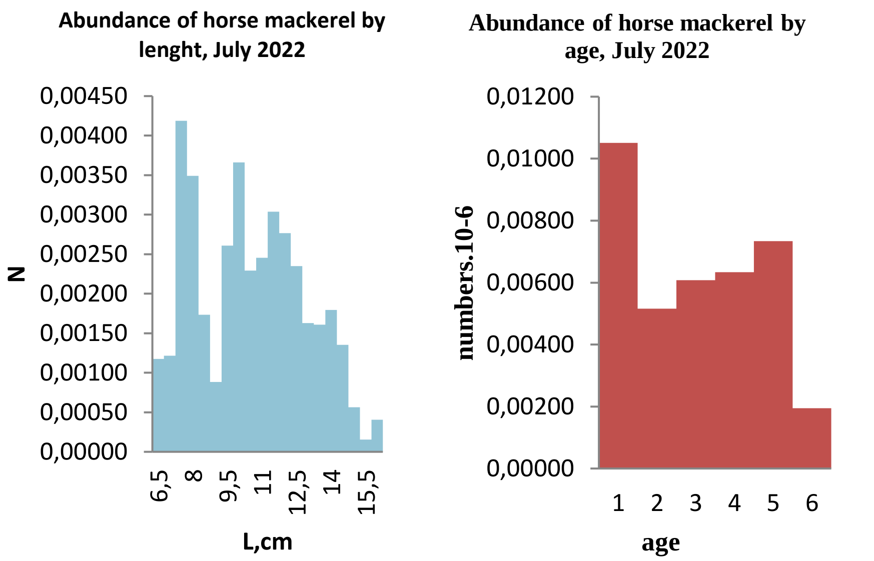


Figure 3.2.5. Biomass and abundance by length and age of red mullet, July 2022.



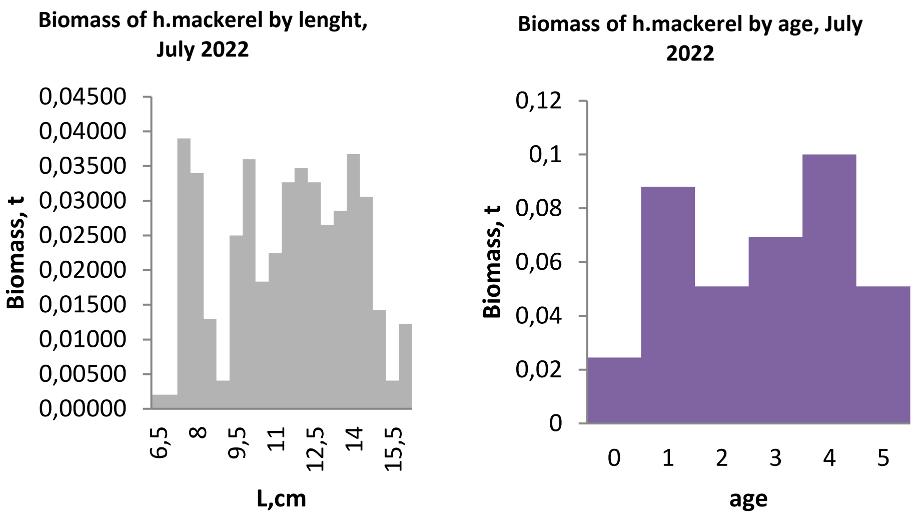


Figure.3.2.6. Biomass and abundance by length and age of horse mackerel, July 2022.

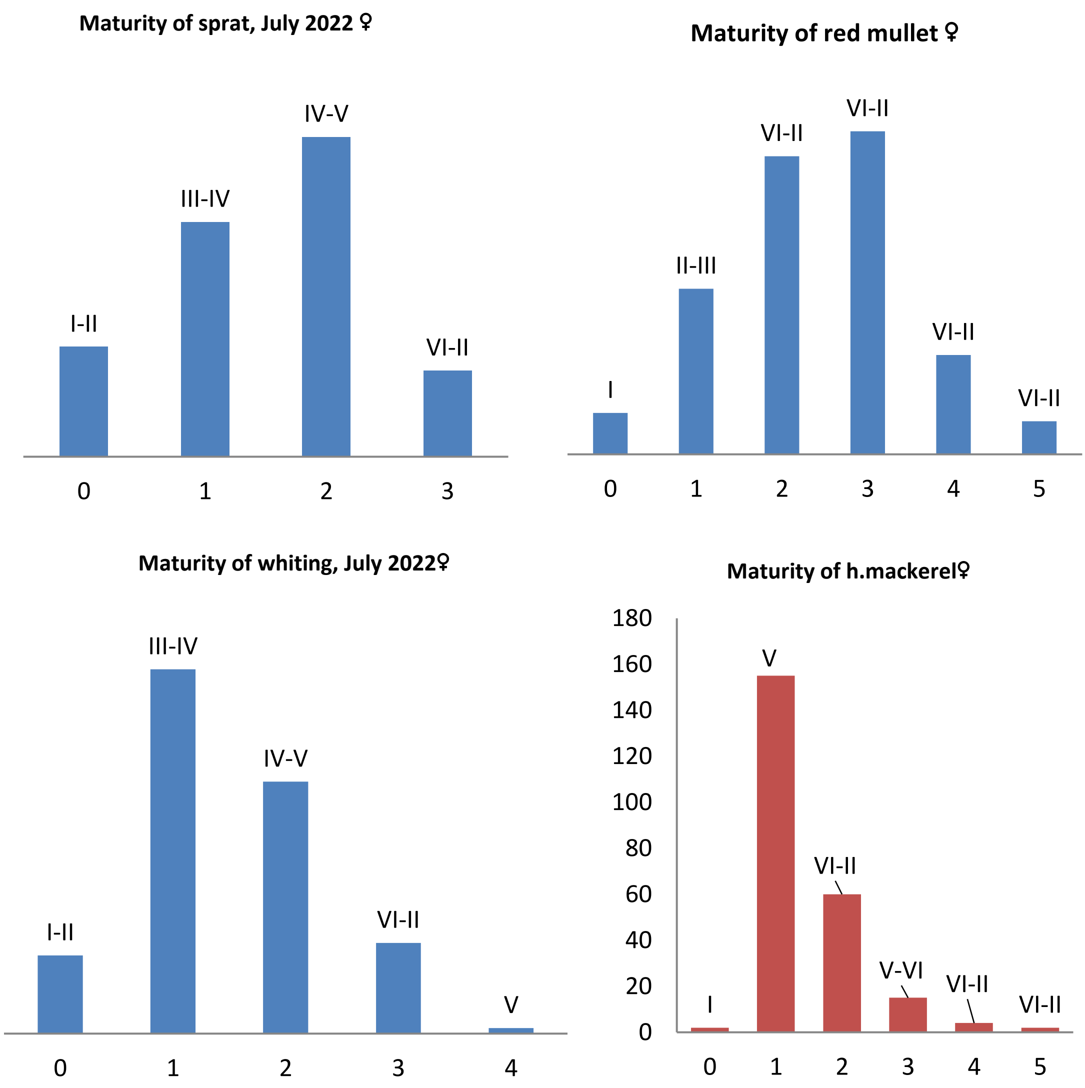


Figure. 3.2.7. Maturity stages of sprat, red mullet, whiting and horse mackerel.

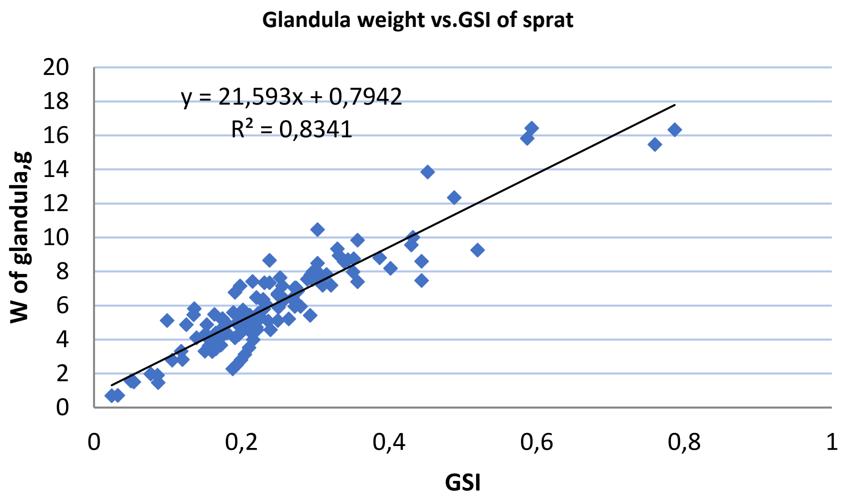


Figure. 3.2.8. Gonado somatic index of sprat, July 2022.

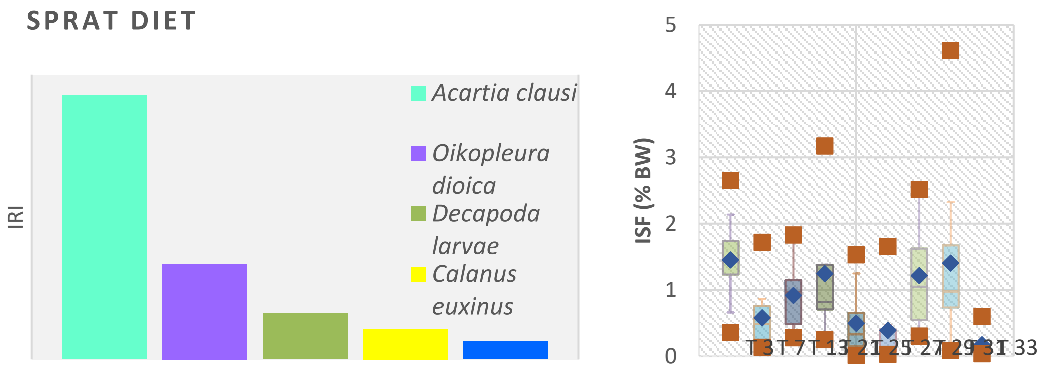


Figure.3.2.9. a) sprat diet b) ISF%.

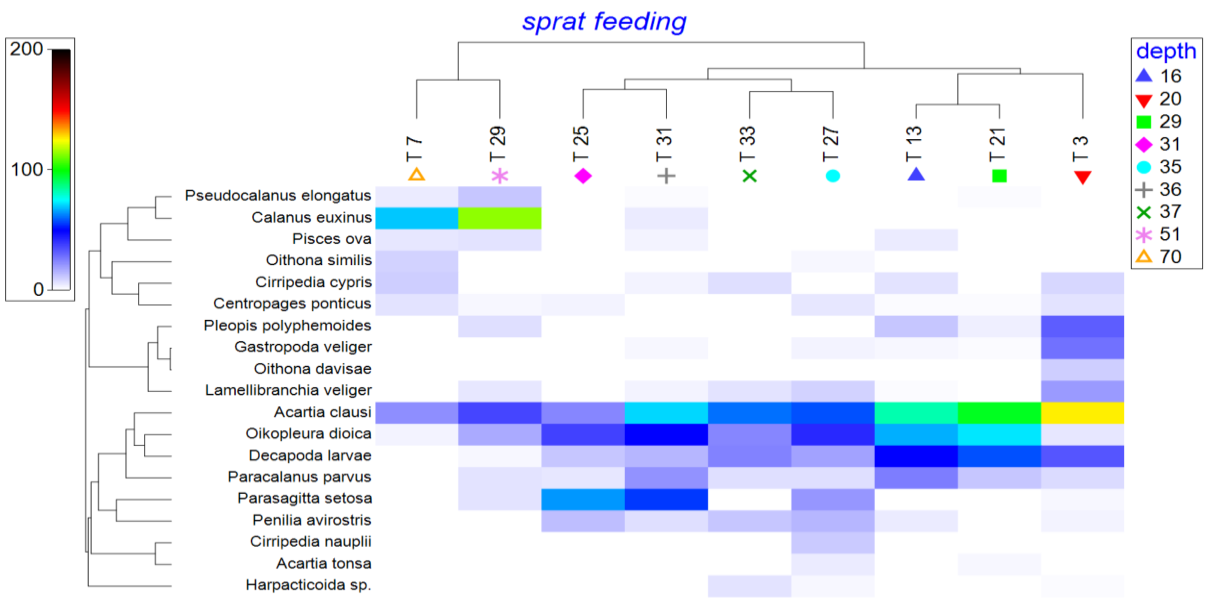


Figure 3.2.10. Grouping of the stations according to the depth of the studied zones and the food composition of sprat (according to the index of relative importance of zooplankton species, IRI).

Pelagic autumn survey

The studied area is 8010.24 km^{-2} and the total estimated red mullet biomass is 8854.217 tonnes.

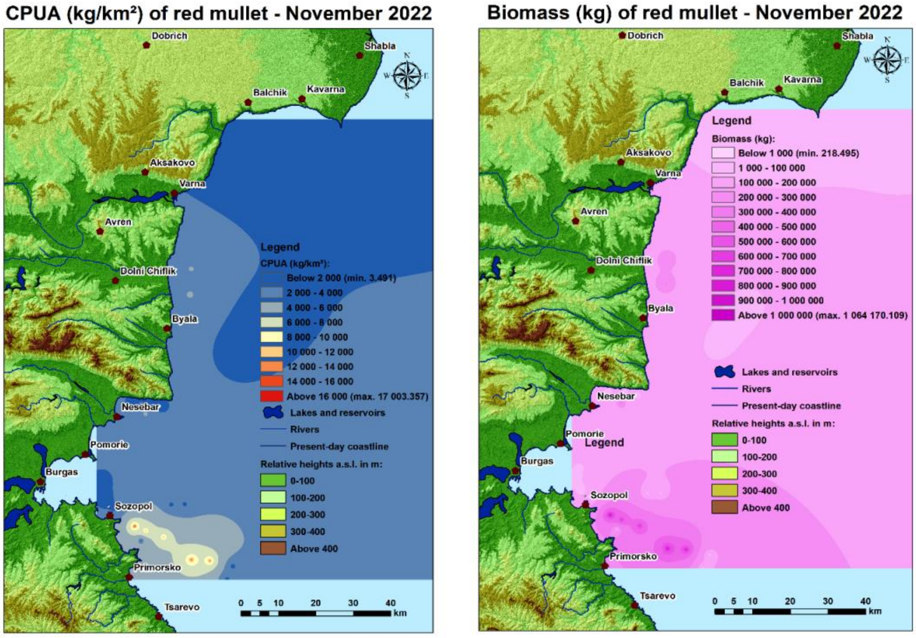


Figure 3.2.11. Abundance and biomass of red mullet, November 2022.

Table 3.2.3. Red mullet biomass estimation in November 2022: mean catch per unit area (CPUA, mean), biomass – in tonnes, area km^{-2} and number of fields per unit area.

Average CPUA	Depth	Biomass	Area km^{-2}	Number of stations
95.5992	15-30	197.4257	2065.14	33
4432.442	30-50	8044,085	1814.82	29
148.345	50-75	408.471	2753.52	66
		8854.217	8010.24	128

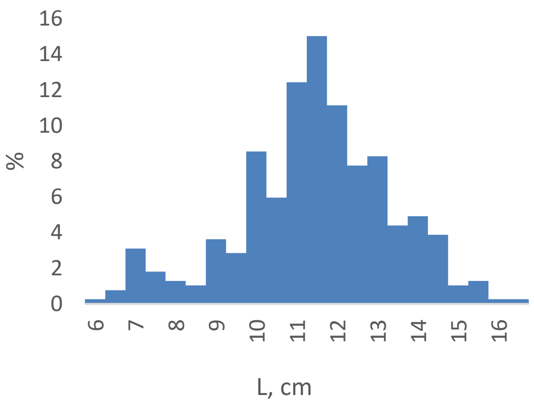


Figure 3.2.12. Length distribution of red mullet, November 2022.

