Report of 8th meeting for MEDiterranean International Acoustic Surveys (MEDIAS)

in the framework of European Data Collection Framework (DCF)

Sète, France, 24-27 March 2015

Steering Committee Report

Contents

Introduction

The MEDIAS (MEDiterranean International Acoustic Surveys) Steering Committee met in Sète, France, on 24-27 March 2015, hosted by IFREMER and chaired by Angelo Bonanno from IAMC-CNR. Participants in the meeting were representatives from the European Union countries involved in acoustic surveys in the Mediterranean Sea (i.e. Greece, Spain, Croatia, France and Italy) and in the Black Sea (Romania). One scientist from Tunisia working on fisheries acoustics in Mediterranean Sea was invited to participate (see list of participants in Annexes I and II).

The main aims of the meeting were:

a) to present the results from the Mediterranean International Acoustic Surveys (MEDIAS) carried out in 2014;
b) to coordinate the MEDIAS to be performed in 2015;
c) to improve and update the common Protocol for the MEDIAS that is incorporated in the DCF framework and reflected in the MEDIAS Handbook;
d) to revise the ToRs from 2015 and to establish the ToRs for 2016.

The agenda of the 8th MEDIAS Meeting (see ANNEX III) was adopted by the participants. Following the agenda, during the first day results from the 2014 MEDIAS acoustic surveys, carried out by the MEDIAS partners (Figure 1), were presented, as well as results from two surveys carried out by Romania in the Black Sea in the period 2012-2013.

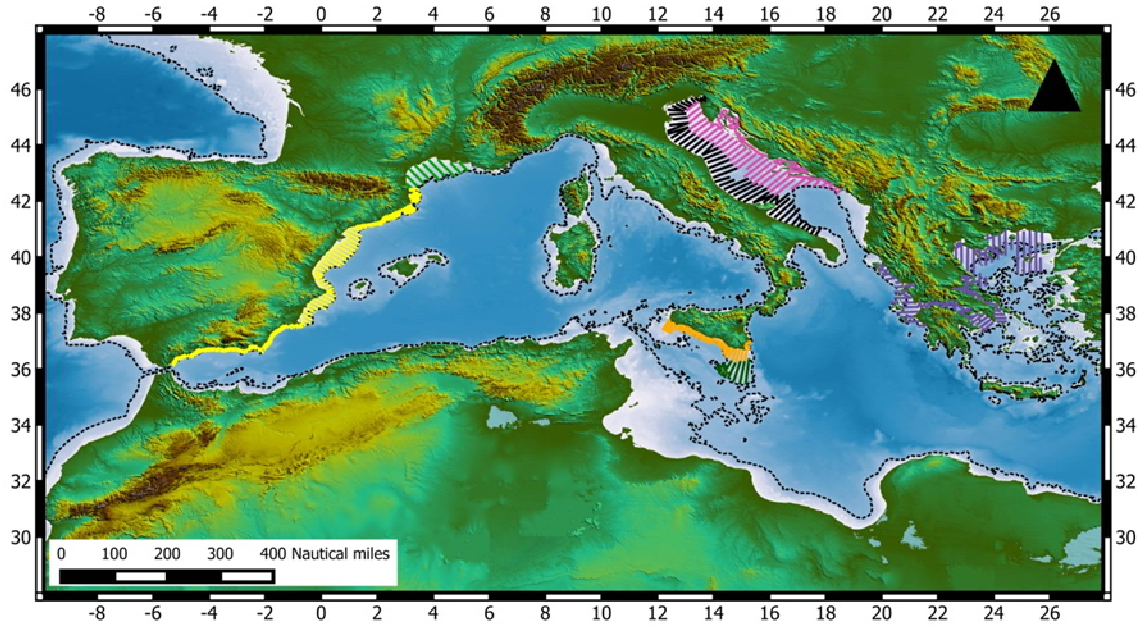


Figure 1: Acoustic surveys in the framework of MEDIAS in 2014.

In the second and third day of the meeting a workshop on the standardization of the allocation of trawl catches on acoustic data (following the results of the last workshop

on EchoR in Vigo) and a workshop on the CV estimation with different procedures were carried out.

The main objective of the first workshop was to use the EchoR scripts with the data collected by each research group in the MEDIAS, in order to overcome the problems met during the workshop in Vigo (17-21 November 2014).

During the second workshop a specific R script was proposed for CV estimation using geostatistical simulations, according to a procedure similar to the one proposed by Walline (2007).

Furthermore, some activities on acoustic data analysis and a Common Database proposal were presented during the third day of the meeting.

During the fourth day, the revision of the common MEDIAS protocol and an update of the MEDIAS handbook were carried out. Part of the day was dedicated also to define the Terms of Reference (ToRs) for the next year (2016), and to discuss and propose common studies in the framework of MEDIAS.

Results of surveys held in 2014 in the framework of the Mediterranean International Acoustic Surveys (MEDIAS)

a) Italian Acoustic survey in Adriatic Sea - MEDIAS in the western GSA 17 and GSA 18 (Iole Leonori, Andrea De Felice, Ilaria Biagiotti, Giovanni Canduci, Ilaria Costantini, Sara Malavolti and Rocco De Marco).

In 2014 acoustic survey was carried out in July-August in GSA 18 and in August-September in GSA 17 including territorial waters of Slovenia (in collaboration with FRIS). Acoustic data were logged over a grid of systematic parallel transects perpendicular to coastline/bathymetry (inter-transect distance 8-10 nmi) for a total of around 2500 nmi, identifying an area of about 15700 nmi^2 (13200 nmi^2 in the western part) in the Adriatic Sea.

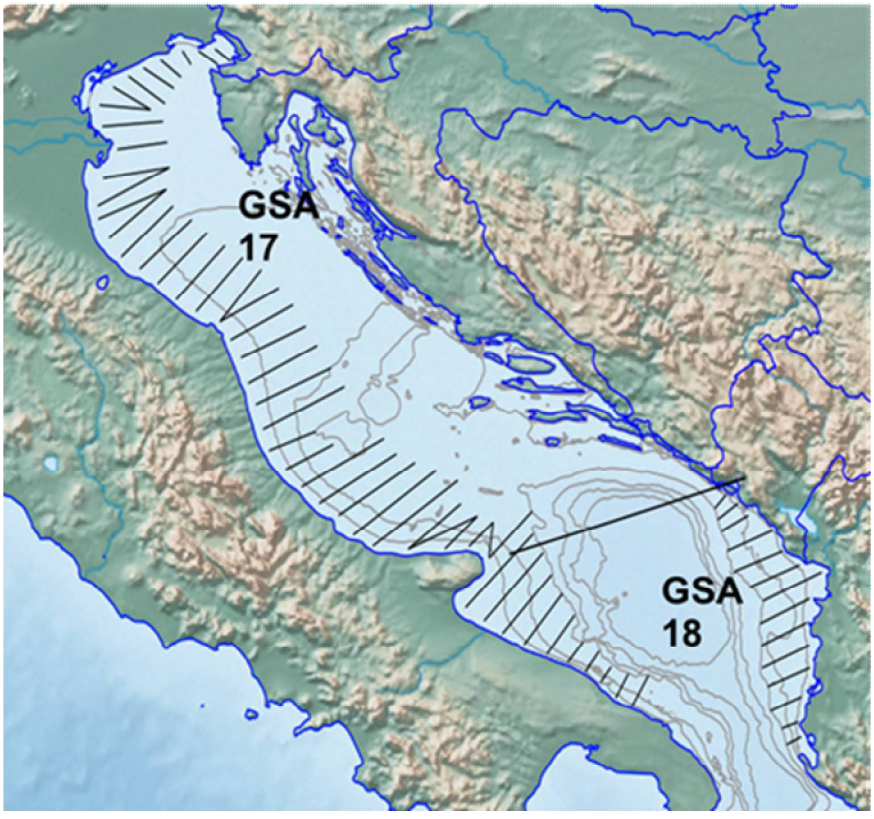


Figure 2: Surveys performed in 2014 in the GSAs 17 and 18

Acoustic survey in western GSA 18 was carried out in July 2014; area coverage was 100%, 450 nautical miles in 11 transects were monitored and 15 pelagic trawls were conducted. 58 CTD and plankton stations were made for the assessment of anchovy

Spawning Stock Biomass by means of DEPM - Daily Egg Production Method and to determine mesozooplankton biomass as a whole as RITMARE project activity.
Acoustic survey in eastern GSA 18 was conducted in July - August 2014 in the framework of FAO AdriaMed project as extension of the MEDIAS project. The area coverage was 100%, 472 nautical miles in 14 transects were monitored and 16 pelagic hauls were conducted. 62 CTD and plankton stations were made for the Assessment of anchovy Spawning Stock Biomass by means of DEPM - Daily Egg Production Method in collaboration with IBMK of Montenegro and University of Tirana, Albania.
Acoustic survey in western GSA 17 was conducted in August - September 2014; the coverage of the area was 100%, 1518 nautical miles in 39 transects were monitored and 38 pelagic trawls were conducted. 96 CTD stations were made and in 45 stations out of 96 mesozooplankton samplings by means of WP2 net (mesh size 200 nm) were made in collaboration with OGS of Trieste (Italy)as RITMARE project activity.
Biomass estimations of anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) stocks in western Adriatic Sea show that sardine biomass was slightly lower in 2014, while anchovy presents a decrease respect to 2013 in the GSA 17 and a slight increase in GSA 18.

b) MEDIAS in the eastern part of GSA 17 - Croatian survey (Vjekoslav Ticina)

Second acoustic survey in eastern part of GSA 17, carried out after accession of Croatia to EU in accordance with DCF-MEDIAS protocol has been presented. The survey was performed in September 2014, being harmonized with Italian acoustic survey in the western part of GSA 17. During this survey, acoustic data has been collected within 1414 EDSU, covering entire survey area of 13.578 nmi^2 as planned (Fig. 3). In total, 30 vessel days were used.
Fish sampling by mid-water trawl have been performed 59 times, obtaining 56 hauls with catch. Qualitative analyses of collected fish samples were presented (Fig. 4). Oceanographic properties of the survey area was described on the basis of 89 CTD vertical profiles. Laboratory analyses on detailed biologic information on both target species (age, maturity, sex) were still in elaboration, and some preliminary results were presented only.
Based on acoustic data collected, spatial distributions (GIS analyses) of anchovy and sardine stock within survey area were presented (Figs. 5 and 6). With the aim to estimate abundance of target species, TS equations based on 20 log has been used in accordance with MEDIAS agreements. Acoustic data for stocks abundance analyses have been collected during daytime only. According to preliminary results it seems that abundance indices for anchovy and sardine indicate decrease of anchovy and increase of sardine abundance in September 2014 in comparison to September 2013. in the eastern part of GSA17 area. However it seems that overall biomass of target

species (anchovy + sardine) in this area did not changed significantly from 2013 to 2014.

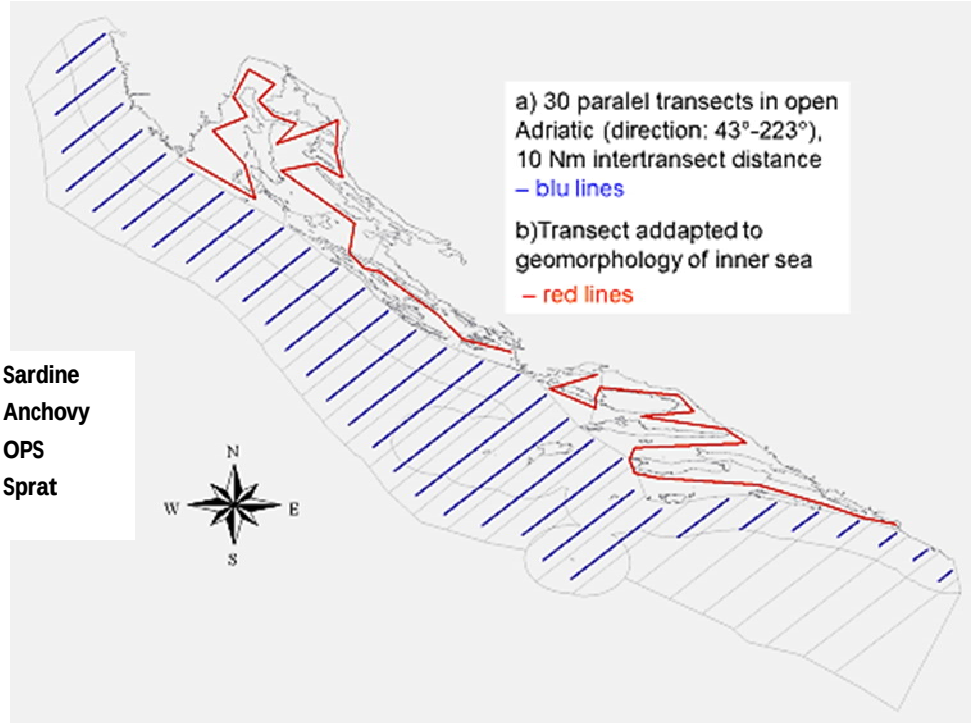


Figure 3. Survey design of acoustic transects in the eastern part of GSA 17.

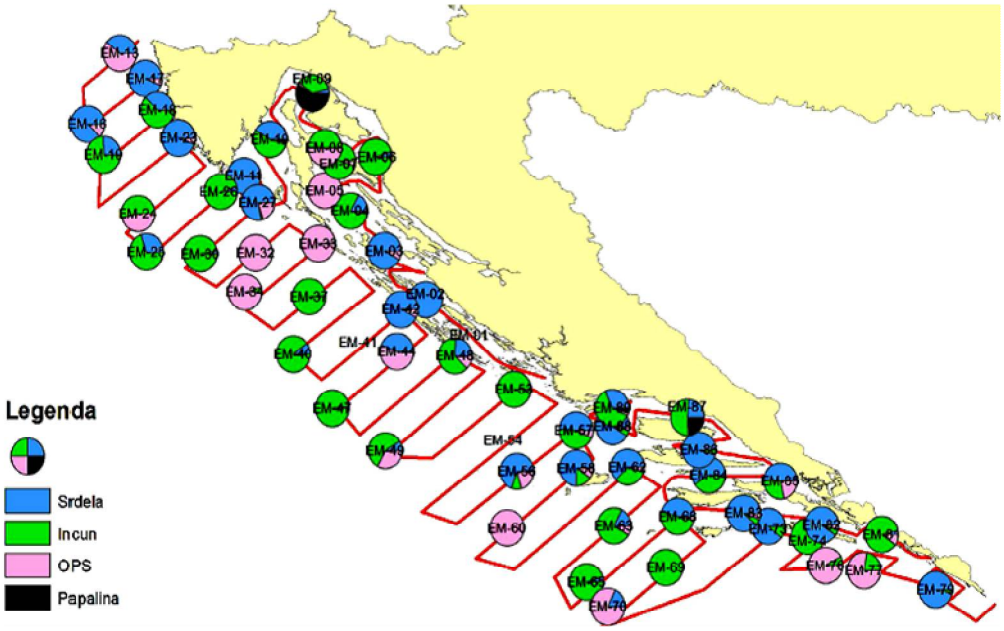


Figure 4. Compositions of pelagic fish assemblages in the eastern part of GSA 17 in September 2014.

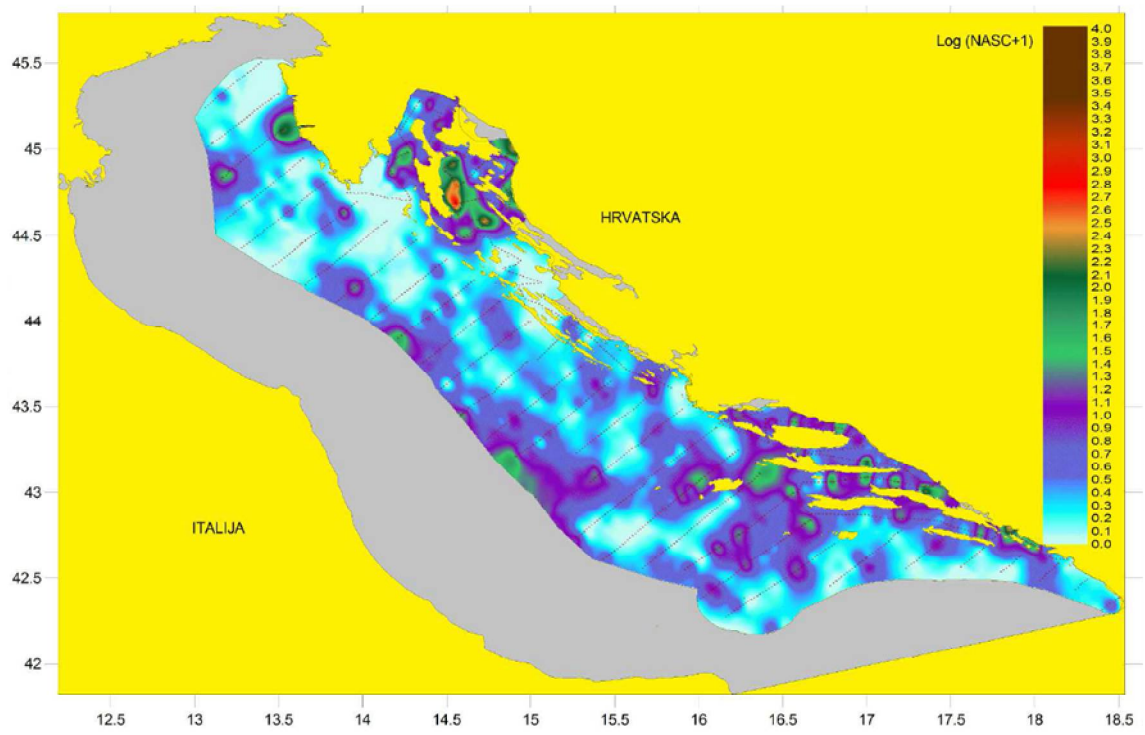


Figure 5. Spatial distribution (GIS analyses) of anchovy stock within survey area (September, 2014).

