Report of 10th meeting for MEDiterranean International Acoustic Surveys (MEDIAS)

in the framework of European Data Collection Framework (DCF)

Palma de Mallorca, Spain, 4-6 April 2017

Steering Committee Report

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Introduction

The MEDIAS (MEDiterranean International Acoustic Surveys) Steering Committee met in Palma de Mallorca, Spain, on 4-6 April 2017, hosted by IEO and chaired by Andrea De Felice from ISMAR-CNR. Participants in the meeting were representatives from the European Union countries involved in acoustic surveys in the Mediterranean Sea (i.e. Spain, Croatia and Italy) and in the Black Sea (Romania). Unfortunately scientists from France and Greece could not attend the meeting this year due to local problems. One scientist from Morocco, working on fisheries acoustics in the Atlantic Ocean and in the Mediterranean Sea, and a representative from GFCM Secretariat were 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 2016;
b) to coordinate the MEDIAS surveys to be performed in 2017;
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 2017 and to establish the ToRs for 2018.

The agenda of the 10th MEDIAS Coordination Meeting (see ANNEX III) was adopted by the participants. Following the agenda, during the first day results from the 2016 MEDIAS acoustic surveys, carried out by the MEDIAS partners (Figure 1), were presented, as well as results from the survey carried out by Romania in the Black Sea.

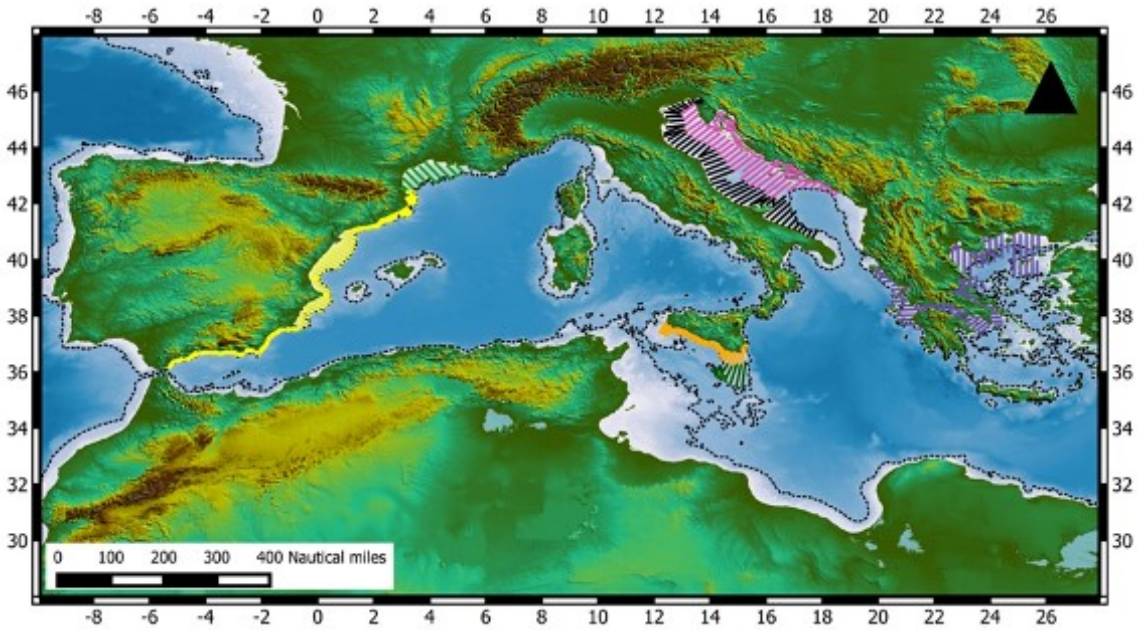


Figure 1: Acoustic surveys in the framework of MEDIAS in 2016

There was also the presentation of GFCM mid-term strategy 2017-19 by the representative attending the meeting and also the discussion on acoustic survey period, foreseen by last MEDIAS Coordination Meeting, and a discussion on the possible ways to anticipate the submission of MEDIAS survey results as asked by RCM Med&BS-LP in 2016. During the second day of the meeting a workshop on "plankton removal using multifrequency analysis" was carried out, together with an update of the work on CV calculation with a common R procedure. Aspects concerning possible ecosystem indicators from acoustic surveys were also undertaken.

During the third day, the revision of the common MEDIAS protocol and an update of the MEDIAS handbook were carried out. There was also a discussion on technical aspects related to anchovy age determination practices and the decision on standard contents to be put, from now on, in the survey results presentations by each MEDIAS group. Part of the day was dedicated to define the Terms of Reference (ToRs) for the next year (2018), and to discuss and propose common studies and publications in the MEDIAS framework.

Results of the surveys carried out in 2016 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)

The 2016 acoustic survey was carried out in June in western GSA 18 and GSA 17 including territorial waters of Slovenia (Dr. Tomaz Modic took part in the cruise in Slovenia waters). Acoustic data were logged over a grid of systematic parallel transects perpendicular to coastline/ bathymetry. Inter-transect distance was 8-10 nmi. Acoustic monitoring was done during daytime (6:00 am – 7:00 pm). Scientific echosounder: Simrad EK60 equipped with 38, 120, 200 kHz and EK80 with 70 kHz split beam transducers hull-mounted. R/V G. Dallaporta Vessel speed: 9.5 knots. The acoustic system was calibrated in June 2016 using the standard sphere method (Foote et al., 1987; Demer et al., 2015).

In western GSA 17 total nautical miles were 1552 for a total area of 10636 nmi^2, in western GSA 18 total nautical miles were 402 for a total area of 2510 nmi^2. All this account for a total of about 2000 nautical miles, identifying an area of about 13200 square nautical miles in the western part of Adriatic Sea, that rise up to 15700 square nautical miles (about 2500 nmi) including the Montenegro and Albania survey, thus ensuring a strong synopticity to the monitoring of such a large area. The survey in eastern GSA 18 was conducted in the second part of May 2016 with the same MEDIAS methodology but under FAO AdriaMed and CNR fundings, covering 427 nautical miles for a total area of 2597 nmi^2.

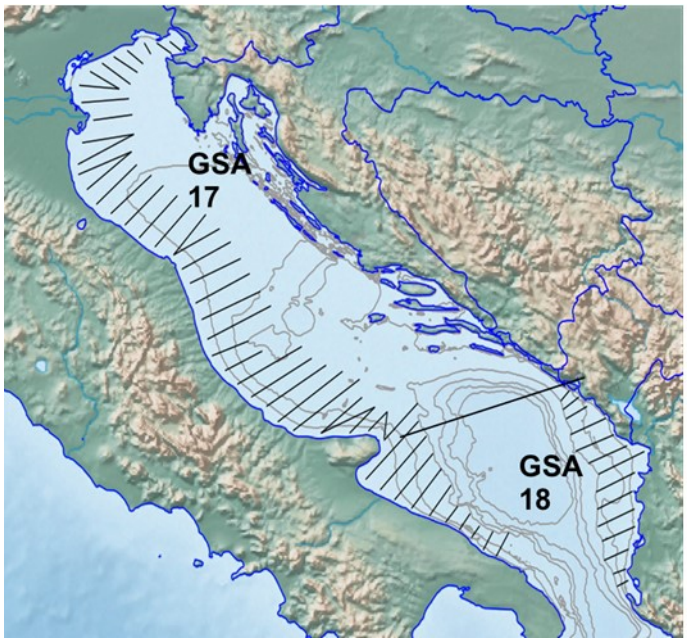
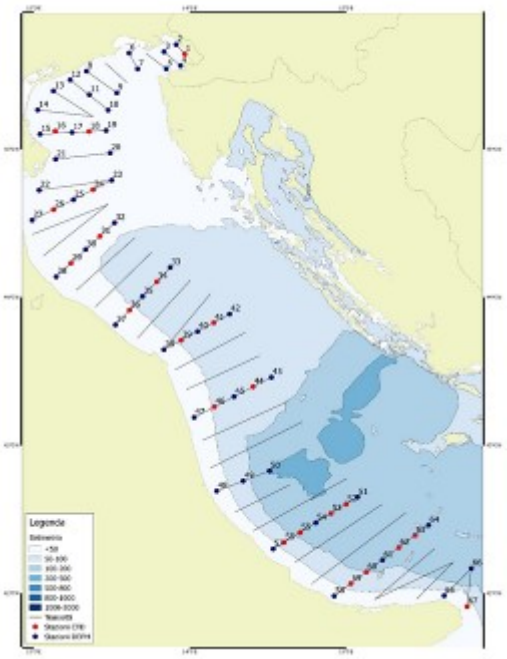


Figure A1. Acoustic survey route plan in western GSA 17 and GSA 18

In detail, the MEDIAS acoustic survey in western GSA 18 was carried out in June 2016; area coverage was 100%, 402 nautical miles were monitored and 10 pelagic trawls were conducted. 58 ichthyoplankton stations to apply Daily Egg Production Method were made, combining CTD and plankton net sampling.

The MEDIAS acoustic survey in western GSA 17 was conducted in June 2016; the coverage of the area was 100%, 1552 nautical miles were monitored and 34 pelagic trawls were conducted. 86 CTD stations were made and in 45 stations out of them plankton sampling by means of WP2 net (mesh size 200 µm) was carried out.



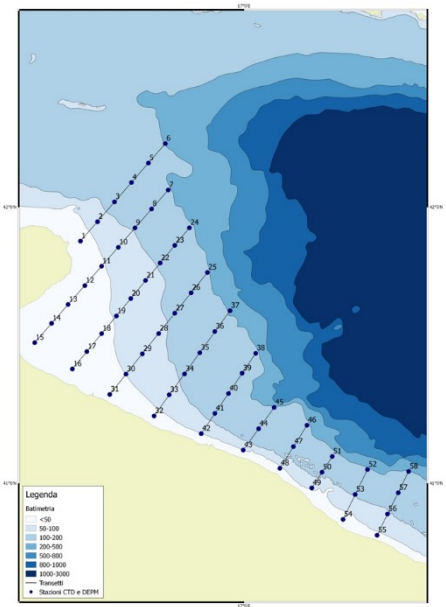


Figure A2. Acoustic survey route plan in western GSA 17 and western GSA 18. The positions of prefixed stations of CTD & plankton sampling are shown (in blue CTD&plankton stations, in red only CTD stations)

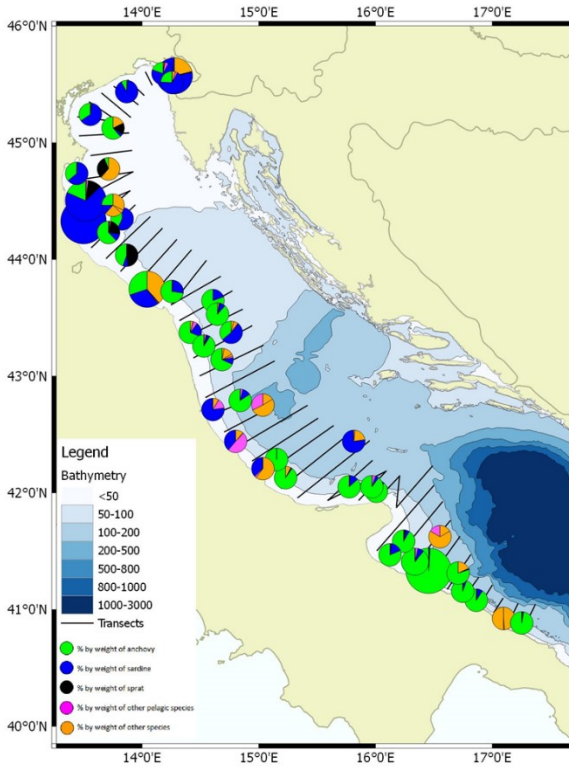


Figure A3. Acoustic survey route plan in western GSA 17 and western GSA 18. The catch composition of net samplings carried out in 2016 are reported

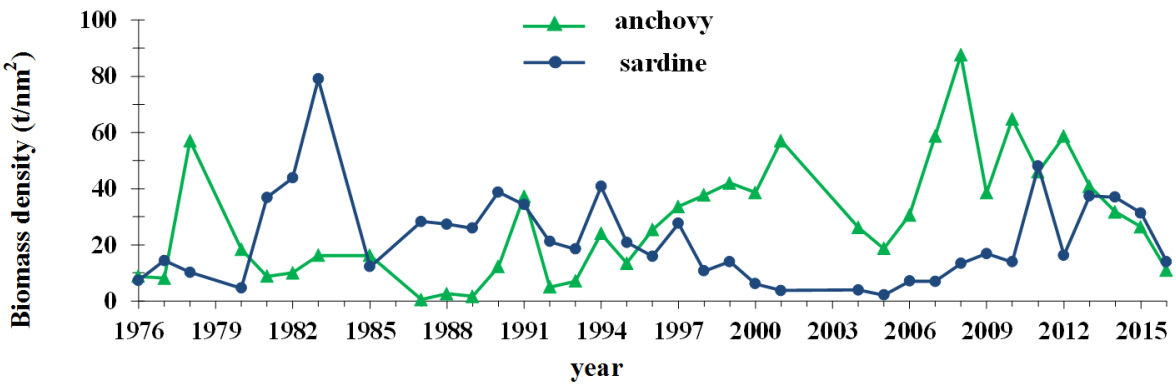


Figure A4. Trends of anchovy and sardine in Northern Adriatic

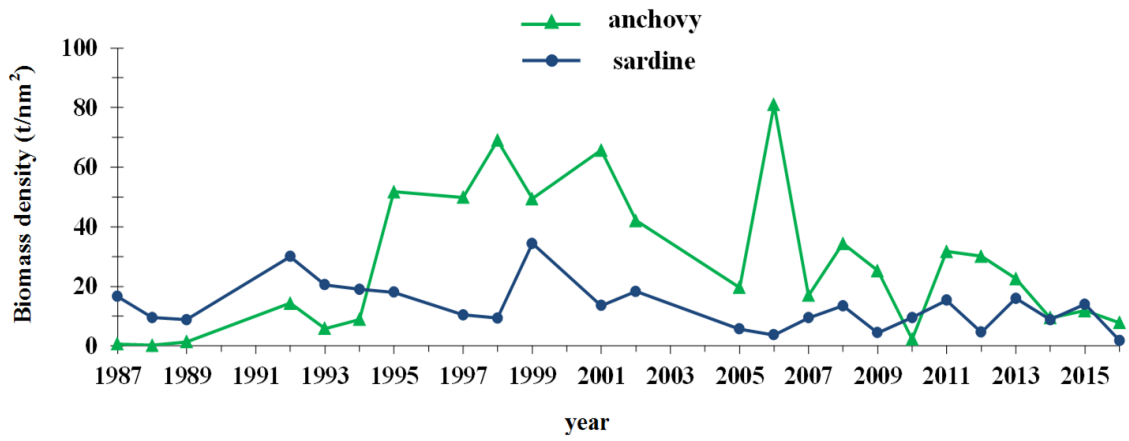


Figure A5. Trends of anchovy and sardine in Middle Adriatic

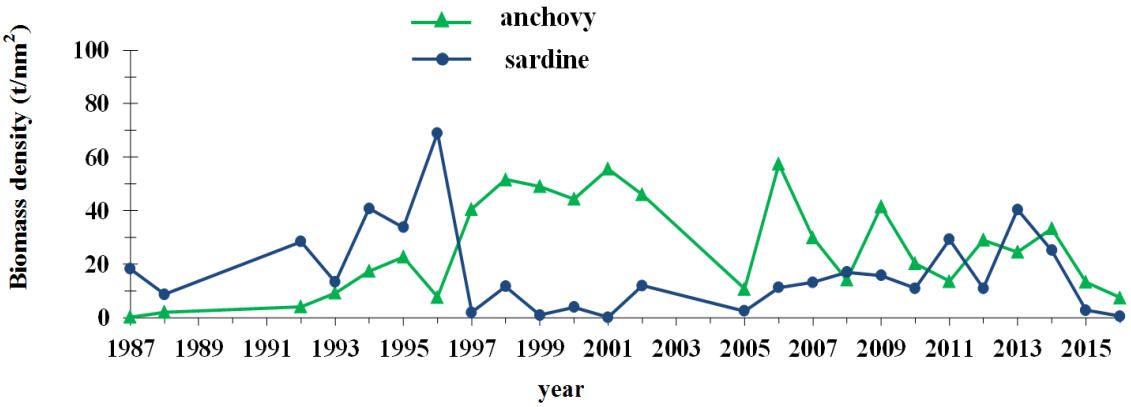


Figure A6. Trends of anchovy and sardine in Southern Adriatic

In the last period biomass estimations of anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) stocks in western Adriatic Sea until 2015 show a slight decrease in the biomass in the northern part, a weak increase in the central Adriatic and a severe decrease in the southern Adriatic Sea (GSA 18) especially for sardine, that comes back to very low levels. In 2016 there is descrease of anchovy and sardine biomass in all the GSA 17 and GSA 18 areas.

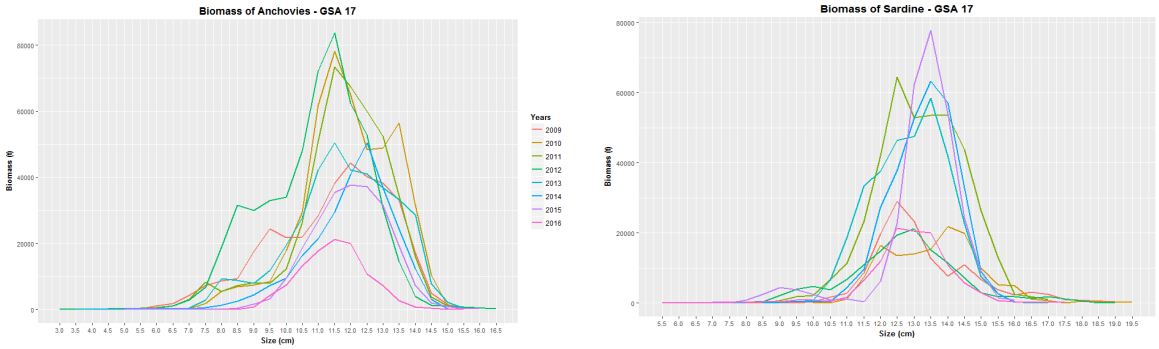


Figure A7. Anchovy and sardine biomass per length class in GSA 17 in 2009-2016

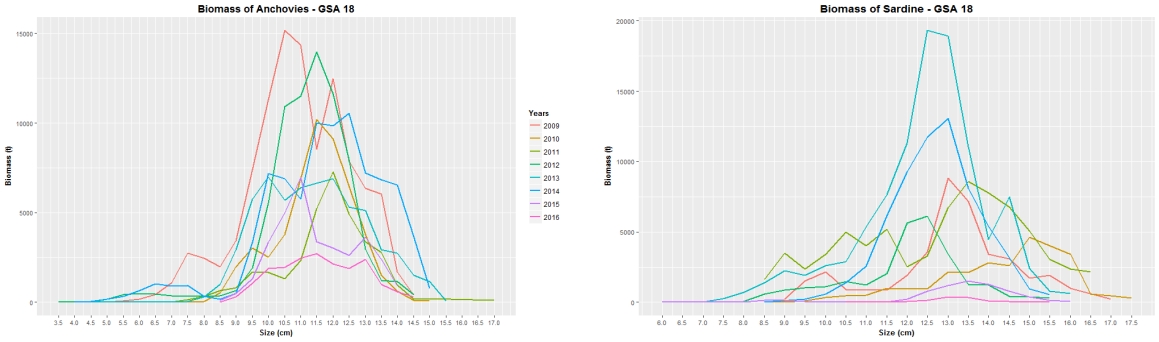


Figure A8. Anchovy and sardine biomass per length class in GSA 18 in 2009-2016

Due to the joint requests by GFCM and Data Collection Regulation we are asked to produce survey results much earlier than before. In order to fulfill this commitment, in a large area as Adriatic Sea there are not much alternatives to a shift and a fusion of our survey periods. That is why in 2015 and 2016 we conducted acoustic survey in June and no more in September in GSA 17 and the same is foreseen for 2017. GSA 18 now is conducted in June while in the recent past the survey was in July.