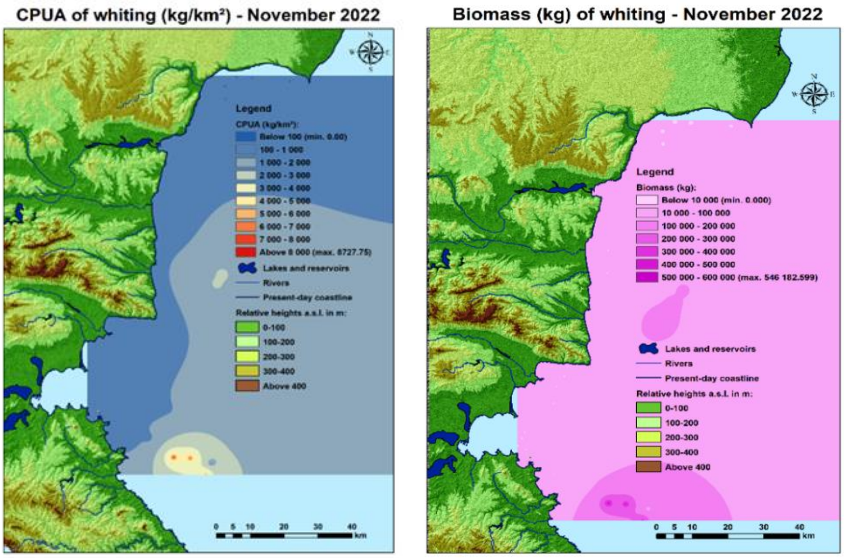


Figure 3.2.13. Abundance and Biomass of whiting, November 2022.

Total investigated area was 8010.24 km^{-2}, total whiting biomass was 5576,516 tonnes.

Table.3.2.4. Biomass and CPUA estimation of whiting, November 2022

average CPUA	Depth	Biomass	Area km^{-2}	№ of stations
1421.565	15-30m	2935.731	2065.14	33
1093.974	30-50m	1985.366	1814.82	29
158.6864	50-100m	655.4191	4130.28	66
		5576.516	8010.24	128

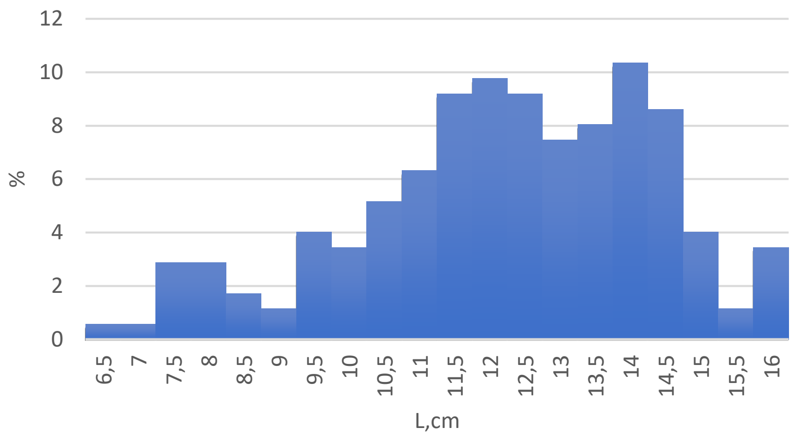


Figure.3.2.14. Length distribution of whiting, November, 2022.

Table 3.2.5. Biomass estimation of horse mackerel, November 2022.

CPUA, average	depth	Biomass	Area Km^{-2}	№ of stations
66.86749	15-30m	138.0907	2065.14	33
583.5653	30-50m	1059.066	1814.82	29
243.6889	50-100m	1006.503	4130.28	66
	15-100m	2203.66	8010.24	128

Total investigated area was 8010.24 km^{-2}, total horse mackerel biomass was 2203.66 tonnes.

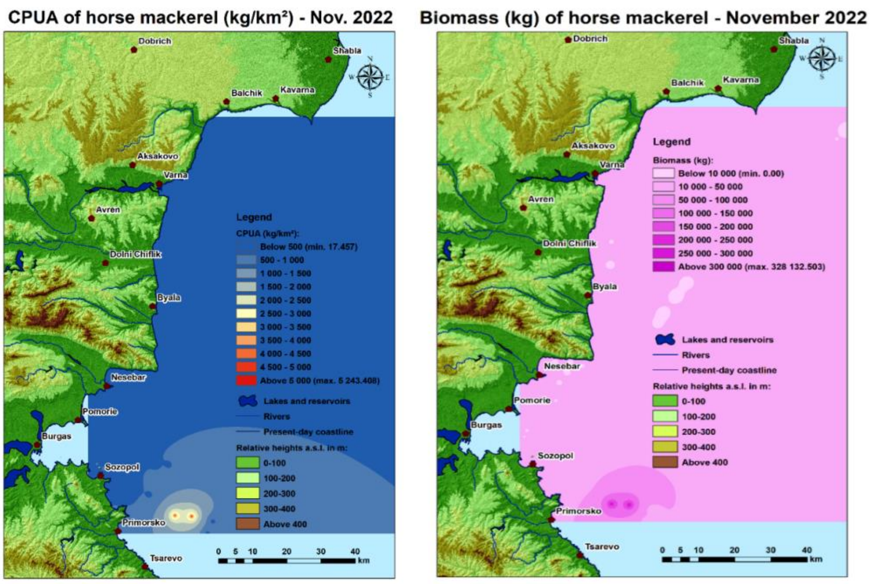


Figure.3.2.15. Abundance and biomass of horse mackerel, November 2022.

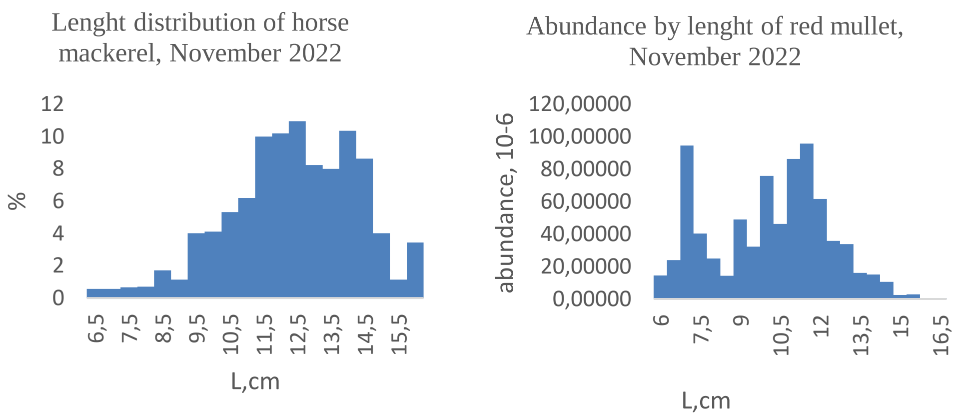


Figure 3.2.16. Length distribution and abundance by length of horse mackerel, November 2022.

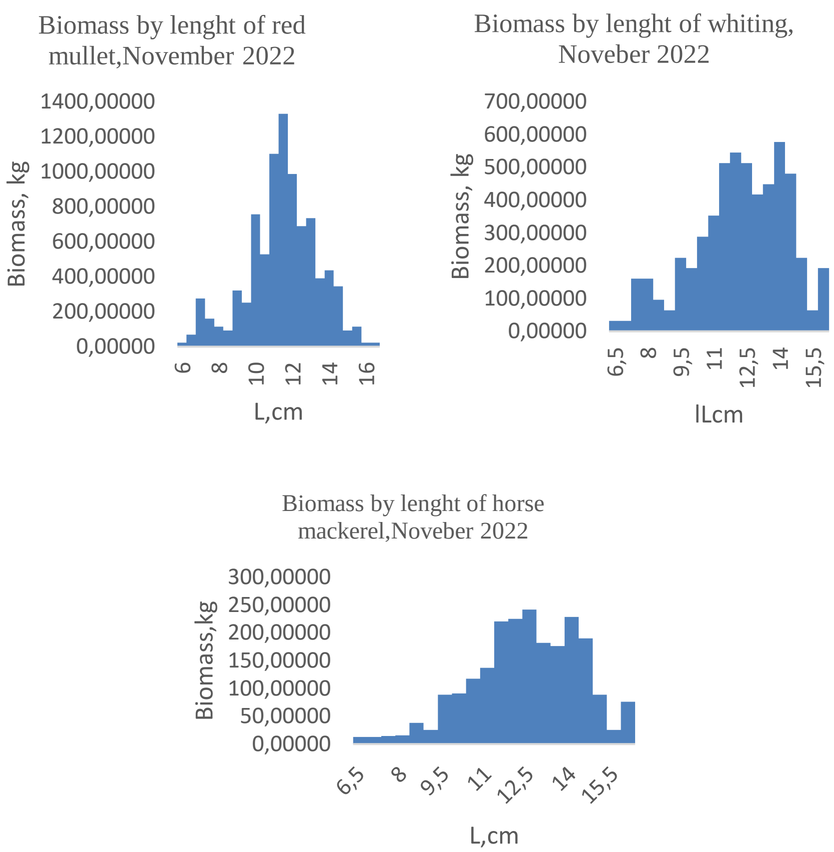


Figure 3.2.17. Biomass by length of red mullet whiting, h.mackerel, November 2022.

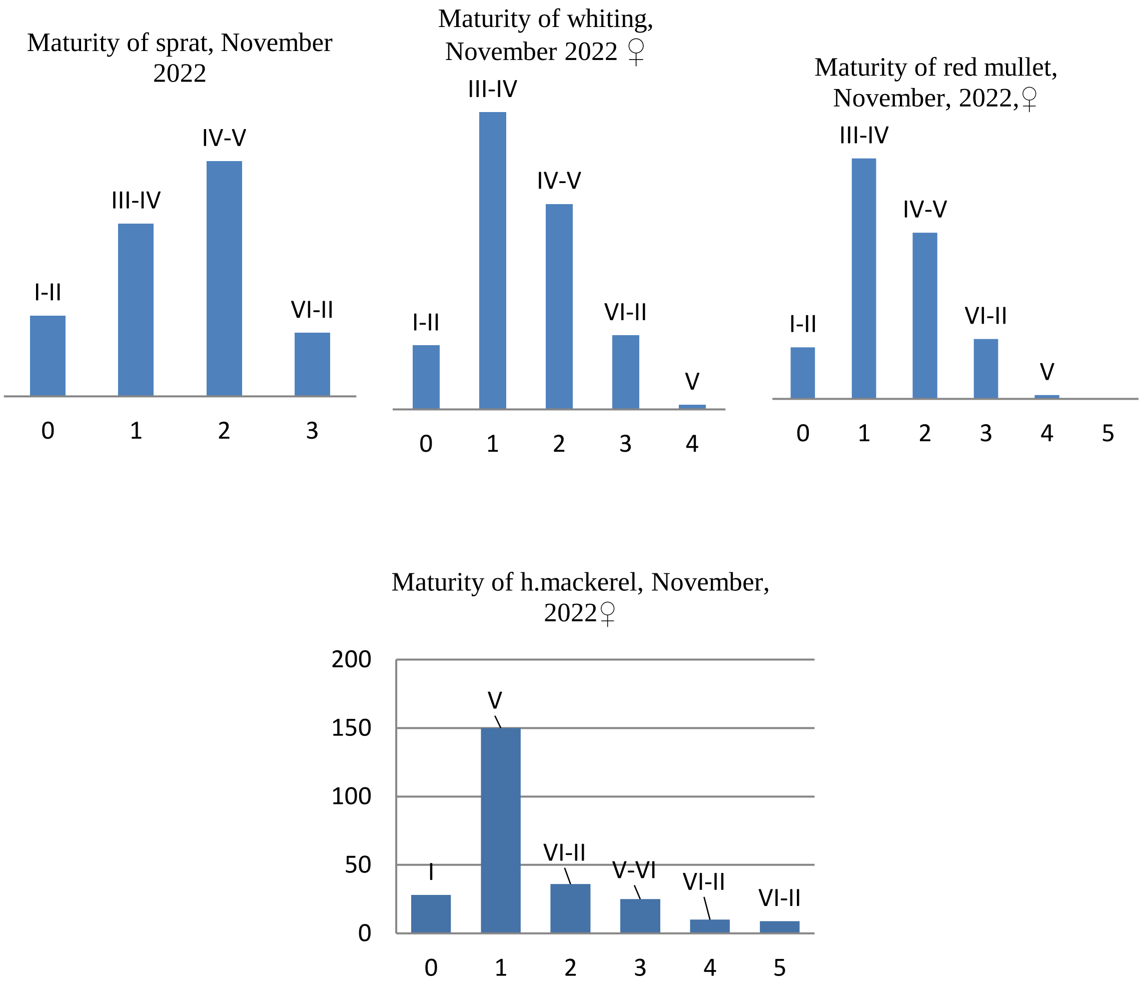


Figure.3.2.18. Maturity of species in November 2022.

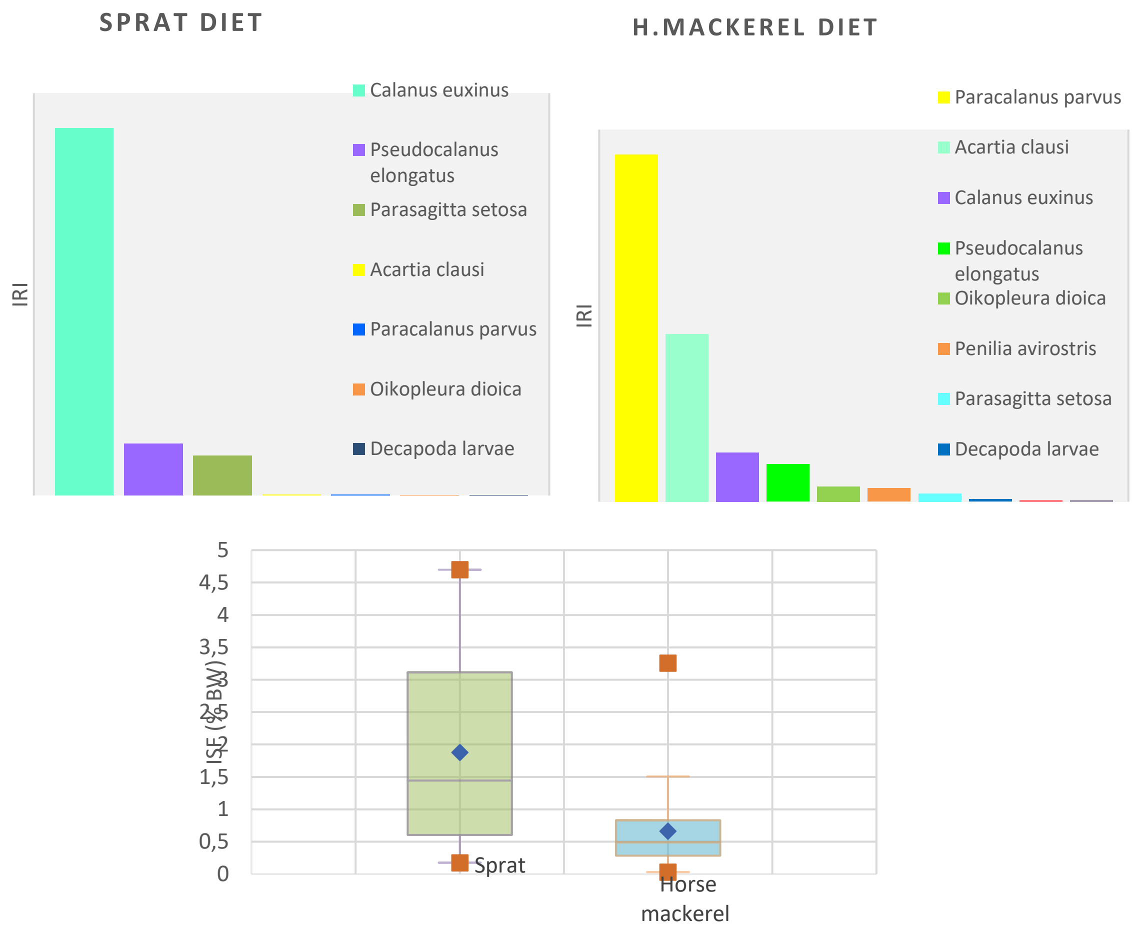


Figure.3.2.19. Sprat and horse mackerel diet and ISF%, November 2022.