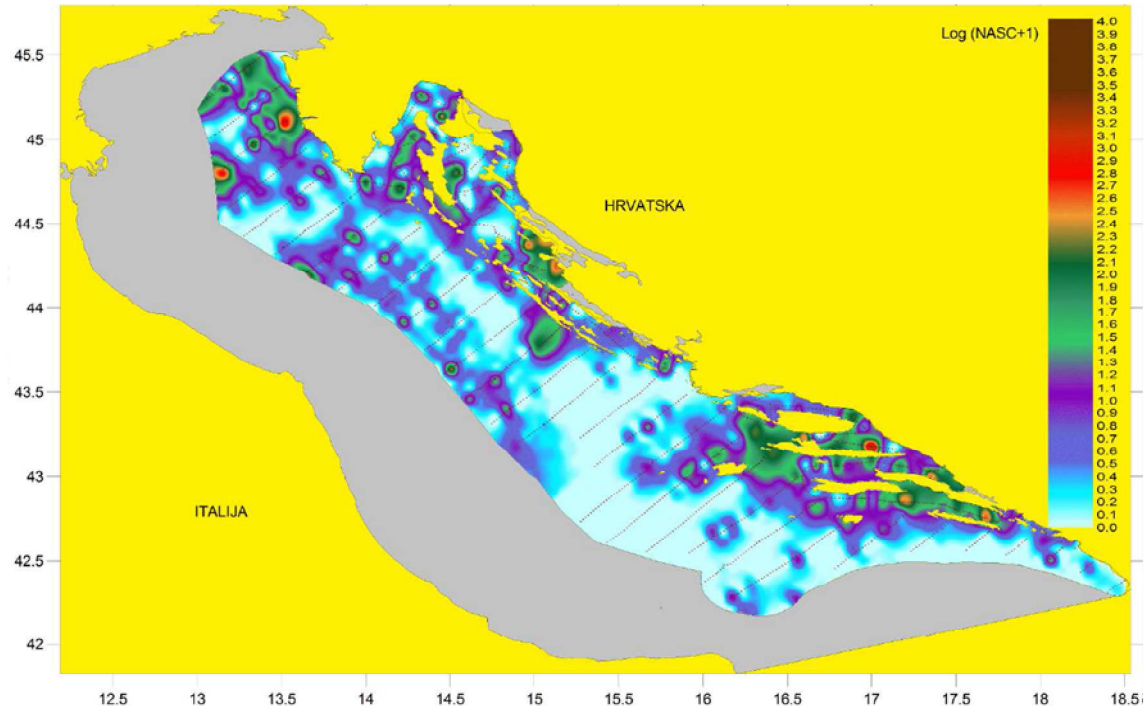


Figure 6. Spatial distribution (GIS analyses) of sardine stock within survey area (September, 2014).

c) Gulf of Lion survey (Jean-Louis Bigot, Jean-Herve Bourdeix, Claire Saraux).

Pelmed surveys cover the Gulf of Lions (3300 nm²) and have been performed annually in July since 1995 with R/V L'Europe to estimate the spatial distribution and abundance of all small pelagic fish, including anchovy and sardine which are the target species. Since 2008, the survey had also been covering the north Catalan Sea. However, we were not able to cover this area in 2014, due to the absence of authorization from Spain to enter their territorial waters. Such area was covered in 2014 by Spain, so this lack of authorization has not represented a loss of information for the MEDIAS.
The survey design is made of 9 parallel transects perpendicular to the coastline and 12 nm apart, from the 20 m isobath to the 200 m one. The EDSU is 1 nm. The surveying acoustic vessel speed is 8 knots. Echotraces are identified with a pelagic haul. Acoustic recording and trawl hauls are performed during day time and the survey lasts approximately 26 days. The split beam echo sounder used is SIMRAD ER60, with the 38, 70, 120 and 200 kHz frequencies. The pulse duration is 1024 ms. The echo sounder is calibrated at each survey. Acoustic data are saved both in HAC and RAW format. The threshold for acquisition is –80 dB and that for processing for the assessment (38 KHz) is –60 dB. Additionally, the new multi-beam echo sounder SIMRAD ME70 was used for the first time this year enabling to visualize 3D echoes.

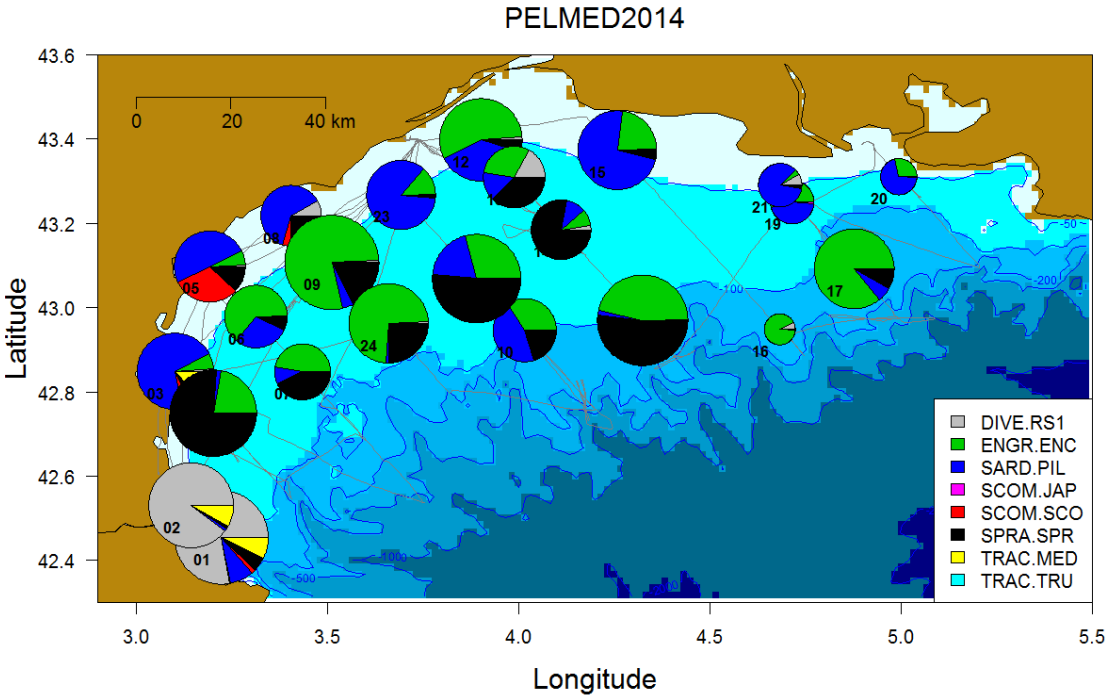


Figure 7. Map of the assessed area and sampling design. 2014 survey is used as an example to show the trawl positions and species composition.

Sardine biomass was slightly lower than last year. But the important information of the year was the quasi absence of recruitment. The size distribution of sardines is usually

bimodal during the PELMED July survey. However, this year the first peak (between 8 and 10 cm) was totally missing. Similar observations were made on sprats for which the first peak was barely visible. This suggests poor environmental conditions for recruits of winter spawners and is worrying for the sardine population in the next 1 or 2 years. This year, some large individuals were observed but still very few compared to a decade ago. Further, the body condition index (as for anchovies) is at its worse. All these signs show that the population has not yet recovered, so that poor (if not null) recruitment might have important consequences on the future. Anchovy biomass was slightly higher than last year but still below the precautionary biomass. Further, biological parameters show that anchovies were slightly larger than the previous year, but their condition was even poorer, suggesting that they have not recovered from poor exogenous environmental factors yet. Landings are still low for both species and the situation is believed to be mainly a consequence of unfavorable environmental conditions.

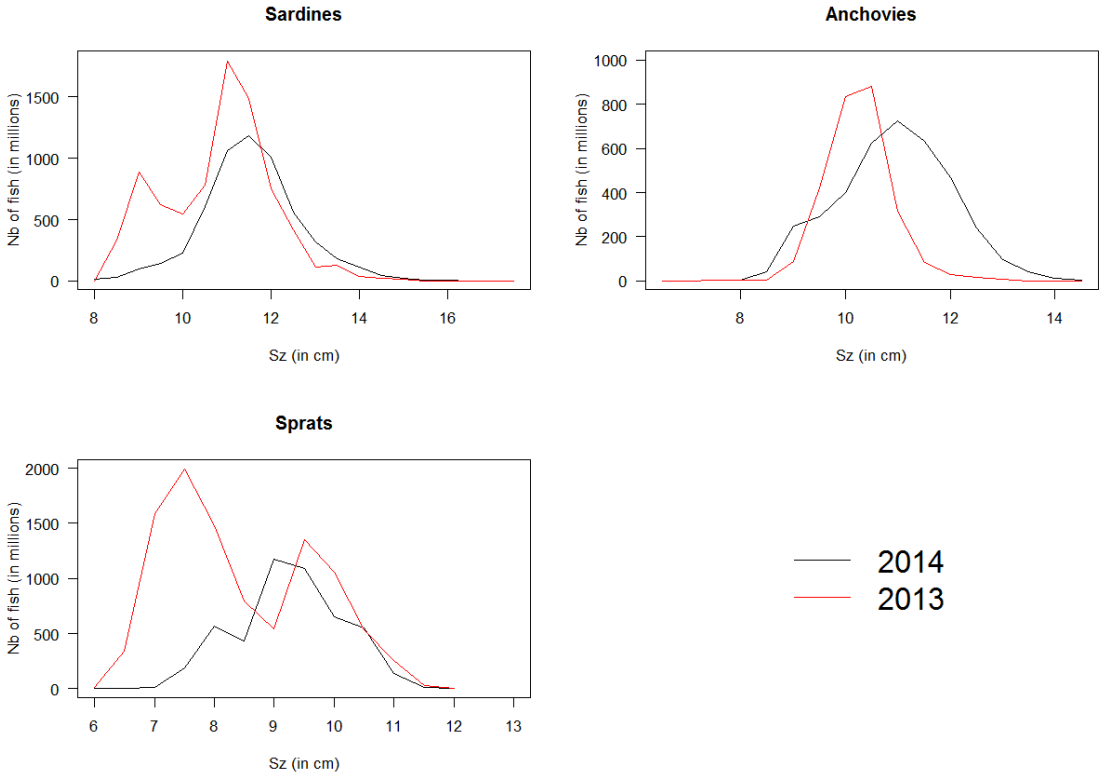


Figure 8. Size distribution of anchovies, sardines and sprats from 2014 (in black) and 2013 (in red) surveys. The absence of the first peak for sardines and sprats is visible by comparing both curves.

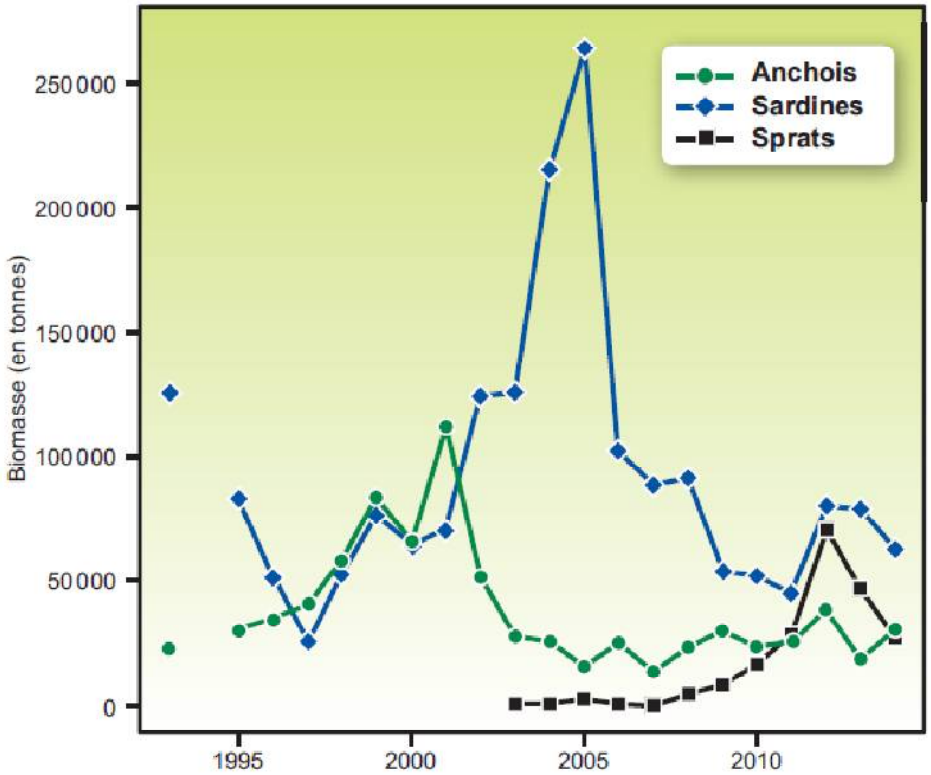


Figure 9. Direct assessment of biomass since the start of the PELMED acoustic survey.

Finally, the really bad weather encountered during the survey prevented us from trawling as often as we wanted to. The acoustic prospection lasted much longer than usual as well. For all of these reasons, the uncertainty associated with 2015 assessments should be higher.

Indeed, the use of different scenarios of trawl allocation led to much bigger CV than previous years even for targeted species (around 15-20% for sardines and anchovies vs. less than 5% usually).

d) Acoustic survey in the Strait of Sicily - GSA 16 (Angelo Bonanno, Gualtiero Basilone, Simona Genovese, Rosalia Ferreri, Marco Barra)

Acoustic data were collected during the echosurvey carried out in the period 3-18 July 2014 on board the R/V "G. Dallaporta" in the GFCM Geographical Sub-Area 16 (GSA 16 – South of Sicily). Acoustic biomass estimates and spatial distribution of sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) for the year 2014 are presented.

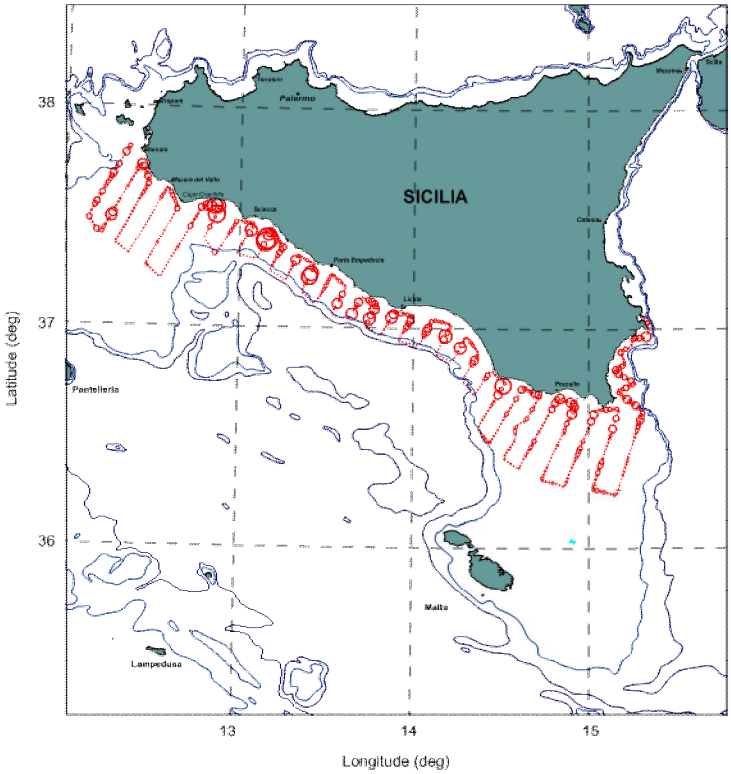


Figure 10. Fish NASC estimated in the GSA16.

The total biomass of anchovy stock (3857.6 t) has further decreased reaching a level similar to the minimum value estimated in 2008 (3130 t). The spatial distribution showed that anchovy was mainly concentrated in the southernmost tip of Sicily. The age structure highlighted the presence of juveniles and two main age classes (1 and 2).
In the case of sardine population the biomass in 2014 (24200 t) increased in comparison to that estimated in previous years; only in the period 1999-2000 higher sardine biomasses were. However, the distribution of biomass among age classes shows a breakdown of the population mainly in two age classes (0 and 1). Although the increase in biomass levels over the previous years constitutes a positive signal, one cannot certify that the state of the stock is improving. In fact, the risk of collapse of sardines in the Strait of Sicily could be referable not only to the age structure, but also to a decline in the total biomass of the stock shown by the estimates obtained in recent years.

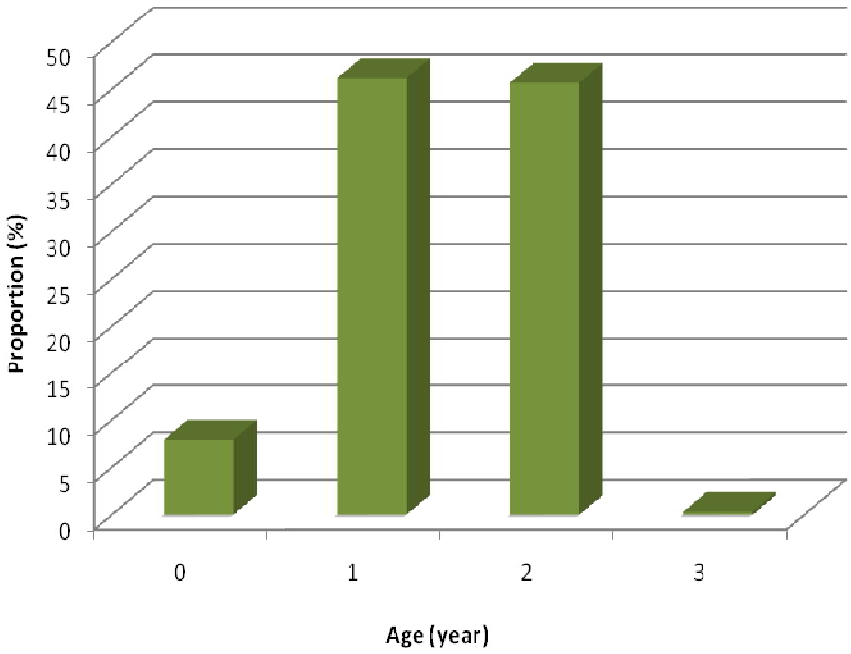


Figure 11. Anchovy age classes distribution (%).

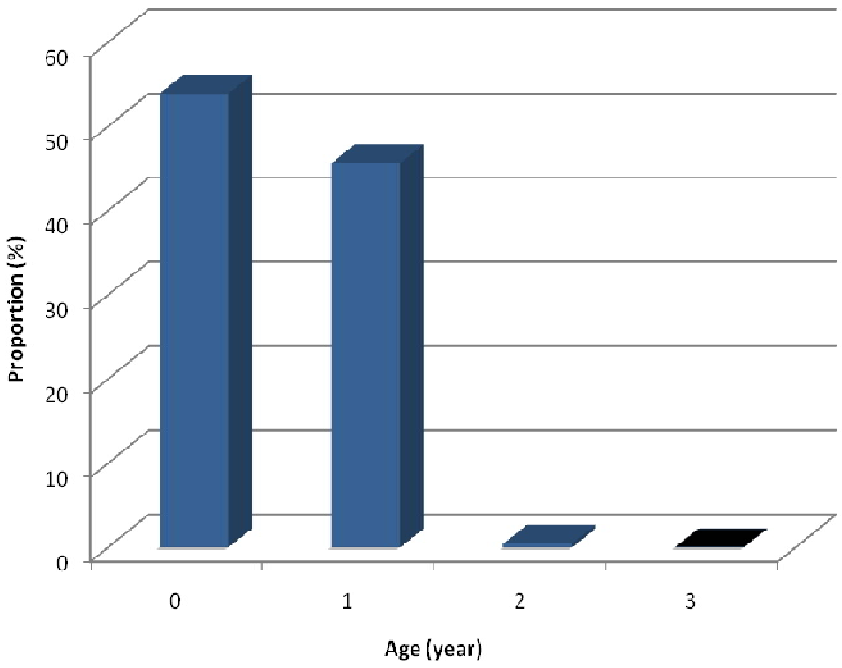


Figure 12. Sardine (*S. pilchardus*) age classes distribution (%).

e) Maltese waters survey in GSA 15 (Roberta Mifsud, Angelo Bonanno, Reno Micallef, Gualtiero Basilone, Simona Genovese, Rosalia Ferreri, Marco Barra)

The echosurvey in the Maltese waters was carried out in summer 2014 on board the RV "G. Dallaporta" in collaboration with the Italian colleagues of IAMC-CNR.