Due to the change in the survey time in GSA 17, a statistical analysis was performed in order to identify if there are significant differences on the length frequency distributions between 2015 and 2016 and the previous years, but also among all the years to verify if these differences are only between June and September or are present among the September surveys too. Anchovy mean lengths from the surveys 2004-2016 show alternate values over the years with 2015 mean lenght being the highest, even if the gap with the previous years is little and 2016 in line with other values. Sardine mean lengths present a quite evident decreasing trend over the years.

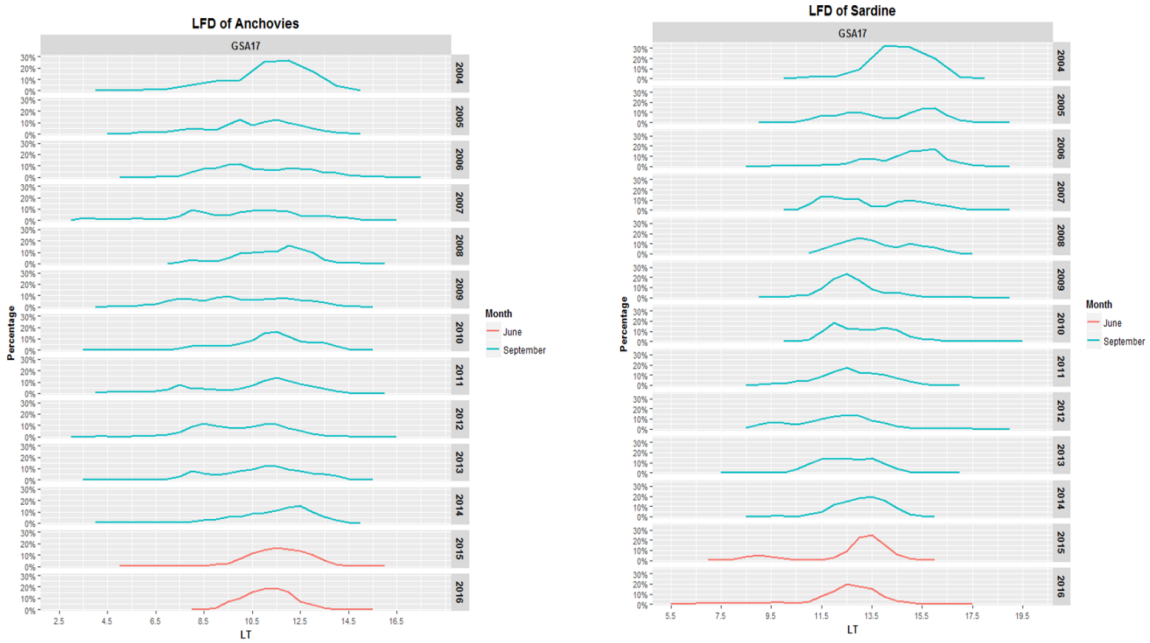


Figure A9. Anchovy and sardine LFD in western GSA 17 from 2004 to 2016

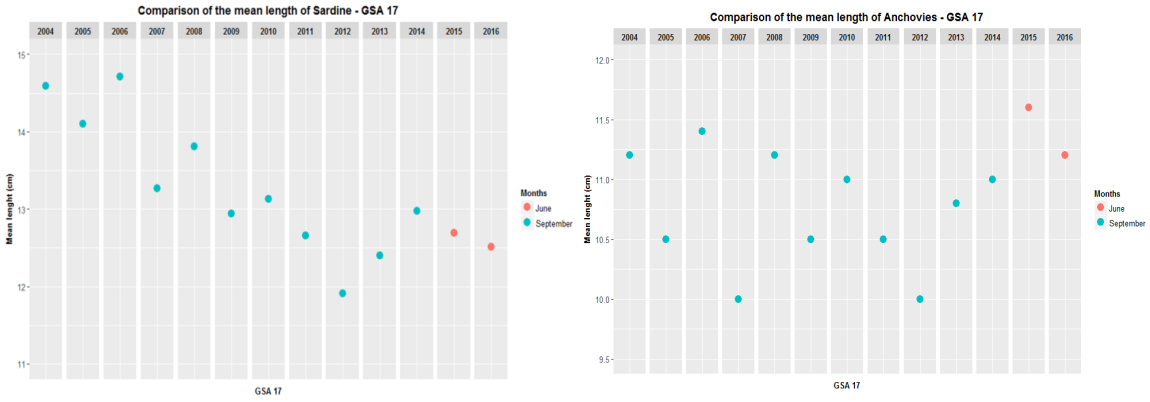


Figure A10. Anchovy and sardine mean lenght in western GSA 17 from 2004 to 2016

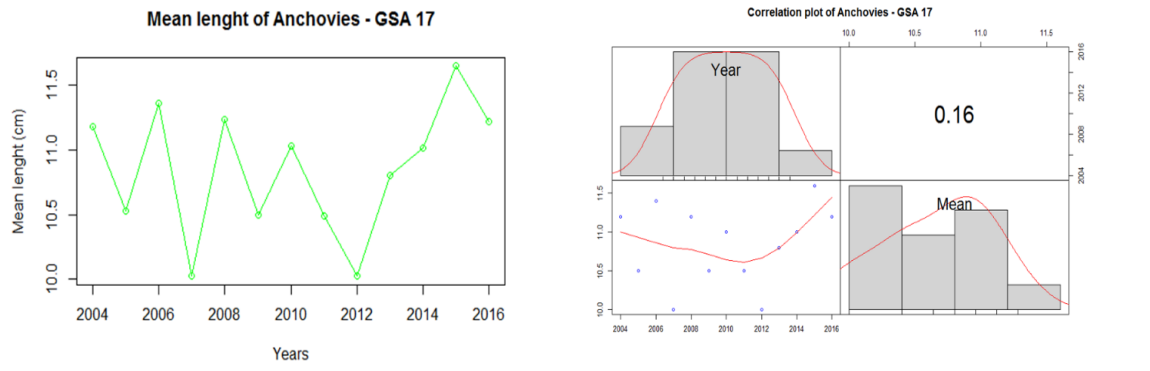


Figure A11. Anchovy mean lenght in western GSA 17 from 2004 to 2016 and Correlation plot. No trend of mean sizes over the years

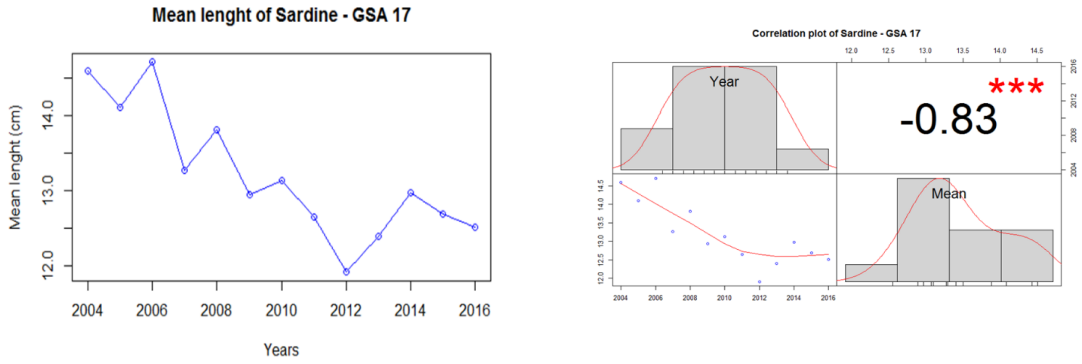


Figure A12. Sardine mean lenght in western GSA 17 from 2004 to 2016 and Correlation plot. Decreasing trend of mean sizes over the years

Comparing the means in pairs performing pairwise t-tests with Bonferroni correction methodology (Calculate pairwise comparisons between group levels with corrections for multiple testing) the results show that not only 2015 and 2016 means are different in most of the cases with the other years means, but also most of the "September" means are significantly different between them, stating that there is a substantial variability of LFD between years even keeping the month of the survey constant.

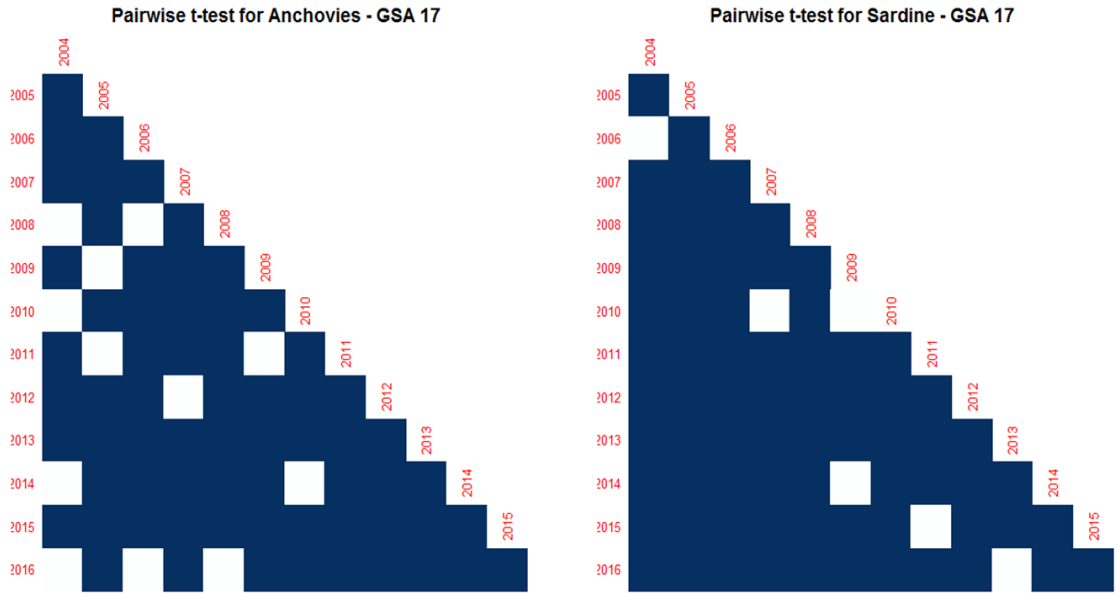


Figure A13. Results of pairwise T- test "Bonferroni" showing in dark the significant differences between couples of mean size values, in white the non-significant differences

FINAL REMARKS

In 2014, after extensive discussions, the General Fisheries Commission for the Mediterranean (GFCM) adopted the Recommendation GFCM/38/2014/1, amending Recommendation GFCM/37/2013/1, and on precautionary and emergency measures for 2015 on small pelagic stocks in the GFCM GSA 17.

In line with such Recommendation, the Commission suggested that technical elements for the management of small pelagic fisheries in the Adriatic Sea be addressed during the next intersessional period, with the aim to (among others):

− Identify gaps and evaluate ways to strengthen the working methodology when performing acoustic surveys. Thus, propose alternatives to reduce the amount of time between the acoustic survey and the availability of data for stock assessment;

− Identify gaps and needs on scientific data and evaluate the way forward to obtain a complete stock assessment of sardine and anchovy for the whole Adriatic Sea (i.e. including GSA 18).

In 2015 the General Fisheries Commission for the Mediterranean (GFCM) adopted the Recommendation GFCM/39/2015/1 establishing further precautionary and emergency measures in 2016 for small pelagic stocks in the Adriatic Sea (GSA 17 and GSA 18):

− RECALLING that the SAC has considered that the stocks of anchovy and sardine are distributed in GSA 17 and GSA 18;

− NOTING that hydroacoustic surveys have the potential of providing latest biomass estimates and their results can support management decisions;

− ADOPTS in conformity with the applicable relevant provisions of the GFCM Agreement that (among others).

− The SAC shall propose alternatives to make the results of the hydroacoustic surveys of the previous year available during the first month of the year.

In 2016 the General Fisheries Commission for the Mediterranean (GFCM) adopted the Recommendation GFCM/40/2016/3 and remarked the will of anticipate the date of the availability of hydroacoustic survey results.

PART III Scientific monitoring (pg. 4) - 13. The SAC shall suggest alternative solutions to ensure the availability of hydroacoustic survey results of the previous year not later than 31 January of a given year.

This could be possible only continuing to carry out the surveys in Adriatic in June-July.

In order to produce in the future survey results by the end of January or before, in a large area as Adriatic Sea (wGSA 17 + GSA 18: 15700 mni^2), there are not much alternatives to a shift and a fusion of our survey periods, that is what we are doing since 2015.

A more meaningful statistical analysis of the differences due to the period shift in GSA 17 will be performed next year with 3-years data of acoustic survey in June available.

b) Acoustic survey in the eastern part of the GSA 17 (Adriatic Sea – Croatia)
(Vjekoslav Ticina)

After accession of Croatia in EU, 4th acoustic survey in eastern part of the Adriatic Sea (GSA 17) have been carried out within Data Collection Framework (DCF), as a part of international Pan European Mediterranean acoustic surveys (MEDIAS). Acoustic survey carried out in the period 24. Aug. – 22. Sept. 2016 successfully covered 100% of total area of eastern part of GSA 17 that need to be covered within Croatian DCF (>13,500 nm^2); in total, 30 days of R/V "BIOS DVA" were used for this purpose.

Acoustic sampling have been carried out along transects in Croatian territorial waters, as well as within Croatian protected ecological-fishery zone (Fig.1.). In total, acoustic data were collected in more than 1450 EDSU. Fish sampling has been attempted 64 times, obtaining 62 hauls with fish sampled. Oceanographic properties of survey area during survey period were described based on 92 CTD stations (Fig 2.). Data collection during acoustic survey has been done in accordance with MEDIAS Handbook (March, 2015).

Based on survey data collected, spatial distributions (GIS analyses) of anchovy and sardine stock within study area were presented (Fig. 3 and 4). According to given results, biomass indices for anchovy indicate slight increase in biomass in August-September 2016 compared to September-October 2015 in eastern part of GSA17, without significant change in anchovy abundance. According to new ALK, anchovy from age group 1 showed the highest portion in biomass distribution by age.

In the same time, according to results obtained, biomass and abundance indices for sardine indicate slight decrease in August-September 2016 compared to September-October 2015 in eastern part of GSA17. Sardines from age group 0 showed the highest portion in biomass distribution by age, indicating a good recruitment in 2015, but unfortunately spawning stock biomass - SSB (i.e. older age groups) was very low. Size structured abundances of anchovy and sardine populations on eastern part of GSA17 in September are shown in Fig.5.

It seems that overall biomass of target species (anchovy & sardine) observed by acoustic survey in eastern part of GSA 17 was lower in 2016 than in 2015. However,

it is not clear to which extent changes in assessed sardine biomass could be related to spawning migrations.

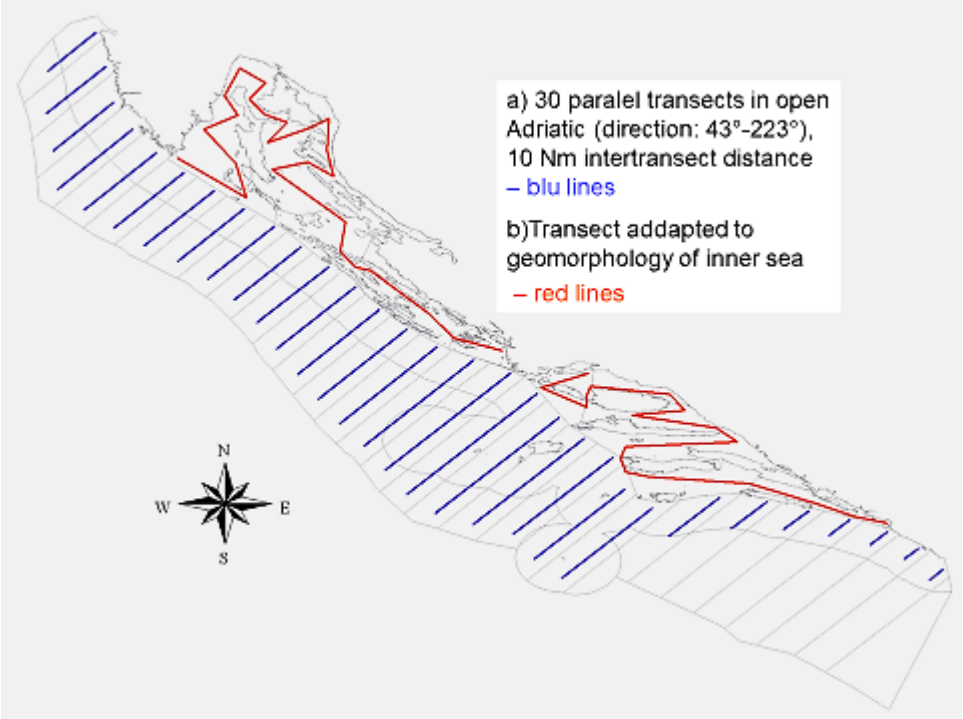


Figure B1. Survey design of acoustic transects in the eastern part of GSA 17.