4. Communication with DG-MARE

As agreed in previous years, a representative from DG-MARE Unit C3, Venetia Kostopoulou, attended the meeting to ensure regular communication with the MEDIAS steering committee. During her intervention, Venetia Kostopoulou reminded the group about general information regarding the DCF (Data Collection Framework) and its legal context, highlighting the following points:

- Data collection is part of the core functioning of the Common Fisheries Policy (CFP). Reliable and complete data are central to well-functioning fisheries management as they provide the basic information for scientific advice and for the monitoring of the European fisheries sector.

- The Data Collection Framework (DCF) comprises of a basic Regulation and a number of COM Decisions, further specifying the data that Member States have to collect and the format to report their data collection activities (through Work Plans on planning of activities and Annual Reports on implementation). The EU MAP contains the mandatory aspects of data collection, but is not exhaustive. The Member States shall establish multiannual national sampling programmes, which are standardised and in accordance with established quality standards.

- This framework is based on a harmonised approach, allowing at the same time regional specificities, where that is necessary. Member States have the obligation to collect data under the DCF and the EMFAF (European Maritime Fisheries and Aquaculture Fund) provides for the funds to help Member States in this obligation. The purpose of data collected is to be used and to serve the CFP objectives. To fulfil those objectives, end users ask for this data, in order to provide scientific advice for management purposes.

- Regional coordination, achieved mainly through the Regional Coordination Groups (RCGs), is considered one of the big achievements of the DCF. These groups have gained a lot in responsibilities in the new DCF and are involved in all steps of the process from the development of national work plans, through to agreeing on how sampling should be carried out to finally evaluating the quality of the data collected at regional/stock level. Member States of the same sea basin or sharing the same fisheries can established bi- or multi-lateral agreements to share tasks in their collection of data. This can result in considerable savings for all Member States involved, compared to if they had to establish and run individual data collection programmes. Carrying out joint sampling also results in overall cost reduction and avoidance of duplication or excess of data collected. The ultimate goal is for RCGs to develop regional sampling plans. This ensures harmonisation of data collection as well as addressing specificities at regional level.

- Under the current DCF, raw data (primary data: associated with individual vessels, person, samples) on commercial and recreational fisheries, aquaculture and the processing industry are collected by the competent national bodies and stored in national computerised databases. These data are owned by Member States. Member States must make detailed and aggregated data available to end-users to support scientific analysis. Specific rules apply on data sharing and these are outlined in the DCF Regulation.

- The main areas of interest include: (i) the Quality Assurance Framework (QAF), that has been strengthened under the current Work Plans and Annual Reports; (ii) ensuring data availability through better interconnection of IT systems, aiming to reduce workload and costs for Member States, while offering data users the opportunity to use data in the format, at the timing and at the aggregation level they need. MARE/2020/08 regional grant RDBFIS has developed an application for the Med & BS, that will be further developed under a Framework Contract Med & BS study (RDBFIS II); (iii) regional work plans that will allow a harmonised approach at sea basin level for the Member States involved. To this end, MARE/2020/08 regional grants Fish N Co and Streamline drafted test regional work plans for the North Sea basins and Med & BS, respectively; (iv) to make data multi-purpose and reusable, provided that rules on personal data protection are respected. The STECF Plenary 21-02 discussed data availability and 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. 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 and COM fully support 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.

In the discussion that followed, DG-MARE informed the MEDIAS SC of the need of RCG and MSs to provide harmonized information about the survey timing in the Table 2.6 (Scientific Surveys) of the new Regional Work Plans 2025-2027 to be submitted by 2023. The issue of standardizing the time period of the MEDIAS survey was discussed given that MEDIAS surveys take place from June to October depending on vessel availability (summer/Autumn depending on the area)

In response to the issue of survey timing, Marianna Giannoulaki (HCMR) pointed out that it's not something very simple to solve because the major constraint is the research vessel availability. This issue is becoming more and more difficult to resolve because from one hand, we are all trying to expand the areas covered by survey, and on the other hand, in most MSs, only one research vessel is available to carry out surveys. So, it's a rather difficult equation to solve. And it's not just a research vessel availability issue if we consider that you have also bad weather and bureaucratic constraints in some areas. She also mentioned that it's important to keep in mind the purpose of the surveys and the target species, which are sardines and anchovies for MEDIAS, and for which June-July should be the best period for biological reasons. As research vessels are also used to carry out MEDITS surveys, which focus on different target demersal species, the equation becomes even more complicated, as all these elements have to be taken into account simultaneously to make a decision.

The Chair emphasized the need to continue this discussion at the next Regional Coordination Meeting, as the presence of a MEDITS representative is required to make progress on this issue.

Stelios Somarakis (STECF) also asked DG MARE for clarification on the procedures for integrating additional data collection activities into MEDIAS, such as zooplankton monitoring and anchovy eggs and how is it linked to funding opportunities. Venetia Kostopoulou (DG-MARE) explained that the DCF work plan contains two parts for test studies and for additional data collection activities. So, it is up to the member states to include anything they consider relevant in their data collection in that sense, and additional sampling could thus be included under MEDIAS. This means that MSs can add additional activities to their national work plans, since the DCF and EU MAP are flexible enough to address future needs. For the work plans, and in the annual report of MSs there is specific section for additional data collection activities that are not included in the EU MAP and which are related to EMFAF operational programme. Another possibility is also the recently launched call for proposals for Scientific Advice on Fisheries under the European Maritime, Fisheries and Aquaculture Fund (EMFAF) that can address specific need identified by MSs.

5. 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 #4 of the RCM Med&BS meeting in 2022, dealing with the establishment of technical group on the regional database RDBFIS. Steering committee for the regional database during it 4th meeting agreed to establish a technical group to communicate with the regional project Med&BS RDBFIS (MARE/2020/08) regarding technical aspects of RDB development and the further support development of the regional database. MSs shall nominate national expert on a voluntary basis before the next RCM Med& BS meeting te be involved in testing the RDBFIS.

- Recommendation #7 of the RCM Med&BS meeting in 2022, dealing with the expansion of MEDIAS to GSA 15 on a voluntary basis and following the conclusion of MEDIAS steering committee in 2022 on the future involvement in MEDIAS activities in GSA 15. MS is encouraged to conduct MEDIAS within GSA 15 on a non-mandatory basis, given that the MS could make use of the cost-sharing agreement with another MS which carries out MEDIAS, since the MS does not have access to such research vessel.

In addition, the Chair informed MEDIAS SC about the discussions held with the Croatian representative (Ivana Vukov) during the 2022 RCM Med & BS with respect to the presentation on MEDIAS survey. Croatia applauded the initiation of the working groups for harmonisation of the otolith reading among MEDIAS and other working groups, and further commented on a current and pressing issue of outmost importance on the sub-regional level of Adriatic Sea. Namely, harmonisation should firstly be done on the regional level enabling stock assessment trials. Although large expert pool can help to improve scientific work, harmonisation between commercial and survey data ageing is of crucial importance in the models. In 2022, the GFCM SAC has identified the importance of this process on a sub-regional level for the purpose of WGSASP before November 2022. MEDIAS Chair pointed out that age reading harmonization for anchovy in the Adriatic Sea has been finalised and criteria are the same at Adriatic, MEDIAS and ICES level, while for what concerns sardine it is running in this period among Adriatic countries into GFCM framework and this work has to end before next benchmark. For both species, commercial otolith readers together with survey otolith readers were involved. MEDIAS Chair also reminded that MEDIAS Handbook foreseen the use of common criteria for age determination (e.g., WKARA2, 2016) agreed by international group of scientists at that WKARA2 meeting. Following actions in harmonisation should be taken by EU Member States and not by international survey groups (e.g. MEDIAS). The MEDIAS Chair also reminded that the two subgroups of experts on biological analyses are organized by MEDIAS SC within the only possible "MEDIAS framework" but this does not prevent the experts of MEDIAS from working also in other larger frameworks.

The Chair informed also MEDIAS SC about of his participation as a guest member to the steering committee meeting for the Mediterranean & Black Sea Regional Database (Med&BS RDB SC) which took place in December 2022. The work on MEDIAS data will be tackled in the new project (RDBFIS), and Tarek Hattab (IFREMER) suggested starting with a test case study using the MEDIAS data from GSA 7. The Chair also stressed that it would be important to take decisions regarding which data to include (e.g., both mandatory and non-mandatory data?), and for which species (anchovy and sardine are the target species, but data are collected on other species too).

6. Northern Alboran Sea survey issues and solutions (Magdalena Iglesias, Ana Ventero & Pilar Córdoba, IEO-CSIC)

Following the recommendations of the Working Group on Stock Assessment of Small Pelagic Species (WGSASP), an in-depth analysis of the singularities of the Northern Alboran Sea (GSA01) related to the inconsistency between the data obtained during the survey and those obtained from the catches reported in this area, has been carried out. The results indicate that, although the length-frequency distribution of sampled anchovies and sardines has sometimes been slightly different for surveys and landings, the data collected in the MEDIAS survey accurately reflect the behaviour of the fleet, the composition of pelagic species and trends in biomass and abundance of the main species evaluated. The intense occupation of the continental platform in summer (when the survey is carried out) is noteworthy, a fact that influences the difficulty in obtaining biological samples during the day. Finally, the nocturnal identification of the echotraces (night fishing) is proposed for the next survey as a solution to improve abundance estimates in the area and minimize inconsistencies. During the SC MEDIAS meeting, the use of a purse seiner to carry out identification fishing was suggested as an alternative option, although its viability in the study area makes night fishing the most feasible solution in the short term.

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

Based on email communications prior to the meeting, The MEDIAS Chair has been informed that Ana Ventero (IEO-CSI) will be the Spanish team's new representative on the sub-group of maturity analysis. Besides, Rossella Ferreri (CNR-IAS) has also volunteered to lead the maturity analysis sub-group.

The joint work carried out last year between the IEO-CSIC and CNR/IAS provided a sampling protocol that was accepted by the rest of the participants in this group. The species chosen for such exchange programme were the main MEDIAS target species: *Engraulis encrasicolus* and *Sardina pilchardus*. During the meeting, the new sub-group leader, Rossella Ferreri (CNR-IAS) presented this protocol (see Annex IV) which has been circulated among the people identified as representative member for each MEDIAS group before the beginning of 2023 surveys in order to start catching gonad images during sampling. The plan is to take up ten pictures for each sex and for each maturity stages (according to the ICES 2009 scale, as agreed by the

MEDIAS SC), when possible. Since the MEDIAS surveys are carried out during the spawning season for anchovy and resting/growing one for sardine not all the maturity phases are most likely available for both species during the sampling period. These photos should consist of both fresh and frozen samples, in order to include all the possible analysis situation. For each fish, measures of body length and weight should be also provided.

Currently, the plan is to share the gonad pictures as well as the data about individuals. Each participant can include photos already available or implement them after the next surveys. The idea was to finalize the evaluations of exchanged images by the end of the year, in order to discuss the results during the MEDIAS SC meeting in 2024.

In the discussion that followed, Alessandro Mannini (STECF) he recalled that under the umbrella of the GFCM, an Atlas of maturity stages in a Mediterranean context has been published, which could help to give ideas on how this work should be carried out. Even though this ATALS is based on a MEDITS maturity scale, and therefore different from the ICES scale used by MEDIAS, it can still serve as a guide, as there is a conversion table between the two scales. Rossella Ferreri (CNR-IAS) reminded participants that we have chosen the ICES scale for sardine and anchovy in the MEDIAS protocol because partial spawner species requires this specific scale which is not in agreement with the MEDITS scale. Discussions have already taken place at several MEDIAS coordination meetings, hence our protocol has adopted this specific scale, which makes it possible to distinguish between adults, spawner and partial spawner and other phases.

With regard to age-reading standardization, Ilaria Costantini (CNR-IRBIM) informed the SC of progress made in this topic during the previous year. In the Adriatic, the harmonization of sardine otolith readings has advanced significantly. The benchmark assessment under the GFCM framework included ad hoc sessions on otolith readings review. The ICES SmartDots platform was used to facilitate otolith exchange among experts (commercial and survey readers) from five Adriatic Sea countries (Albania, Montenegro, Croatia, Italy, and Slovenia) and an age scheme was used following the ICES WKARA2 (2017) in accordance with what was agreed during the 11th MEDIAS (2018) too. In total, 387 otoliths were analysed from commercial and MEDIAS acoustic survey data, both from GSA 17 and GSA 18. The outcomes demonstrated the usefulness of the exercise, and Adriatic experts recognized the significant progress that has been made and improvement in reading quality. Following the new readings, experts reread otoliths (commercial and survey otoliths) from 2013 onward and reviewed the time series using new ALKs.

Regarding anchovies, the MEDIAS group was informed of the current otolith exchange within the ICES framework. Several experts from the group participated in this exercise, and the outcomes of this inter-calibration will be presented in the upcoming MEDIAS SC.

The MEDIAS group noted what was determined during the 11th MEDIAS (2018), namely, using otolith reading criteria for anchovy and sardine in accordance with the ICES WKARA2 report (2017) and following the recommendation of that meeting to consider as birthdate for both anchovy and sardine the 1st of January from an assessment point of view in relation to time-steps in the assessment.

8. Changes detected in the structure of sardine otoliths (Ana Ventero, IEO-CSIC)

During the MEDIAS survey carried out in the North Western Mediterranean, around 1500 pairs of sardine otoliths (*Sardina pilchardus*) are collected annually to determine the demographic structure of the sardine stocks inhabiting in GSA01 (Northern Alboran Sea) and GSA06 (Northern Spain). In recent years a change in external structure in sardine otoliths has been detected in this area, specifically the otoliths present very marked lobulations on the ventral edge.

This fact was exposed and discussed among the experts in age reading of the different GSAs, sharing different methods to be able to analytically evaluate the interannual variability in the otoliths shape, through advanced image processing. The lobed border appears to be a common feature of other GSAs. Changes in temperature and food availability, closely linked to the zooplankton composition, stand out among the causes that may be related to changes in the external structure of the otoliths.

9. Work on MEDIAS regional database structure

Mr Stefanos Kavadas (HCMR) the coordinator of RDBFIS & RDBFIS-II projects provide an overview of these projects objectives and the progress made in the development of the regional database structure.