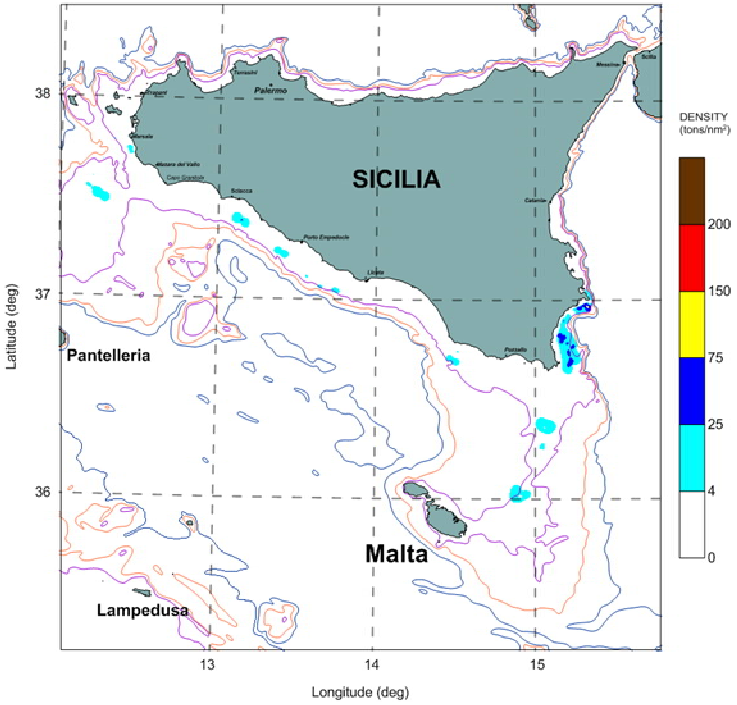


Figure 13. Anchovy spatial distribution estimated in the GSAs 15 and 16.

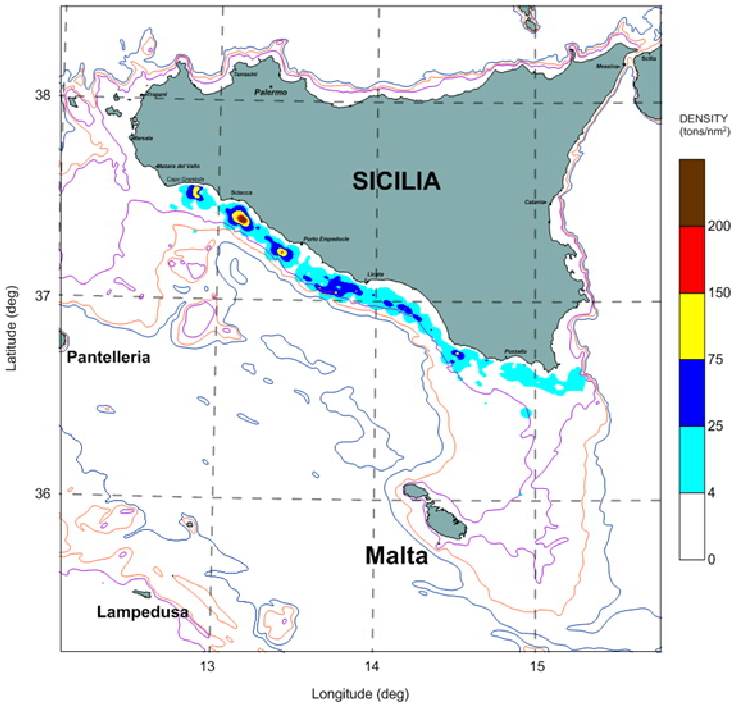


Figure 14. Sardine spatial distribution estimated in the GSAs 15 and 16.

The survey track was 328 nm long and covered an area of 2026 nm^2; 6 pelagic hauls were completed during such survey. The estimated sardine biomass was 176 t while anchovy abundance was 558 t. The NASC Fish distribution shown in the previous figure

4 evidences the presence of pelagic fish only east of Malta located in the central part and on the Maltese shelf.

f) Greek acoustic survey in GSAs 20 and 22 (Athanassios Machias, Marianna Giannoulaki, Konstantinos Tsagarakis, Maria Myrto Pyrounaki, Stylianos Somarakis, Nikos Nikolioudakis, Eudoxia Schismenou)

The echosurvey in the Greek waters was carried out in June-July 2014 in GSA 22 and in September 2014 in GSA 20 on board the RV "PHILIA". The survey design is made of parallel transects perpendicular to the isobath from 10 m to 200 m depths. The inter-transect distance is 10 nm. The EDSU is 1 nm. The average surveying acoustic vessel speed is 7.5 knots. Echotraces were identified based on the catch composition of the pelagic haul. Acoustic recording was performed by day time. The survey covered North Aegean Sea, North Evoikos gulf, and the eastern part of Ionian Sea including Patraikos and Amvrakikos gulfs. The survey track involved 51 acoustic transects, that covered an area of 7240 NM^2 in North Aegean Sea and 30 transects that covered an area of 2535 NM^2 in Ionian Sea (Fig. 15). In addition 119 CTD Stations in Aegean and 54 in Ionian Sea, as well as 167 zooplankton sampling stations in Aegean and 54 in Ionian Sea were completed during the survey.
The anchovy biomass was estimated to be 23209 t in North Aegean Sea and 13389 t in the East Ionian Sea. The sardine biomass was estimated to be 16401 t in North Aegean Sea and 11306 t in East Ionian Sea. The biomass distribution of each species is shown in Figs. 16 and 17. The length composition for anchovy and sardine are shown in Figs. 18 and 19.

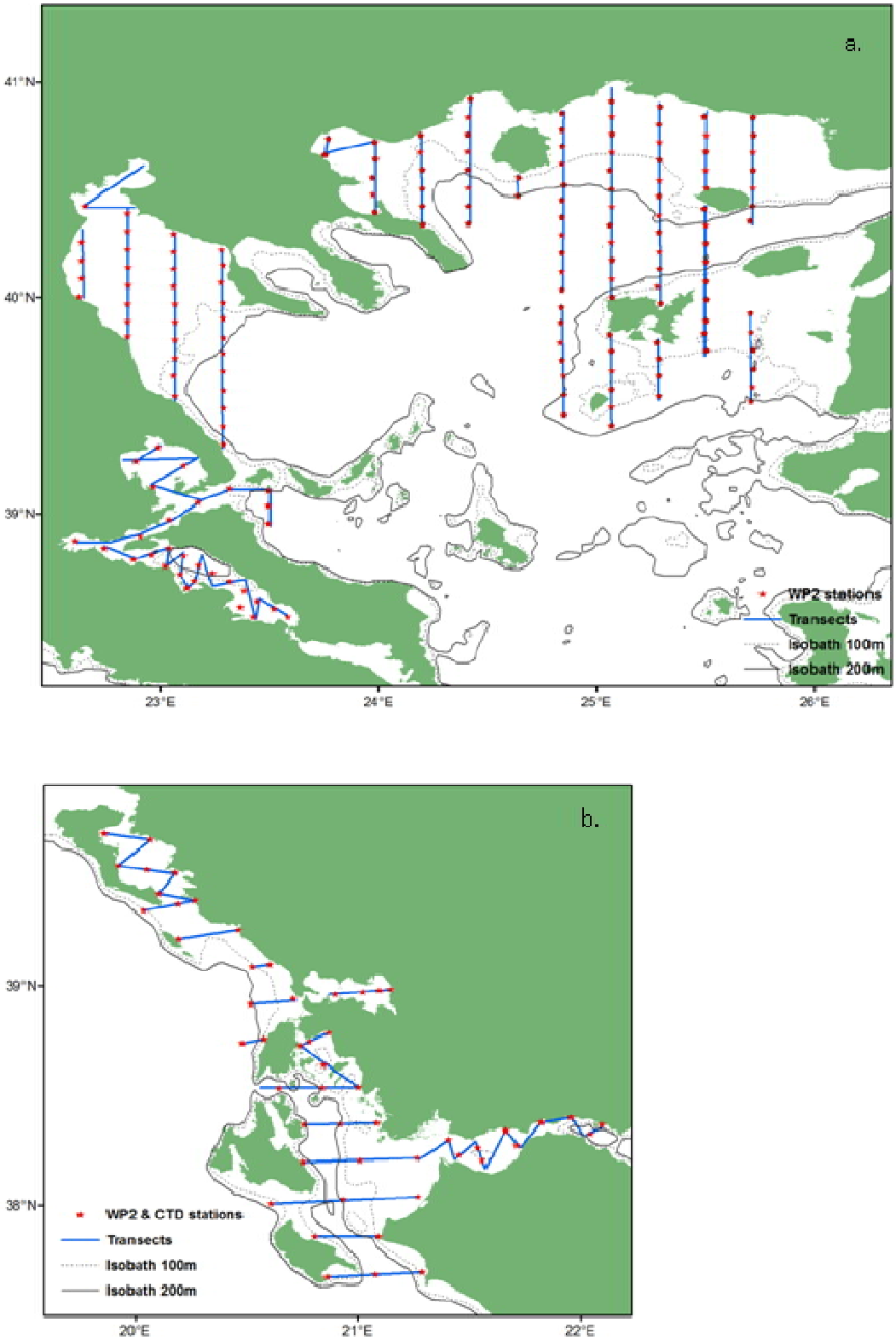


Figure 15. Map of the survey area and the survey design a) in GSA 22 and b) in GSA 20 at the Greek acoustic survey in 2014.

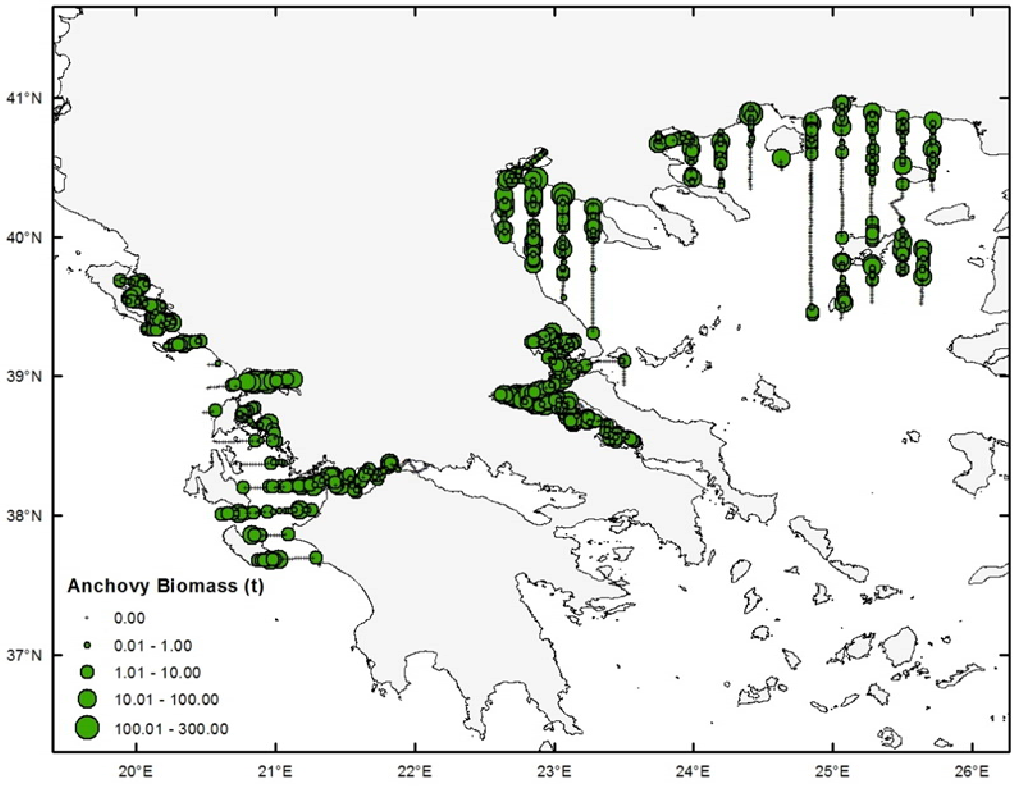


Figure 16. The distribution of anchovy biomass as estimated in the Greek Survey in 2014.

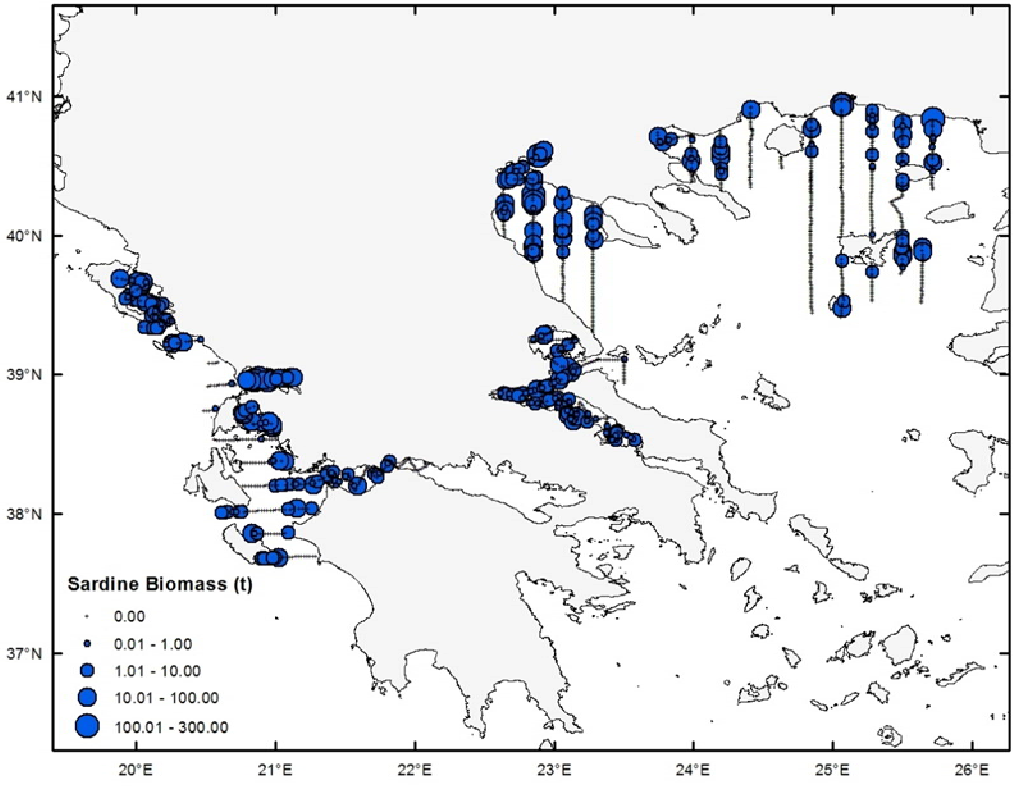


Figure 17. The distribution of sardine biomass as estimated in the Greek Survey in 2014.

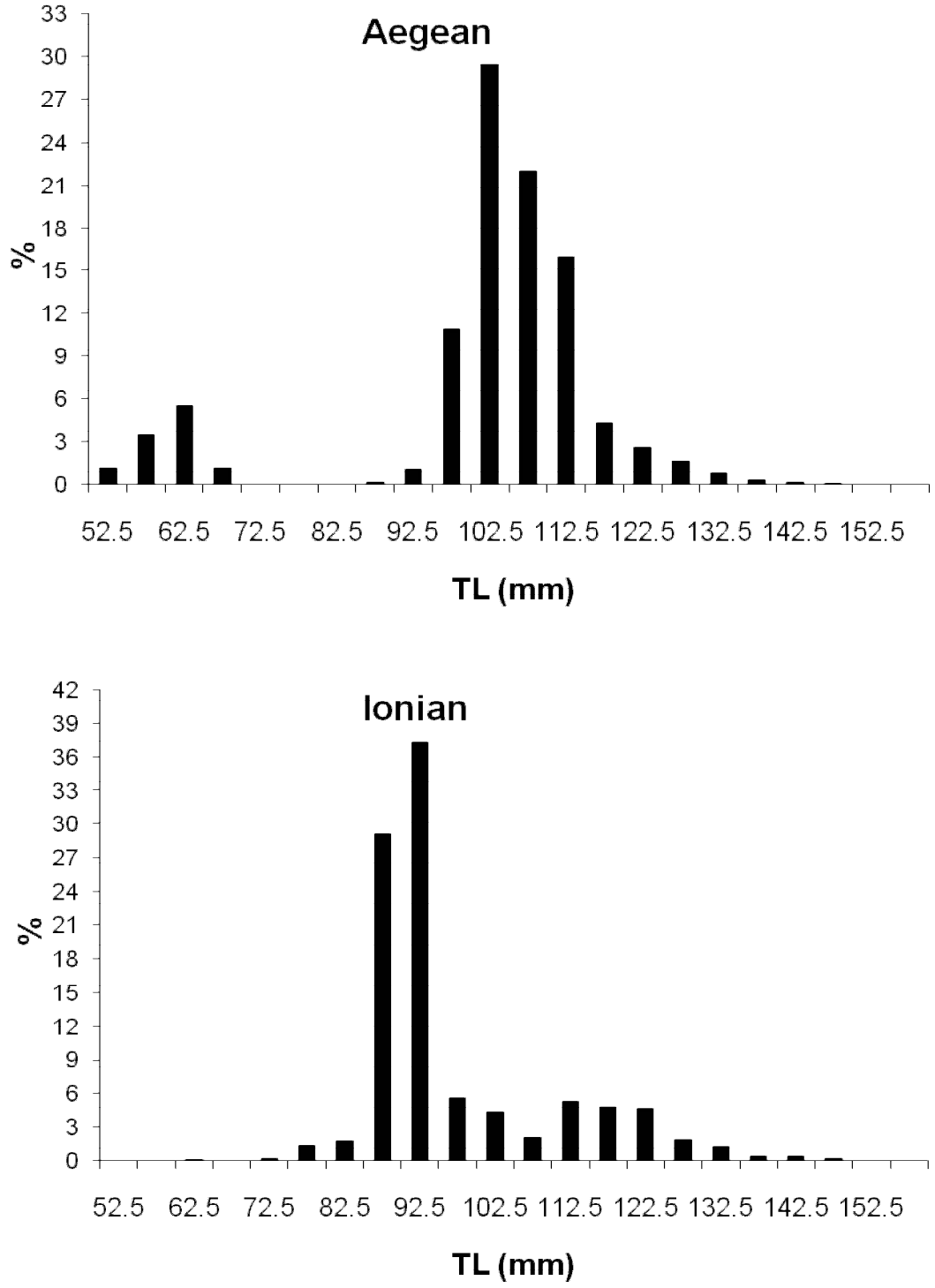


Figure 18. Length frequency distributions of anchovy catch during the survey in Greek Waters in 2014.