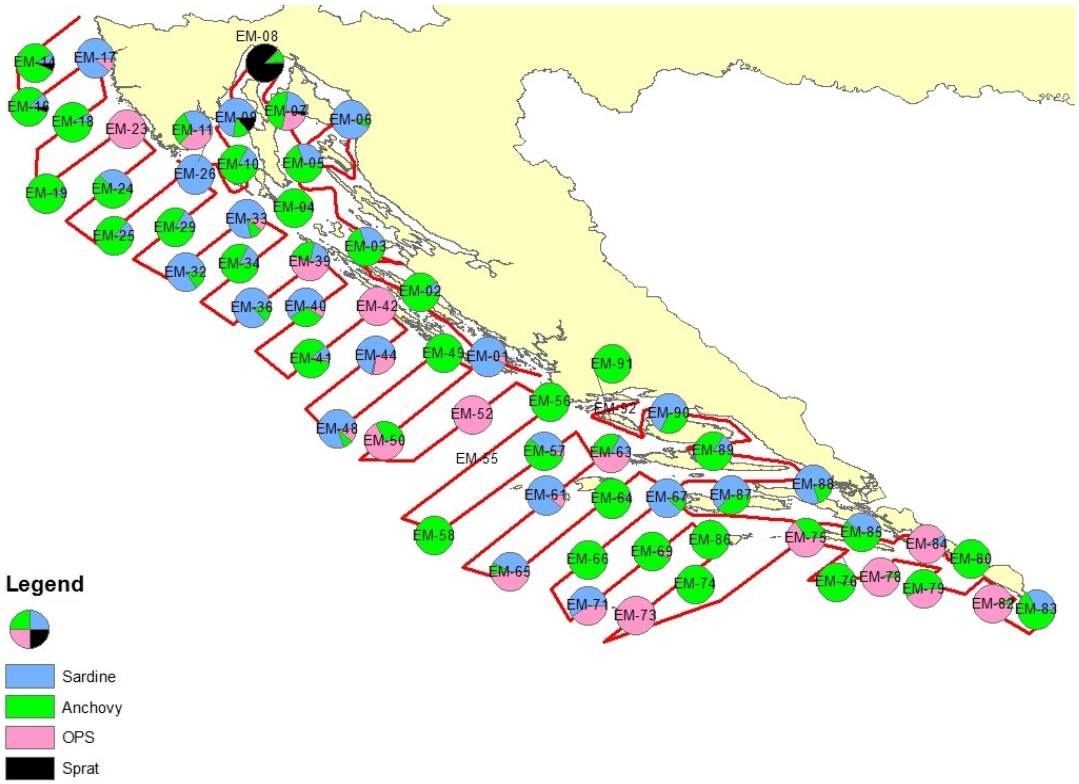


Figure B2. Compositions of pelagic fish assemblages in the eastern part of GSA 17 in September 2016.

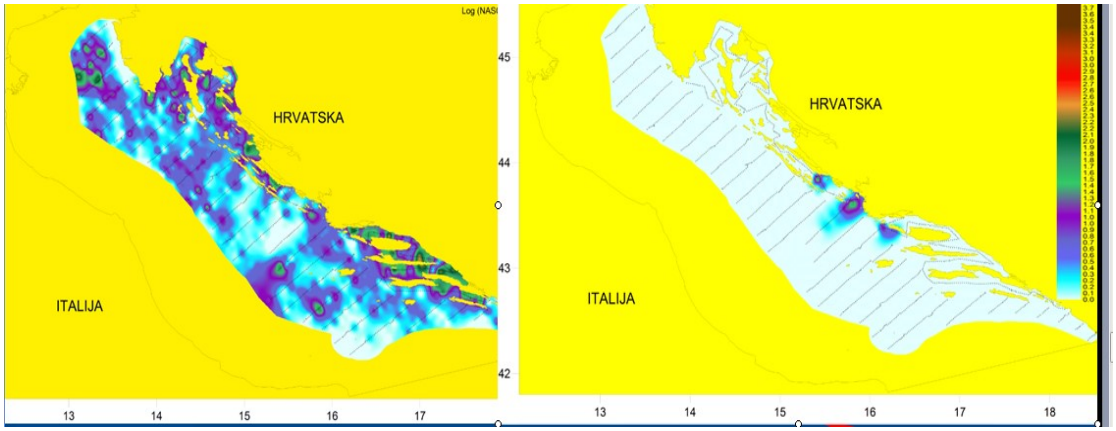


Figure B3. Spatial distribution (GIS analyses) of anchovy (left: LT>6cm; right: LT<6cm) within survey area (September, 2016).

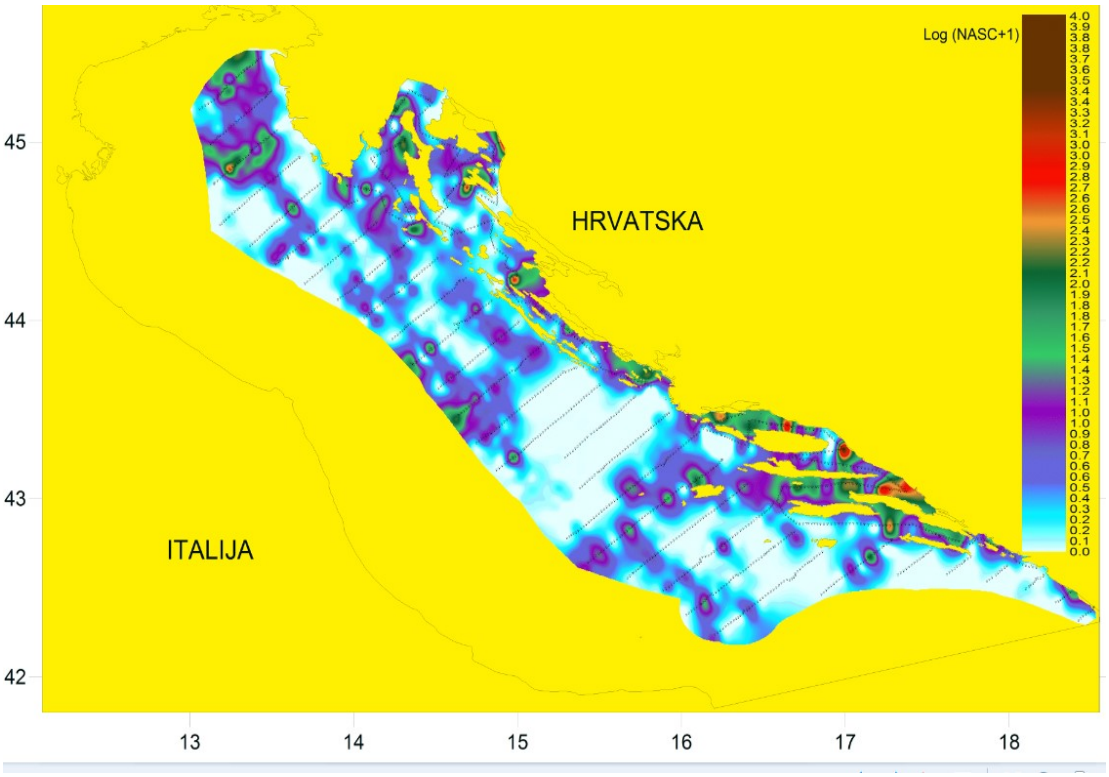


Figure B4. Spatial distribution (GIS analyses) of sardine within survey area (September, 2016).

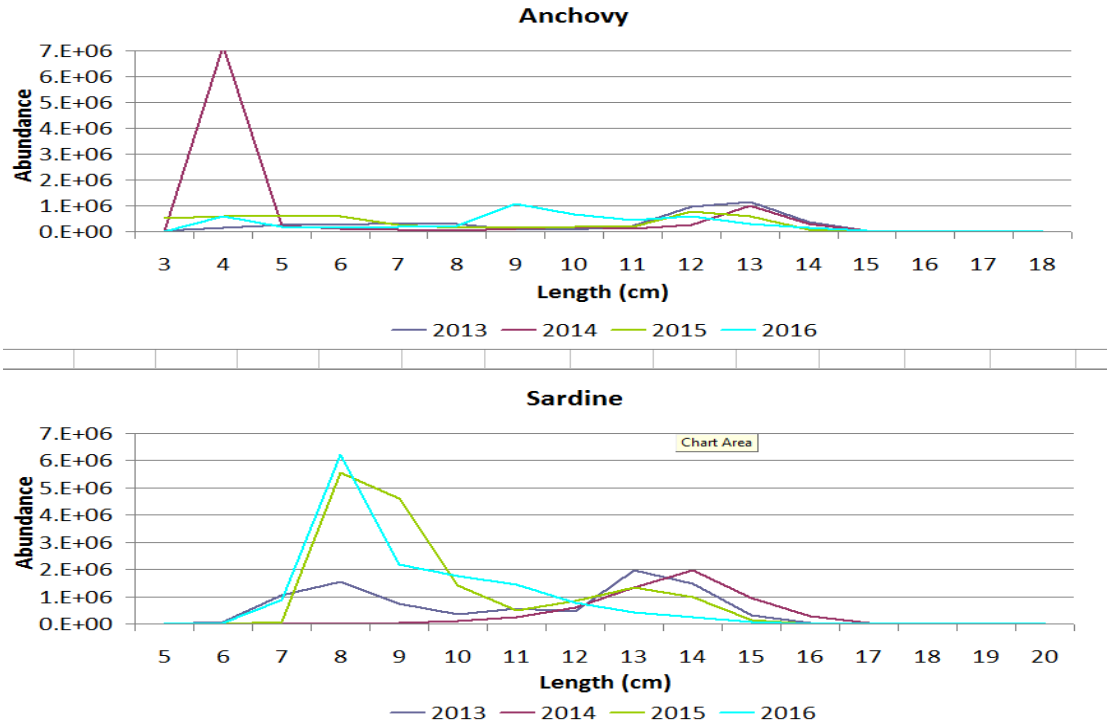


Figure B5. Size structured abundance (in thousands) of anchovy and sardine in September (GSA17-eastern part; 2013-2016)

c) 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 4 – 19 July 2016 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 2016 are presented. In order to obtain a more complete picture on the spatial distribution of the two species in the Sicilian waters, the survey covered also the continental shelf in the western part of GSA 19.

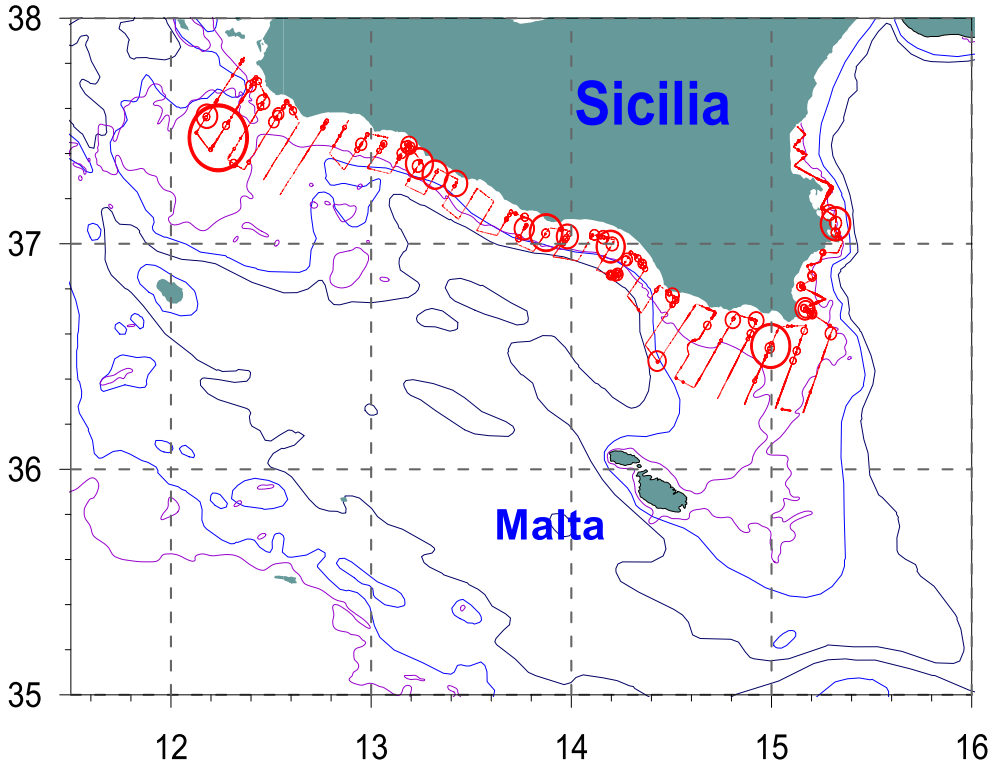


Figure C1. Fish NASC estimated in the GSA16.

The total biomass of anchovy stock was 8023.71 t in the GSA 16 (surveyed area of 2499 nm^2) and 2754.18 t in the western Ionian waters (surveyed area of 222.4 nm^2). The spatial distribution showed that anchovy was mainly concentrated in the more coastal part of the study area in the Strait of Sicily and in the western Ionian Sea. The age structure highlighted the presence of two main age classes (1 and 2) and a small abundance of specimens of age 0.

In the case of sardine population, the biomass in 2016 was 10176.95 t in GSA 16 and 380.37 t in the western Ionian Sea. Sardine biomass decreased in comparison to those

ones estimated in previous years. The distribution of biomass among age classes shows a breakdown of the population mainly in two age classes (0 and 1).

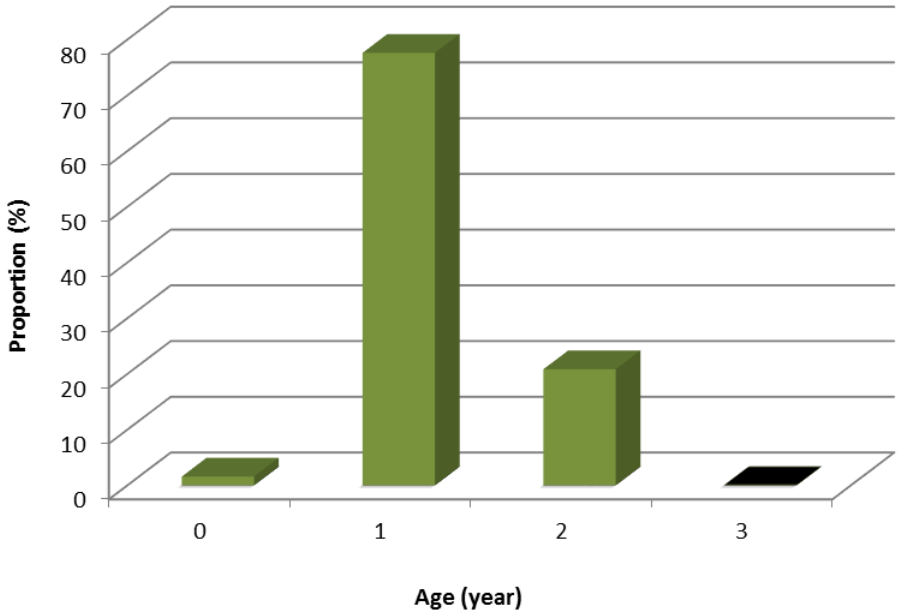


Figure C2. Anchovy age classes distribution (%) – Echosurvey 2016.

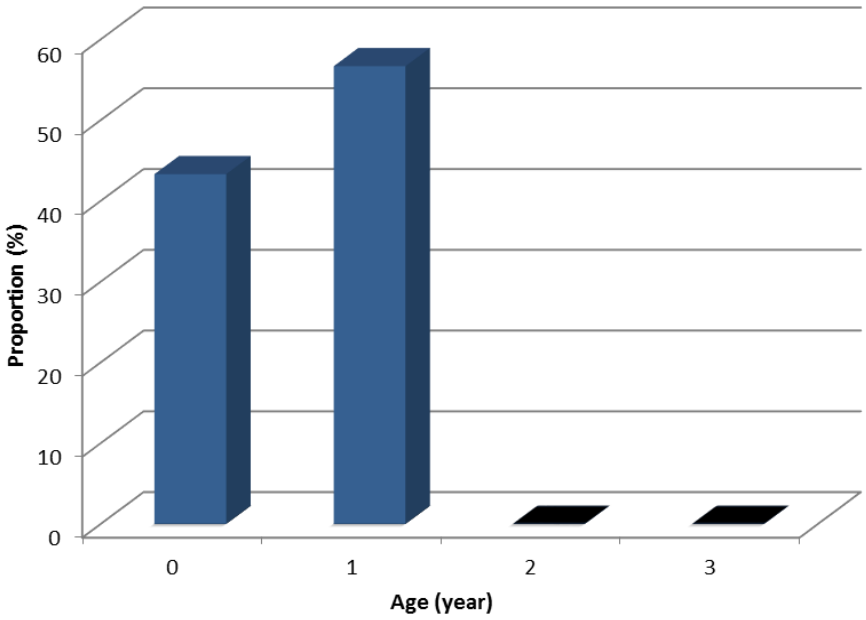


Figure C3. Sardine (*S. pilchardus*) age classes distribution (%) – Echosurvey 2016.

d) 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 2016 on board the RV "G. Dallaporta" in collaboration with the Italian colleagues of CNR-IAMC. The survey track was 303 nm long and covered an area of about 1876 nm^2; 8 pelagic hauls were completed during such survey. No sardine specimen was collected during the survey and, consequently, the sardine biomass was 0.0 t, while anchovy abundance was 523.2 t. The Anchovy NASC distribution shown in the previous figure E1 evidences the presence of anchovies in the eastern part of the Maltese shelf.

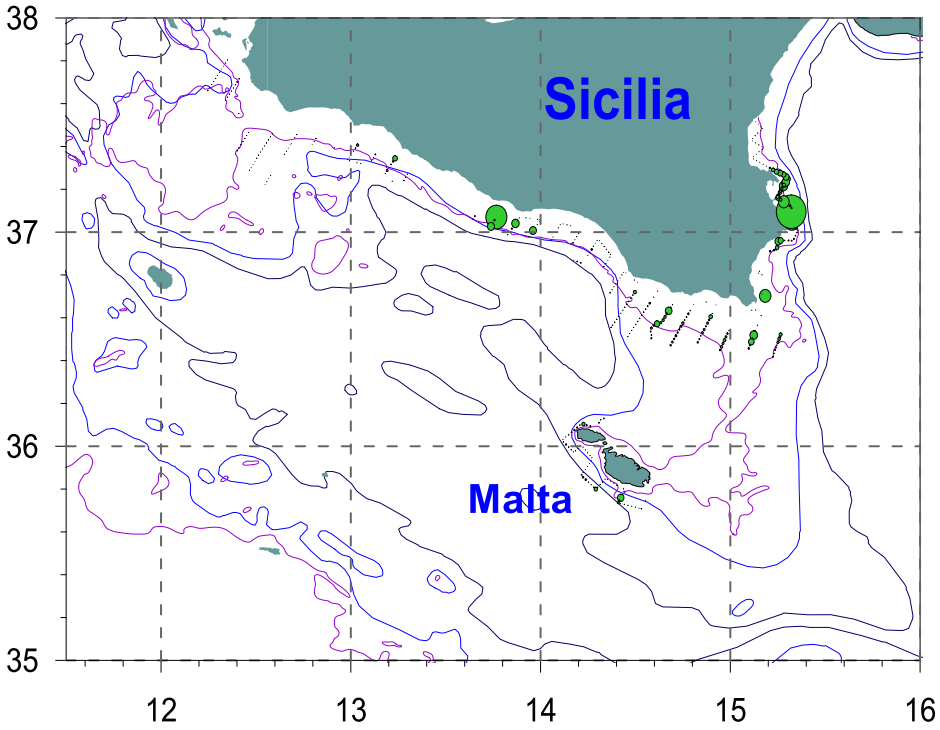


Figure D1. Anchovy NASC spatial distribution estimated in the GSAs 15 and 16.

e) **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). For the years 2015 and 2016, the echosurvey in the GSAs 9 and 10 was funded by the Italian Ministry of Agriculture, Food and Forestry in the framework of the European Maritime and Fisheries Fund (EMFF) Reg. (UE) n. 508/2014, through two specific contracts.