The regional grant MARE/2020/08 Med&BS RDBFIS was launched by DG MARE on 1 January 2021 aiming to develop a Regional Data Base (RDB) for the Mediterranean and Black Seas. The implementation was completed on 28 February 2023 (having received a 2 month extension). RDBFIS worked closely with all involved parties; DG MARE, Med&BS RCG, JRC, Med&BS Member States, survey coordination groups, GFCM, other MARE/2020/08 regional grants, ICES/RDBES.

RDBFIS is a web-based integrated fisheries information system for the Med&BS, the main futures/advantages can be described as:

- Centralize regional database for DCF Med&BS
- A power full tool for Med&BS RCG, Member States, end users
- Common quality checks, processing, reporting
- Surveys are included
- Integration of spatial information

The basic components of RDBFIS are:

- RDB= Regional data base for the Med&BS

- GUI= Graphical user interface
- Quality checks= R package for data quality checks
- Processing= R package for data processing
- Reporting= R package for error reporting

Available data sets in RDBFIS:

- Data provided during official datacalls including Med&BS, FDI, Med&BS RCG detailed biological data, GFCM/DCRF
- Species list (WoRMS, ITIS, MEDITS FM list)
- Coding system (parametric tables to ensure referential integrity)
- EU fleet
- Fishing ports
- Spatial data
- Environmental data
- MEDITS data (GRC)

Under FRAMEWORK CONTRACT – EASME/EMFF/2020/OP/0021, a specific Contract N°04 - CINEA/EMFAF/2021/3.1.2/03/SC04/SI2.881222 – 'Hosting, maintenance and further development of the regional database for the Mediterranean and the Black Sea', is the RDBFIS follow up project (called RDBFIS-II) started on 1 April 2023 for the next two years.

A description of the modules to be developed during the implementation of RDBFIS-II is given bellow:

i. A further improvement is concerning the consistency of data quality checks. Specifically, particular attention will be paid to enhancement of the quality checks considering the RDBES formats, focusing on the hierarchies applied in the Mediterranean for the biological samplings;

ii. Concerning the MEDITS survey data, another improvement to be included in the RDBFIS is represented by the embedding of an upgraded BioIndex R package that provides relevant statistics on survey data, as biomass and density indices by year, length-frequency distributions, recruitment/spawner indices and maps;

iii. The integration of MEDIAS survey into RDBFIS will be implemented with the assistance of MEDIAS chair and scientists;

iv. Integration of fleet economic data;

v. Data elaboration routines as well as data entry forms for stomach content, PETS, alien species, Eggs and larvae and recreational fisheries is foreseen to be developed;

vi. Fleet analysis: Considering that: (i) several components of the application will have open access and (ii) the usefulness of disseminating information about Europe's commercial fishing fleet, a dynamic tool will be developed portraying the evolution of fleet dynamics in Europe;

vii. FDI spatial checks: R routines already implemented in JRC supporting the FDI EWG works, will be incorporated into RDBFIS. Discussions have started with the R routines developers and a meeting is scheduled to discuss technical integration issues in RDBFIS;

viii. Work Plan and Annual Reports: An effort will be made to enable Member States to send the Work Plan and Annual Reports online through a web based form. Syntax and consistency checks are foreseen to be implemented;

Figure 9.1 and 9.2 show the proposed structure for acoustics and pelagic trawls. See Annex V for an analytical description of each table.

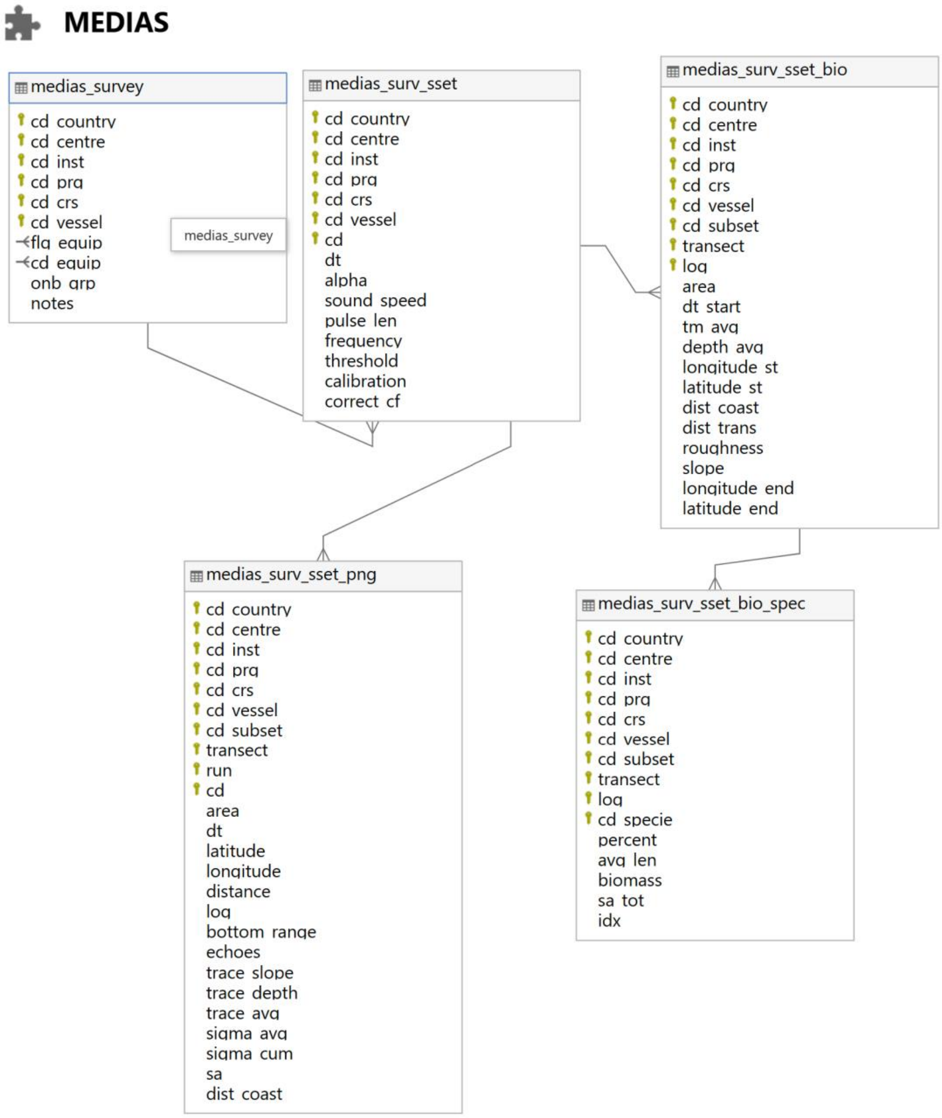


Figure 9.1. Acoustic database schema diagram.

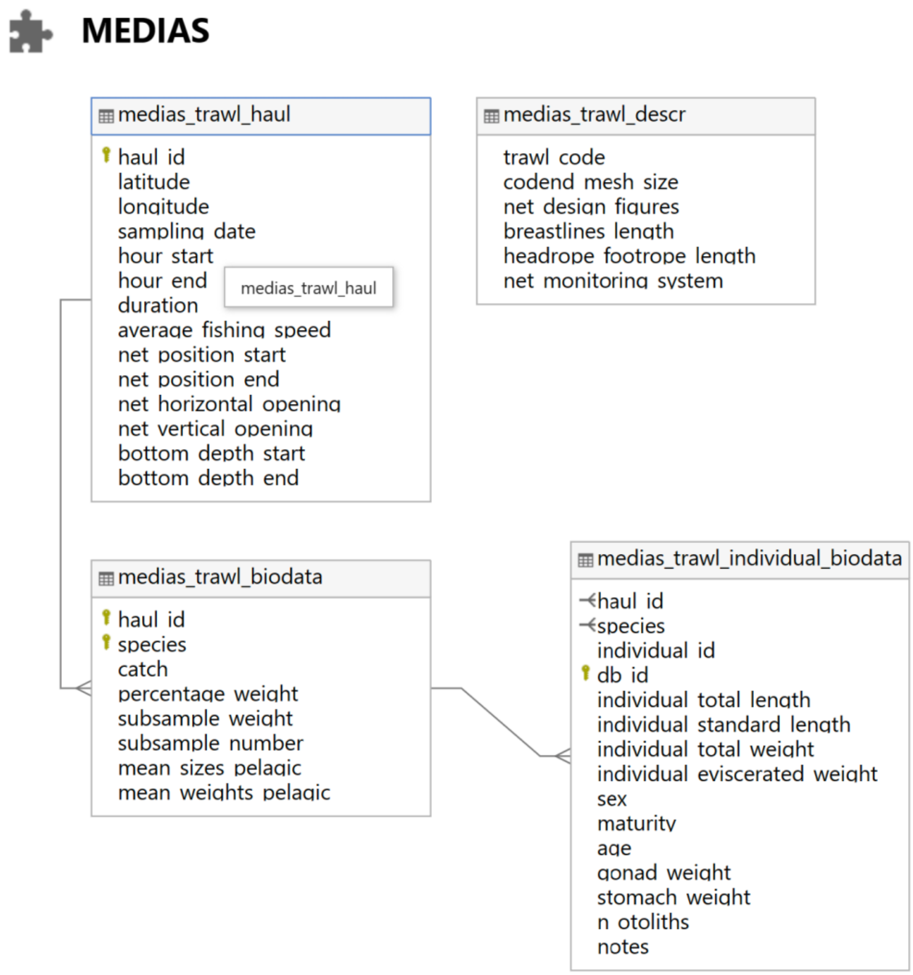


Figure 9.2 Trawl database schema diagram.

Following Stefanos Kavadas' presentation, several questions were raised by participants about the structure and composition of the first database tables. This turned out to be a very technical and time-consuming task, and it appeared that the time slot set aside for these discussions was very short to allow all the necessary questions to be addressed. Kapelonis Zakarias (HCMR) pointed out that the discussions are very technical to be addressed within the group, and he proposed to set up a working group focusing on these technical issues to have high-level discussions about database structure and use. The group adopted this proposal, and the Chair suggested designating one expert per team and agreeing on a date in May for a full working day on this subject. Stefanos Kavadas also suggested that other people involved in the RDBFIS 2 project should be invited to this meeting and pointed out that the proposed database structure is essentially based on database design agreed during the 5th MEDIAS coordination meeting to store collected acoustic and biological data. He also pointed out that discussions had already taken place with Greek colleagues involved in MEDIAS on the structure of the database. Venetia Kostopoulou (DG-MARE) underlined the added value and the usefulness of having a regional database and she clarified that the idea is not to replicate what already exists, as aggregated data is already available from the MED&BS DataCall and other DG-MARE JRC databases. The added value of RDBFIS, over regional database in general, is to have somewhere lower aggregation data in the same place that will allow carrying out common quality checks and aggregating data to respond to DataCalls and reporting obligations and this is why the EC is so much in favour and advocating for the MSs taking on board this initiative. She pointed out that this it is a very good opportunity to find how to best use this tool, also to the advantage of the MEDIAS group. Finally, she proposed to share the final report of the RDBFIS 2 project when it is finalized and publicly available. The report will also provide details about data policy on access rights, and what has been already agreed that ensures that MSs have a say in how data is used, and how data will be shared. This does not mean that once the data is put in the database everybody will be able to look at it and use it, the consent of the member states will be required. Magdalena Iglesias (IEO-CSIC) asked for clarification on Spain's non-participation in the RDBFIS 2 project. Stefanos Kavadas explained that he had already made contact with Spanish colleges from CSIC when setting up the RDBFIS 1 & 2 projects, but had not received a favourable answer. Venetia Kostopoulou (DG-MARE) reacted to Spain's non-participation issue and she specified that the consortium of RDBFIS 2 should fall within the consortium of the framework contract of MED&BS meaning that the relevant institutes or entities should already be included in the consortium of RDBFIS 2 and in any case, any change in the consortium composition would request an amendment, which is an administrative procedure that can take place. Finally, a last point was discussed concerning routines that will be available within the web-based integrated fisheries information system for the computation of survey abundance and biomass indices from disaggregated data. The MEDIAS Chair proposed to focus first on the integration of the disaggregated MEDIAS input (e.g. trawls, NASC) and output data (e.g. biomass and abundance per ESDU, species et length class), and then to work on the data processing routines within the regional database, as this step which will require more time since different data processing methods are used within the MEDIAS group to produce abundance and biomass estimates (e.g. differences in trawls allocation methods).

10. Discussion on the harmonization of acoustic echogram scrutiny procedures

A presentation of the echotraces commonly observed in each GSA was given by each team, together with their species composition and size structure. It emerged that in several Mediterranean GSAs, sardine shoals can in some cases be distinguished from the rest of the shoals, even though mixed shoal clusters are most often observed. This exercise now allows very qualitative, if not subjective, conclusions to be drawn, and a more in-depth analysis would be necessary to make further progress. Kapelonis Zakarias (HCMR) proposed to carry out a qualitative analysis by performing a statistical analysis of fish shoal describers (e.g. morphometric, energetic, elongation, shape, perimeter, symmetry, spatial...etc) and the idea was adopted by the group. So, the group agreed that such an analysis will be presented by each team at the next coordination meeting, where the choice of typical echotraces per area would be based on their own expertise, including the choice of the survey year(s), and by avoiding year(s) with very high or low biomass levels, which could result in different spatial aggregation patterns, leading to atypical echotraces. It was agreed that echotraces should be extracted from transects carried out during the acoustic sampling phase (e.g. vessel speed 8-10 knots) and not during trawling. For the time being, this analysis will only include the survey's target species (sardines and anchovies). Descriptor selection work will be carried out at the next meeting to find descriptors that are common to Movies3D and Echoview analysis software and that would make it possible to deal with the great variability that can characterize such a dataset (*i.e*. perhaps the least sensitive to the size of the shoals).

11. Discussion on standardization of zooplankton sampling

In order to make progress on the issue of standardizing zooplankton sampling, the group has produced a summary of the egg and zooplankton sampling methods used within MEDIAS. Table 11.1 gives an overview of the eggs and zooplankton nets used in each GSA, their mesh sizes, their frequency and the approximate number of samples token per year. It appears that the WP2 net with 200 μm mesh size, is the most widely used vertical sampler among the teams. It also appears that the Bongo net is also used by the most teams as a horizontal sampler, however there is a big difference in the mesh sizes used which can be 200, 300, 350 or 500 μm reflecting differences in purposes behind the use of the Bongo net in the different GSAs.

This work will be continued at the next meeting, as this issue appears to be a priority issue in some GSAs. Besides, the SC emphasizes the need for experts to explore the potential for zooplankton and eggs sampling in parallel with acoustic sampling and request funding from MS through DCF to cover additional efforts.

In addition, the Chair presented the group with a presentation of the ZooCAM system recently used in GSA 7. The ZooCAM is an in-flow system designed to digitize and analyse fish eggs and zooplankton on board ships or in the lab, at high frequency. It enables the quasi real time analysis of large volume samples collected from plankton nets or pumped and concentrated water samples at a flow rate up to 1L/min. The system captures images of water and its particle content (plankton, fish eggs, marine litter) in a calibrated flow cell using LED light source, a telecentric objective and a camera. Each imaged particle is processed to extract morphological features that enable automatic sorting using built-in AI tools. It is a fast, robust, replicable and cost-effective method to provide fish eggs data for fish stock assessment, and zooplankton data for research and ecosystem survey purposes. The current prototype has been used on board IFREMER fish stock assessment surveys since the last 6 years in Atlantic and since 2 years in the Mediterranean Sea.