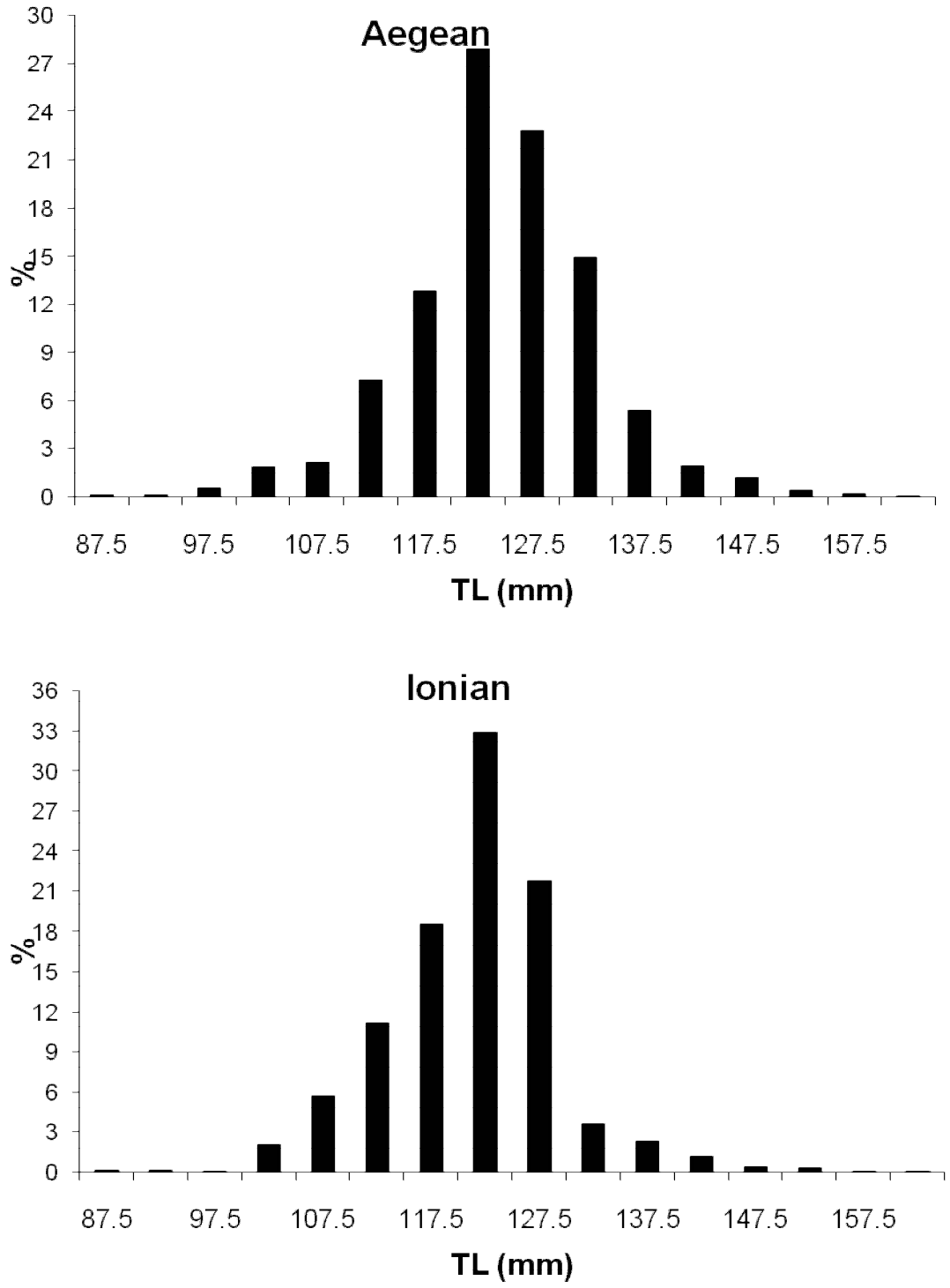


Figure 19. Length frequency distributions of sardine catch during the survey in Greek Waters in 2014.

g) Iberian acoustic survey in the GSAs 01 and 06 (Magdalena Iglesias, Ana Ventero, Joan Miquel, Dolores Oñate)

The MEDIAS 2014 Spanish acoustic survey was carried out in the Mediterranean Spanish waters from 20th June to 22th July 2014 on board R/V "Miguel Oliver" (70 m long). This new research vessel has replaced the R/V "Cornide de Saavedra", the boat that held all the acoustic surveys in the Spanish Mediterranean Sea from 1983 to 2013. Acoustic data were collected over 1299 nautical miles, corresponding to 128 tracks (GSA01 and GSA06) and 51 pelagic trawls were used to scrutinize the echograms. Moreover, 111 CTD stations were performed and 392 CUFES (Continuous Underway Fish Egg Sampler) stations were analyzed. The most abundant species in the pelagic trawls were anchovy (*Engraulis encrasicolus*), sardine (*Sardina pilchardus*), Mediterranean horse mackerel (*Trachurus mediterraneus*) and Atlantic horse mackerel (*Trachurus trachurus*). It has been detected an increase in anchovy abundance, principally at GSA06 (Fig. 20), together with an important decrease in sardine abundance (Fig. 20), due to a very low sardine recruitment (Fig. 21). Sprat (*Sprattus sprattus*) abundance has also experienced a decline, after the expansion reported in GSA06 northern area from 2011 to 2013 (Fig. 22).

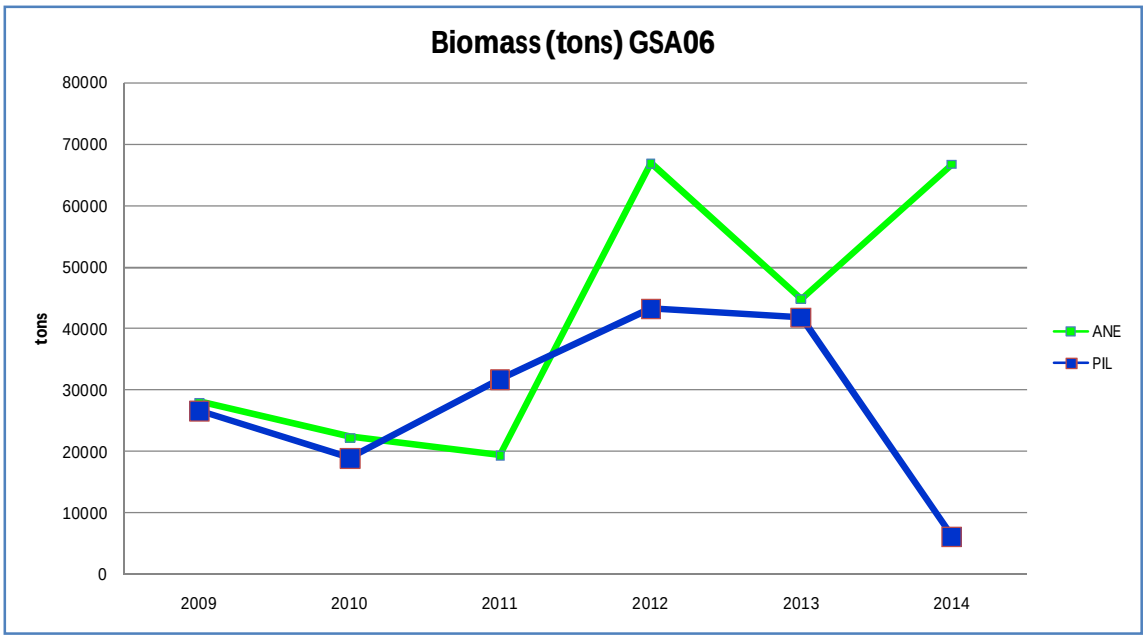


Figure 20. Anchovy (ANE) and sardine (PIL) biomass in tons at GSA06 evaluated during MEDIAS 2014.

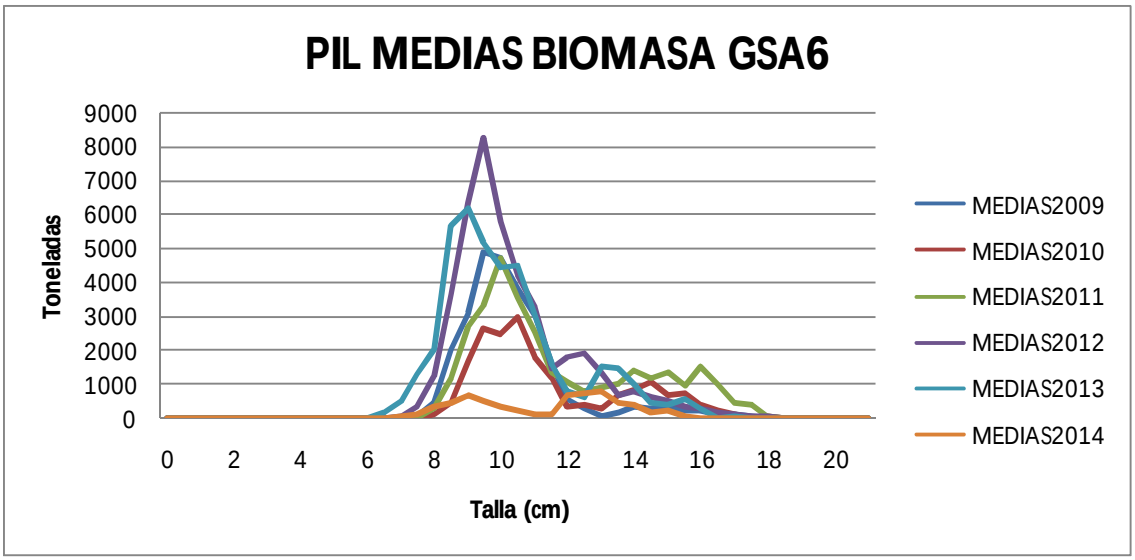


Figure 21. Sardine (PIL) length frequency distribution in tons at GSA06. First mode corresponding to the sardine recruitment.

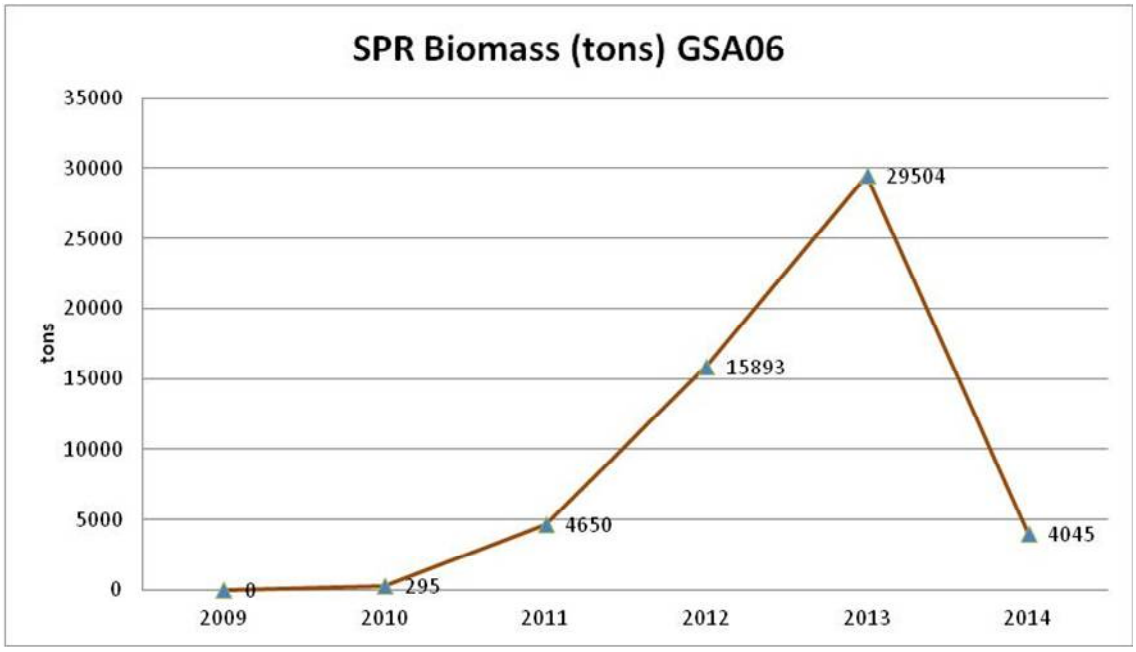


Figure 22. Sprat (SPR) biomass (tons) estimated during the MEDIAS Spanish acoustic surveys.

h) **Pelagic Surveys at the Romanian Black Sea Littoral** (Valodia Maximov, George Tiganov Tiganov)

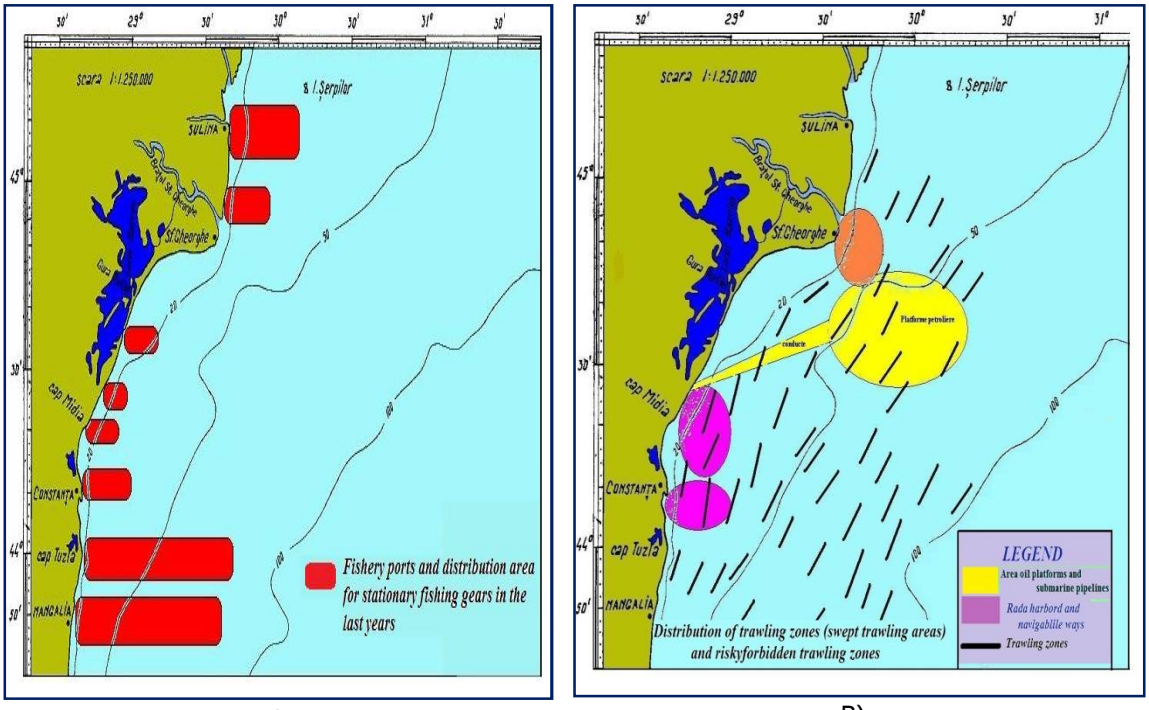
Description of the Fisheries

The Romanian fishing fleet is operating in the area of competence of the Regional Fisheries Management Organisations - G.F.C.M., Area 37 - Mediterranean and Black Sea, Sub-area 37.4., Division 37.4.2, GSA 29. Taken into account the evolution of the marine fisheries in the last 25 years, the structure of the vessels in the fleet in the last

4 - 5 years (with small size - more than 90% and low technological investment per fishers), generally using traditional fishing techniques, for subsistence or local, small markets, limited infrastructure for landing and keeping of catches, research, management, and monitoring, we can considered as being small-scale/artisanal fisheries. The Romanian fishing area is comprised between Sulina and Vama Veche; coastline extends for over 240 km, which can be divided into two main geographical and geomorphologic sectors:

♦ the northern sector (about 158 km in length) lies between the secondary delta of the Chilia branch and Constantza, constituted of alluvial sediments;

♦ the southern sector (about 85 km in length) lies between Constantza and Vama Veche characterised by promontories with active, high cliffs, separated by large zones with accumulative beaches often protecting littoral lakes.



A) B)

Figure 23. A) Fishery ports and distribution area for stationary fishing gears. B) Distribution of trawling zones

The distance from the sea shore to the shelf limits (200 m depth) varies from 100 to 200 km in the northern sector and to 50 km in the southern one. The submarine slope of the shelf is very gentle in the north, while in the southern sector the slope increase very quickly.

In the coastal zone of the Romanian marine sector with small depth, fishing with fixed gear is characterized by the concentration of activity mainly in the first six-seven months of the season (March-September), when usually the species migrates to the coastal area for reproduction and other species migrate for feeding. In generally, total

fishing season being of about eight months. The capture level and the level of fishing productivity differs from one year to another, depending on the fishing effort (number of pound nets and effective fishing days), and also depends on the evolution of hydro climatic conditions and at last but not least, the state of fish stocks. The structure on species in the catches mirrored only partly the composition of Black Sea ichtyofauna from the Romanian sector, because the type of gear conditions the ratio between the different fish species. As a general rule, the pelagic species, small-sized and short life cycle keep continue to be dominant in catches.