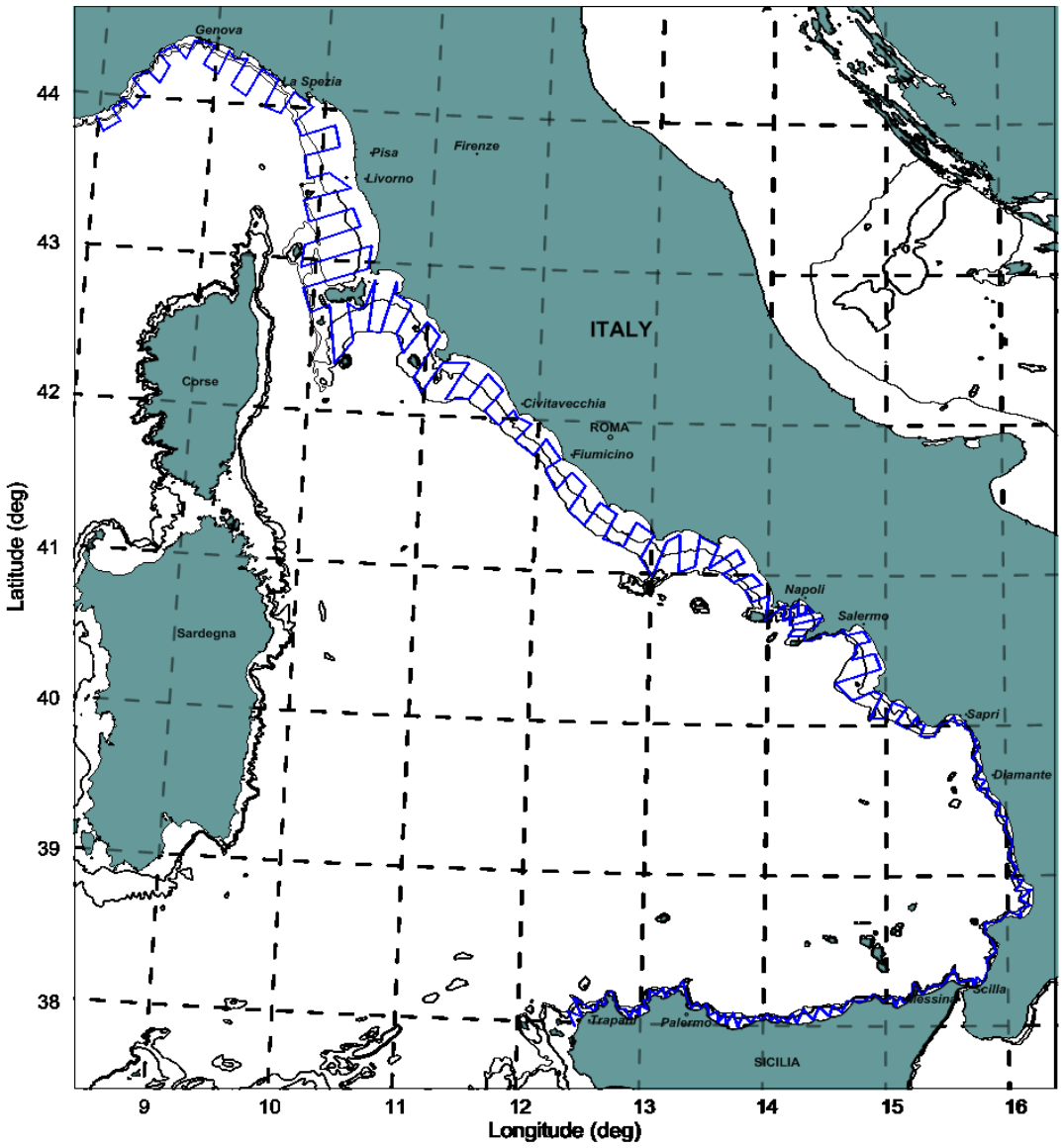


Figure E1. Map of the survey design in GSAs 9 and 10 adopted during the survey in 2016.

The survey was carried out in the period 25 July – 21 August 2016. The track length was 1900 nm for a surveyed area of about 6644 nm^2. During the survey, 55 trawl hauls were completed and 270 CTD casts were collected with a SBE 911 plus multiparametric probe.

The spatial distribution of both anchovy and sardine confirmed the previously observed patterns for the two species.

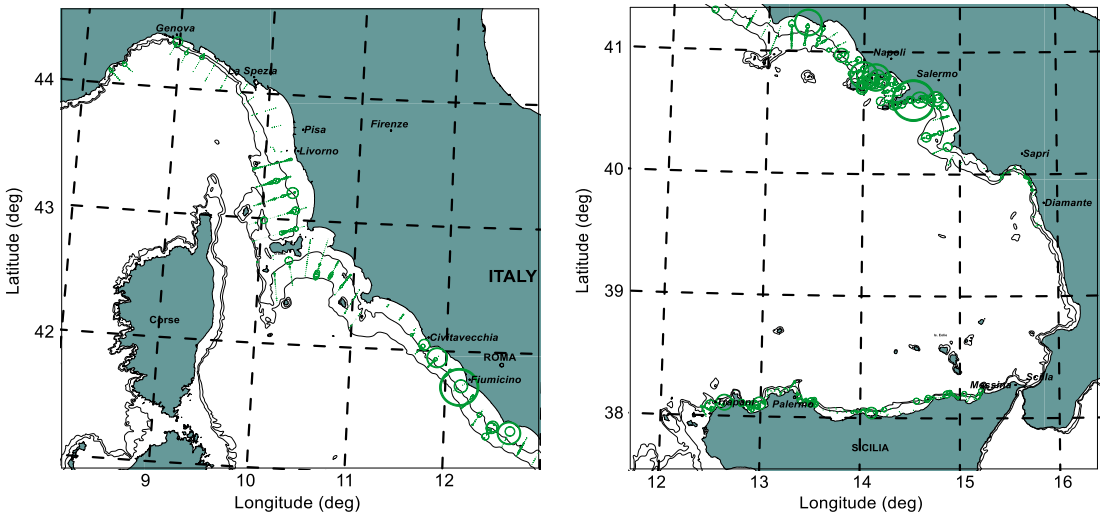


Figure E2. Spatial distribution of anchovy during the survey in 2016.

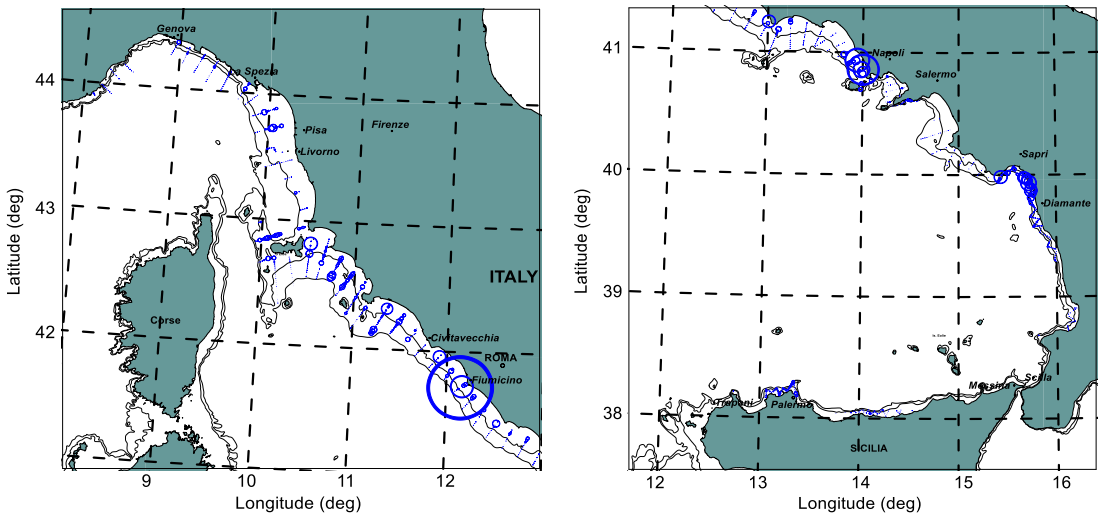


Figure E3. Spatial distribution of sardine during the survey in 2016.

During the survey both species were more abundant in GSA 9 than in GSA 10. In particular, the biomass of *Engraulis encrasicolus* was estimated to be 44018 t in GSA 10, while in GSA 9 it was 50660 t. The *Sardina pilchardus* biomass was 48861 t in GSA 9 and 15403 t in GSA 10.

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

The echosurvey in the Greek waters was carried out in June 2016 in GSA 22 and in September 2016 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 8 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 74 acoustic transects, that covered an area of 9504 NM^2 in North Aegean Sea and 44 transects that covered an area of 3246 NM^2 in Ionian Sea (Fig. 1). In addition 147 CTD Stations in Aegean and 72 in Ionian Sea, as well as 201 zooplankton sampling stations in Aegean and 59 in Ionian Sea were completed during the survey.

The anchovy biomass was estimated to be 77531 t in North Aegean Sea and 20008 t in the East Ionian Sea. The sardine biomass was estimated to be 31007 t in North Aegean Sea and 3758 t in East Ionian Sea. The biomass distribution of each species is shown (Figs. 2 & 3). The length composition for anchovy and sardine are shown in Figs. 4 and 5.

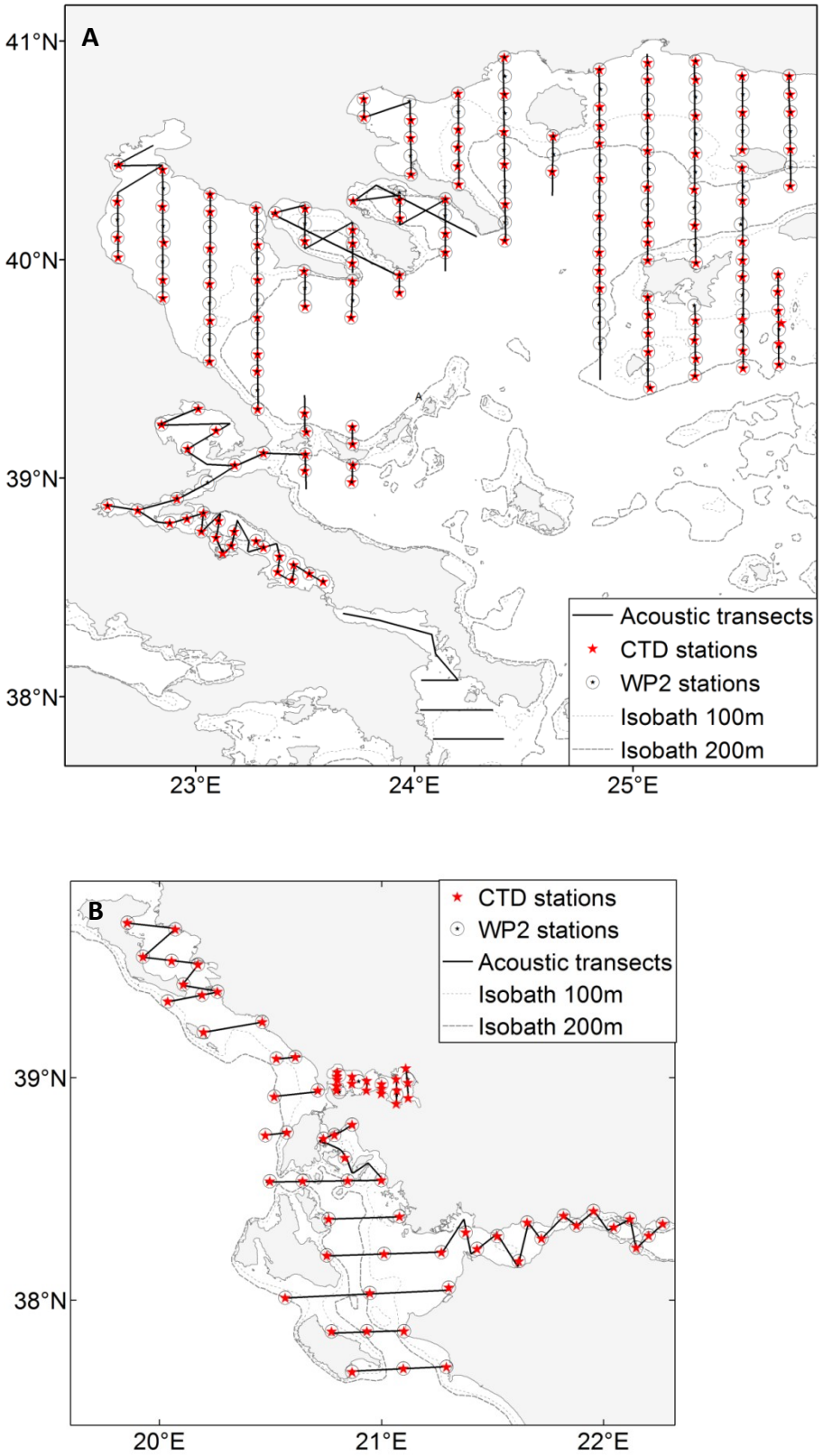


Figure F1. Map of the survey area and the survey design a) in GSA 22 and b) in GSA 20 at the Greek acoustic survey in 2016.

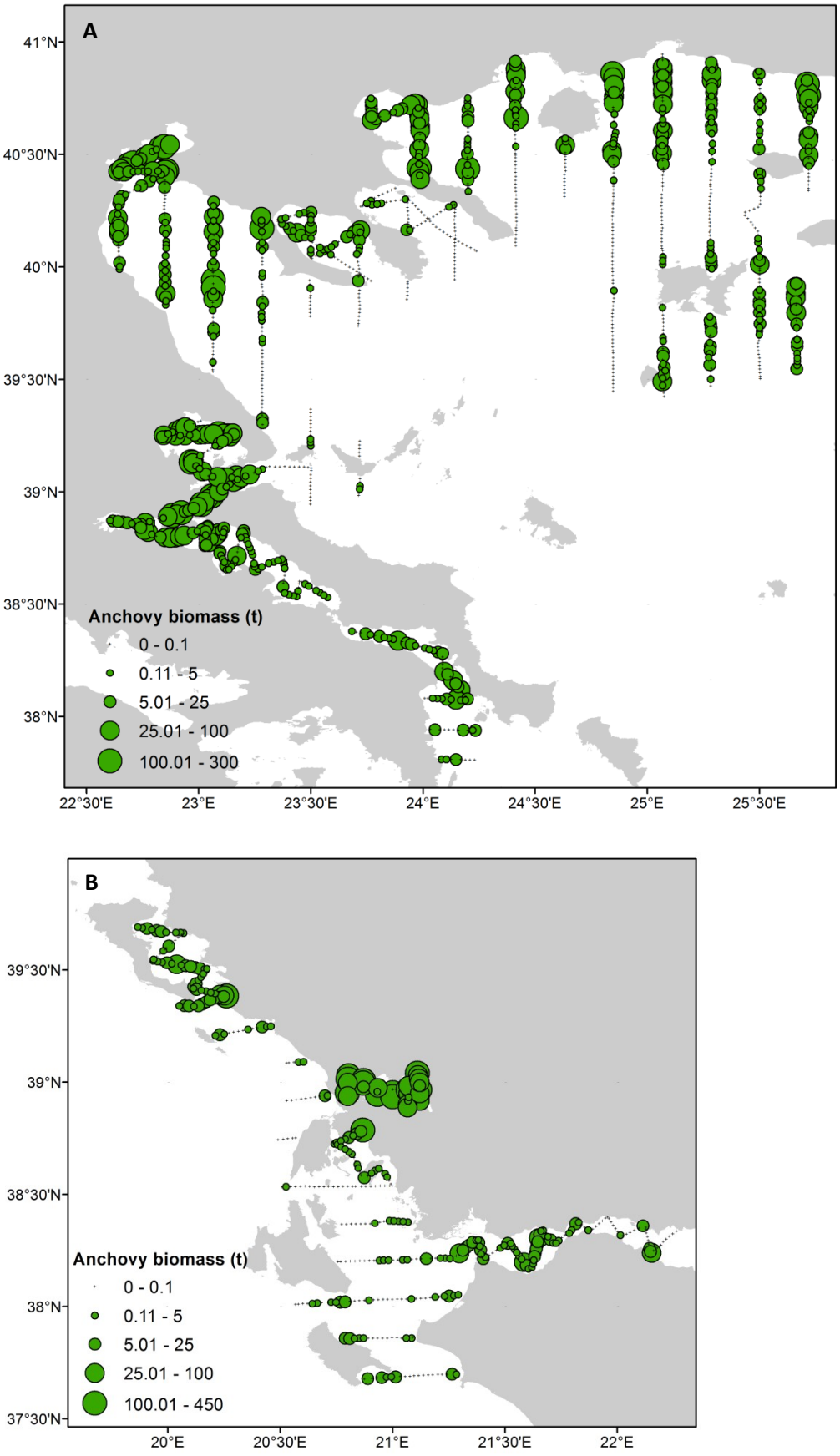


Figure F2. The distribution of anchovy biomass (t) per EDSU in a) Aegean Sea and b) Ionian Sea during June and September 2016, respectively.