Some participants asked about ZooCAM's taxonomic resolution. The Chair clarified that this imaging technique, which allow a decrease in the analysis time, it cannot achieve the taxonomic resolution obtained under microscopes. The ZooCAM consider taxonomical resolutions broader than the species (i.e. taxonomic and morphological or life stages groups and not acoustic groups), yet it can be very useful to estimate mesozooplankton community size and taxonomic descriptors that can be the base for consistent large scale monitoring of plankton communities. Such monitoring is required by the European Marine Strategy Framework Directive (MSFD). Time and cost-effective, automatic, techniques are of high interest in this context. The Chair pointed out that ZooCAM is manufactured by the Detection, Sensors and Measurements Laboratory at IFREMER and is not available for sale, however there is a possibility of manufacturing some units for the needs of the MEDIAS group with a cost of 29 k€ per unit with 6 months of employee time. He also presented the Ecotaxa online platform (https://ecotaxa.obs-vlfr.fr/), which is an web application dedicated to the visual exploration and the taxonomic annotation of zooplankton images which manages the images produced by ZooCAM and enables collaborative work during the taxonomic annotation.

Finally, Stelios Somarakis (STECF) noted that in the presented example of staged eggs produced by ZooCAM, the eggs were in most cases destroyed, which should not allow staging to be carried out. The Chair clarified that this should rather be due to the sampling method used on the example images shown (CUFES on the PELGAS survey which may actually damage the eggs) and not the consequence of digitizing the sample with ZooCAM.

Table 11.1 Overview of the eggs and zooplankton nets used in each GSA (numbers represent mesh size and number of samples per survey).

	Sampling nets					Counting methods		Applications	
GSA	**WP2 net**	**PairoVET**	**Bongo net**	**JA BA Y**	**CUFES**	**Mesozooplankton**	**Eggs**	**Time series**	**Daily egg production method (DEPM)**
GSA01	-	-	500 µm (3-10)	-	333 µm (75-100)	Microscopic count	Microscopic count	no	no
GSA06	-	-	500 µm (3-10)	-	333 µm (200-250)	Microscopic count	Microscopic count	no	no
GSA07	200 µm (~40)	-	350 µm (~20)	-	-	ZooCAM (since 2022)	ZooCAM (since 2022)	WP2	no
GSA09	-	150 µm	200 µm (~20)	-	-	Microscopic count	Microscopic count	no	no
GSA10	-	150 µm	200 µm (~20)	-	-	Microscopic count	Microscopic count	no	no
GSA15	-	150 µm	200 µm (~20)	-	-	Microscopic count	Microscopic count	Bongo, PairoVET	no
GSA16	-	150 µm	200 µm (~100)	-	-	Microscopic count	Microscopic count	Bongo, PairoVET	yes
GSA17E	200 µm (~9)	-	-	-	-	Microscopic count	Microscopic count	WP2	no
GSA17W	200 µm (~46)	-	-	-	-	Microscopic count	Microscopic count	WP2	no
GSA18	200 µm (~12)	-	-	-	-	Microscopic count	Microscopic count	WP2	yes
GSA20	200 µm (~80)	-	300 µm (~ 20)	-	-	Microscopic count	Microscopic count	WP2	no
GSA22	200 µm (~180)	-	300 µm (~ 40)	-	-	Microscopic count	Microscopic count	WP2	yes
GSA29	200 µm (~10)	-	-	150 µm	-	Microscopic count	Microscopic count	WP2	no

12. Reviewing the target strength of ancillary small pelagic species: is it time for a change? (Antonio Palermino Andrea De Felice, Ilaria Biagiotti, Giovanni Canduci, Ilaria Costantini & Iole Leonori, CNR IRBIM)

Antonio Palermino (CNR IRBIM) presented the results of different studies conducted on the Target Strength (TS) of the three ancillary species *Sprattus sprattus*, *Scomber colias* and *Trachusur mediterraneus*. The ex-situ experiment carried out on *S. colias* and *T. mediterraneus* already presented during the 15th MEDIAS Steering Committee was summarized. Then, several updates about the in-situ study performed on sprat were presented: a specific workflow was developed in Echoview software (v. 10) and R environment to face some common problems in poor data state TS measurements obtaining eight new conversion parameters b20 for the species. The authors showed a general decrease of biomass estimates up to 20% along the time series (from 2014 to 2021) due to the use of the new b20 of -68.2 (dB re 1 m2) proposed herein instead of the current one now in use in the Adriatic Sea of -71.7 (dB re 1 m2).

Two analyses on the application of theoretical backscattering models on the three species were shown. 84 specimens of *S. colias* and *T. mediterraneus* were subjected to X-Ray scan for the use of the Kirchhoff Ray Mode (KRM) model. The TS was computed as a function of tilt angle obtaining new b20 values all higher compared to the ones coming from the ex-situ experiment. Nevertheless, the authors underlined that considering an abnormal swimming behavior of fish with a negative tilt of 10°, the results are more comparable with the ex-situ experiment values. Accordingly, 45 specimens of sprat were subjected to computer tomography scan for the application of the Finite Element Method (FEM) on 3-D swimbladder morphology shapes considering a broadside tilt angle of the fish. The new b20 of -68.4 dB re 1 m^2 derived from the computations falls exactly in the range of value obtained during the in-situ experiment (from -67.5 to -68.8 dB re 1 m^2) proving a good agreement between model end empirical results.

Finally, the authors showed the influence of the new conversion parameter summarized in Table 12.1 on the biomass estimation of the pelagic categories assessed through MEDIAS's survey in the Adriatic Sea due to the application of mixed species formula. There is a general decrease in biomass of all the categories mostly due to the use of the new higher b20 for sprat which, however, should be still considered preliminary. At the end of the presentation, the author opened a discussion with the MEDIAS SC about the possibility to consider the new b20 values presented herein as new reference values for the three species in the Mediterranean Sea. Moreover, the author pointed out the possibility to apply theoretical models on the target species anchovy and sardine along with the collection of broadband in-situ data for species identification and TS measurement purposes.

During the following discussion, Zacharias Kapelonis (HCMR) suggested the use of the workflow described during the presentation for the analysis of in-situ anchovy data along with the use of theoretical models (FEM and KRM) to implement the TS manuscript in the light of a detailed description of the protocol employed for the data collection provided by the author.

Magdalena Iglesias (IEO/CSIC) raised some issues due to the limited LFD of *S. colias* employed during the ex-situ experiment measurements and the small dataset analyzed for the in-situ experiment of sprat. She, while acknowledging the importance of the work, suggested that the results on TS presented herein have to be still considered preliminary since any small variation in the conversion parameter values may lead to a change in the biomass estimation of the pelagic categories. The author admitted several limitations of the methods which, however, have been partly overcome through the application of the theoretical models. In fact, both the LFD and the amount of data have been increased for chub mackerel and sprat through this approach.

Table 12.1 Comparison among the results of b20 obtained herein, the current b20 values in use in the Adriatic Sea and the b20 values from related species in literature (*Sprattus sprattus, Scomber japonicus, Trachurus capensis, Trachurus symmetricus murphy*).

Species	**Current b_{20} (dB)**	**New b_{20} (dB)**			**b_{20} related species in literature (dB)**
		Ex-situ	*In-situ*	Model	
S. sprattus	-71.7		-68.2	-68.4	-65.1 / -71.2
S. colias	-68.7	-71.6		-69.7	-68.7 / -79.8
T. mediterraneus	-68.7	-71.4		-70	-65.2 / -76.6

13. Anchovy TS manuscript status

The leading author of the manuscript about anchovy TS, Kapelonis Zakarias reminded the group of the difficulties encountered with the publication of the accomplished work, notably the problem of unbalanced sample sizes and the differences in the precision of the data acquired per survey, which is insoluble without acquiring more data. Kapelonis Zakarias also noted that there are also some methodological details to be reviewed during the next year, particularly in relation with the choice of TS threshold and certain parameters of the single target detection algorithm. He also proposed to launch a call to the whole group for the collection of additional data. Finally, he mentioned that an application of theoretical backscattering models, as presented by Antonio Palermino (CNR IRBIM), could also be an avenue to explore in order to enrich the analyses and compare the empirical TS with theoretical one.

14. Space-time analysis of small pelagic fish communities using EchoR package (Tarek Hattab, IFREMER)

Tarek Hattab (IFREMER) presented new features in the EchoR package related to the analysis time series of spatially-explicit data. An application of these functions was presented to the group, whose aim was to characterize the spatial distributions and temporal dynamics of the size-structured communities of clupeiformes in two contrasted French shelf seas: the Gulf of

Lion (GoL) in the Mediterranean and the Bay of Biscay (BoB) in the Atlantic where a consistent decrease in the size of clupeiformes (anchovy, sardine and sprat) has been reported since the early 2000s. These analyses were conducted to determine: i) if the decrease in size is associated with a spatial reshuffling of communities, ii) if it occurred in response to a local or rather a large scale environmental change, and iii) which environmental factors shaped the fish spatial distributions. Acoustic survey data were gridded by applying a block averaging procedure to derive long-term time-series of spatially-explicit data. Multivariate space-time ordination methodologies (i.e. Multi-factor analysis, min–max autocorrelation factors) were then applied to characterize space-time patterns in biomass-at-length and hydrology. Fish habitats were spatially consistent in time in both regions but structured differently, depending on local environmental gradients, related to chlorophyll-*a* and water column stratification in the GoL and sea bottom temperature in the BoB. The decrease in fish body size was caused by local changes in species:size compositions. Large anchovy and sardine were replaced by small sprat in coastal and mid shelf habitats in the GoL. In the BoB, large sardine near sea surface in North Western areas progressively disappeared, while small clupeiforms increased near the seabed in Southern and adjacent coastal areas. Though conditions structuring spatial distributions were different between regions, the two systems showed a replacement of large fishes by small fishes, not necessarily belonging to the same species.

15. Progress update and agreement on production of standardized NASC maps at the Mediterranean scale

According to the latest MEDIAS report, a regional anchovy map has been produced using the acoustic datasets (NASC values) from the 2019 surveys. All datasets were made available for this task except the one from GSA17 East, due to pending approval from the Ministry. One of the potential problems in producing a common map is the large difference in abundance and aggregation level among areas, which results in the most productive sectors masking abundance patterns in less productive ones. According to previous discussions, in case it is not possible to clearly show abundance patterns in less productive areas by using a specific colour scale, a possible approach would be to standardize the data at the area level or to use a specific data transformation method. Thus, the first step towards the production of the common anchovy NASC map was the inspection of the main characteristics of each data set.

Table 15.1. Basic statistics of anchovy NASC by GSA

			Strictly positive values				
GSA	**n. EDSU**	**% 0 values**	**minimum**	**maximum**	**median**	**mean**	**Skewness**
GSA01	273	72.2	0.002	417.7	0.6	35.6	2.9
GSA06	870	52.1	0.003	5141.3	68.7	248	4.5
GSA07	266	0	0.005	2342.1	38.4	114.2	5.6
GSA09	588	44.4	0.01	1487.6	5	54.3	5.3
GSA10	880	29.1	0.01	4278	13.1	105.8	7.7
GSA15	230	68.7	0.003	665.4	0.9	38.8	3.7

GSA16	577	49.4	0.004	562.3	9.3	32.2	4.7
GSA19	58	10.3	0.068	897.3	14.3	56.7	4.5
18West	260	20.8	0.002	1191.4	16	78.6	3.8
17West	1055	10.7	0.001	5347.1	37.3	172.9	5.7
GSA20	493	68.6	0.74	5700.8	19.9	305	3.8
GSA22	1206	75.1	0.041	5776.1	93.2	276.5	5.3

In a second step, different data transformation approaches were evaluated by plotting the proportional representation of NASC values for each approach. This exercise made it possible to identify the best transformation to use in case it was necessary to work with transformed data. In particular, the best visualization was obtained by transforming the whole dataset according to

$$\text{transformed.NASC} = \text{sqrt}(\text{NASC})/\max(\text{sqrt}(\text{NASC}))$$

As the focus of the regional map was to visualize abundance patterns, only the IDW was considered in terms of interpolation methods. Different values of the parameters p (i.e. the power to be used in weighting) and n (i.e. the number of nearest observations to be used for estimation) were tested. The best result was obtained with p=2 and n=10.

In order to evaluate the possibility of clearly visualizing the local pattern on the interpolated surface, the colour scale was developed according to the "natural breaks Jenks" and the "quantile" methods. The latter resulted in the best approach (Fig. 15.1).

The use of a data transformation approach was avoided as the resulting map allowed local and regional patterns to be clearly visualized.

The MEDIAS SC, considering that surveys are carried out in different periods, also proposed for the next year to produce different maps according to the different survey periods and to extend mapping to all sardine and anchovy NASC data between 2019 and 2022.

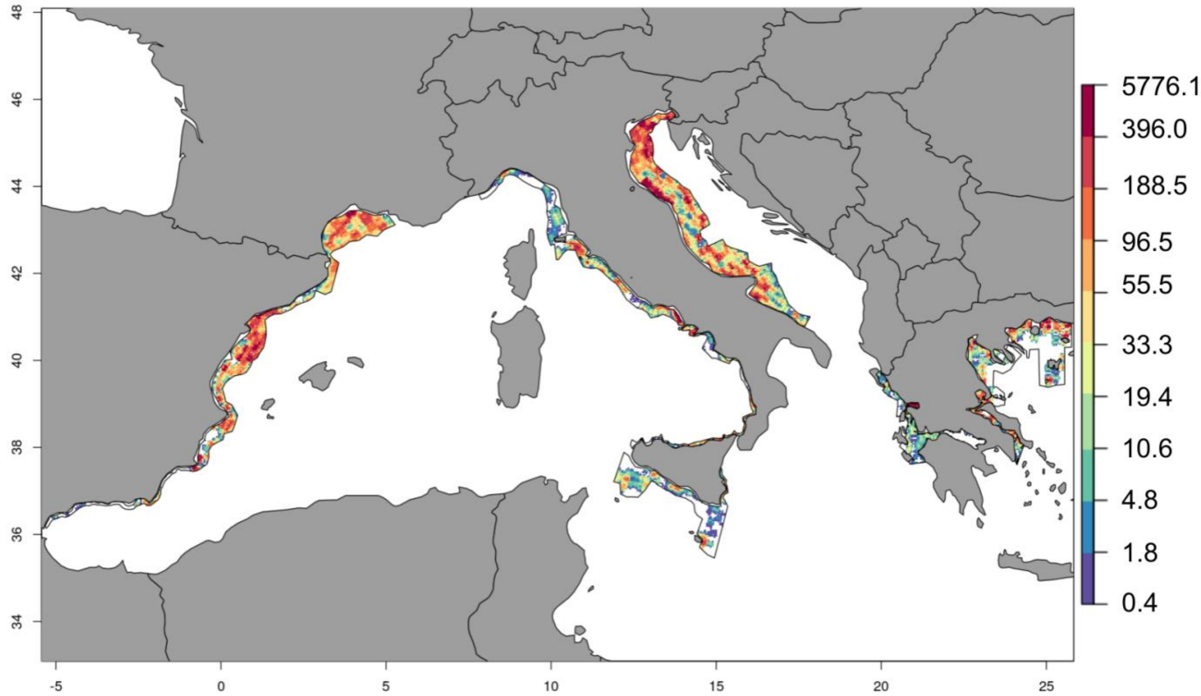


Figure 15.1 Regional map of NASC anchovy values.