Survey 2012 – 2013:

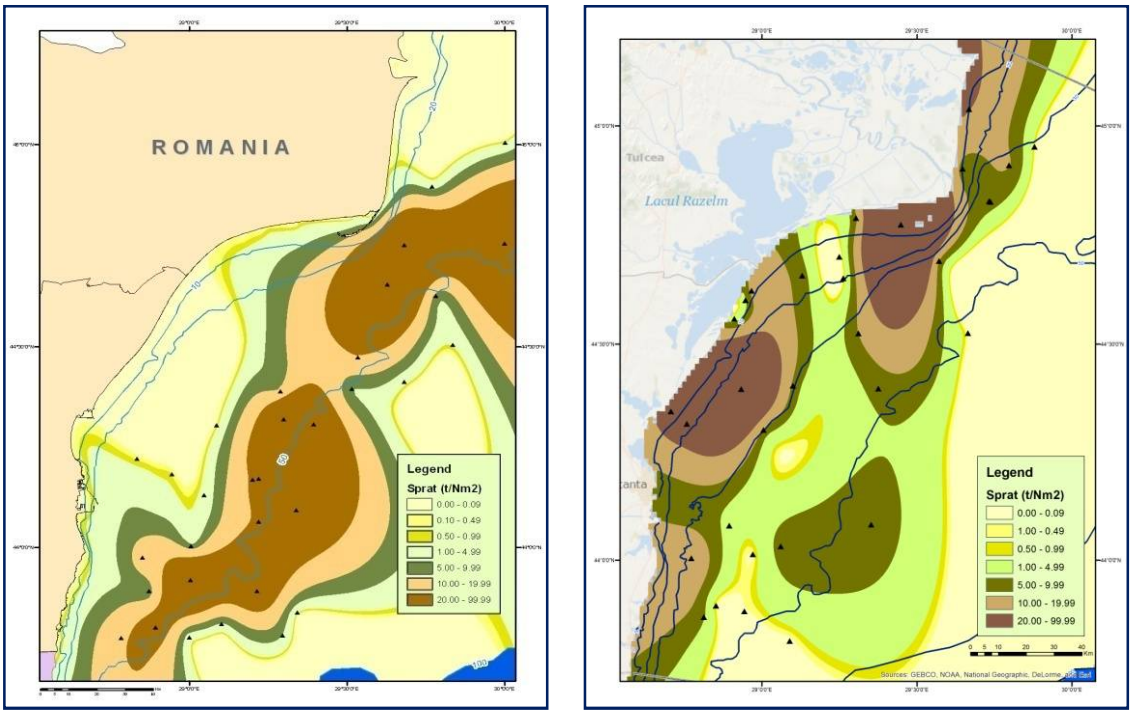
- period: 02 - 12 December 2012 and 11 - 23 June 2013
- type of fishing vessel: B-410 (*STEAUA DE MARE 1*);
- characteristics: pelagic trawls: 36/26-59 m; horizontal trawl opening - 20 m; vertical trawl opening 11-12 m; no trawls 32 ÷ 30; drepth 30.3 - 62.1 m; trawl speed 3.2 knots; time trawling 30 min; catch 50–2,000 kg.

Estimated total biomass:

- *Sprattus sprattus* (european sprat):

Autumn 2012 - in the **32** sample trawlings made with the pelagic trawl, on a surface of **2,856** Nm², the average values of the catches were of about **8.99-21.396** t/Nm². The maximum value was recorded in the Gura Portiţa-Sf. Gheorghe (30-50 m) and Chituc-Constanta (45-60m) sectors. The estimated biomass for sprat crowds, in the research a area, was of about **68,887 to**.

Spring 2013 - in the **32** sample trawlings made with the pelagic trawl, on a surface of **1,600** Nm², the average values of the catches were of about **0.00-89.977** t/Nm². The maximum value was recorded in the Zaton-Sf. Gheorghe (0-30 m) and Chituc–Cap Midia (0-30 m) sectors. The estimated biomass of about **56,428.955 to**.



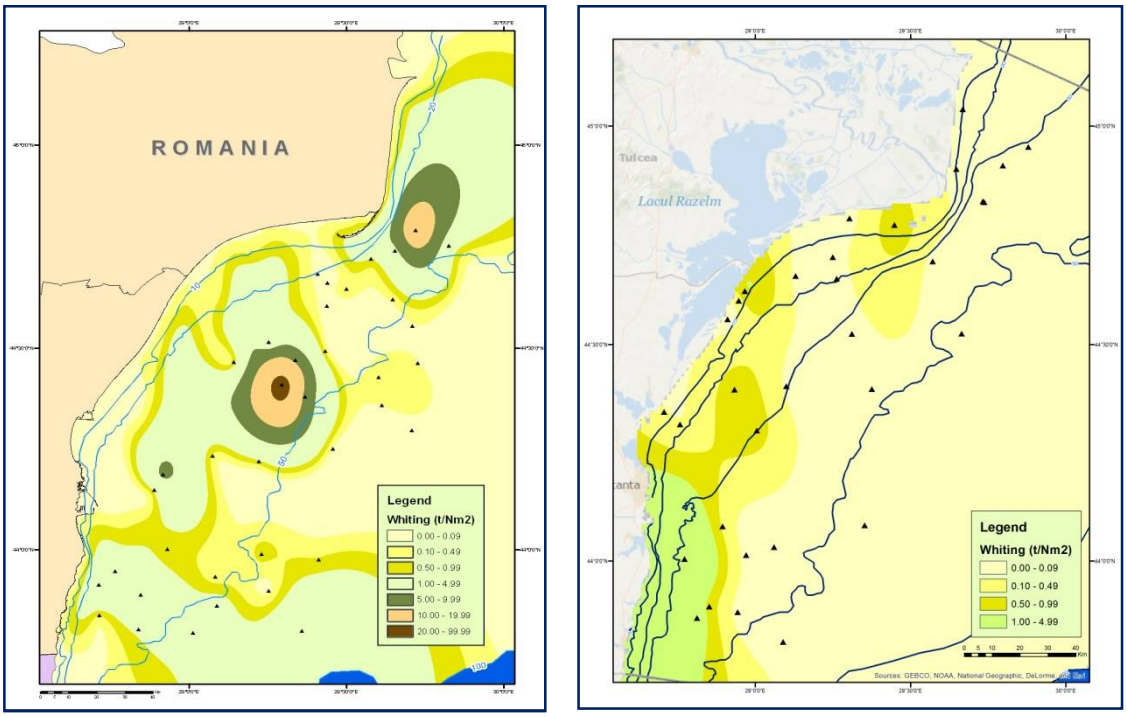
2012 2013

Figure 24.

- *Merlangius merlangus* (whiting):

Autumn 2012 - in the **32** sample trawlings made with the pelagic trawl, on a surface of **2,856** Nm², the average values of the catches were of about **0.95-1.35** t/Nm². The maximum value was recorded in the Gura Portiţa-Cape Midia (30 - 50 m) and Vama Veche–Constanta (50-70 m) sectors. The estimated biomass for the whiting crowds, in the research area, was of about **5,633 tones**.

Spring survey 2013 – sweeping area procedures were conducted on an surface of **1,600** Nm^2. The average values of whiting catches, were situated in the limits between **0.0-3.27** t/Nm^2. Revealed that whiting had a flat distribution in large area between Constanta–Vama Veche (**0.0-1.08** t/Nm^2 / depth 0-30 m, respectively **0.0–3.27** t/Nm^2 / depth 30-50 m. Estimated biomass of about **464.22** tones and the estimated one for the Romanian platform about **1,450.67** tones.



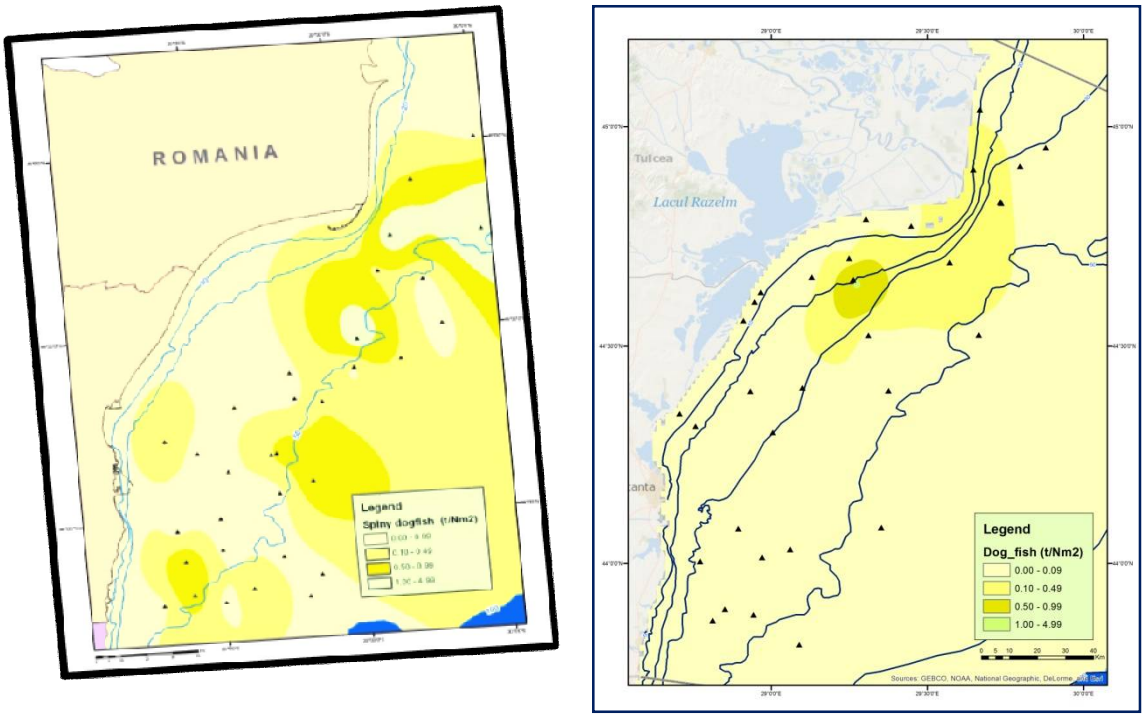
2012 2013

Figure 25.

- *Squalus achanthias* (dogfish).

Autumn 2012 - in the 32 sample trawlings made with the pelagic trawl, on a surface of **2,856** Nm², the average values of the catches were of about **0.161-0.736** t/Nm². The maximum value was recorded in the Perisor-Sf. Gheorghe (30-50 m) and Constanta (50-70 m) sectors. The estimated biomass for the dogfish crowds, in the research area, was of about **1,515.883 to**.

Spring 2013 - in the 32 sample trawlings made with the pelagic trawl, on a surface of **1,600** Nm², the average values of the catches were of about **0.0–1.60 t**/Nm². The maximum value was recorded in the Chituc-Sf. Gheorghe (0–30 m and 30-50 m) sectors. The estimated biomass in the research area, was of about **1,515.883 to**.



2012 2013

Figure 26.

The agglomeration biomass of the main species from Romanian littoral (t)

The swept area method is used for assessment of the biomass of fishing agglomerations of sprat, whiting, turbot, dogfish based on the statistic processing of productivity data obtained in sampling trawling and industrial trawling; The calculated biomasses by swept area for main species at the Romanian littoral ranged between: sprat (30,917 tons and 68,887 tons); turbot (627 t and 1,712 t); whiting (6,565 t and 26,171 t) and dogfish (967 t and 5,635 t.

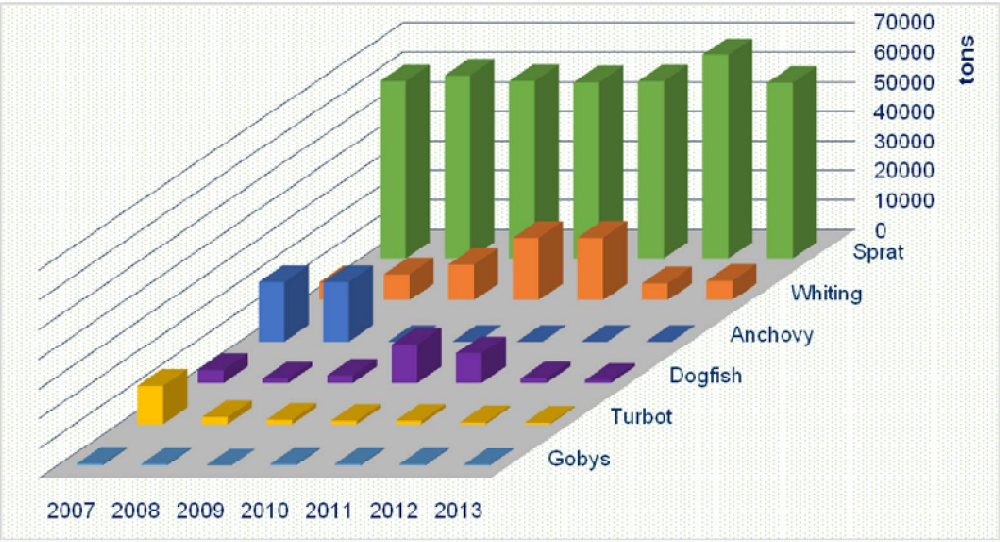


Figure 27. The agglomeration biomass of the main species from Romanian littoral (t).

i) **Echosurveys on small pelagics in GSAs 9 and 10** (Angelo Bonanno, Gualtiero Basilone, Simona Genovese, Rosalia Ferreri, Marco Barra)

In the Italian waters, echosurveys on small pelagics are regularly carried out only in the northern sector of the Sicily Channel (GSA 16) and the western part of the Adriatic Sea (GSAs 17 and 18) since 2009 as part of the National Data Collection Program on Fisheries (EU Reg. 199 / 2008). In GSAs 9 and 10, despite the importance of the stock of small pelagic fishes, this activity has never been funded, producing a severe lack of information that prevented to evaluate and consistently manage the status of the small pelagic resources.

In the period 2009-2014 the research group of CNR-IAMC of Capo Granitola, that regularly performs acoustic surveys for estimating the abundance and distribution of small pelagic fish species in GSA 16 (Project MEDIAS), carried out four echosurveys in the waters of the Tyrrhenian sea. In particular, in summer period in 2009, 2011 and 2014, the acoustic survey was performed in both the GSAs 9 and 10, while in 2013 the survey took place only in the GSA 10.

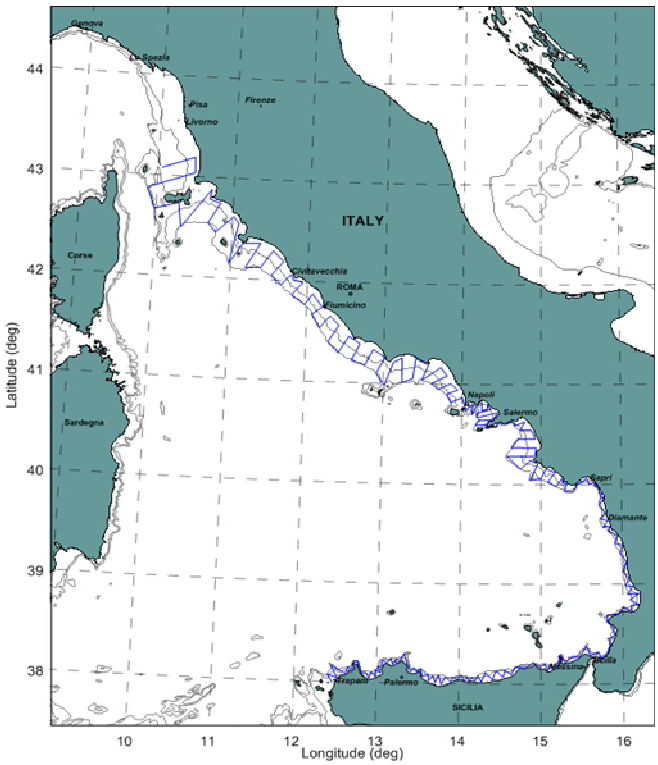


Figure 28. Map of the survey design in GSAs 9 and 10 adopted during the survey in 2014.

The spatial distribution of both anchovy and sardine, observed during the four surveys, evidenced different patterns for the two species with anchovy mainly selecting the northern part of GSA 10 and sardine generally more abundant in the GSA 9.

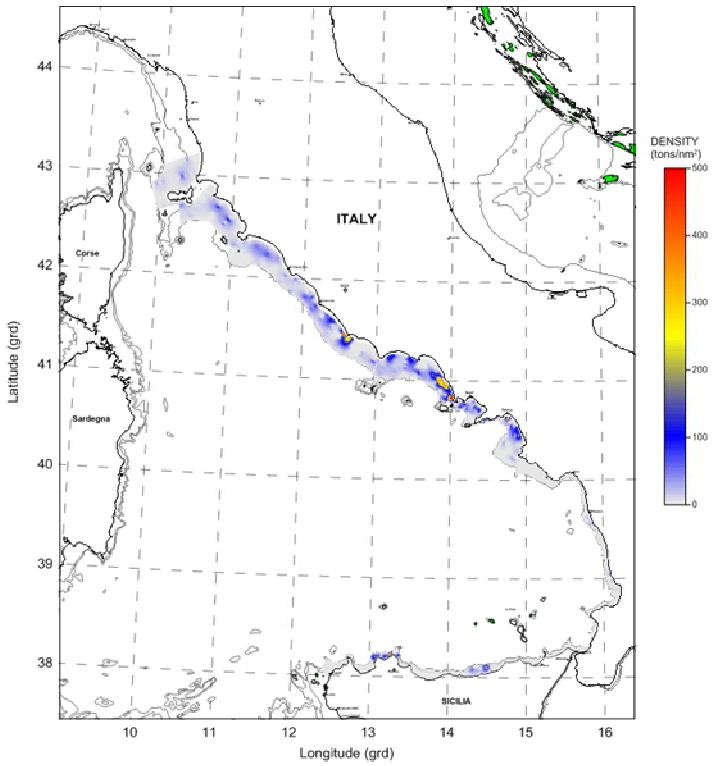


Figure 29. Spatial distribution of anchovy during the survey in 2014.

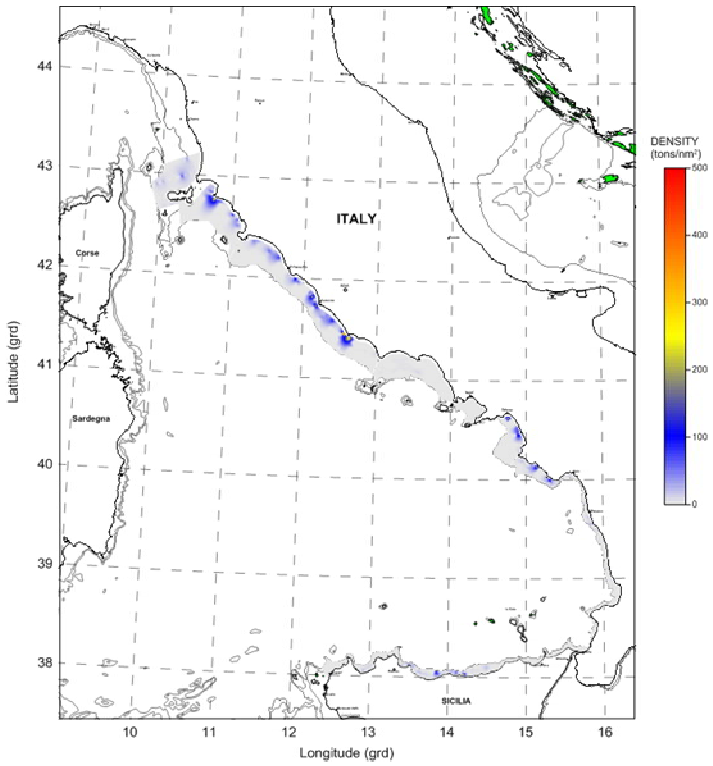


Figure 30. Spatial distribution of sardine during the survey in 2014.