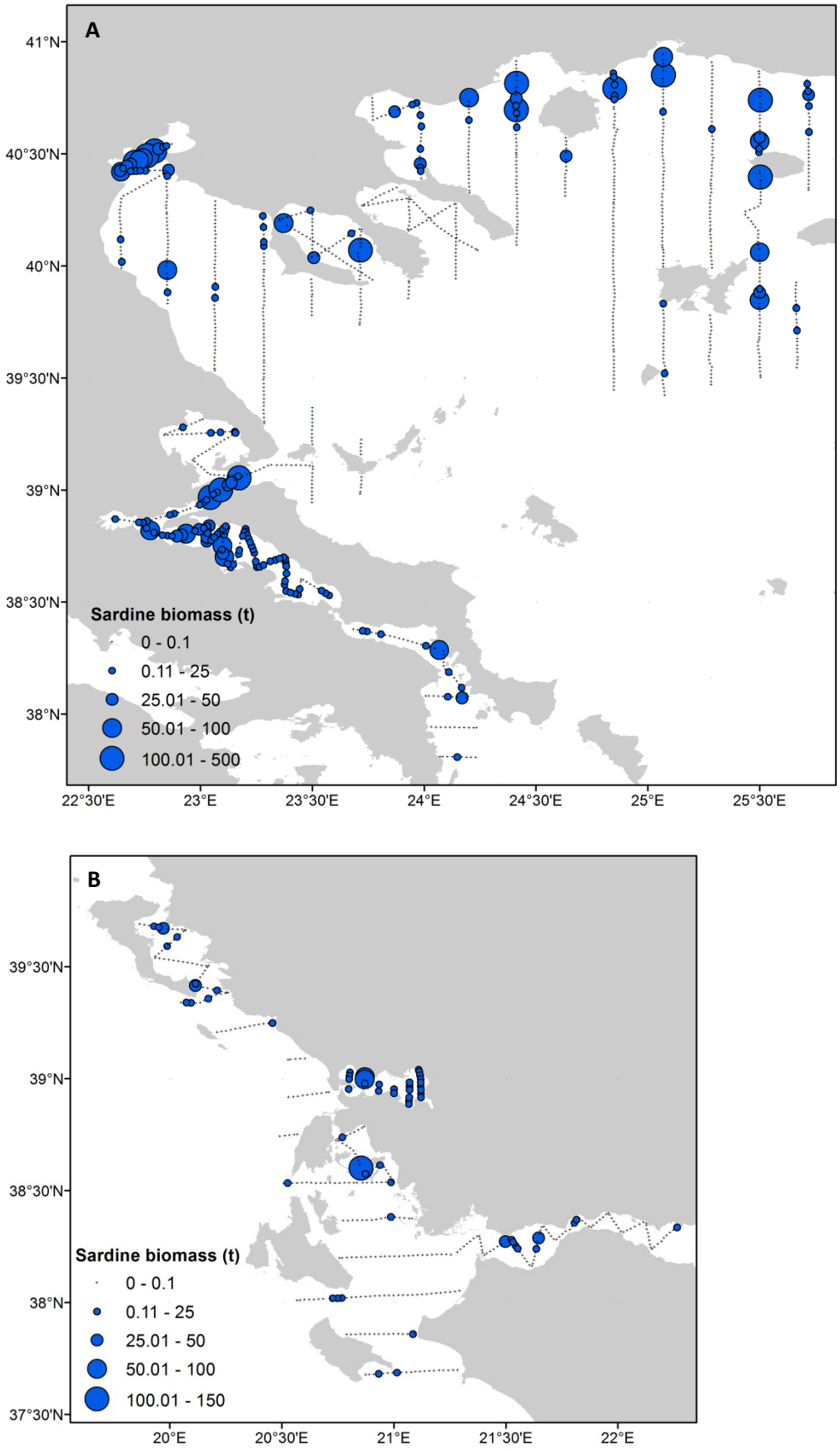
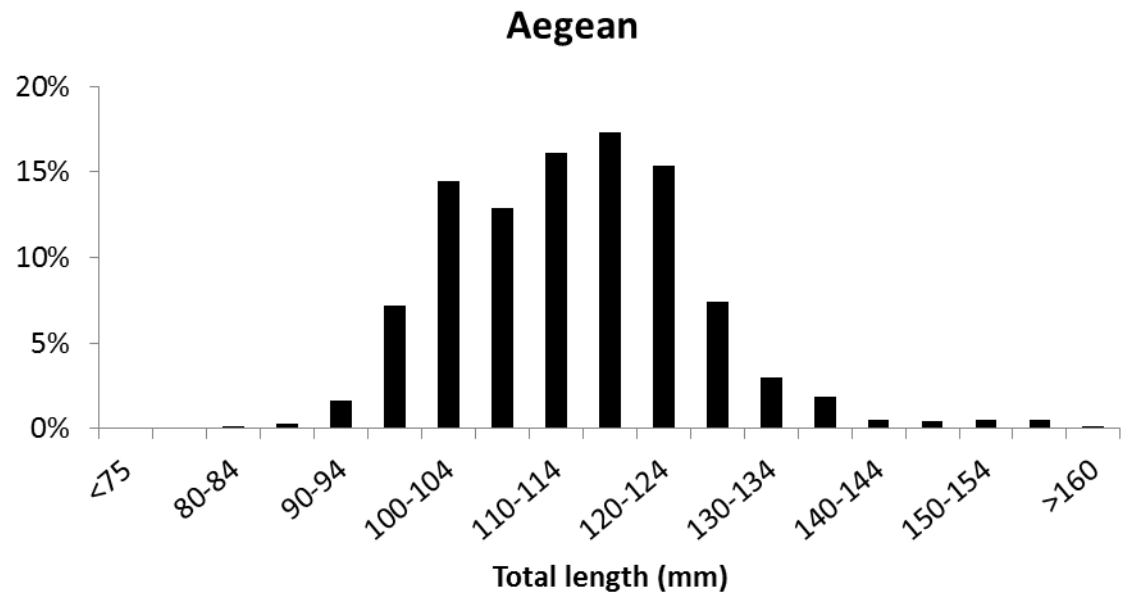


Figure F3. The distribution of sardine biomass (t) per EDSU in a) Aegean Sea and b) Ionian Sea during June and September 2016, respectively.



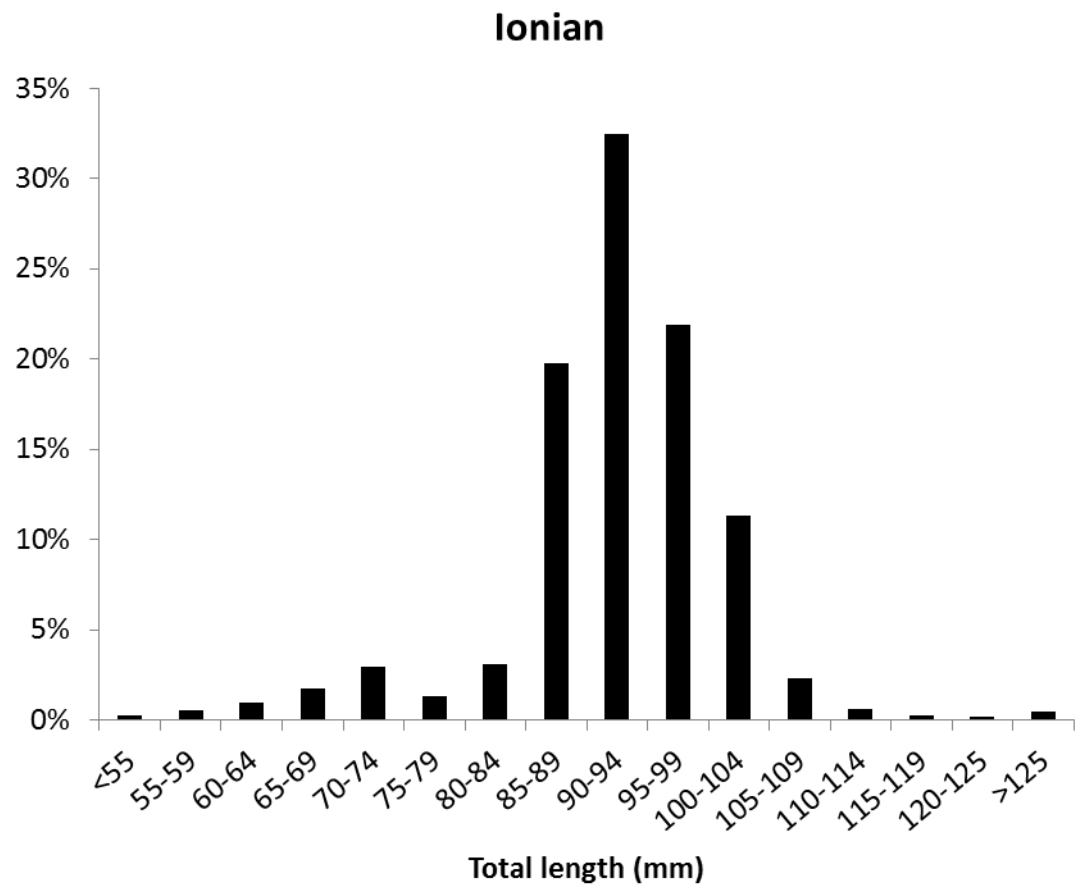


Figure F4. Length frequency distributions of anchovy catch during the survey in Greek Waters in 2016.

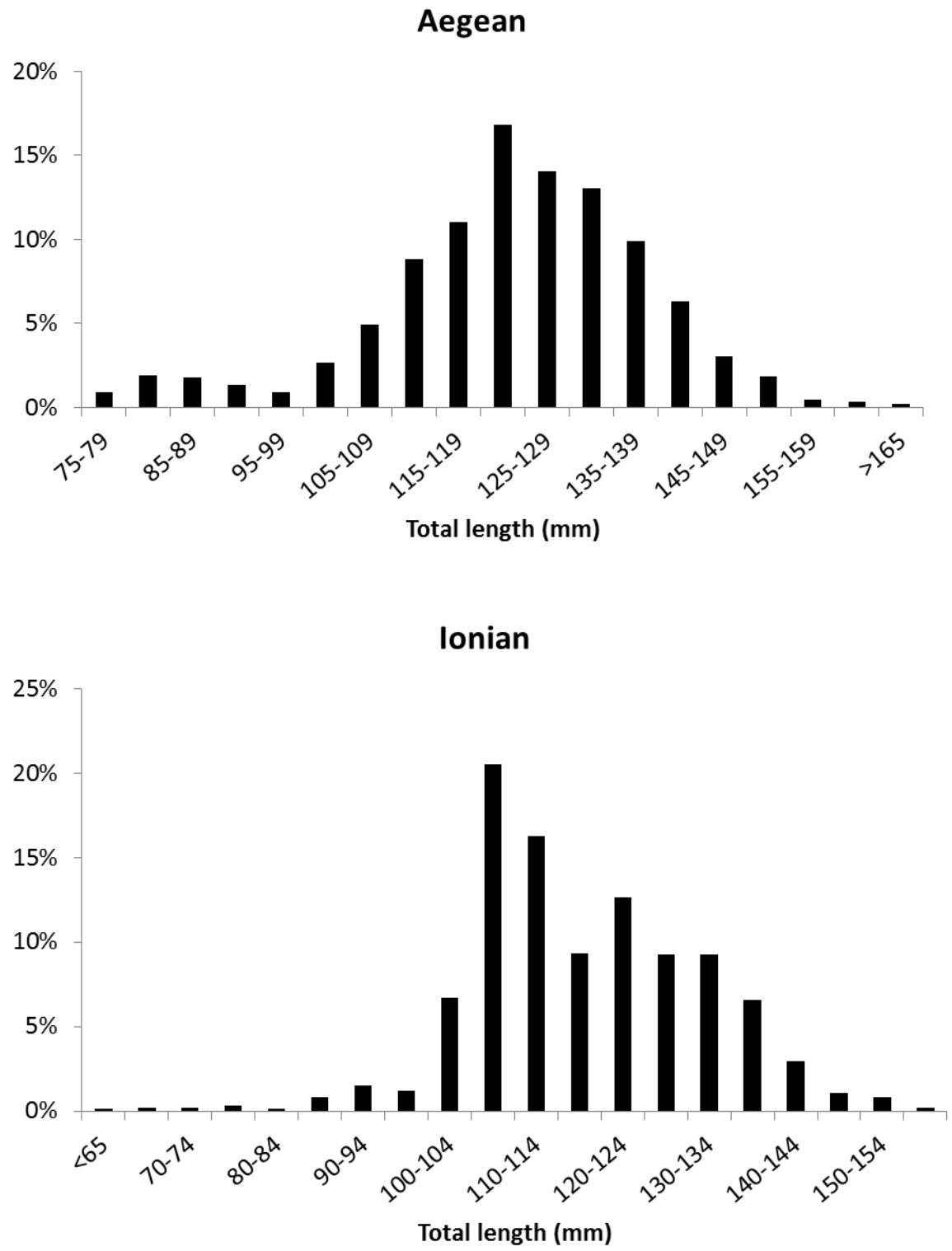


Figure F5. Length frequency distributions of sardine catch during the survey in Greek Waters in 2016.

g) **Results from Iberian survey MEDIAS 2016** (Magdalena Iglesias, Ana Ventero, Dolores Oñate, Pilar Córdoba)

MEDIAS 2016 acoustic survey was carried out in the Mediterranean Spanish waters from 24 June to 26th July 2016 (33 days) on board the R/V "Miguel Oliver" (70 m long). Acoustic data were collected over 1129 nautical miles (nmi), corresponding 851 nmi to GSA06 and 278 nmi to GSA01 GFCM geographical sub-areas. Twenty nine (29) pelagic hauls were carried out in GSA06 and nineteen (19) in GSA01 to be used for the scrutinizing of the echograms (Fig. 1). 83 CTD stations were performed in GSA06 and 42 in GSA01.

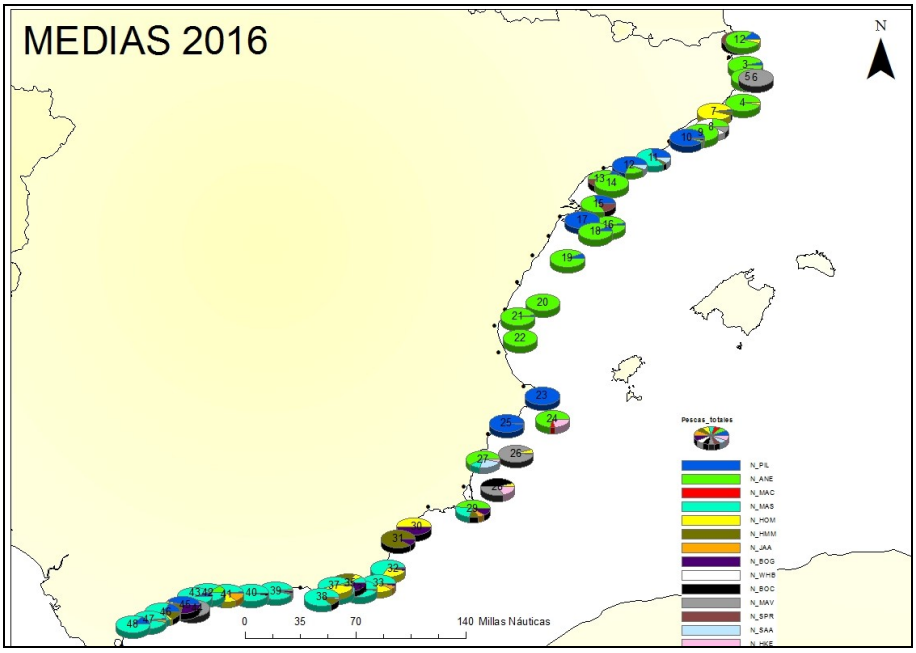


Figure G1.- Survey area and pelagic hauls carried out during the Spanish acoustic MEDIAS survey carried out in June - July 2016.

Biomass (tons) (Fig. 2 & 3) and abundance (nº individuals) of sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) were estimated by GSA. Sardine and anchovy were the most abundant species in the GSA06 area. The fish pelagic community detected and estimated includes sardinella (*Sardinella aurita*), sprat (*Sprattus sprattus*), horse mackerel (*Trachurus trachurus*, *T. mediterraneus* and *T. picturatus*)), bogue (*Boops boops*) and Spanish mackerel (*Scomber colias*), that was the most abundant species en GSA01.

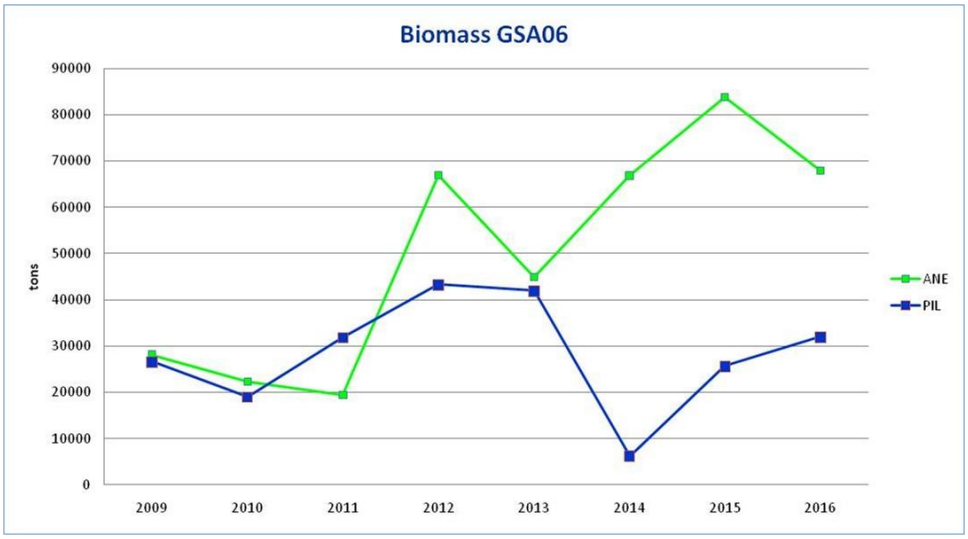


Figure G2. Anchovy (ANE) and sardine (PIL) biomass (tons) in GSA 06 in the period 2009-2016.

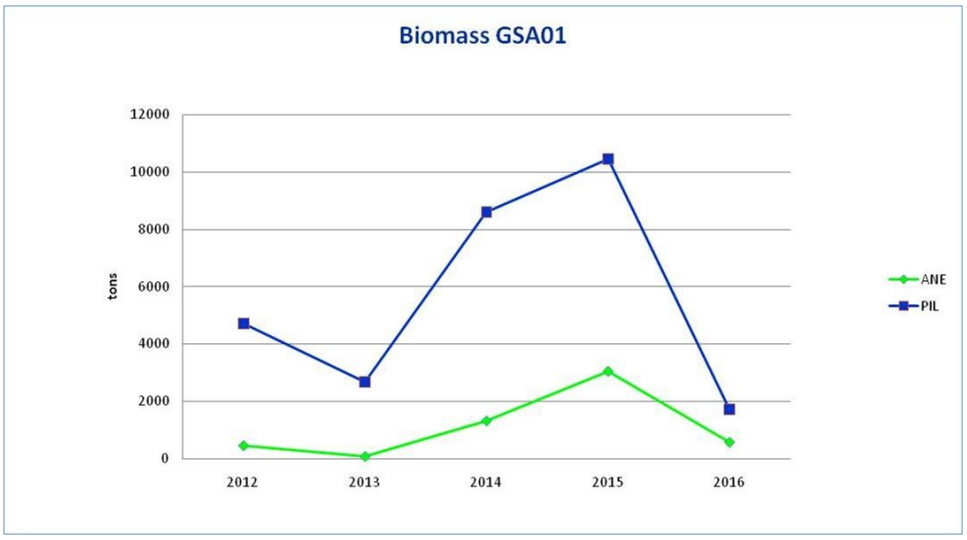


Figure G3. Anchovy (ANE) and sardine (PIL) biomass (tons) in GSA 01 in the period 2012-2016.