The group agreed to host the NASC map in IFREMER's Geoportal SEXTANT (https://sextant.ifremer.fr/). Hattab Tarek will be responsible for data transmission to SEXTANT.

16. Trachurus mediterraneus: Interannual changes (2009-2020) in biological parameters in NW Mediterranean (José Carlos Rodríguez, IEO-CSIC)

A presentation by José Carlos Rodríguez (IEO-CSIC) was sent to the group dealing with an observed changes in biological parameters of Mediterranean horse mackerel in NW Mediterranean. *Trachurus mediterraneus* is captured as by catch by the fishing fleet in the Spanish Mediterranean and usually landed as the global category of *Trachurus* spp., consequently there is a prominent lack of biological data on this species. Data collected in the MEDiterranean International Acoustic Survey (MEDIAS) 2009–2020 time series, carried out in July, has been analyzed to determine the evolution of the main biological and ecological aspects of *T. mediterraneus* in two GFCM management units: Northern Spain (GSA06) and Northern Alboran Sea (GSA01). The preliminary results regarding *T. mediterraneus* age and growth seemed to indicate a faster growth during the first two years in GSA01 than in GSA06. In both areas, potential changes in the life history traits of this species were evidenced, with a decreasing trend in the Length frequency distribution, size at first maturity and condition factor over the years. The relevance of this study lies in the growing need for robust and current biological data of intermediate species in the marine food web and it contributes to the global purpose of achieving an integrated management of fishery resources.

17. Update of MEDIAS Website

MEDIAS SC reviewed the current MEDIAS website and Marco Barra informed the group that a few of last year's suggestions had not yet been incorporated, as he was planning to migrate the entire website to a new content management system. The identified points that still need to be updated include:

- News page. e.g., information about the renovation of the R/V Philia, information about MMS-SI, information about new surveys (e.g. in GSA11), list of previous and current MEDIAS chairs (e.g., 2008- 2010: Athanassios Machias; 2011 - 2013: Magdalena Iglesias; 2014 - 2016: Angelo Bonanno; 2017 - 2019: Andrea De Felice; 2020 - 2022: Vjekoslav Tičina; 2023 - present: Tarek Hattab), etc.

- Publications page (should be visible and accessible without having to log in). To do this, the group decided to provide Marco Barra with the entire list of publications per survey in a format manageable by a reference management software like Zotero, Mendeley, EndNote etc...to facilitate reference formatting and future updates.

- A page with reference images of otoliths and gonads could be created.

- A page called "Other Acoustic Projects" including links to other projects that use hydroacoustics (e.g., projects on mesopelagic fish, tuna larvae, etc..).

18. Review and updates of MEDIAS Handbook

A clarification on the timing of the survey has been added to the MEDIAS HANDBOOK (Annex VII) in the "Survey Design" section as follows:

The survey must be held during 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.

19. Terms of reference, venue and date for the next MEDIAS Steering Committee coordination meeting (2024)

MEDIAS SC discussed and accepted the Terms of References (ToR) for the next, 17th MEDIAS coordination meeting in 2023 (Annex VI).

The next meeting will take place from April 9 to 11, 2023. Angelo Bonanno from CNR-IAS kindly proposed the organisation of the 17th MEDIAS SC meeting to be held in Capo Granitola (Sicily).

20. Other issues

A suggestion to create a mailing list address for the MEDIAS group has been proposed to simplify correspondences. The Chair will enquire with IFREMER's IT service about the feasibility of creating multiple domain distribution lists.

The group agreed to relaunch the biannual cycle of the joint sessions ICES WGACEGG/MEDIAS. The MEDIAS Chair will contact the ICES WGACEGG Chair to see if it would be possible to schedule such joint session at the next meeting.

21. Conclusions and decisions of the 16th MEDIAS Steering Committee (SC)

1. The question of the extension of the MEDIAS survey in Crete was addressed, the Greek team mentioned that some trials were carried out in 2023. However, this extension raised questions about the availability of the research vessel PHILIA which can compete with the survey in GSA20 and GSA22. It was noted that the new proposed survey should not affect in any way the implementation of the existing surveys in terms of available resources for surveys at sea. The expansion of the survey in GSA23 will contribute to the exploration of new pelagic resources, especially lessepsian pelagic species like *Etrumeus golanii*.

2. Regarding the implementation of the MEDIAS survey in GSA15, the Maltese team mentioned that this is now part of the DCF national work plan and that a coordination with the Sicilian team is underway in order to conduct this survey in 2023. Since carrying out surveys in this area requires an additional 5 days at sea, its feasibility will mostly depend on the availability of the Italian Research Vessel, even though the vessel's schedule for 2023 appears to be favourable for its realization.

3. In communication with the representative of EC, a reminder about DCF regulation, regional coordination and new data collection possibilities that can be integrated during the establishment of the national work plan as well as the link with EMFAF was given to the group. The group was also informed of the tentative regional work plan timeline planned for the next few years.

4. The issue of standardizing the time period of the MEDIAS survey was discussed given that MEDIAS surveys take place from June to October depending on vessel availability (summer/Autumn depending on the area). This question cannot be easily solved within the group because on the one hand there are several attempts to extend the surveys in new areas, on the other hand most of the member states have only one research vessel which makes the equation more difficult to solve and especially when bad weather and administrative problems occur. As the question of the availability of vessels cannot be settled within the group, the steering committee stressed that it is important to keep in mind that differences in survey periods can generate differences in biomass estimates, and that these differences need to be taken in consideration when combining data from different surveys to perform shared analysis. In case of one such analysis, Adriatic Sea stock assessment, changing time of survey would disrupt

data time series and include additional variable, since new index would be needed for the new period, as observed with previous timing changes. June-July is the best period for MEDIAS survey for biological reasons, even if the period could be extended to September in case of research vessel availability problems and to avoid precedent time series interruption.

This may also result in a bias in the NASC regional mapping as this mapping may show both spatial and temporal trends that could only be resolved through separate NASC mapping of the summer and autumn surveys.

5. The group also discussed the benefits of using the ZooCAM during the surveys as a tool for processing meso-zooplankton and anchovy egg data. This tool which was used for the first time in GSA7 allows to digitize and analyse on board large volume samples of preserved and living mesozooplankton (i.e. multicellular zooplankton) and fish eggs > 300 µm. The ZooCAM has been specifically designed to overcome the difficulties to analyse zooplankton and fish eggs in the framework of the acoustic survey, and provide high frequency data. The ZooCAM enabled the accurate prediction and fast on board validation of staged anchovy and sardine eggs in almost real time after collection. Hence the ZooCAM can be considered as an appropriate tool for the development of on board, high frequency, high spatial coverage zooplanktonic and ecosystemic studies. This tool is manufactured by the Detection, Sensors and Measurements Laboratory at IFREMER and is not available for sale, however there is a possibility of manufacturing some units for the needs of the MEDIAS group with a cost of 29 k€ per unit with 6 months of employee time.

6. The MEDIAS steering committee was informed that former leader of the expert subgroup on maturity Nuria Zaragoza has left the Spanish team and has been replaced by Rossella Ferreri. The new leader of the sub-group will send to the whole MEDIAS group a protocol for the exchange of photos on the maturity stages which will be implemented during the next MEDIAS surveys.

7. With regard to the standardization of age readings, the MEDIAS Steering Committee informed that several inter-calibration exercises have been carried out among the MS involved in the Adriatic Sea surveys. These exercises have resulted in a standardization of the sardine age-length-keys, and that all the data collected between 2013 and 2023 has been reanalysed based on the new agreement. The same exercise is underway for the anchovy, where the same working group will continue this standardization effort. Furthermore, the group was informed about the next ICES WKARA3 WG which will take place before the end of the year and which would require the participation of all the experts involved in the age readings of anchovy.

8. Following discussions with the coordinator of the RDBFIS & RDBFIS-II projects regarding the development of the regional database, it was decided to organize a workshop dedicated to the design of the structure of the future MEDIAS regional database. A representative of each group should participate in this workshop whose date should be fixed soon.

9. A first regional map of anchovy NASC in 2019 has been produced and adopted by the group. It was decided to update this analysis by producing maps for the period 2020-2022 for anchovy but also by extending this mapping to sardine as well. These data should be transmitted to Marco Barra before February of next year. In addition, the SC also decided to make these maps and their associated metadata and symbology available to the scientific community by publishing them in the IFREMER GEOportal. Three maps per year and per species will be produced, with one map for the summer surveys, one map for the autumn surveys, and finally one map combining both seasons.

10. The group has made progress on the question of standardizing echogram scrutiny procedures by qualitatively comparing the echotypes observed in all surveys. Several similarities in the structure of the fish schools were identified as a result of this exercise. Quantitative analyses will be continued next year, where each team will calculate quantitative descriptors of the typical echotypes observed in each region. The definition of typical echotypes will largely rely on the expertise of each team on echograms scrutinizing.

11. The Spanish team informed the group of the difficulties encountered during acoustic surveys in GSA01 in connection with the hyper-use of the coastal region by tourism and navigation activity that does not allow trawling in shallow waters. The proposed solution would be to use night time pelagic trawls as a first option. Purse seiner VMS data can also be used to identify hot spot areas of small pelagic fish. In addition, collaboration with purse seiners for the realization of fishing operations during the survey was suggested as a possible solution.

12. The Chair raised the question of the participation of Romanian survey in MEDIAS given that there is no acoustic sampling involved but only a bottom trawling. The MEDIAS SC proposed that the Romanian survey will benefit by its evaluation during the MEDITS coordination meeting, given that this survey seems to be more in line with the MEDITS protocol, in spite of the fact that the target species is pelagic.

13. The group also made a first attempt to standardize the sampling methods for zooplankton and eggs by listing all the methods used in the various surveys. This work will be continued at the next meeting, as this issue appears to be a priority issue in some GSAs. Besides, the SC emphasizes the need for experts to explore the potential for zooplankton and eggs sampling in parallel with acoustic sampling (i.e. for sampling of zooplankton scattering layers and the implementation of DEPM method) and requests funding from MS through DCF to cover additional efforts.

14. The group discussed the value to include methodologies presented by Antonio Palermino (i.e. ex situ and numerical backscattering models) in the context of standardization for the target strength measurement for the target species. In this aspect, a numerical simulation approach (i.e. backscattering modelling) will be considered to improve the methodology used for the common paper on the TS of anchovy.

22. Closure of the meeting

The Chair thanked all experts for their participation in the 16th meeting of the MEDIAS Steering Committee and particularly to Jan Potočnik Erzin (FRIS, Slovenia) and Tomaž Modic (FRIS, Slovenia) for hosting the meeting, the efficient organization and technical support of this hybrid meeting. The 16th MEDIAS Steering Committee was closed on 20 April 2023 at 15:00.

23. ANNEXES

Annex I: List of participants (2023)

Person	Organisation	Modality	Contact
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Vanja Čikeš Keč	IZOR	zoom	cikes@izor.hr
Venetia Kostopoulou	EC	zoom	Venetia.KOSTOPOULOU@ec.europa.eu
Violin Raykov	IO-BAS	zoom	vio_raykov@abv.bg
Zacharias Kapelonis	HCMR	in person	zkapelonis@hcmr.gr

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

STECF: Scientific, Technical and Economic committee for Fisheries.

Annex III: Agenda of 16th MEDIAS Coordination meeting

16th MEDIAS Coordination Meeting

Ljubljana, Slovenia (Antiq Palace Hotel)

and ZOOM (Hybrid meeting)

April 18-20 2023

Draft Agenda (updated)

Tuesday 18/04/2023

09:00 – 09:30	Connection testing; Opening of the meeting & participants introduction; Adoption of the agenda.
09:30 – 10:00	Presentation of the 2022 acoustic surveys in GSA 1 - Northern Alboran Sea and GSA 6 - Northern Spain (IEO) - Magdalena Iglesias, Ana Ventero and Pilar Córdoba
10:00 – 10:30	Presentation of the 2022 acoustic surveys in the GSA 7 - Gulf of Lion (IFREMER) - Tarek Hattab and Jean-Hervé Bourdeix
10:30 – 11:00	Presentation of the 2022 acoustic survey in GSA 9 and GSA 10 – Tyrrhenian and Ligurian Seas (CNR-IAS and CNR-ISMAR) - Angelo Bonanno, Marco Barra, Simona Genovese, Gualtiero Basilone and Rosalia Ferreri
11:00 – 11:30	Coffe break
11:30 – 12:00	Presentation of the 2022 acoustic surveys in GSA 16 - South Sicily (CNR-IAS and CNR-ISMAR) - Angelo Bonanno, Marco Barra, Simona Genovese, Gualtiero Basilone and Rosalia Ferreri
12:00 – 12:30	Presentation of the 2022 acoustic survey in the eastern part of GSA 17 - Northern Adriatic Sea (IZOR) - Nedo Vrgoc and Tea Juretic
12:30 – 13:00	Presentation of the 2022 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
13:00 – 14:30	Lunch break
14:30 – 15:00	Presentation of the 2022 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

15:00 – 15:30 Presentation of the 2022 surveys in the GSA 29 - Black Sea: Bulgarian survey (IO-BAS) - Dimitar Dimitrov and Violin Raykov

15:30 – 16:00 Presentation of the 2022 surveys in the GSA 29 - Black Sea: Romanian survey (NIMRD) - George Tiganov

16:00 – 16:30 Coffe break

16:30 – 18:00 General Discussion (on surveys presented)

Wednesday 19/04/2023

09:00 – 09:15 Input on general relevant priorities and actions at EU level (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 – 09:45 Northern Alboran Sea survey issues and solutions (Magdalena Iglesias, Ana Ventero and Pilar Córdoba)

09:45 – 10:45 Progress update on standardization of age reading and maturity estimates

10:45 – 11:00 Changes detected in the structure of sardine otoliths (NW Mediterranean) (Ana Ventero)

11:00 – 11:30 Coffee break

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

12:30 –13:00 Discussion on common types of echograms from different areas and their respective trawl samples composition

13:00 – 14:30 Lunch break

14:30 –14:45 Discussion on common types of echograms from different areas and their respective trawl samples composition

14:45 – 15:00 Discussion on the harmonization of acoustic echogram scrutiny procedures

15:00 – 15:15 Discussion on standardization of zooplankton sampling

15:15 – 15:30 Trachurus mediterraneus: Interannual changes (2009-2020) in biological parameters in NW Mediterranean (José Carlos Rrodrígue)

15:30 – 15:45 reviewing the target strength of ancillary small pelagic species: is it time for a change? (Antonio Palermino Andrea De Felice, Ilaria Biagiotti, Giovanni Canduci, Ilaria Costantini and Iole Leonori)

15:45 – 16:00 Anchovy TS manuscript status (Zacharias Kapelonis)

16:00 – 16:30 Coffee break

16:30 – 16.45 Space-time analysis of small pelagic fish communities using EchoR package (Tarek Hattab)

16:45 – 18.00 Progress update and agreement on production of standardized NASC maps at the Mediterranean scale (Marco Barra)

Thursday 20/04/2023

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 (2024); 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: Gonad imaging protocol

Protocol for ANE and PIL maturity exchange

For both sexes:

- 10 pictures for each maturity stage for **fresh** fish. It would be interesting consider individuals of different sizes.
- 10 pictures for each maturity stage for **frozen** fish. It would be interesting consider individuals of different sizes.