In the southern part of GSA 10 (north Sicily and west Calabria), characterized by a narrow continental shelf, a patchy distribution, with evident differences among surveys, was recorded. During the survey in 2014 anchovy biomass in GSA 9 was 35782

tons while in GSA 10 it was 46897 tons. Sardine biomass was 18290 tons in GSA 9 and 5898 tons in GSA 10.

MEDIAS website (Marco Barra)

The MEDIAS website is available on the net following the link www.medias-project.eu.

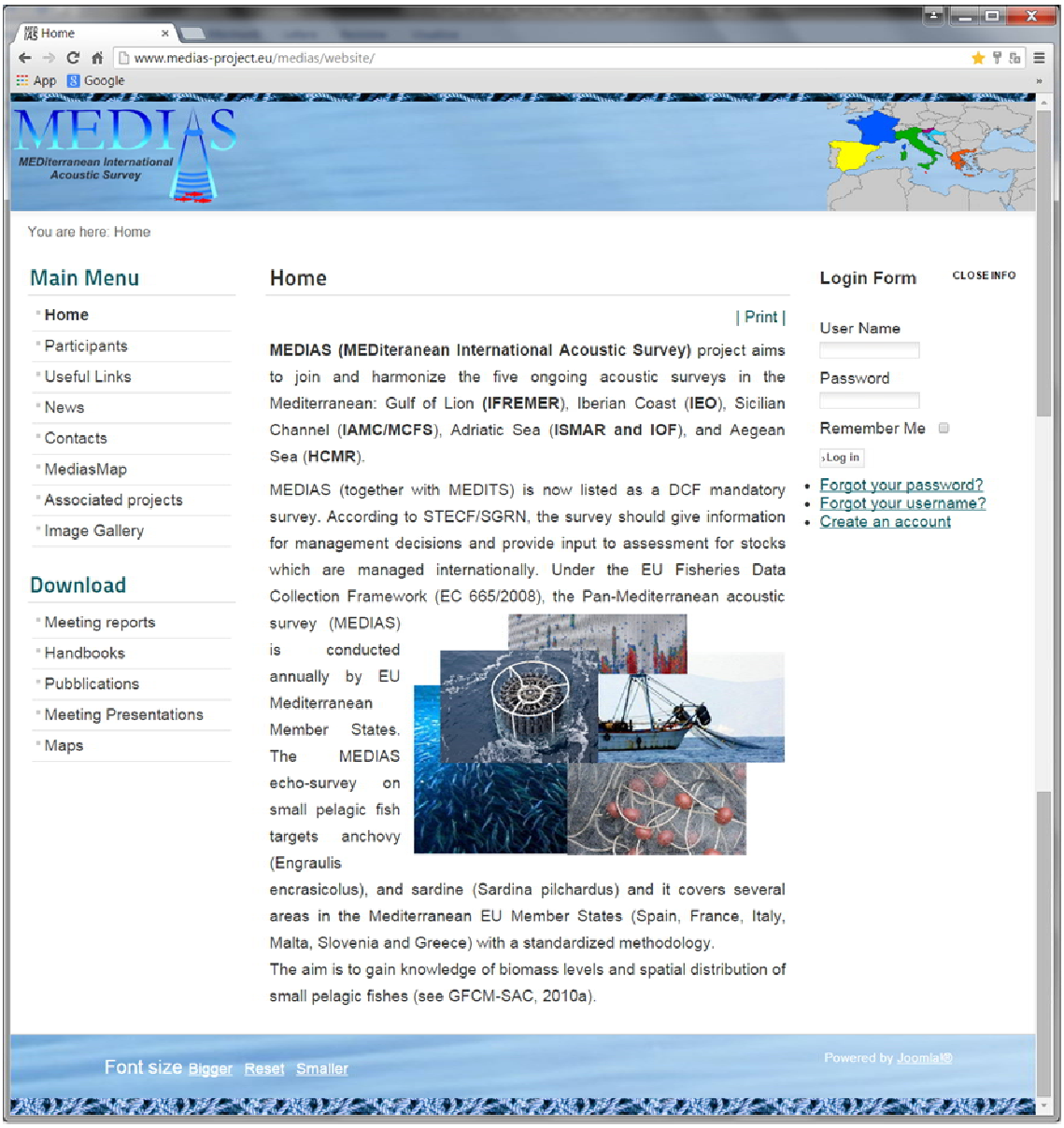


Figure 31. The home page of the MEDIAS website.

Since the last meeting no further improvements were made on the website, and only general updates (2014 survey traks, meeting presentations, involved partner and publications) will be carried out at the end of the 2015 meeting. During the meeting all the MEDIAS partner agreed on the proposal to give public access to the MEDIAS HANDBOOK; the website rule to access to such resource will be changed accordingly.

Common database design proposal (Iole Leonori, Andrea De Felice, Rocco De Marco, Ilaria Costantini)

During the 7th MEDIAS Meeting (2014) in Heraklion, it was decided to start to develop a common database for the MEDIAS project. CNR-ISMAR of Ancona was in charge to start a preliminary design of this database.

Survey data were divided into 3 groups:

- Acoustic data containing information about the scientific echosounder, survey design and preprocessed acoustic data;
- Environmental data namely CTD and Satellite data;
- Biological data which includes the trawl description and the general and biological information of the trawl.

All this groups are related to information about the survey, like the GSA, the size of the area, the vessel, etc.
The first step to achieve this aim is to create a valid and well-performing database design.
The database is a collection of tables; it is a "relational database" because relationships do exist both among the columns within a table and among the tables. These relationships take three logical forms: one-to-one, one-to-many, or many-to-many. These are stored as a series of tables with foreign keys that are used to connect the related data.
In our design we can identify four groups named: General data, Biological data, Acoustic data and Environmental data.
The group General data contain all the information about the survey and is divided in six tables (t), namely: t_vessel, t_survey, t_sub_survey, t_survey_type, t_zone and t_haul.
In this six tables we can find information like the geographical sub area, the year, the latitude and the longitude, the total catch, etc.
Another group consists of Biological data, that is divided in five tables: t_catch, t_sample_composition, t_sample_distribution, t_category and t_species.
In this section there are all the information about the sample like the species, the category (e.g. OPS, target species), the length class etc.
The data structure is ready and tested with our data and the applications design for most of the computations are done.

The third group is Acoustic data which consists in six tables t_transect, t_echo_sounder_parameter, t_edsu, t_nasc_per_species,t_layer and t_layer_nasc.
The data structure is still work in progress because we have to do an alignment of the older and newest data.
Finally there is the group Environmental data, that contain five tables t_station (DEPM station), t_ctd_station, t_ctd_info, t_ctd_data and t_ctd_sensor.
In this group we can identify all the information about the DEPM and CTD stations.
The data structure is being tested, but some applications are already developed.
For the analysis of the data we use different tools (all freeware) and we separated the data that are coming from the survey and the data that are coming from the laboratory:

- the data that are collected during the survey; in details: CTD, Sensors and the Web app like Web2py (e.g. balance software or the data coming from the hauls) data. All this information is stored in a local database on board and when the survey ends it is validated through R scripts and afterwards incorporated into the Main Data Store at the Institute;
- the samples of anchovy, sardine and sprat taken on board are analyzed in laboratory for the age and sex determination and the data are input through Web2py into the local database, validated through R scripts like acoustic and CTD data and incorporated into the Main Data Store.

All the structure and the data acquired during the survey can be viewed and extracted using PgAdmin III through the Query Tool that allows you to execute SQL commands.
The user have two options to upload the data: paste the SQL queries in the provided field or upload a local file to be executed.
PgAdmin III allows the creation of tables and views that can relate different tables of the database. Users don't need to know SQL language, they just have to import the query and run it.
The analysis of the acquired data is carried out through R script. R and RStudio are very useful programs for the realization of reports, graphs (e.g. Length/Weight relationship) and computations. The user can import data in the workspace of R or RStudio by .csv, Excel spreadsheets or directly through the database connection (library RPostgresSQL).
Another very useful feature of R/Rstudio is the possibility to convert the data from the database in EchoR format. The user can establish a connection to the database and run the script. The output is a .csv file.
Finally, through the views or stored procedure is possible to create georeferenced maps by the use of QuantumGis. The user can import the data like CTD and hauls position, NASC and haul composition by .csv files or directly connect to the database through the DB manager tool.
We have highlighted some missing in our common database proposal:

- acoustic data database design is still incomplete/under development;

- all the views/store procedure have to be standardized and documented;
- the most of the R scripts have to be uniformed;
- the development has been done around the CNR ISMAR case study, and needs to be generalized.

In the future we are planning to support EchoR to produce well formatted dataset.
In conclusion, if standard tables and fields are established for all the MEDIAS participants, we can work for the creation of a common database that with few instruments can be functional and fast in data processing.

Workshop on the standardization of the allocation of trawl catches on acoustic data, following the results of the last workshop on EchoR in Vigo.

As planned during the steering committee meeting of MEDIAS 2014, most of the MEDIAS partners participated to the EchoR workshop, held in Vigo by Mathieu Doray during the WGACEGG meeting (Working Group on Acoustic and Egg Surveys for Sardine and Anchovy in ICES Areas VII, VIII and IX), in the period 17-21 November 2014. During the workshop Mathieu Doray presented a set of R scripts using EchoR functions to perform different tasks such as the data check, length-weight relationships computation as well as the species total biomass estimation. All the participants largely appreciated the work done since it allowed to perform most of the steps required by the analysis in a straightforwad way, using a well defined procedure. Anyway due to some differences in the data structure, as well as in the procedure adopted by each MEDIAS partner, it was not possible to run the entire set of scripts working on own data. During the last MEDIAS meeting in Sète, thanks to Claire Saraux most of the problems in running the scripts were solved clarifying how to manage differences in data structure and procedures. Anyway, even though all participans were interested in the use of EchoR, some work must be done further in order to evaluate the obtained results, and eventually develop specific functions to manage particular tasks (if any) not implemented in EchoR.

Workshop on the CV with different procedures

Based on the work carried out during the MEDIAS 2014 meeting, a simple example (R script) on how to run geostatistical simulations was presented. Specifically the CV was estimated following a procedure similar to the one proposed by Walline (2007). The method consits in running two different types of geostatistical simulations. In a first step, Indicator simulations are carried out to take into account the indetermination in the area of presence of the considered species. Such simulations are also required since for the second set of simulations, strictly positive values are transformed by

means of normal-score transformation in order to obtain normally distributed positive values required to run Gaussian geostatistical simulations. Indeed normal score transformation cannot be used when the dataset is characterized by a large number of zero values, and consequently a second set of simulation must be computed working on positive values only. In a second step, as stated above, Gaussian simulation are carried out on normal-score tranformed positive values, by passing at each iteration as interpolation grid the ones obtained during indicator simulations. At the end of the procedure, a vector of possible realizations of total biomass is obtained, and it can be used to compute the 95% confidence intervals of the obtained mean total biomass. Differently from the procedure proposed by Walline (that takes into account also the indetermination due to the biological sampling) in this simple example we worked directly on density values, and then obtained confidence intervals consider only the indetermination due to the spatial sampling. Some of the partecipants tried to run the script using their own dataset. Since the CI estimation is one of the key points of the biomass estimates, all partecipants agreed on the possibility to include such step in the final part of a common procedure. Marco Barra has expressed his willingness to provide before the next meeting a more formal version of the script in order to consistently evaluate obtained results by all participants.

References

Walline, P. D. (2007). Geostatistical simulations of eastern Bering Sea walleye pollock spatial distributions, to estimate sampling precision. ICES Journal of Marine Science, 64: 559–569.

Research activities in the framework of MEDIAS and proposals for common studies and manuscripts.

Project IRIS-SES "Integrated Regional monitoring Implementation Strategy in the South European Seas" (Magdalena Iglesias)

The Marine Strategy Framework Directive (2008/56/EC) (MSFD) stated that monitoring programs to assess progress towards achieving Good Environmental Status (GES) had to be established by 2014.
In order to facilitate the international coordination of MSFD related monitoring task the Directorate-General for the Environment (DGENV) launched in 2012 the call for proposals “New Knowledge for an integrated management of human activity in the sea” Reference: ENV/PP 2012/SEA. This call asked for projects that should develop integrated monitoring strategies in selected pilot regions, based on existing sampling across various disciplines (physical, chemical, biological) and scope the potential for joint programs (within and between Member States).

These pilot projects should demonstrate a practical way in which current effort could be redeployed to more efficiently use existing resources, through for example the multi-use of existing monitoring platforms, and thus promote resource efficiency. Such integrated monitoring programs should be mainly built on the ongoing monitoring under the Regional Sea Conventions, the Data Collection Framework (DCF) and other relevant directives.
The IRIS-SES project (http://iris-ses.eu/), presented by a consortium of several institutions from Western and Eastern Mediterranean and Black sea countries (e.g IEO, Spain; HCRM, Greece), was one of the pilot projects selected within this call. Within the framework of the activities carried out up to now the MEDIAS (Mediterranean International Acoustic Surveys) program have been identified as one of the already existing Joint Monitoring Programs in the Mediterranean that could be integrated in the MSFD monitoring system. It already provides data useful for some of the indicators applied to evaluate the achievement of the GES in relation to MSFD Descriptor 3 (Population of commercial fish/shell fish) but it presents the potential of being used as platform to address some of the sampling requirements of other descriptors.
Thus, one of the tasks envisaged within IRIS project is to elaborate a MSFD related report based on MEDIAS surveys, considering the applicability of actual MEDIAS monitoring methodologies to provide data or biological samples to address other MSFD descriptors.

Epipelagic plankton layer in Alboran Sea: Matching acoustical and biological data
(Ana Ventero)

During the Spanish Mediterranean acoustic surveys carried out in summer time (June-July) over the continental shelf (30-200 m) for small pelagic assessment, a persistent epipelagic scattering layer is detected. Its presence can negatively influence the fish detection since both coexist in the water column. During the MEDIAS_2013 and MEDIAS_2014, a specific study was made in Alborán Sea in order to optimize echogram scrutinizing.
The specific objective was to characterize the epipelagic scattering layer, using a calibrated EK60 scientific echosounder operating at 5 frequencies (18, 38, 70, 120 and 200 kHz) and 4 different mesh sizes (250, 333, 500 and 2000 microns) to cover the meso and macrozooplancton size range. One of the achieved challenges was developing the necessary technology to monitor the net track in real time.
The workflow to process the acoustic data was: Background noise removal, integration cell determination and volume backscattering strength exportation.
Biological samples were preserved on board in formalin, once in the laboratory 3 aliquots were analyzed and the total abundance of the 9 main zooplankton groups

present in the samples (Small Crustacea, Big Crustacea, Chaetognatha, Appendicularia, Doliolida, Siphonophora, Heteropoda, Egg and Fish larvae) was determined.
Final results on the relationship between acoustic energy at different frequencies and biological abundance (nº individuals) per mesh size are still in progress.

Noise Removal from the Greek acoustic data (Maria Myrto Pyrounaki, Marianna Giannoulaki, Konstantinos Tsagkarakis, Athanassios Machias)

To analyze the Greek survey acoustic data in 2014 we used an Echoview dataflow template based on the outcome of the MEDIAS Echoview workshop that took place in Sicily (Capo Granitola) in 2013. We aimed to exclude any ambient noise present in the underwater environment before analyzing the acoustic data, so we focused on two steps of the dataflow template: i) the background-noise removal (BNR) and ii) the intermittent-noise flecks removal.
The configuration settings for the BNR variable concerning the averaging cell was 20 pings horizontal extent and 2 m vertical extent; the maximum noise was set at -110dB; and the minimum threshold for signal to noise ratio (SNR) was set at 3dB. We concluded to these settings after checking the sensitivity of the noise estimate to changes in the horizontal and vertical extent in the averaging cell (Figs. 32 and 33) following De Robertis and Higginbottom (2007). The maximum noise was determined empirically. Finally, the appropriate minimum SNR was estimated following De Robertis and Higginbottom (2007) approach (Fig. 34).
The second step was the intermittent-noise removal. We considered as intermittent-noise flecks, pings that presented decimal difference between the adjacent pings higher than 14dB. This allowed us to avoid losing strong echoes from the core of small schools.

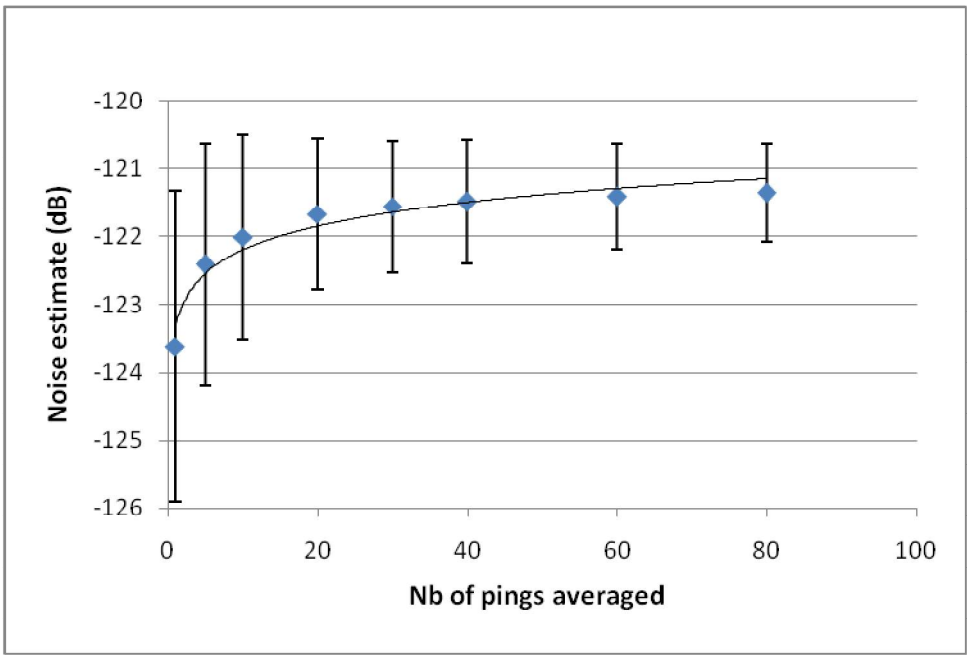


Figure 32. The sensitivity of the noise estimate to the number of pings (horizontal extent) averaged in each 2m deep grid cell at 120 kHz. Graphs show ± 1 s.d.