Age was estimated for sardine and anchovy by counting growth rings on the otoliths and age-length key calculated (Fig. 4 & 5).

Sardine recruitment detected in GSA06 in 2016 was in an average level of the MEDIAS series (Figure 6).

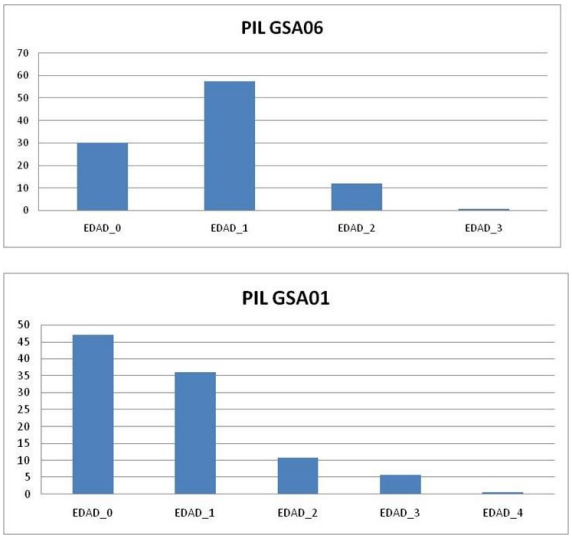


Figure G4. Sardine age readings from biological sample in MEDIAS 2016 in GSA06 and 01.

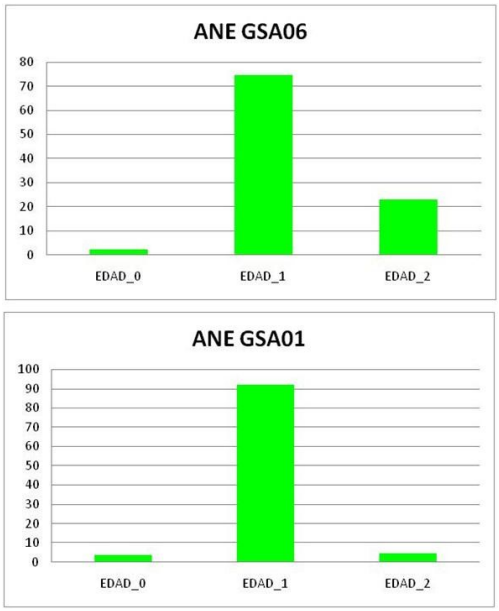


Figure G5. Anchovy age readings from biological sample in MEDIAS 2016 in GSA06 and 01.

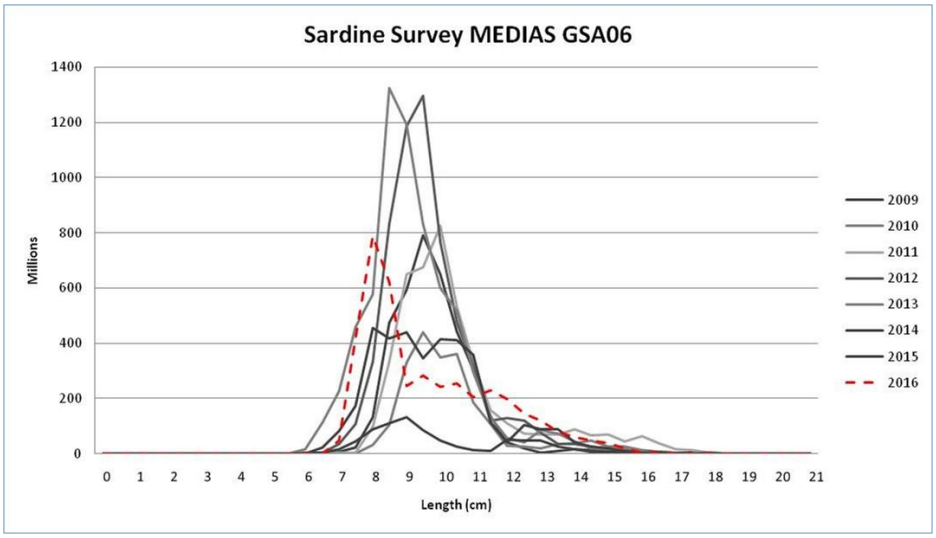


Figure G6. Sardine (PIL) abundance in GSA06 detected during the MEDIAS 2016 acoustic survey in summer in the period 2009-2016. 2016 sardine recruitment (red dash line).

h) Pelagic Surveys at the Romanian Black Sea Coast (GSA 29)

Valodia **Maximov**, Simion **Nicolaev**, Gheorghe **Radu**

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. The Romanian fishing area is comprised between Sulina and Vama Veche; the 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 Constanta, and is constituted of alluvial sediments;

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

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 (Fig. 1 and 2).

Fig. H1 Fishery ports and distribution area for stationary fishing gears

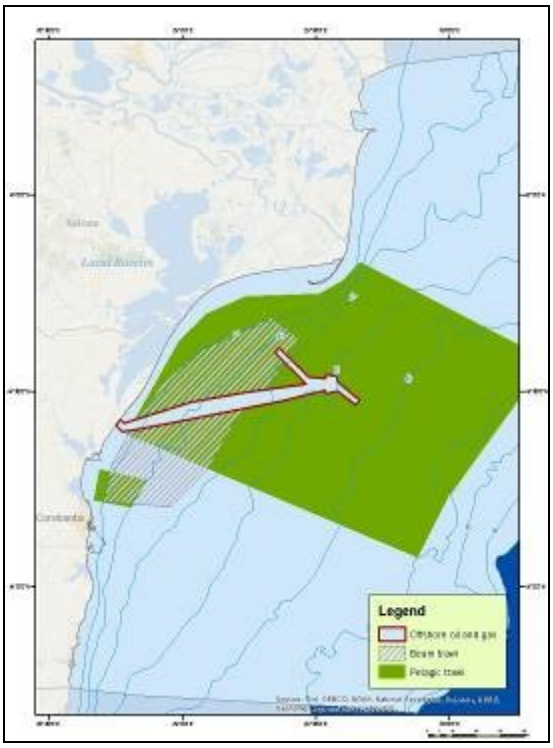


Fig. H2 Distribution of trawling zones for active fishing gears

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 migrate to the coastal area for spawning and other species migrate for feeding. Generally, the total fishing season lasts about eight months. The catch 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, last but not least, the state of fish stocks. The structure on species in the catches mirrors only partly the composition of Black Sea ichtyofauna from the Romanian sector, because the type of gear used determines the ratio between the different fish species. As a general rule, the small-sized short-lived pelagic species continue to be dominant in catches.

In **2016**, only **151 vessels** were registered, of which **121** were active. Even though compared to the previous years the total number of registered vessels slightly dropped (about 5%), the number of active vessels increased, by the activation of 12 - 18 m and 18 - 24 m LOA vessels, specialized for rapa whelk fishing. The passive fishing gears include the equipment for catching in general the fish migrating for spawning and feeding in shallow waters, namely: long lines and bottom lines; gillnets for turbot, Danube shad, gray mullet, gobies and horse mackerel; trap nets for gobies; sea pound nets. Another category of fishing equipment used in the Romanian coastal zone

includes the active fishing gear like beach seine, pelagic trawl and, since 2013, beam trawl.

Qualitative and quantitative structure of catches

After a decreasing trend during 2002-2010, when it dropped from more than 2,000 t, in 2002, to 1,390-1,940 t, during 2003-2006, and below 500 t during 2007 - 2009, reaching a minimum value in 2010/258 t, in the past years the total catch has had an increasing trend, namely 568 t, in 2011, 835 t, in 2012, 1,711 t in 2013, 2,231 t in 2014 (more than 23.31% higher than the previous year), 4,847 in 2015 (more than 105.5 % higher than the previous year) and 6,839.5 tons in 2016, official registered (Fig. 3). During 2011 - 2016, the total catches increased compared to the previous period due to the rapa whelk catches. The main species in the 2016 catches were: rapa whelk (6,504.5 tons / 95 % of total catches); anchovy (102.42 tons); sprat (49.27 tons); turbot (30 tons); horse mackerel (32.34 tons); shad (13.77 tons) and gobies about 20.24 tons (Fig. 4).

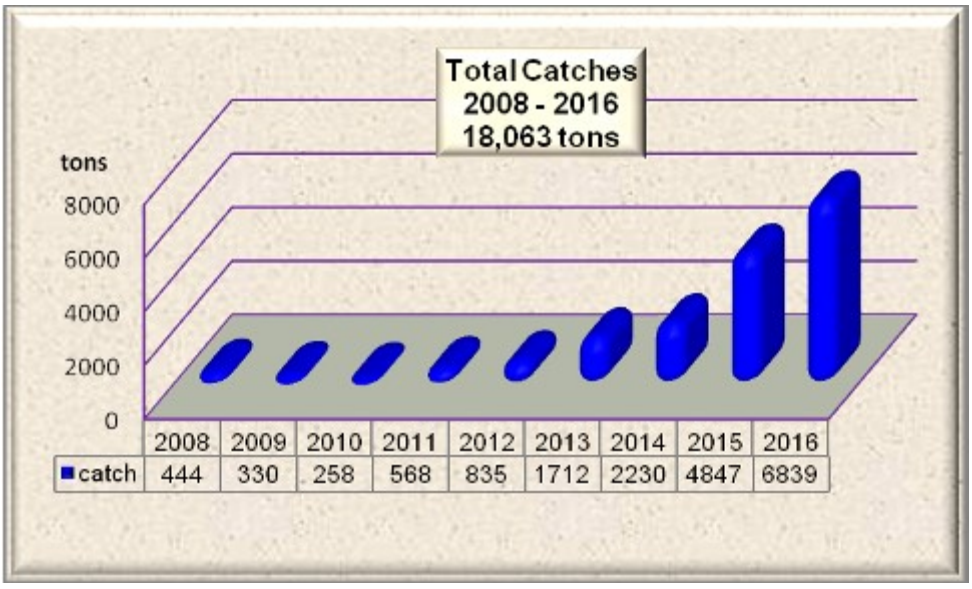


Fig. H3 Total catches at the Romanian littoral

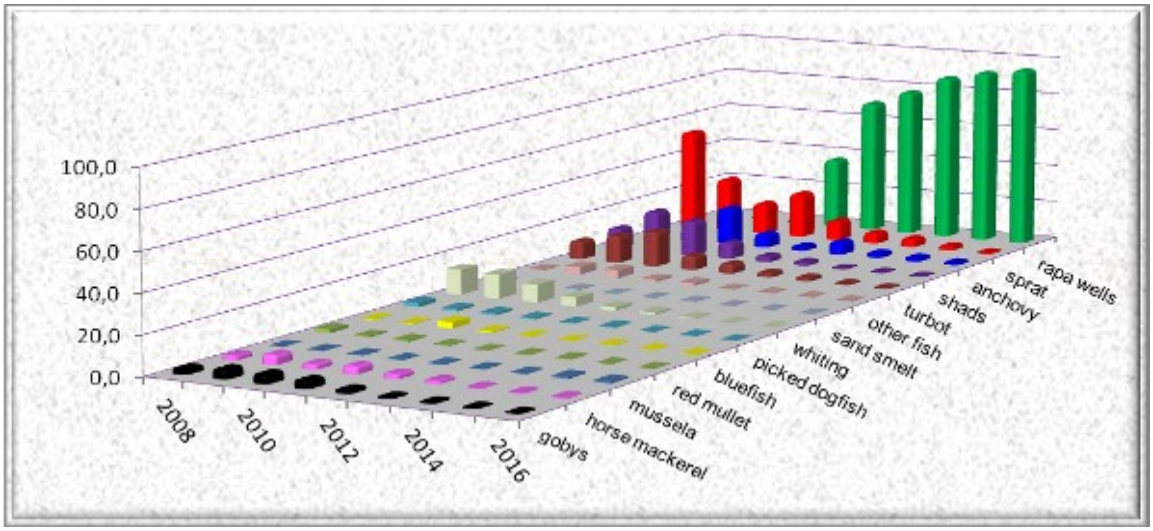


Fig. H4 Structure on species at the Romanian littoral, during 2008 - 2016

Survey 2016:

♦ period: 31 May - 12 June and 20 October - 20 November 2016

♦ type of fishing vessel: B-410 (***STEAUA DE MARE 1***);

♦ *methodology*: evaluation of part of the stock of sprat (fishing agglomerations) was made by the method holistic trawl survey (surface method), that can be applied to restricted areas, without regard of the distribution of the entire stock and used as parameters: vessel speed, and the horizontal opening of the trawl during trawling;

♦ characteristics: pelagic trawls: 36/26-59 m; horizontal trawl opening - 20 m; vertical trawl opening 11-12 m; no trawls 42 ÷ 30; drepth 30.3 - 62.1 m; trawl speed 3.2 knots; time trawling 30 min; catch 50 - 2,500 kg.

Estimated total biomass:

a. ***Sprattus sprattus*** (European sprat):

Spring - in the **42** sample trawlings made with the pelagic trawl, on a surface of **3,075** Nm², the average values of the catches were of about **6.51 - 75.14** t/Nm². The maximum value was recorded in the depths of 0-50 m along entire Romanian coast, between Sf. Gheorghe and Mangalia sectors (Fig. 5a). The estimated biomass for sprat agglomerations, in the research a area, was of about **114,652.7 to**.

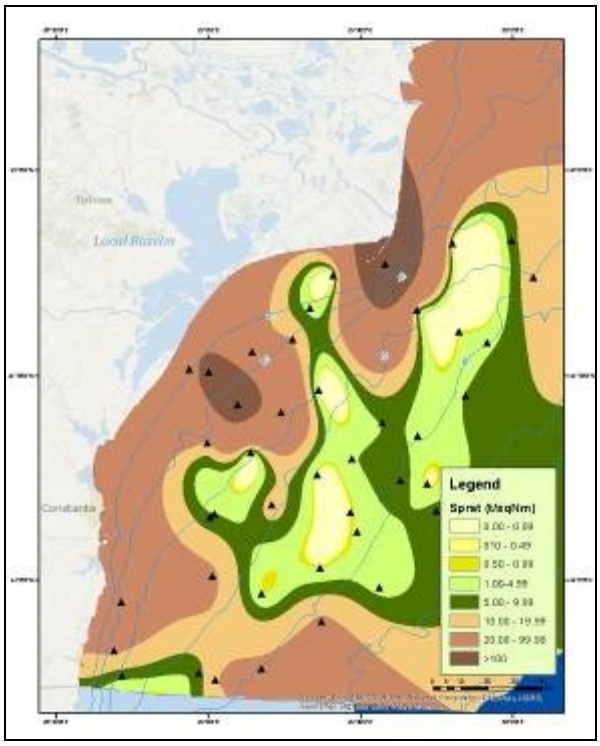
Assessment of sprat agglomerations (tons), in spring survey (June) 2016

Depth range (m)	***0 - 30 m***	***30 - 50 m***	***50 - 70 m***	***Total***
Investigated area (Nm^2)	600	1225	1250	3075
Variation of the catches (t/ Nm^2)	0.37- 209.68	0 - 147.45	0 - 22.23	0 - 209.68
Average catch (t/ Nm^2)	75.144	23.877	6.509	22.930
Biomass of the fishing	45086.602	29249.331	8136.519	70511.39

agglomerations (t)				
Biomass extrapolated for the Romanian shelf (t)				**114652.7**

The analysis of the structure by lengths and weights of sprat shoals during the survey highlighted the presence of mature specimens and a high homogeneity of fish shoals. The lengths of sprat individuals were within the limits of classes of length 55.0-105.0 mm / 0.96 - 5.6 g. The dominant classes were 75.0 - 95.0 mm / 2.7 - 4.8 g (Fig. 6). Females were dominant - 65%, compared to males (35%). The average body length was 77.82

mm and the average weight 2.9 g.

a. 

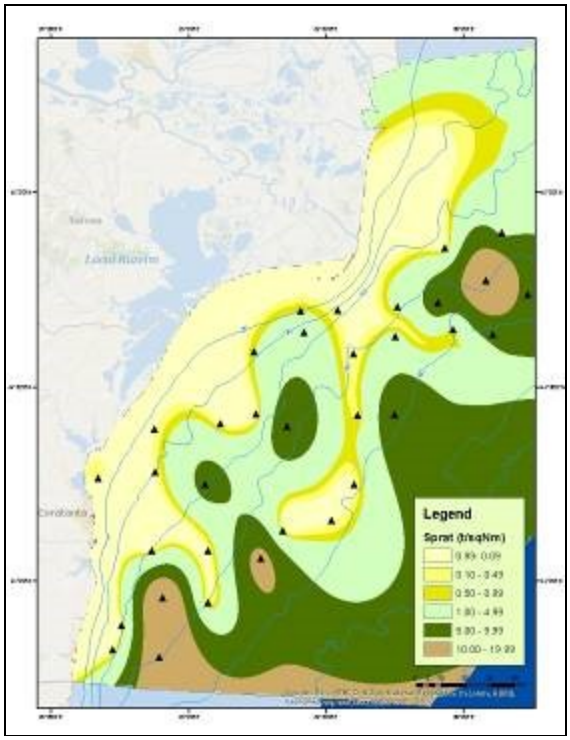
b. 

Fig. H5 The distribution of the sprat agglomerations in spring (a) and autumn (b), pelagic trawl survey, in the Romanian area

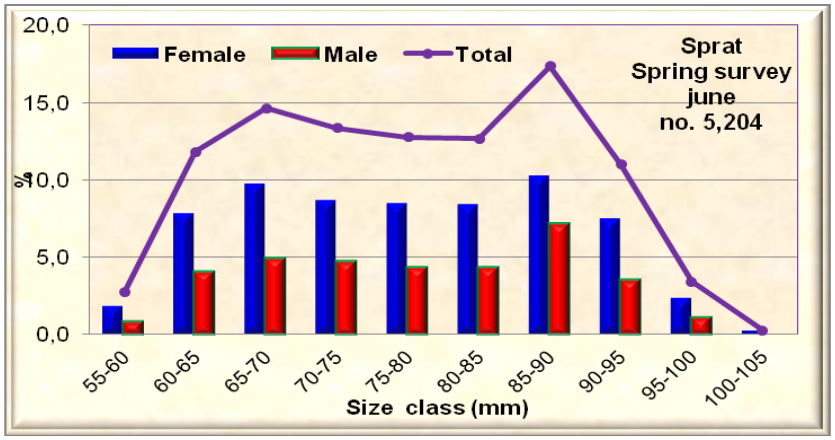


Fig. H6 Structure by lengths of sprat during the spring survey

The age composition of sprat catches indicates the presence of individuals from 1 to 3 years old. Most of the individuals caught are 1 year old (65.4% of all specimens analyzed), followed closely by those 2 years old (29.1 %) and 3 years old (5.5 %)(Fig. 7).