For each individual:

1. Take measures of total length and total weight
2. Dissect the body cavity
3. Remove stomach, intestines and any other organs, only leaving gonads within the body cavity
4. Take pictures on a millimetre paper background including the whole body cavity with gonads well visible inside (see image examples below).
5. Remove gonads and weight them if it is possible.
6. Include all information in each picture.

Notes:

Big attention must be used when organs are removed from the body cavity, to avoid any damage of the gonads.

The fish have to be frozen (and defrosted) making attention to maintain the fish integrity as much as possible.

When the picture will be taken the whole body cavity have to be well visible, because of the relative size of gonads respect to the body size is one of the information to take into account for maturity stage identification.

Make attention that the light homogenously illuminates cavity and gonads, to avoid shaded parts or colour alteration.

The gonad weight could help on validating the staging by the estimate of the gonadosomatic index (GSI).

Image example:

Annex V: An analytical description of each table of the RDBFIS database

medias_survey

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_survey
Type	Table
Module	MEDIAS

Hydro Acoustic Survey

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	cd_country	🔑	character varying(3)		Default: 'GRC'::character varying		Country
2	cd_centre	🔑	character varying(6)				Centre Code
3	cd_inst	🔑	character varying(8)				Institute Code
4	cd_prg	🔑	character varying(4)				Program
5	cd_crs	🔑	character varying(8)				Cruise
6	cd_vessel	🔑	character varying(3)				Vessel
7	flg_equip		character varying(1)	✔	Default: 'A'::character varying	e_equip	Equipment flag
8	cd_equip		character varying(10)			e_equip	Acoustic system
9	onb_grp		character varying(256)	✔			OnBoard Group
10	notes		character varying(256)	✔			Notes

medias_surv_sset

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_surv_sset
Type	Table
Module	MEDIAS

Hydro Acoustic SubSet (calibration)

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	cd_country	🔑	character varying(3)			medias_survey	Country
2	cd_centre	🔑	character varying(6)			medias_survey	Centre Code
3	cd_inst	🔑	character varying(8)			medias_survey	Institute Code
4	cd_prg	🔑	character varying(4)			medias_survey	Program
5	cd_crs	🔑	character varying(8)			medias_survey	Cruise
6	cd_vessel	🔑	character varying(3)			medias_survey	Vessel
7	cd	🔑	numeric				Subset ID
8	dt		timestamp without time zone				Date
9	alpha		numeric	✓			Alpha
10	sound_speed		numeric	✓			Sound Speed
11	pulse_len		numeric	✓			Pulse Length
12	frequency		numeric	✓			Frequency
13	threshold		numeric	✓			Threshold
14	calibration		numeric	✓			Calibration
15	correct_cf		numeric	✓			Correction CF

medias_surv_sset_png

Hydro Acoustics: Pings

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	cd_country	🔑	character varying(3)			medias_surv_sset	Country
2	cd_centre	🔑	character varying(6)			medias_surv_sset	Centre Code
3	cd_inst	🔑	character varying(8)			medias_surv_sset	Institute Code
4	cd_prg	🔑	character varying(4)			medias_surv_sset	Program
5	cd_crs	🔑	character varying(8)			medias_surv_sset	Cruise
6	cd_vessel	🔑	character varying(3)			medias_surv_sset	Vessel
7	cd_subset	🔑	numeric			medias_surv_sset	Subset ID
8	transect	🔑	numeric				Transect
9	run	🔑	numeric				Run
10	cd	🔑	numeric				Ping
11	area		character varying(32)	✔			Area
12	dt		timestamp without time zone	✔			Date
13	latitude		integer	✔			Latitude
14	longitude		integer	✔			Longtitude
15	distance		numeric	✔			Distance
16	log		numeric	✔			Log
17	bottom_range		numeric	✔			Bottom Range
18	echoes		numeric	✔			Echoes
19	trace_slope		numeric	✔			Trace Slope
20	trace_depth		numeric	✔			Trace Depth
21	trace_avg		numeric	✔			Trace Average Db
22	sigma_avg		numeric	✔			Average Sigma
23	sigma_cum		numeric	✔			Cum Sigma
24	sa		numeric	✔			Sa
25	dist_coast		numeric	✔			Distance from coast

medias_surv_sset_bio

Schema	medbs_rdb_schema
Name	medias_surv_sset_bio
Type	Table
Module	MEDIAS

Hydro Acoustic: Biomass

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	cd_country	🔑	character varying(3)			medias_surv_sset	Country
2	cd_centre	🔑	character varying(6)			medias_surv_sset	Centre Code
3	cd_inst	🔑	character varying(8)			medias_surv_sset	Institute Code
4	cd_prg	🔑	character varying(4)			medias_surv_sset	Program
5	cd_crs	🔑	character varying(8)			medias_surv_sset	Cruise
6	cd_vessel	🔑	character varying(3)			medias_surv_sset	Vessel
7	cd_subset	🔑	numeric			medias_surv_sset	Subset ID
8	transect	🔑	numeric				Transect
9	log	🔑	numeric				Log (mile)
10	area		character varying(64)	✓			Area
11	dt_start		timestamp without time zone	✓			Start Date Mile
12	tm_avg		numeric	✓			AverTime
13	depth_avg		numeric	✓			Avg Bottom Depth
14	longitude_st		integer	✓			Start Longitude
15	latitude_st		integer	✓			Start Latitude
16	dist_coast		numeric	✓			Distance from coast
17	dist_trans		numeric	✓			DIST_TRANS
18	roughness		numeric	✓			Roughness
19	slope		numeric	✓			Slope
20	longitude_end		integer	✓			End Longitude
21	latitude_end		integer	✓			End Latitude

medias_surv_sset_bio_spec

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_surv_sset_bio_spec
Type	Table
Module	MEDIAS

Hydro Acoustic: Biomass Species Identification

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	cd_country	🔑	character varying(3)			medias_surv_sset_bio	Country
2	cd_centre	🔑	character varying(6)			medias_surv_sset_bio	Centre Code
3	cd_inst	🔑	character varying(8)			medias_surv_sset_bio	Institute Code
4	cd_prg	🔑	character varying(4)			medias_surv_sset_bio	Program
5	cd_crs	🔑	character varying(8)			medias_surv_sset_bio	Cruise
6	cd_vessel	🔑	character varying(3)			medias_surv_sset_bio	Vessel
7	cd_subset	🔑	numeric			medias_surv_sset_bio	Subset ID
8	transect	🔑	numeric			medias_surv_sset_bio	Transect
9	log	🔑	numeric			medias_surv_sset_bio	Log
10	cd_specie	🔑	character varying(3)				Species
11	percent		numeric	✓			Species Percent
12	avg_len		numeric	✓			Species Average Length
13	biomass		numeric	✓			Species Biomass
14	sa_tot		numeric	✓			Total Sa
15	idx		numeric	✓			Acoustic Index

medias_survey_design

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_survey_design
Type	Table
Module	MEDIAS

Direct link
Essential vie

MEDIAS survey design

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	transects_design		character varying(128)	✔			Transects design
2	inter_transect_distance		smallint	✔			Inter-transect distance (NM)
3	time_of_day		character varying(16)	✔			Time of day for acoustic sampling
4	edsu		smallint	✔			EDSU (nm)
5	distance_from_coast		integer	✔			Distance from the coast according to the bottom depth (min, m)
6	echo_sounding_depth_min		smallint	✔			Echo sounding depth (min, m)
7	echo_sounding_depth_max		smallint	✔			Echo sounding depth (max, m) recording
8	vessel_speed		real	✔			Vessel speed
9	analysis_sw		character varying(128)	✔			Software for analysis
10	file_format		character varying(36)	✔			File format
11	applied_ts		double precision	✔			Applied TS (dB)

medias_survey_identity

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_survey_identity
Type	Table
Module	MEDIAS

MEDIAS Survey identity

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	geographic_area		character varying(128)	✔			Geographic Area
2	gsa_area		character varying(7)	✔			GSA Area
3	covered_area_size		real	✔			Size of Area to be covered (NM2/km2)
4	effectively_covered_area_size		real	✔			Size of Area effectively covered (NM2/km2)
5	vessel_info		character varying(128)	✔			Vessel (Horse power, noice level, draft)
6	number_hauls		smallint	✔			Number of hauls
7	number_ctds		smallint	✔			Number of CTDs
8	n_edsu		integer	✔			Total number of EDSU processed
9	dates_survey		character varying(64)	✔			Dates of survey

medias_echosounder_param

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_echosounder_param
Type	Table
Module	MEDIAS

MEDIAS Echo sounder parameters

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	echo_sounder_type		character varying(7)	✔			Type of echo sounder
2	assessment_frequency		real	✔			Frequency for assessment (kHz)
3	complementary_frequency		real	✔			Complementary frequency (kHz)
4	pulse_duration		integer	✔			Pulse duration (ms)
5	beam_angles		smallint	✔			Beam Angles (degrees)
6	athwartship_beam_angle		smallint	✔			Athwartship Beam Angle
7	alongship_beam_angles		smallint	✔			Alongship Beam Angles
8	acquisition_threshold		smallint	✔			Threshold for acquisition (dB)
9	assessment_threshold		smallint	✔			Threshold for assessment (dB)

medias_processed_acoustic

Documentation medbs_rdb@195.251.37.45_rev
Schema medbs_rdb_schema
Name medias_processed_acoustic
Type Table
Module MEDIAS

MEDIAS processed acoustic data

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	edsu		character varying(10)	✔			Edsu
2	latitude		double precision	✔			Latitude
3	longitude		double precision	✔			Longitude
4	trancect_id		smallint	✔			Trancect number
5	nasc_fish		character varying(32)	✔			NASC fish
6	species		character varying(3)	✔			Target species NASC
7	species_biomass		double precision	✔			Target species biomass
8	species_number		bigint	✔			Target species number
9	echogram_figures		character varying(128)	✔			Echogram figures especially related to hauls

medias_trawl_haul

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_trawl_haul
Type	Table
Module	MEDIAS

MEDIAS haul general information

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	haul_id	🔑	character varying(16)				
2	latitude		double precision	✔			
3	longitude		double precision	✔			
4	sampling_date		timestamp without time zone	✔			
5	hour_start		timestamp without time zone	✔			
6	hour_end		timestamp without time zone	✔			
7	duration		smallint	✔			
8	average_fishing_speed		real	✔			
9	net_position_start		character varying(16)	✔			
10	net_position_end		character varying(16)	✔			
11	net_horizontal_opening		real	✔			
12	net_vertical_opening		real	✔			
13	bottom_depth_start		smallint	✔			
14	bottom_depth_end		smallint	✔			

medias_trawl_biodata

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_trawl_biodata
Type	Table
Module	MEDIAS

MEDIAS trawl biological data

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	haul_id	🔑	character varying(16)			medias_trawl_haul	
2	species	🔑	character varying(3)				
3	catch		double precision	✓			
4	percentage_weight		real	✓			
5	subsample_weight		integer	✓			
6	subsample_number		integer	✓			
7	mean_sizes_pelagic		double precision	✓			
8	mean_weights_pelagic		double precision	✓			

medias_trawl_individual_biodata

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_trawl_individual_biodata
Type	Table
Module	MEDIAS

MEDIAS trawl individual biological data

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	haul_id		character varying(16)	✓		medias_trawl_biodata	
2	species		character varying(3)	✓		medias_trawl_biodata	
3	individual_id		smallint	✓			
4	db_id	🔑	bigint				
5	individual_total_length		real	✓			
6	individual_standard_length		real	✓			
7	individual_total_weight		real	✓			
8	individual_eviscerated_weight		real	✓			
9	sex		character(1)	✓			
10	maturity		character varying(2)	✓			
11	age		real	✓			
12	gonad_weight		real	✓			
13	stomach_weight		real	✓			
14	n_otoliths		numeric(1, 0)	✓			
15	notes		character varying(1024)	✓			

medias_trawl_descr

Documentation	medbs_rdb@195.251.37.45_rev
Schema	medbs_rdb_schema
Name	medias_trawl_descr
Type	Table
Module	MEDIAS

MEDIAS Trawl description

Columns

	Name	Key	Data type	Null	Attributes	References	Description
1	trawl_code		character varying(7)	✔			Trawl code
2	codend_mesh_size		smallint	✔			Codend mesh size
3	net_design_figures		character varying(64)	✔			Net design - figures
4	breastlines_length		smallint	✔			Breastlines length
5	headrope_footrope_length		smallint	✔			Headrope and footrope length
6	net_monitoring_system		character varying(16)	✔			Net monitoring system

Annex VI: Terms of Reference for the MEDIAS SC meeting in 2024

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 standardization of zooplankton and eggs sampling;
- Continuing the work on echogram scrutiny procedures;
- Continuing the work on standardization of age reading and maturity estimates;
- Continuing the work on MEDIAS RDB structure.
- Present at the next meeting all the TS values used in the different surveys for the different pelagic species.

Annex VII: MEDIAS HANDBOOK

(Version: April, 2023)

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
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

Notes: * This area includes both GSA 16 (South of Sicily) and part of GSA 15 (Malta)

** Official inclusion of this survey in DFC is pending

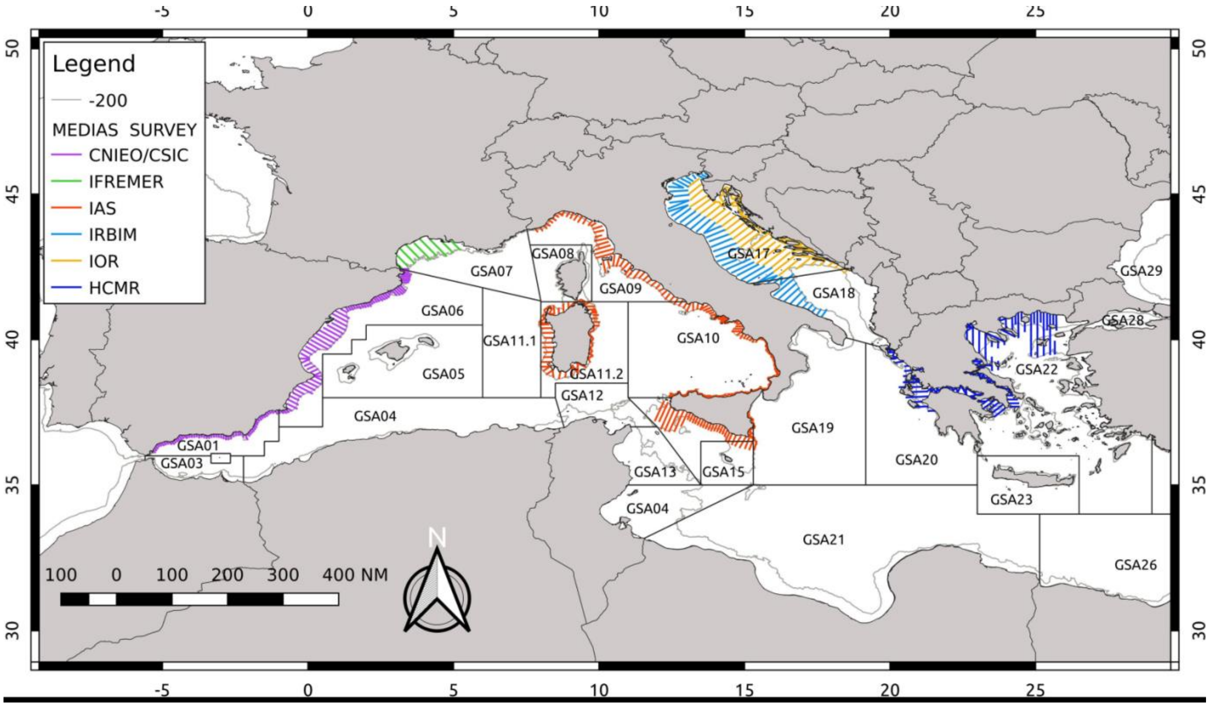

Figure 1: Surveys designs in the EU-MEDIAS.