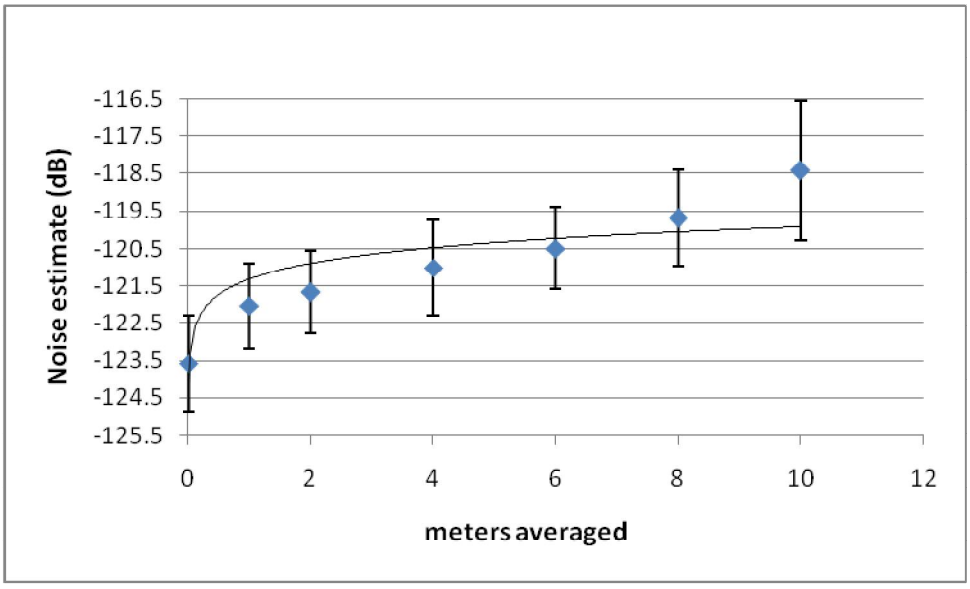


Figure 33. The sensitivity of the noise estimate to the vertical extent (in meters) averaged in each 20 pingsat 120 kHz. Graphs show ± 1 s.d.

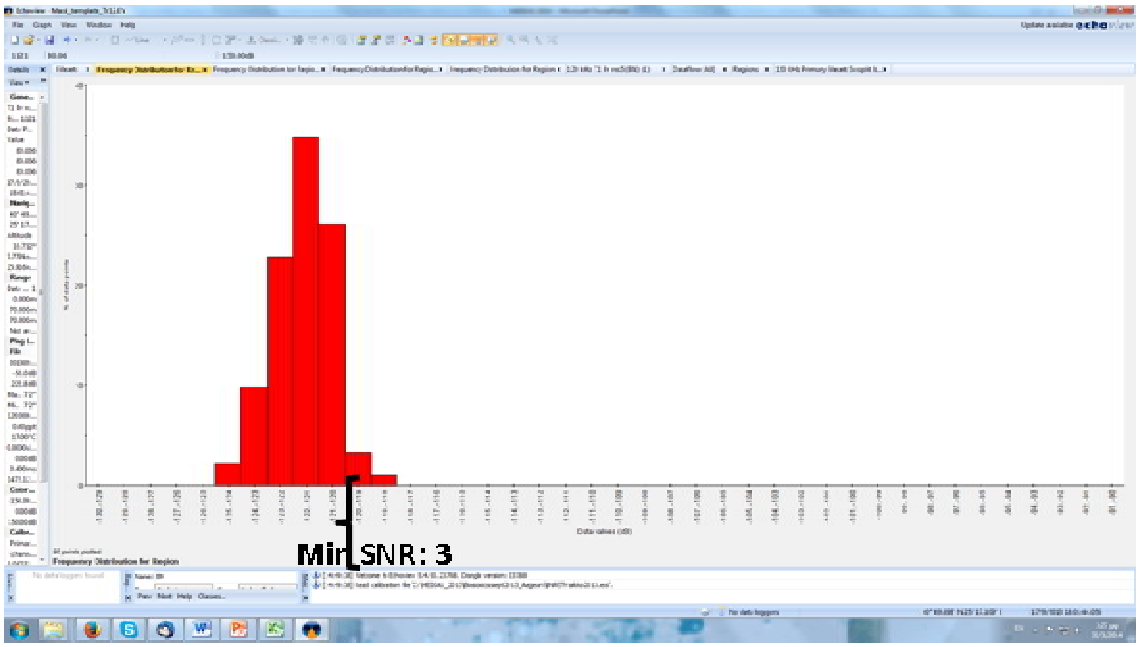


Figure 34. Plot showing the background noise distribution at 120 kHz. A SNR threshold of 3dB is required to suppress the upper tail of the distribution when the data are averaged in bins of 2m vertical extent and 20 pings horizontal extent.

References

De Robertis, A., and Higginbottom, I. 2007. A post-processing technique to estimate the signal-to-noise ratio and remove echosounder background noise.*ICES Journal of Marine Science,* 64: 1282-1291.

Terms of Reference for the "MEDIAS 2016"

General:

- to join and harmonize the ongoing acoustic surveys in the Mediterranean Sea and Black Sea;
- to provide information for management decisions;
- to provide input for stock assessment purposes concerning the stocks which are managed internationally;
- to provide information for Good Environmental Status in the MSFD.

Specific:

- Update MEDIAS handbook
- Update the MEDIAS Website
- Update the structure of the common database
- Update the workflow for the analysis of the echograms and, in particular, the aspects concerning the multifrequency analysis
- To complete the EchoR workflow
- To work on common scripts to be adopted for the estimation of CV in a standardized way and the allocation of trawl catches on acoustic data
- To work on Marine Strategy Framework Directive for ecosystem descriptors and to evaluate the contribution of MEDIAS

Conclusions and decisions of the MEDIAS Steering Committee

In the 8th MEDIAS meeting the results of the acoustic surveys carried out in 2014 were presented by participants of the seven countries working in MEDIAS: Spain, Greece, Italy, Malta, France, Slovenia and Croatia. Moreover, results from the surveys carried out in 2012-2013 by Romania in the Black Sea, and from four acoustic surveys in the GSAs 9 and 10 (Ligurian and Tyrrhenian seas) were also presented.

During the two workshops on the "Allocation of trawl catches on acoustic data" and on "CV estimation with different procedures" the Steering Committee agreed on the need to use a standard procedure for the MEDIAS partners.
The procedure (and the R script) adopted during the workshop permitted to obtain confidence intervals due only to the indetermination related to the spatial sampling. Since the CI estimation is one of the key points of the biomass estimates, all the participants agreed on the possibility to include such step in the final part of a common procedure. A more formal version of the script will be provided by Marco Barra before the next MEDIAS meeting in order to consistently evaluate obtained results by all participants.
The adoption of EchoR scripts, considered as a possible choice for the "Allocation of trawl catches on acoustic data", was appreciated by most of the participants even though some work must be done further in order to evaluate the results obtained during the workshop, and eventually develop specific functions to manage particular tasks not yet implemented. Consequently, taking into consideration the progress of the work and the preliminary results, it was decided to keep the subject on CV estimation and the allocation of trawl catches on acoustic data also for the agenda of the next 9th MEDIAS meeting.

Some steps were made by the MEDIAS group in the development of the workflow for the analysis of the echograms. In particular, a procedure for the analysis and removal of background noise was presented and discussed. It was decided to continue the work on a common workflow for acoustic data processing and to discuss during the next MEDIAS meeting the aspects concerning the multifrequency analysis.

The structure of the common database was presented and discussed. In order to obtain the necessary funds for the development of the MEDIAS database, it was proposed to include in each of the National Programs of the Member States working in MEDIAS a specific proposal for contributing to the MEDIAS database. The MEDIAS Steering Committee agreed and the necessary steps will be undertaken by each partner.

During the meeting some of the participants highlighted the importance to adopt a common procedure for otoliths reading for both target species (anchovy and sardine). For anchovy the MEDIAS group adopted the procedures reported in the "ICES Report of the Workshop on Age reading of European anchovy" (WKARA - 9-13 November 2009, Sicily, Italy - ICES CM 2009/ACOM:43, 122 pp.). Unfortunately, even if it was requested to the ICES Commission, a similar workshop for sardine, involving also the Mediterranean countries, was not yet carried out. Thus, based on the assumption that from the methodological perspective the differences between the two species are small, reading methods similar to that established for anchovy were followed. However, in the otolith microincrement workshop, carried out at Mediterranean and Atlantic level (WKMIAS, 2013), an important agreement was reached for both species defining the minimum radius of the first true annual ring (the distance of first annulus from the nucleus). Taking into account also that ages of small pelagics, through otoliths reading, are evaluated also on specimens from commercial landings (National programmes for the collection of primary biological, technical, environmental and socio-economic data in the fisheries sector - Under Council Regulation (EC) N° 199/2008 and Commission Regulation (EC) N° 665/2008), it is important that procedures for otoliths reading be tuned among the involved research groups. The MEDIAS Steering Committee agreed on the need to propose two workshops (one for anchovy and one for sardine) for tuning the otoliths reading among the groups working on small pelagics both in MEDIAS and in the "Biological Variables" sector within the Data Collection Framework.

Some new research activities, to be performed in the framework of MEDIAS, were proposed and discussed during the meeting. Moreover, Angelo Bonanno proposed to work on a special issue to be submitted to a scientific journal, and that may collect scientific contributions from all the countries in the Mediterranean and in the Black Sea. As first hypothesis it was proposed the following theme for the Hydrobiologia Journal: "Environmental and biological factors influencing pelagic communities in different areas of the Mediterranean and Black sea". In the next three months the focus arguments for the Special Issue will be finalized through the contributions of all the MEDIAS partners.

The Steering Committee decided to resubmit to the next RCMMed&BS 2015 the proposal for a study “Inter-calibration exercise of the MEDIAS research vessels”, taking into account the importance of such study for the entire MEDIAS group.

The development of the MEDIAS website has been discussed by the MEDIAS group. Marco Barra, from CNR-IAMC, presented the updated MEDIAS website (http://www.medias-project.eu). It was decided to give open access to the MEDIAS Handbook.

The Maltese colleagues did not participate to the meeting in Sète but Roberta Mifsud from MSDEC-DFA sent to the chair of MEDIAS the following text, that was read during the meeting: "*Since 2009 MEDIAS has been part of Malta's National Programme within the Data Collection Framework. It is pertinent to note that this survey targets anchovies and sardines for which no fishery exists in the Maltese Islands. In this regard Malta feels that there is limited scope in continuing the surveys as the benefits are not commensurate with the associated administrative burdens. To this end Malta is proposing that the survey is carried out by other Member States, which may have a vested interest in the fisheries involved, within the framework of regional cooperation. Malta notes that Italy may be interested in performing the MEDIAS survey in GSA 15 as part of the survey it already carries out in GSA 16. It is understood that such an arrangement would yield the present level of data knowledge which is of interest to the Italian fisheries exploiting these stocks. Under this cooperation agreement Malta would be in a position to grant the necessary authorisations to the research vessel used by Italy to work within the waters under Malta's jurisdiction. If such an arrangement finds no objection from the MEDIAS Coordination Committee, Malta will take the necessary steps to formalise a bilateral agreement with Italy which would be included in Malta's DCF National Programme and submitted to the EU Commission for approval*".
From the other side, the Italian researchers working in the MEDIAS surveys in GSAs 15 and 16 highlighted the importance of continuing to perform the echosurvey in the GSA 15, which is in the same continental shelf of GSA 16 and is complementary to this latter area. The two surveys gives, and may give in the future, a clearer picture of anchovy and sardine spatial distribution in the Sicily Channel. Consequently, the Italian researchers have expressed their willingness to continue the echosurvey in the GSA 15 and to give their support to formalise a bilateral agreement between Malta and Italy.
The MEDIAS Coordination Committee agreed on such proposal and no objection was expressed.
Concerning the MEDIAS HANDBOOK, the MEDIAS group has been working on it, updating some subjects according to what was agreed during the meeting. An updated copy has been included in this report (Annex IV). It was confirmed that this handbook, as well as the MEDIAS website, will be updated and improved according to the outcomes and changes developed by the MEDIAS partners on an annual basis.

The MEDIAS Steering Committee approved the Terms of Reference for "MEDIAS 2016".

Finally, the Steering Committee concluded for the 9th MEDIAS meeting to take place in Split, Croatia, in the period 5-7 April 2016.

Annex I: List of participants

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Annex II: Institutions Acronyms

FRIS: Fisheries Research Institute of Slovenia. Ljubljana, Slovenia

HCMR: Hellenic Center of Marine Research, Greece

IAMC-CNR: Istituto per l'Ambiente Marino Costiero. Consiglio Nazionale delle Ricerche. Capo Granitola, Italy

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

IEO: Instituto Español de Oceanografía. Spain

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

IOF: Institute of Oceanography and Fisheries. Split, Croatia

INRH: Institut National de recherche halieutique. Morocco

INSTM: Institut National des Sciences et Technologies de la Mer. Tunisia

ISMAR-CNR: Istituto di Scienze Marine. Consiglio Nazionale delle Ricerche. Ancona, Italy

METU, IMS: Middle East Technical University, Institute of Marine Sciences. Turkey

MSDEC-DFA: Ministry for Sustainable Development, the Environment and Climate Change - Department of Fisheries and Aquaculture. Marsa, Malta

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

Annex III: Agenda of the 8th MEDIAS Coordination Meeting (Mediterranean International Acoustic surveys)

Sète, France 24-27 March 2015

Agenda

Tuesday 24/03/2015

09.00-09.30: Opening of the meeting & welcome. Adoption of the agenda.

09.30-09.50: Presentation of the Italian Adriatic survey (Iole Leonori, Andrea De Felice).

09.50-10.10: Presentation of Croatian survey (Vjeko Tičina).

10.10-10.30: Presentation of the Iberian survey (Magdalena Iglesias, Ana Ventero).

10.30-10.50: Presentation of Aegean survey (Athanassios Machias, Maria-Myrto Pyrounaki).

10.50-11.10: Presentation of the Gulf of Lion survey (Jean-Louis Bigot, Claire Saraux).

11.10-11.40: Coffee break

11.40-12.00: Presentation of Romania survey in the Black Sea (Valodia Maximov, George Tiganov).

12.00-12.20: Presentation of the echosurveys 2014 - Small pelagics biomass estimation in GSAs 15 and 16 (Angelo Bonanno, Gualtiero Basilone, Marco Barra, Simona Genovese, Rosalia Ferreri).

12.20-12.40: Presentation of the echosurveys on small pelagics biomass estimation in GSAs 9 and 10 (Angelo Bonanno, Gualtiero Basilone, Marco Barra, Simona Genovese, Rosalia Ferreri).

12.40-13.00: General discussion

13:00-14:30: Lunch break

14.30-15.00: Project IRIS-SES "Integrated Regional monitoring Implementation Strategy in the South European Seas" (Magdalena Iglesias).

15.00-16.00: General discussion on MEDIAS contributions for ecosystem descriptors for Marine Strategy Framework Directive.

16:00-16:30: Coffee break

16.30-17.30: MEDIAS website: comments, suggestions, approval.

Wednesday 25/03/2015

09:00-11.00: Workshop on the standardization of the allocation of trawl catches on acoustic data, following the results of the last workshop on EchoR in Vigo.

11.00-11.30: Coffee break

13:00-14:30: Lunch break

14.30-16.00: General discussion and revision of the common MEDIAS protocol.

16:00-16:30: Coffee break

16.30-17.00: "Epipelagic plankton layer in Alboran Sea: Matching acoustical and biological data" (Ana Ventero).

17.00-17.30: Discussion on proposals for common studies and manuscripts.

Thursday 26/05/2015

09:00-09.30: Presentation on Common Database proposal (Ilaria Costantini).

09:30-13.00: Workshop on the CV with different procedures: work on acoustic data analysis for the estimation of CV in a standardized way, taking into account indetermination linked to biological and acoustic spatial sampling.

13:00-14:30: Lunch break

14.30-16.00: Workshop on acoustic data analysis and update of the common workflow.

16:00-16:30: Coffee break

16.30-17.30: Proposal of new research activities in the framework of MEDIAS.

Friday 27/03/2015

09.00-10.00: General discussion and revision of the common MEDIAS protocol.

10.00-11.00: Discussion on proposals for common studies and manuscripts.

11:00-11:30: Coffee break

11:30-12:30: Terms of reference for the next meeting (2016).

12.30-13.00: Adoption of the report.

Annex IV: MEDIAS HANDBOOK

Common protocol for the Pan-MEditerranean Acoustic Survey (MEDIAS)

The geographical areas that will be covered by the MEDIAS surveys and the respective days at sea per survey are presented in the following Table 1 and Figure 1.

Table 1. The size of the geographical area that is covered by each Institute in the Mediterranean Sea and in the Black Sea. (Note that it should be updated on an annual basis). **Day night sampling.

Country	Institute	Geographical area	Size of area	Duration of survey (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	30
Slovenia	FRIS/CNR-ISMAR	Adriatic Sea (Slovenia)	117 NM^2	1**
Italy	CNR-ISMAR	Adriatic Sea (Italy)	13200 NM^2	40**
Italy - Malta	CNR-IAMC/MSDEC-DFA	Sicily Channel	4300 NM^2	16
Spain	IEO	Iberian coast	8829 NM^2	33
Croatia	IOF	Adriatic Sea (Croatia)	13578 NM^2	30
Bulgaria	IO - BAS	Black Sea	3400 NM^2	20
Romania	NIMRD "Grigore Antipa"	Black Sea	4300 NM^2	20

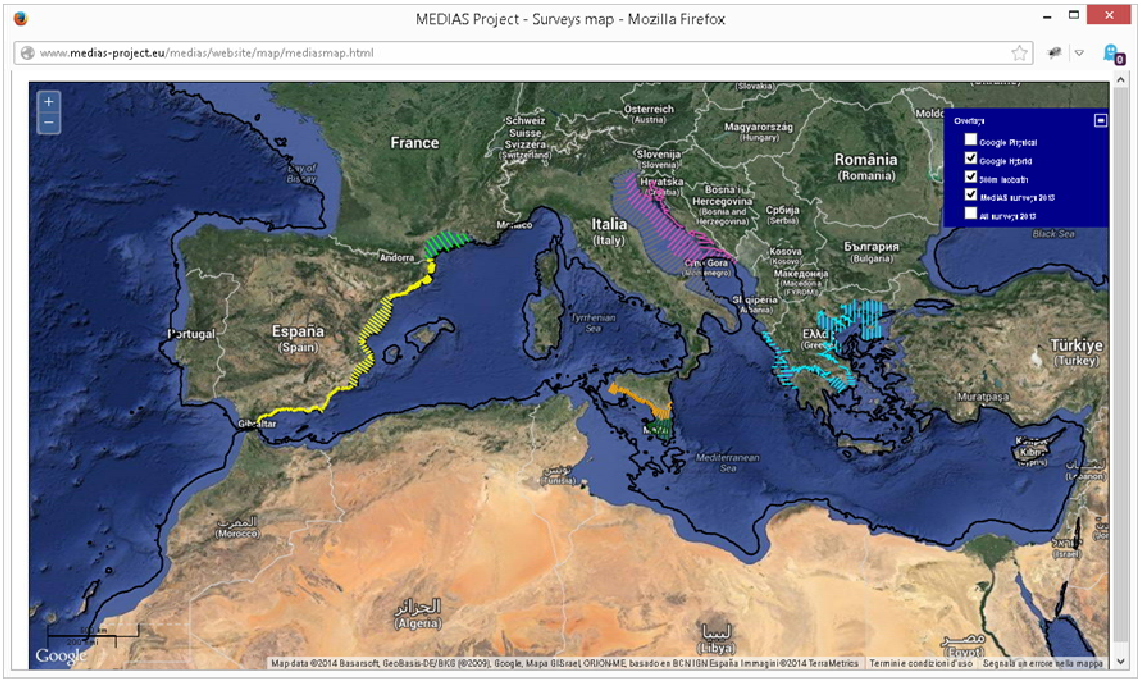

Figure 1: Surveys design in the MEDIAS.