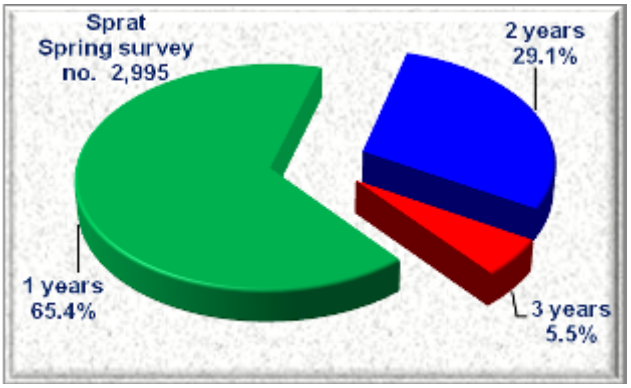


Fig. H7 Structure by age composition of sprat during the spring survey

Autumn - in the **30** sample trawlings made with the pelagic trawl, on a surface of **2,675** Nm², the average values of the catches were of about **0.505 - 4.691** t/Nm² (Fig. 5 b). The maximum value was recorded in the Sf. Gheorghe - Cap Tuzla (50 - 70 m) sectors. The estimated biomass of about **17,929.32 t**.

Assessment of sprat agglomerations (tons) in autumn survey (October/November) 2016

Depth range (m)	***0 – 30 m***	***30 – 50 m***	***50 - 70 m***	***Total***
Investigated area (Nm^2)	625	1,325	725	2,675
Variation of the catches (t/ Nm^2)	0-0.168	0-17.008	0-16.839	0-17.008
Average catch (t/ Nm^2)	0.505	3.88	4.691	3.585
Biomass of the fishing agglomerations (t)	315.744	4,490.410	3,401.016	9,592.187
Biomass extrapolated for the Romanian shelf (t)				**17,929.32**

The lengths of sprat individuals were within the limits of classes of length 75.0-110.0 mm / 2.7 - 6.9 g. The dominant classes were 80.0 - 100.0 mm / 3.2 - 6.1 g (Fig. 8).

Females were dominant - 66%, compared tomales (34%). The average body length was 90.91 mm and the average weight 4.43 g.

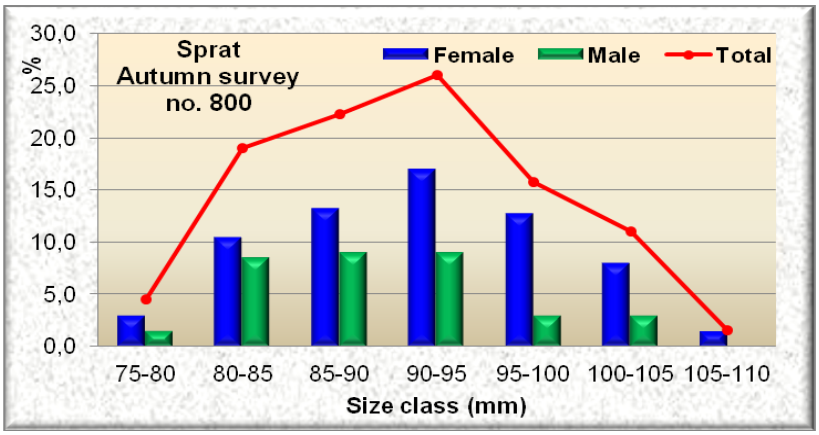


Fig. H8 Structure by lengths of sprat during the autumn survey

Age composition of sprat catches indicates the presence of individuals from 1 to 3 years old. Most of the individuals caught are 1 year old (62.2% of all specimens analyzed), followed closely by those 3 years old (26%) and 2 years old (11.8 %) (Fig. 9).

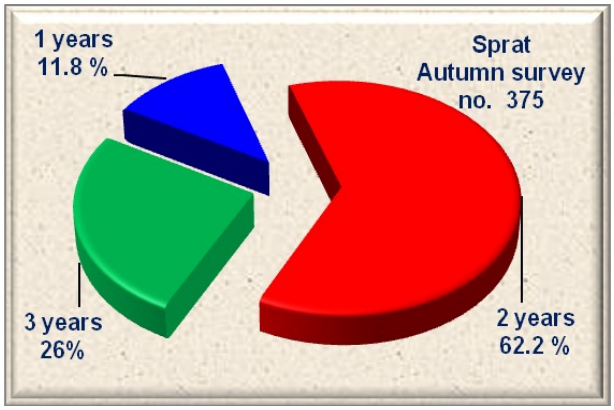


Fig. H9 Structure by age composition of sprat during the autumn survey

b. ***Merlangius merlangus*** (whiting):

Spring - the swept area methods was applied on an surface of **2,725 Nm^2**. The average values of whiting catches were situated in the limits between **0.432 - 1.370 t/Nm^2.** It revealed that whiting had a flat distribution on a large area between Chituc - Mangalia (0.0 - 3.704 t/Nm^2 / depth 30 - 50 m, respectively **0.0 - 1.370** t/Nm^2 / depth 50 - 70 m (Fig. 10a). The estimated biomass for the Romanian continental shelf was about **5,389.5 t.**

Assessment of whiting agglomerations (tons), in spring survey (June) 2016

Depth range (m)	***0 – 30 m***	***30 – 50 m***	***50 - 70 m***	***Total***
Investigated area (Nm^2)	600	1,225	1250	3,075
Variation of the catches (t/ Nm^2)	0 - 1.480	0 - 3.704	0 - 3.704	0 - 3.704
Average catch (t/ Nm^2)	0.432	0.953	1.370	1.077

Biomass of the fishing agglomerations (t)	259.3313	1168.61172	1713.439	3314.545
Biomass extrapolated for the Romanian shelf (t)				**5,389.5**

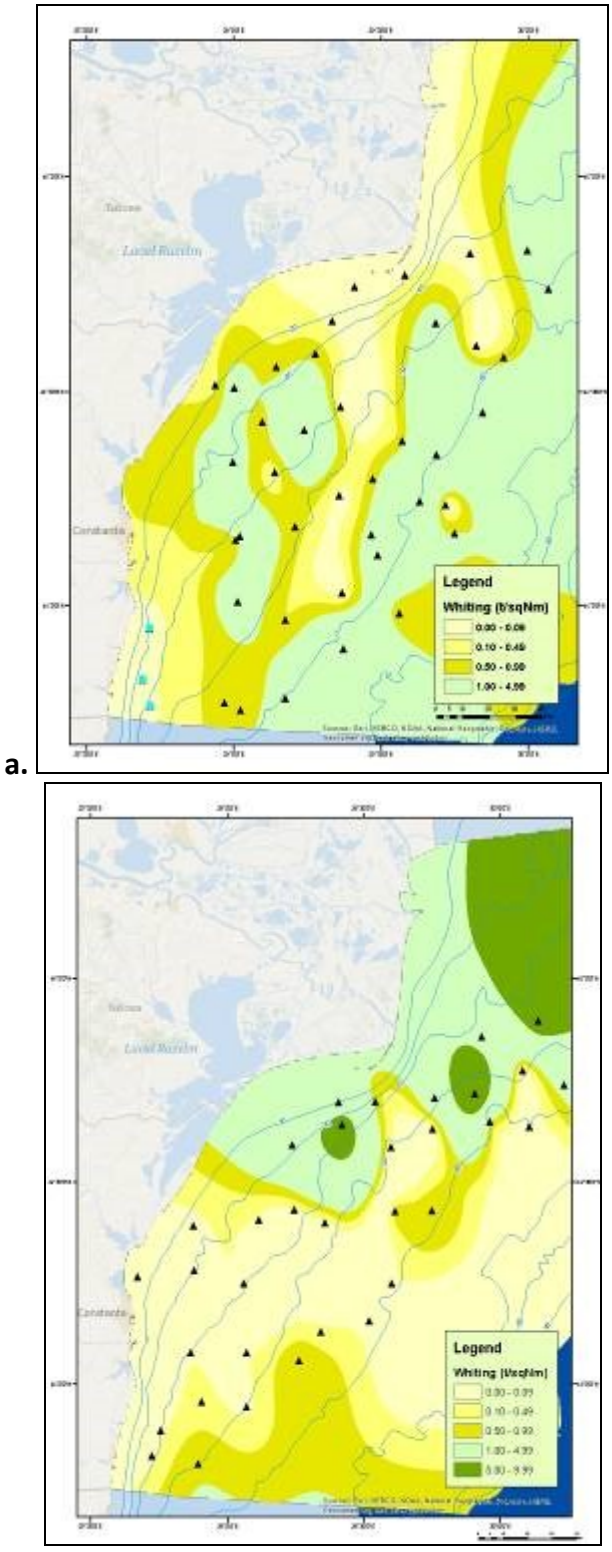


Fig. H10 The distribution of the whiting agglomerations in spring (a) and autumn (b), pelagic trawl survey, in Romanian area

The analysis of structure by lengths and weights of whiting caught during the survey showed that the lengths of whiting individuals are within the limits of classes of length 85.0-160.0 mm / 5.52 - 42.1 g. The dominant classes are those of 105.0 - 135.0 mm / 9.45 - 17.65 g (Fig. 11). Females were dominant - 68.5%, compated to males (31.5%). The average body length was 114.02 mm and the average weight 12.18 g.

Age composition of withing catches indicates the presence of individuals from 1 to 4 years old. Most of the individuals caught are 1 year old (51.9% of all specimens analyzed), followed closely by those 2 years old (23.7%) and 3 years old (16.8%) (Fig. 12).

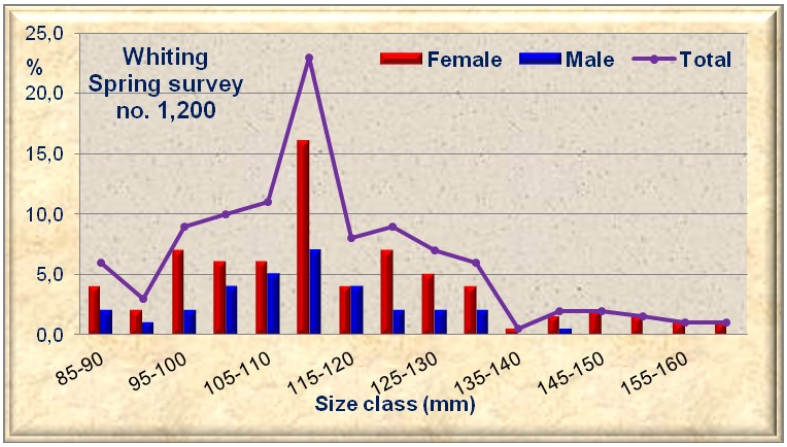


Fig. H11 Structure by lengths of whiting, during the spring survey

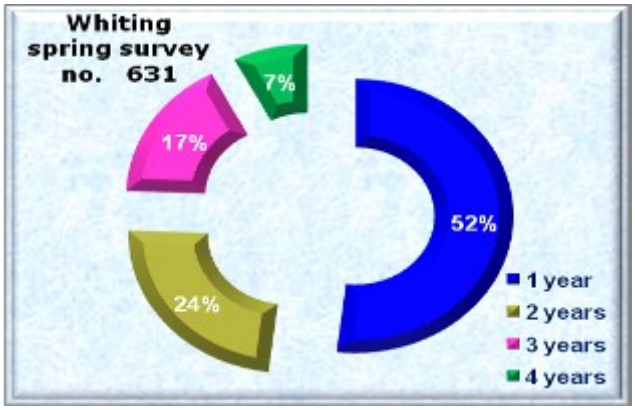


Fig. H12 Structure by age composition of whiting during the spring survey

Autumn - in the **30** sample trawlings made with the pelagic trawl, on a surface of **2,675** Nm², the average values of the catches were of about **0.00 - 7.998** t/Nm². The maximum value was recorded in the Chituc - Managalia sectors (30–50 m and 50-70 m) (Fig 10 b). The estimated biomass for the whiting agglomerations, in the research area, was of about **6,042.48 tones**.

Assessment of whiting agglomerations (tons), in autumn survey (October/November) 2016

Depth range (m)	***0 – 30 m***	***30 – 50 m***	***50 - 70 m***	***Total***

Investigated area (Nm^2)	625	1,325	725	2,675
Variation of the catches (t/ Nm^2)	0 - 3.36	0 - 6.735	0 - 7.998	0 - 7.998
Average catch (t/ Nm^2)	1.473	1.226	1.112	1.208
Biomass of the fishing agglomerations (t)	920.92	1624.64	806.65	3232.73
Biomass extrapolated for the Romanian shelf (t)				**6,042.48**

The analysis of structure by lengths and weights of whiting during the survey showed that lengths of whiting individuals are within the limits of classes of length 80.0-185.0 mm / 5.52-42.1 g. The dominant classes are those of 105.0-140.0 mm / 9.39-20.79 g (Fig. 13). Females were dominant - 64.2%, compared to males (35.8%). The average body length was 117.98 mm and the average weight 13.98 g.

Age composition of whiting catches indicates the presence of individuals from 1 to 5 years old. Most of the individuals caught were 2 years old (42 % of all specimens analyzed) and 1 years old (39 %), followed closely by those 3 years old (11 %)(Fig. 14).

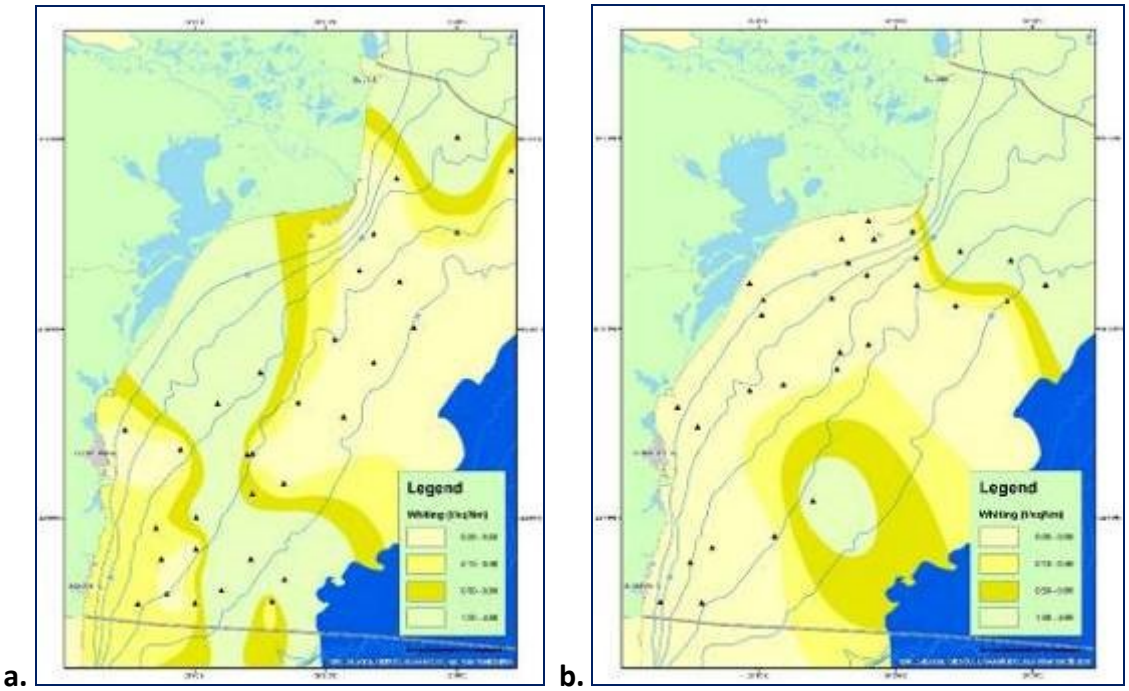


Fig. H13 The distribution of the whiting agglomerations in spring (a) and autumn (b), pelagic trawl survey, Romanian area

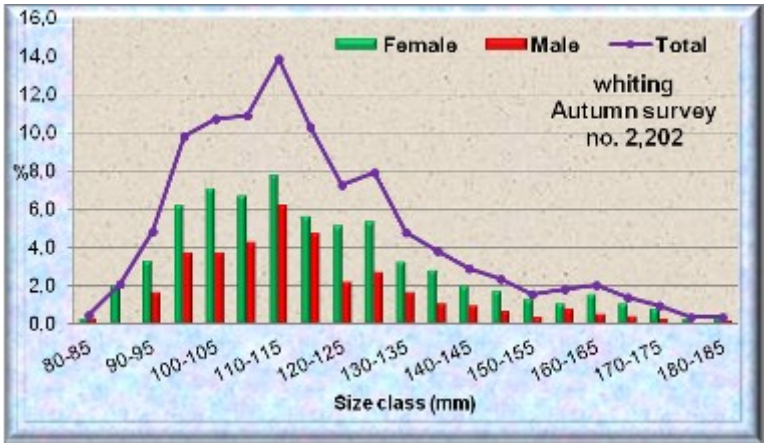


Fig. H14 Structure by lengths of whiting, during the autumn survey

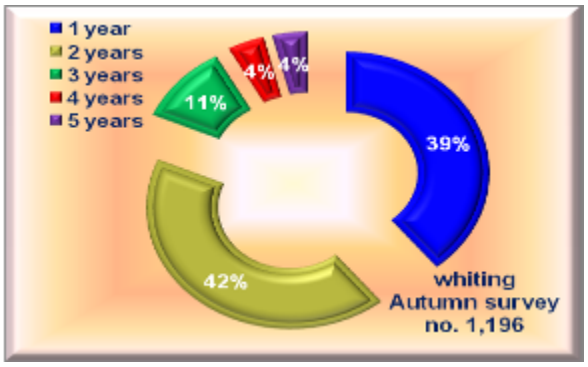


Fig. H15 Structure by age composition of whiting during the autumn survey

c. ***Squalus achanthias*** (piked dogfish)

Spring - in the 42 sample trawlings made with the pelagic trawl, on a surface of **3,075** Nm², the average values of the catches were of about **0.0 - 0.426 t**/Nm². The maximum value was recorded in the Chituc - Constanta (30-70 m) sectors (Fig. 15). The estimated biomass in the research area was of about **99.59 to**.