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 Design

The survey must be held during 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.

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 5th 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 b20 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 VIII). 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 3 the ecosystem indices that can derive from acoustic surveys (based on data regularly collected and analyzed) are reported.

Table 3. Ecosystem indices that could be derived from acoustic surveys.

<table>
<tr><td rowspan="13">**Good Environmental Status indices**</td><td rowspan="3">Spatial/temporal strata</td><td rowspan="2">Spatial strata</td><td colspan="5">GSA</td></tr>
<tr><td colspan="5">Acoustic survey</td></tr>
<tr><td>Time periods</td><td colspan="5">Season (Summer/Autumn depending on the area)</td></tr>
<tr><td rowspan="4">Taxonomic levels</td><td>Community</td><td colspan="5">Pelagic fish (Species composition, occurrence in pelagic hauls)</td></tr>
<tr><td rowspan="3">Target Species</td><td rowspan="3">Adult</td><td colspan="4">Anchovy</td></tr>
<tr><td colspan="4">Sardine (for Mediterranean)</td></tr>
<tr><td colspan="4">Sprat (for Black Sea)</td></tr>
<tr><td rowspan="6">Indices</td><td rowspan="6">Biodiversity</td><td rowspan="6">Species</td><td rowspan="2">Population size</td><td rowspan="2">Acoustic estimates</td><td colspan="2">Total biomass & abundance estimates for target species</td></tr>
<tr><td colspan="2">Estimation error (CV) (i.e. as agreed based on a common estimation procedure, see ToRs)</td></tr>
<tr><td rowspan="2">Population condition</td><td>Biomass & abundance estimate per size/age</td><td colspan="2">Anchovy, Sardine, Sprat (Black Sea)</td></tr>
<tr><td>Recruitment index</td><td colspan="2">Sardine (i.e. Number at Age 0 of the population based on summer surveys)</td></tr>
<tr><td rowspan="2">Habitats</td><td rowspan="2">Habitat condition</td><td rowspan="2">Hydrological condition</td><td>Temperature (i.e. SST: average at 10m, estimated as the interpolated mean value for the whole area)</td></tr>
<tr><td>Salinity (i.e. SSS: average at 10m, estimated as the interpolated mean value for the whole area))</td></tr>
</table>

			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 distribut ion	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 VIII: 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).

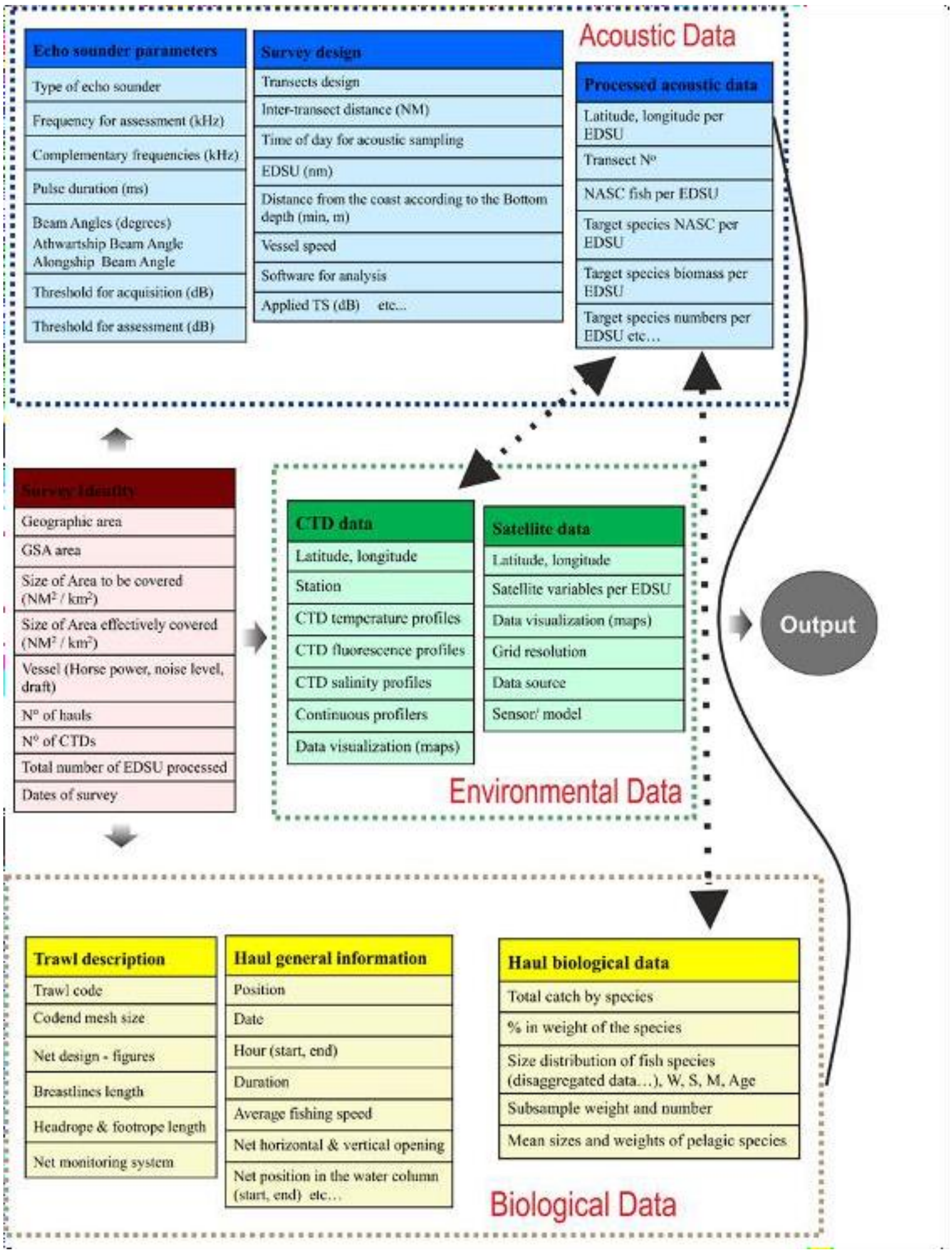


Figure A1. General outline of a database for acoustic surveys.

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.

Acoustic Data

Echo sounder parameters
Type of echo sounder
Frequency for assessment (kHz)
Complementary frequencies (kHz)
Pulse duration (ms)
Beam Angles (degrees) Athwartship Beam Angle Alongship Beam Angle
Threshold for acquisition (dB)
Threshold for assessment (dB)

Survey design
Transects design
Inter-transect distance (NM)
Time of day for acoustic sampling
EDSU (nm)
Distance from the coast according to the Bottom depth (min, m)
Echo sounding depth (min, m)
Echo sounding depth (max, m) recording.
Vessel speed
Software for analysis
File format
Applied TS (dB)

Processed acoustic data
Latitude, longitude per EDSU
Transect N°
NASC fish per EDSU
Target species (i.e. anchovy, sardine) NASC per EDSU
Target species biomass per EDSU
Target species numbers per EDSU
Echogram figures especially related to hauls

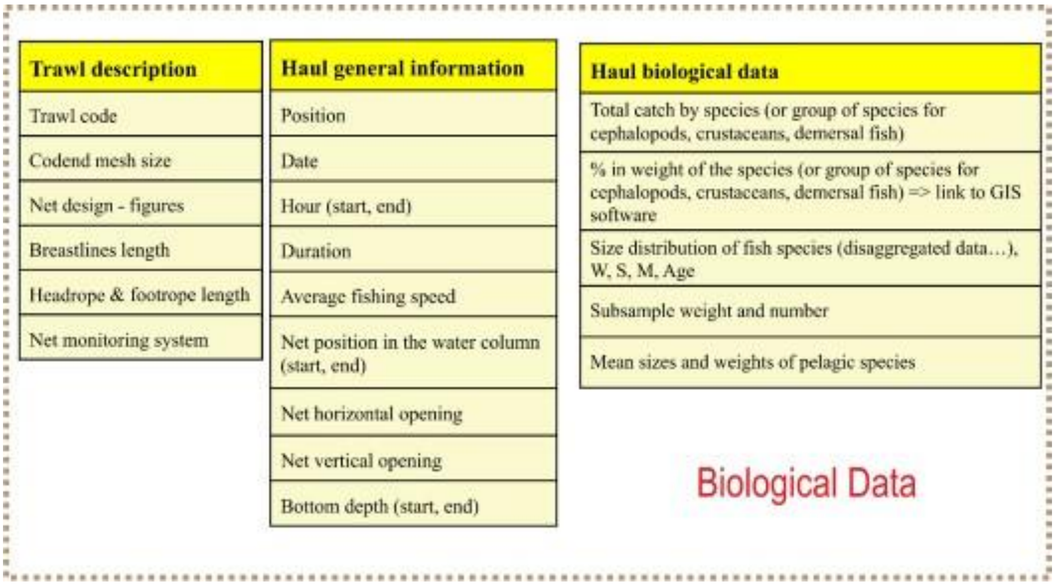
Figure A3. Fields associated with input info on Acoustic Data

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.



Trawl description
Trawl code
Codend mesh size
Net design - figures
Breastlines length
Headrope & footrope length
Net monitoring system

Haul general information
Position
Date
Hour (start, end)
Duration
Average fishing speed
Net position in the water column (start, end)
Net horizontal opening
Net vertical opening
Bottom depth (start, end)

Haul biological data
Total catch by species (or group of species for cephalopods, crustaceans, demersal fish)
% in weight of the species (or group of species for cephalopods, crustaceans, demersal fish) => link to GIS software
Size distribution of fish species (disaggregated data…), W, S, M, Age
Subsample weight and number
Mean sizes and weights of pelagic species

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

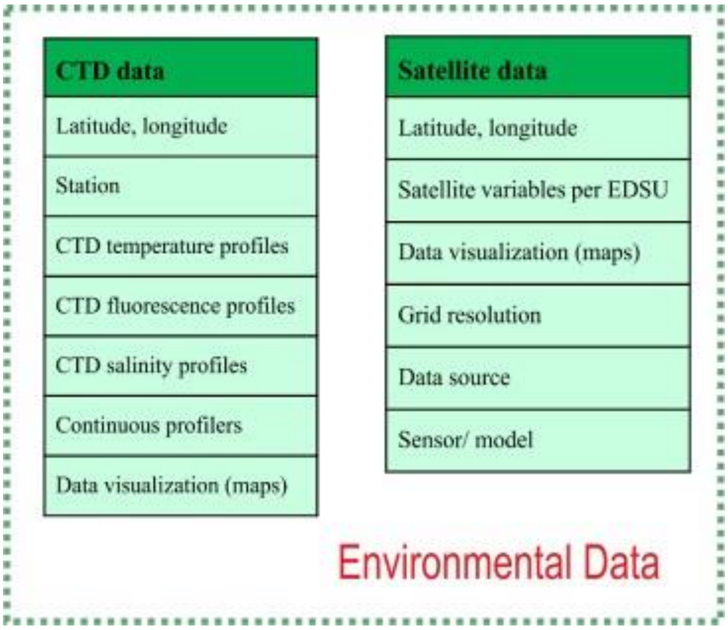


Figure A5. Fields associated with input info on Environmental Data related to acoustic surveys

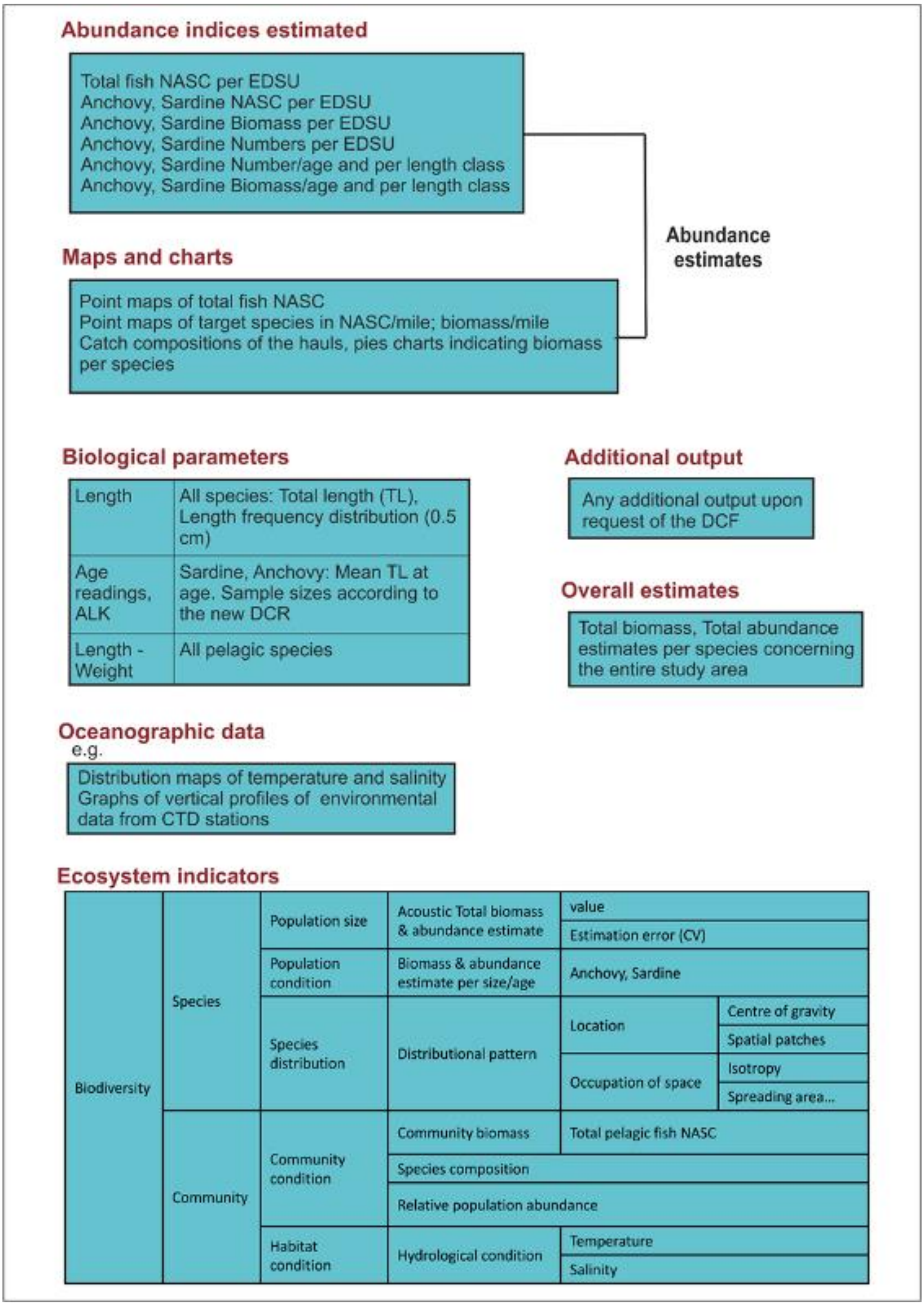


Figure A6. Fields associated with potential acoustic database output.

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

Simmonds J., MacLennan D. 2005. Fisheries Acoustics: Theory and Practice. (2nd Edition) Blackwell Publishing Ltd., 437 p.