1. 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.

2. 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 70, 120 and 200 kHz can operate as complementary frequencies, depending on the research vessel used.

The pulse duration should be 0.5 or 1 ms depending on the technical specifications of each echosounder and it should be reported. 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 echosounder and according to the principles described by Foote *et al.* (1987). The calibration parameters and the results of the acoustic equipment should be reported by survey according to the following Table.

Table 2. Calibration report

Calibration report	
Frequency (kHz)	
Echosounder 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	

3. Survey Design

The survey design for the acoustic sampling should take into account 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 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, taking into account 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 achieve the optimization of the survey design in each area, a workshop with this specific Terms of Reference should be regularly held 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 cavitations.

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 indicated that night estimates can be higher or lower compared to daytime estimates largely depending on the area characteristics

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 always cover the 20 m isobath or less, reaching the 10 m isobath whenever this is possible. 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". The acoustic energy in the inter-transect tracks will not be taken into account 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 scrutinisation. 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 specific 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:

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

where TS=Target Strength, TL=Total Length. The coordination meeting also agreed that IFREMER should continue to use a b_{20}=-71.2 dB in the Gulf of Lions, for compatibility reasons to the long time-series available, as well as because the available data analyzed from the area of Gulf of Lion were very limited.

Analysis results concerning anchovy indicated large differences between areas. For this purpose MEDIAS partners concluded that further analysis using more data from all areas is needed and agreed not to propose a single TS equation and b_{20} value for anchovy. It was suggested that the work regarding anchovy TS should continue within the framework of specific MEDIAS workshops, using available data from additional areas, such as Croatia. Thus it was agreed that for the time being, the historical Target

Strength equations for anchovy will be maintained in each area and the applied TS equation should be reported.

Acoustic data processing for the assessment of the target species, Myriax Echoview or alternative Movies + 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.

4. 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
   The acoustic data acquired by echosounder during the survey are loaded in a software environment for visual exploration in terms of echograms and maps.

b. Calibrate
   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.

c. Remove background noise
   Before analysing the acoustic data any ambient noise present in the underwater environment has to be removed.

d. 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. Specific aspects are:
   Intermittent noise removal
      Evaluate possible interferences that may produce artefacts in the echograms, and adopt a procedure for removing them;
   Surface and seafloor exclusions
      Use lines for correctly separating the backscattering signals from surface and bottom.
   Single targets estimation
      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.

Schools estimation

Use regions and/or mathematical operators for estimating backscattering signal due to fish aggregations.

5. 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 biomass per species.

6. 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 analysed 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.

Taking into account 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.
- 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 regarding length frequency distribution and Length-Weight relationships should also be acquired.

7. 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 two 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.

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.

8. Database

In the framework of the AcousMed project as well as a MEDIAS workshop, a common database design has been concluded for all MEDIAS surveys (See ANNEX B). The 6th 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.

9. Ecosystem Indicators 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 the ecosystem indicators that can derive from acoustic surveys (based on data regularly collected and analyzed) are reported.

Good Environmental Status indicators	Spatial/temporal strata	Spatial strata	GSA				
			Acoustic survey				
		Time periods	Season (Summer/Autumn depending on the area)				
	Taxonomic levels	Community	Pelagic fish (Species composition, occurrence in pelagic hauls)				
		Target Species	Adult	Anchovy			
				Sardine (for Mediterranean)			
				Sprat (for Black Sea)			
	Indicators	Biodiversity	Species	Population size	Acoustic estimates	Total biomass & abundance estimates for target species	
						Estimation error (CV) (i.e. as agreed based on a common estimation procedure, see ToRs)	
				Population condition	Biomass & abundance estimate per size/age	Anchovy, Sardine, Sprat (Black Sea)	
					Recruitment index	Sardine (i.e. Number at Age 0 of the population based on summer surveys)	
				Habitats	Habitat condition	Hydrological condition	Temperature (i.e. SST: average at 10m, estimated as the interpolated mean value for the whole area)
							Salinity (i.e. SSS: average at 10m, estimated as the interpolated mean value for the whole area))
			Community	Fish Community condition	Community Synthesis	Total pelagic fish NASC	
					Species composition (i.e. percentage in terms of weight of pelagic trawls per hour)*		
			Age and size distribution	95% percentile of the population length distribution for the target species			
				Proportion of fish larger than L50 (length at first maturity estimated based on collected data or defined based on literature, explain)			

10. Tables

The data and the common format of the Tables for 2015 Data Call, regularly provided to the DCF, are the following:

TABLE 1 - BIOMASS_medbs.xlsx

COUNTRY	YEAR	START_DAY	END_DAY	START_MONTH	END_MONTH	AREA	NAME_OF_SURVEY	SPECIES	SEX	UNIT	LENGTHCLASS0	LENGTHCLASS1	LENGTHCLASS2	LENGTHCLASS3	LENGTHCLASS4	LENGTHCLASS5	LENGTHCLASS6	LENGTHCLASS7	...
		1<= INTEGER <=31	1<= INTEGER <=31	1<= INTEGER <=12	1<= INTEGER <=12			2015 Data Call. ANNEX 1- Appendix 1.7											
ESP	2014					SA 1, 6	any text of max 10 characters		F	mm									
FRA	2014					SA 7			M	cm									
GRC	2014					SA 19, 22			U										
HRV	2014					SA 17			C										
ITA	2014					SA 16, 17, 18													
MLT	2014					SA 15													
SVN	2014					SA 17													
BUL	2014					SA 29													
ROM	2014					SA 29													

TABLE 2 - ABUNDANCE_medbs.xlsx

COUNTRY	YEAR	START_DAY	END_DAY	START_MONTH	END_MONTH	AREA	NAME_OF_SURVEY	SPECIES	SEX	UNIT	LENGTHCLASS0	LENGTHCLASS1	LENGTHCLASS2	LENGTHCLASS3	LENGTHCLASS4	LENGTHCLASS5	LENGTHCLASS6	LENGTHCLASS7	...
		1<= INTEGER <=31	1<= INTEGER <=31	1<= INTEGER <=12	1<= INTEGER <=12			2015 Data Call. ANNEX 1- Appendix 1.7											
ESP	2014					SA 1, 6	any text of max 10 characters		F	mm									
FRA	2014					SA 7			M	cm									
GRC	2014					SA 19, 22			U										
HRV	2014					SA 17			C										
ITA	2014					SA 16, 17, 18													
MLT	2014					SA 15													
SVN	2014					SA 17													
BUL	2014					SA 29													
ROM	2014					SA 29													

TABLE 3 - ABUND_BIO_medbs.xlsx

COUNTRY	YEAR	START_DAY	END_DAY	START_MONTH	END_MONTH	AREA	NAME_OF_SURVEY	SPECIES	SEX	AGEGROUP0ABUND	AGEGROUP0BIOM	AGEGROUP1ABUND	AGEGROUP1BIOM	AGEGROUP2ABUND	AGEGROUP2BIOM	AGEGROUP3ABUND	AGEGROUP3BIOM	...
		1<= INTEGER <=31	1<= INTEGER <=31	1<= INTEGER <=12	1<= INTEGER <=12			2015 Data Call. ANNEX 1- Appendix 1.7										
ESP	2014					SA 1, 6	any text of max 10 characters		F									
FRA	2014					SA 7			M									
GRC	2014					SA 19, 22			U									
HRV	2014					SA 17			C									
ITA	2014					SA 16, 17, 18												
MLT	2014					SA 15												
SVN	2014					SA 17												
BUL	2014					SA 29												
ROM	2014					SA 29												

11. References

Machias A., Pyrounaki M.M., Leonori I., Basilone G., Iglesias M., De Felice A., Bonanno A., Giannoulaki M. (2013). Catch of pelagic hauls in Mediterranean acoustic surveys: Is it the same between day and night ? Scientia Marina, 77(1): 69-79.

Foote K.G., Knudsen H.P., Vestnes G., MacLennan D.N., Simmonds E.J. (1987). Calibration of acoustic instruments for fish density estimation: a practical guide. ICES Coop. Res. Rep. 144:82.

ANNEX A

Summary of the common protocol for the Pan-MEDIterranean 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)	70, 120, 200 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)	At least 20 m bottom depth, minimum 10 m of echo-sampling.
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	ν Total fish NASC per EDSU ν Anchovy, Sardine NASC per EDSU ν Anchovy, Sardine Biomass per EDSU ν Anchovy, Sardine Numbers per EDSU ν Anchovy, Sardine Number/age and per length class ν Anchovy, Sardine Biomass/age and per length class
Maps and charts	ν Point maps of total fish NASC ν Point maps of target species in NASC/mile; biomass / mile. ν 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 DCR.
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 B

The Common Database structure for Acoustics adopted in the 5th MEDIAS meeting.

The major fields agreed are associated to:

1. input information related to export data from acoustic software (Figs. B2 & B3),
2. input information related to biological sampling and environmental data sampling (Figs. B4 & B5)
3. queries-calculations to fulfill DCF requirements (Fig. B6)
4. queries-calculations to facilitate abundance/biomass estimates (Fig. B6)
5. echosounder calibration report (Fig. B7)
6. data input validation and control checks
7. up to date demands related to surveys and the Ecosystem Approach to Fisheries (Figs. B5 & B6)

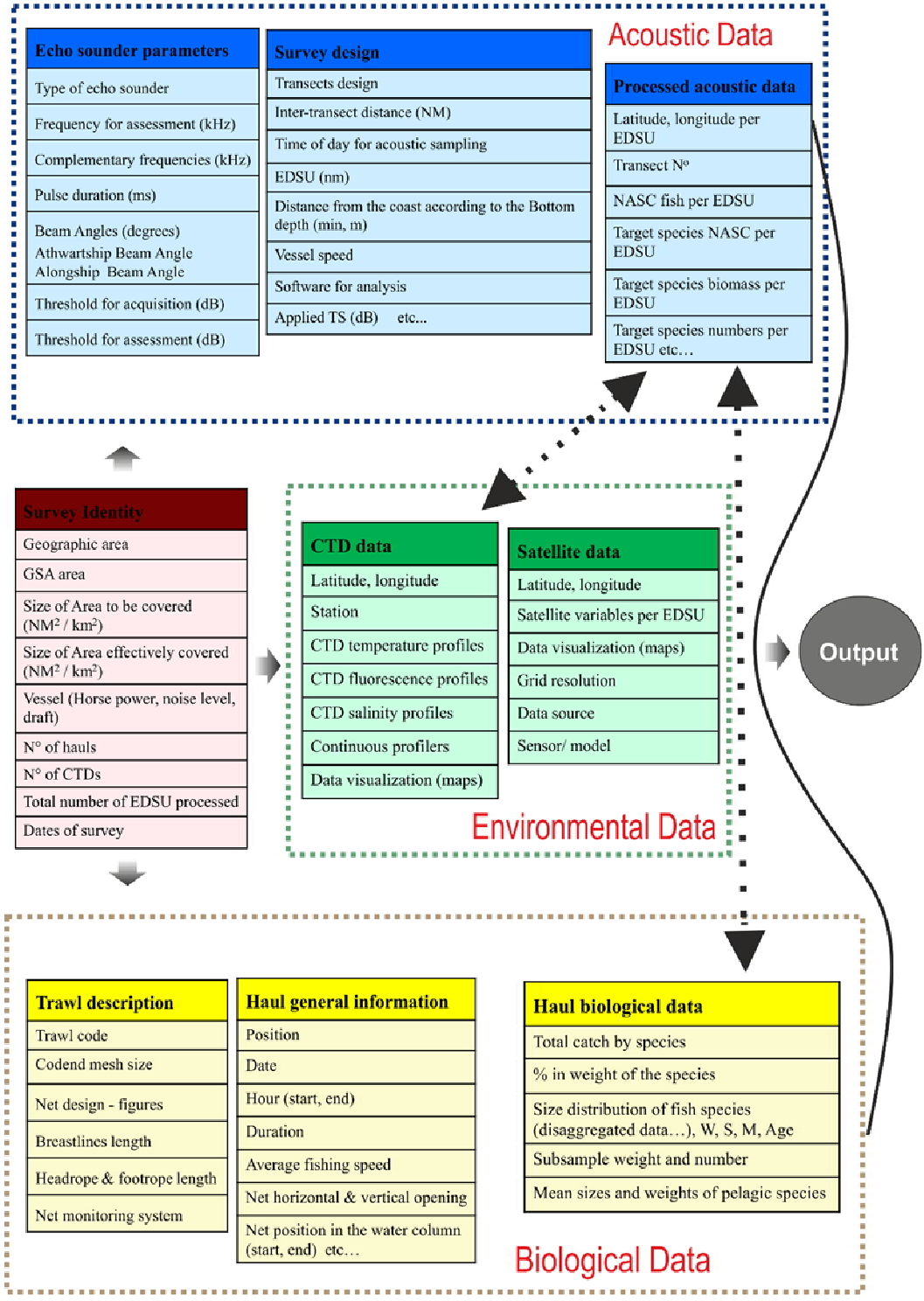

Figure B1. General outline of a database for acoustic surveys.

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 B2. Fields associated with the typical input info about the survey

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)

Acoustic Data

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 B3. Fields associated with input info on Acoustic Data

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

1. Sub-area creation: query that allows the selection of a sub-area along with the underlined acoustic data (i.e. referring to whole transects or parts of transects) and the respective hauls based on certain criteria (e.g. depth, etc.), possibly through a GIS software that will be linked to the database
2. Calculation of NASC average values and standard error in a sub-area

3. Merge haul information in a sub-area: calculation of the mean size by species and the percentage in terms of weight and number of the species composition
4. Biomass estimation per species in a sub-area: using the average NASC value per species and composition information from hauls otherwise through direct allocation of NASC to species.

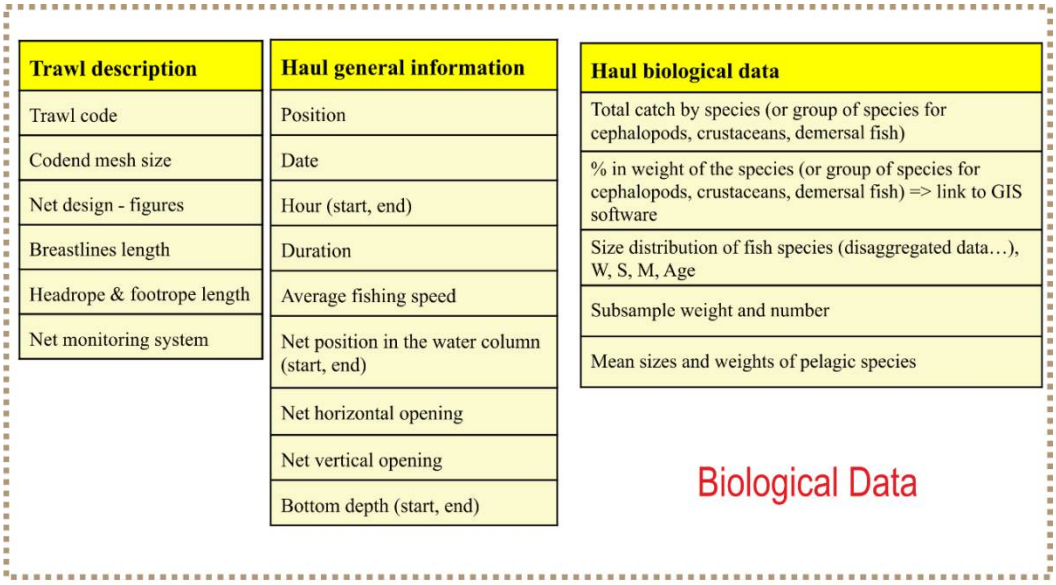

Figure B4. Fields associated with input info on Biological Data related to acoustic surveys

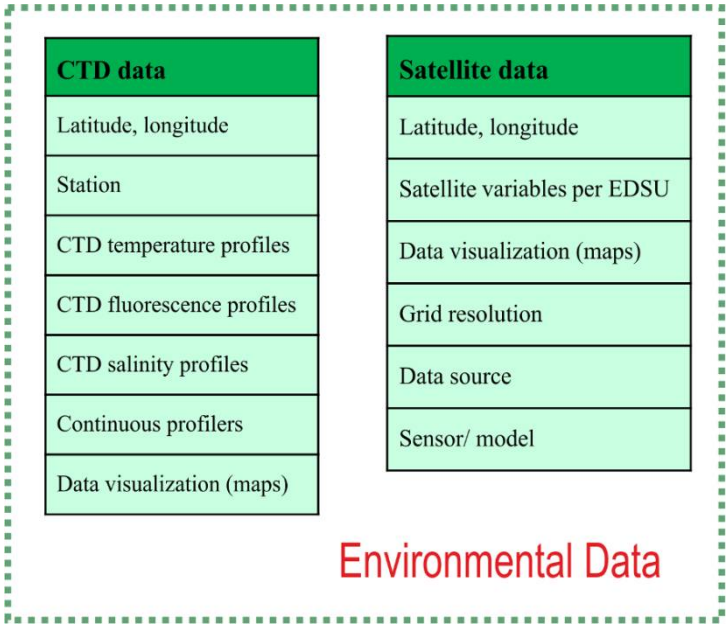

Figure B5. Fields associated with input info on Environmental Data related to acoustic surveys

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

Abundance estimates

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

Biological 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 DCR
Length - Weight	All pelagic species

Additional output

Any additional output upon request of the DCF

Overall estimates

Total biomass, Total abundance estimates per species concerning the entire study area

Oceanographic data

e.g.

Distribution maps of temperature and salinity
Graphs of vertical profiles of environmental data from CTD stations

Ecosystem indicators

Biodiversity	Species	Population size	Acoustic Total biomass & abundance estimate	value	
				Estimation error (CV)	
		Population condition	Biomass & abundance estimate per size/age	Anchovy, Sardine	
		Species distribution	Distributional pattern	Location	Centre of gravity
					Spatial patches
				Occupation of space	Isotropy
					Spreading area...
	Community	Community condition	Community biomass	Total pelagic fish NASC	
			Species composition		
			Relative population abundance		
		Habitat condition	Hydrological condition	Temperature	
				Salinity	

Figure B6. 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 (ºC) 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 B7. Database Fields related to electro-acoustic calibration report.