Assessment of dogfish agglomerations (tons), in spring survey (June) 2016

Depth range (m)	***0 – 30 m***	***30 – 50 m***	***50 - 70 m***	***Total***
Investigated area (Nm^2)	600	1,225	1,250	3,075
Variation of the catches (t/ Nm^2)	0	0 - 0.426	0 - 0.318	0 - 0.426
Average catch (t/ Nm^2)	0	0.026	0.019	0.019
Biomass of the fishing agglomerations (t)	0	32.618	24.080	59.401
Biomass extrapolated for the Romanian shelf (t)				**96.59**

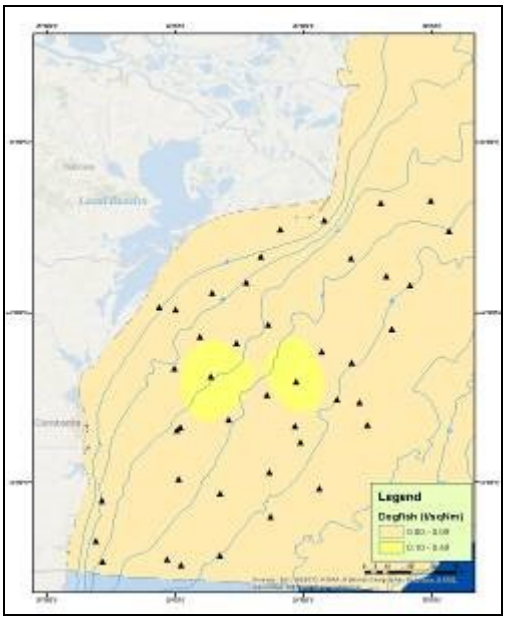


Fig. H16 The distribution of the dogfish agglomerations in spring

The lengths of piked dogfish individuals were within the limits of classes of length 108.5-123.5 mm / 4,880 - 8,150 g. The dominant classes were 110.0 - 120.0 cm / 5,486 - 7,057 g (Fig. 16). Only males were identified (100.0%). The average body length was 114.63 cm and the average weight 6,295.21 g. Age composition of piked dogfish catches indicates the presence of individuals from 13 to 16 years. Most of the individuals caught were 14 years old (47.8% of all specimens analyzed) and 15 years old old (26.1%), followed closely by those of 13 years (17.4%)(Fig. 17).

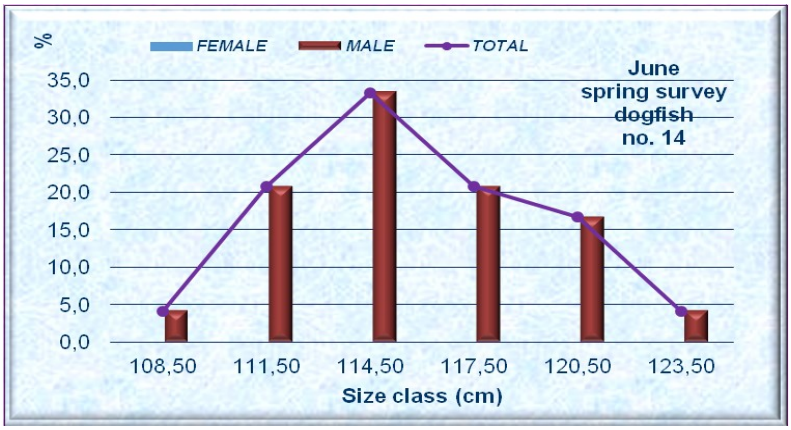


Fig. H17 Structure by lengths of dogfish, during the spring survey

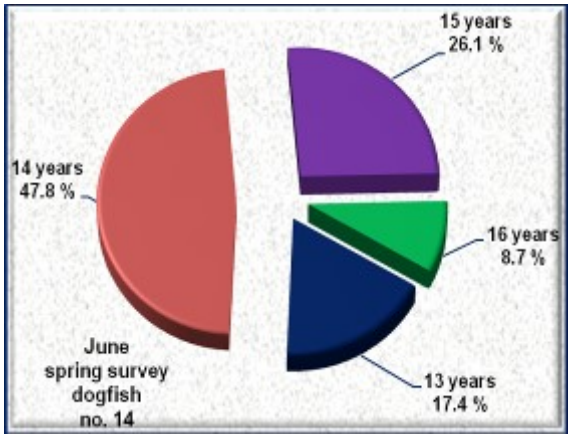


Fig. H18 Structure by age composition of dogfish, during spring survey

Autumn **-** in the 30 sample trawlings made with the pelagic trawl, on a surface of **2,675** Nm^2, the number of dogfish specimens was very small and no assessment was made.

The biomass of the main species' agglomerations from the Romanian coast

The swept area method is used for the assessment of the biomass of fishing agglomerations of sprat, whiting and dogfish, based on the statistical processing of productivity data obtained in sampling trawling and industrial trawling. The calculated biomasses by the swept area method for the main species at the Romanian littoral ranged between: sprat (30,917 tons and 68,887 tons); whiting (6,565 t and 26,171 t) and dogfish (967 t and 5,635 t)(Fig. 18).

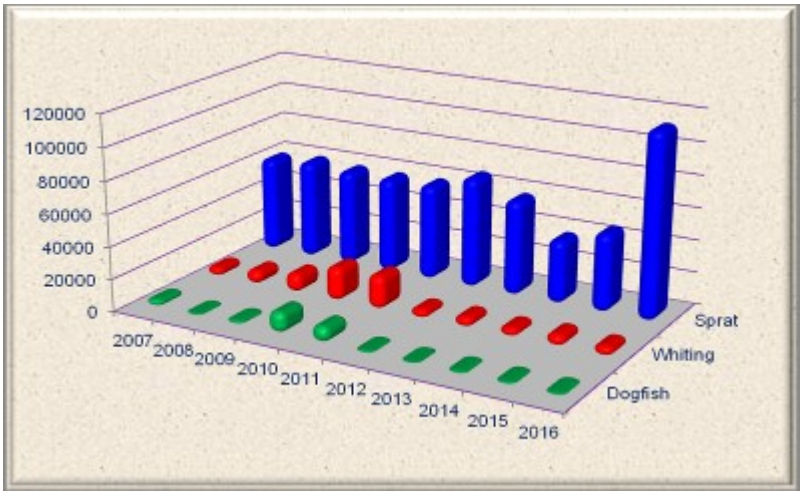


Fig. H19 The biomass of the main species' agglomerations from the Romanian coast

i) Gulf of Lion survey (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. 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, 200 and 333 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 use of a multi-beam echo sounder SIMRAD ME70 enables us to visualize 3D echos and helps in species allocation.

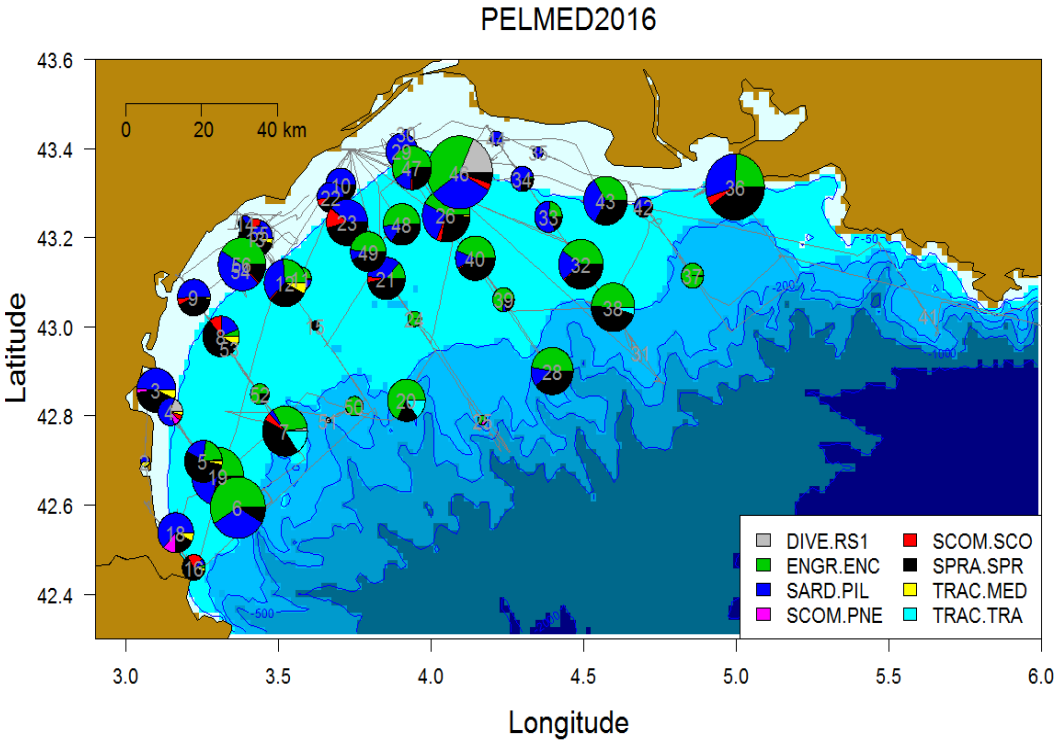


Figure I1. Map of the assessed area and sampling design. 2015 survey is used as an example to show the trawl positions and species composition.

Regarding anchovy, biomass is very low, so that the stock is judged depleted (below B_{lim}). The exploitation level is low and the declining trend in biomass and landings is supposed to be driven mainly by exogenous environmental factors. Further, biological parameters showed slight improvement: anchovies maintained their slightly larger size such as last year, increased the proportion of age 2, and their condition stabilized,

though it is still very low. Despite a slight encouraging improvement in terms of biological parameters, they remained well below average.

Regarding sardine, the current situation still shows small individuals, as a result of a lower growth and the absence of old individuals. However, there has been an important increase in 2016 body condition that returned above the average for the first time in 10 years. Nonetheless, the stock is still judged unbalanced due to its lack of old individuals and problems of growth. The exploitation level is almost null, while the biomass is intermediate.

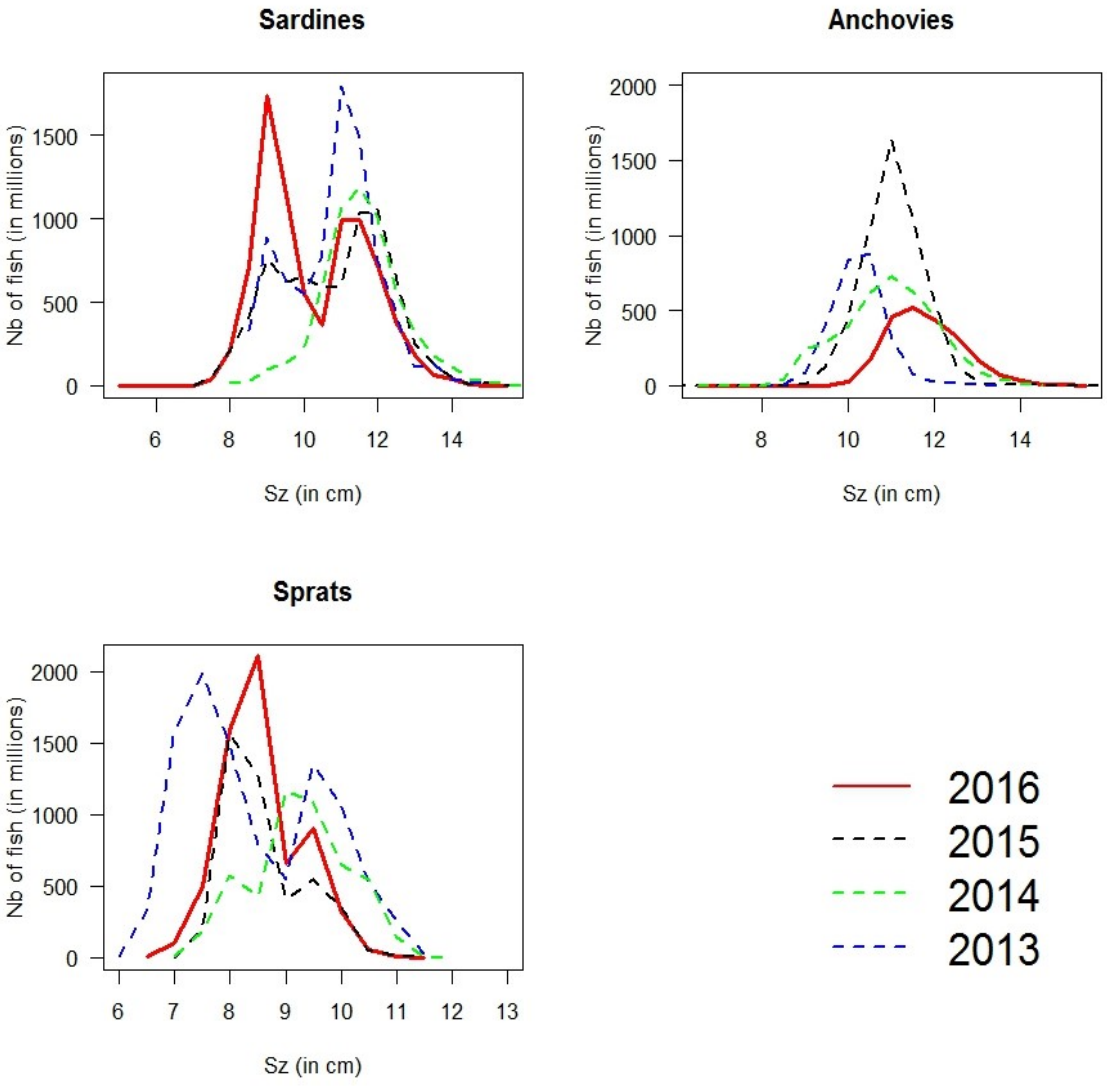


Figure I2. Size distribution of anchovies, sardines and sprats from 2016 (in red), 2015 (in black), 2014 (in green) and 2013 (in blue) surveys.

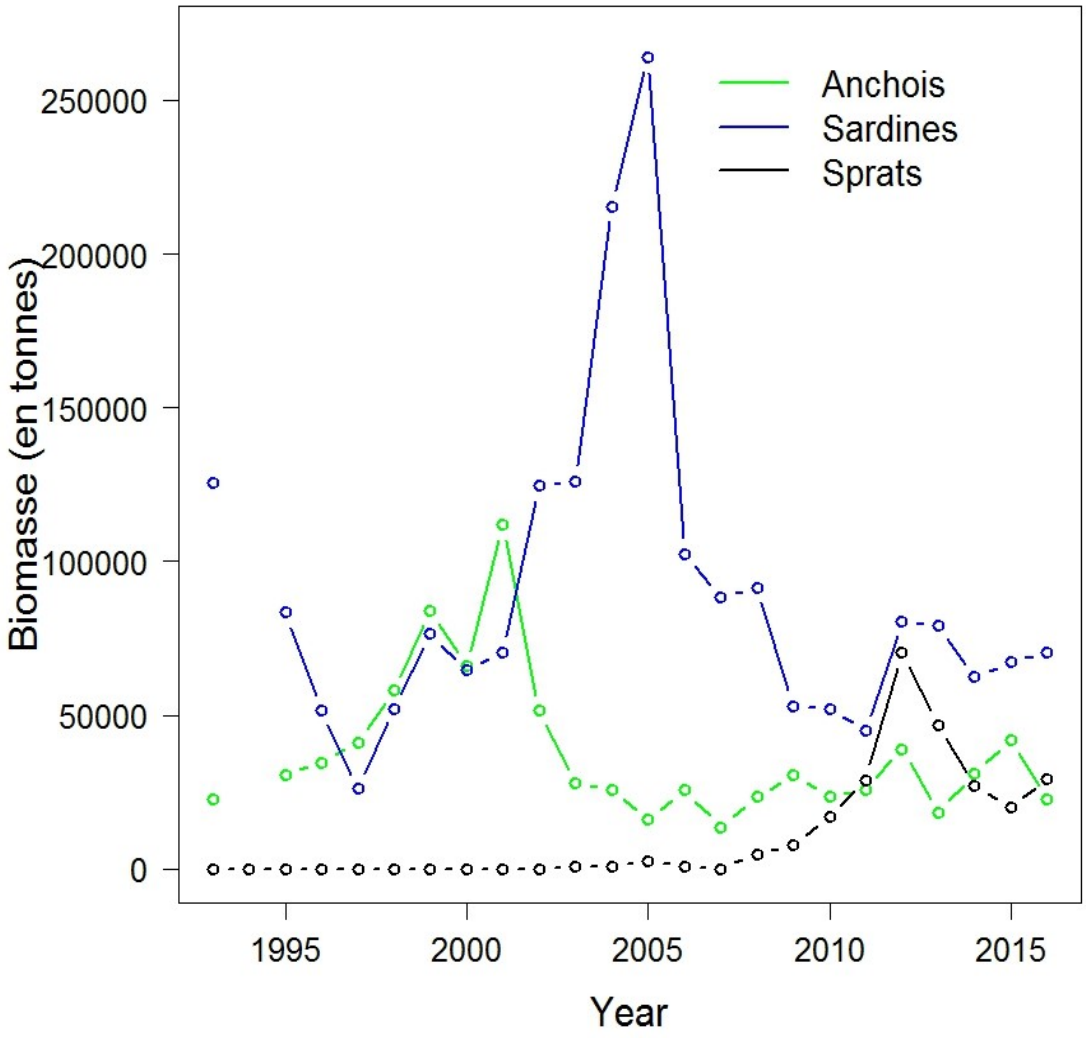


Figure I3. Direct assessment of biomass since the start of the PELMED acoustic survey.

Finally, on top of fish parameters, around 60 hydrological stations have been conducted. Zoopkankton was sampled through WP2 vertical nets and bongo diagonal nets, while phytoplankton was sampled through Niskin bottles in subsurface and at the maximum of chlorophyll depth. Seabirds and marine mammals are also observed all along the survey.

The Mid-term (2017-2020) strategy and the implementation of pelagic surveys
(GFCM Secretariat: Paolo Carpentieri)

The mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries is the fruit of the commitment of GFCM contracting parties, cooperating non-contracting parties and partner organizations to improve, by 2020, the sustainability of Mediterranean and Black Sea fisheries and ensure that the alarming trend in the status of commercially exploited stocks is reversed.

It is based on five targets which include selected outputs and proposed actions: (1) Reverse the declining trend of fish stocks through strengthened scientific advice in support of management; (2) Support livelihoods for coastal communities through sustainable small-scale fisheries; (3) Curb illegal unreported and unregulated (IUU) fishing, through a regional plan of action; (4) Minimize and mitigate unwanted interactions between fisheries and marine ecosystems and environment, and (5) Enhance capacity-building and cooperation.

This strategy stems from existing international and regional legal instruments, it does not create any new obligations on GFCM Contracting Parties and Cooperating non-Contracting Parties (CPCs). On the other hand, it purports to define a course of instrumental action to further progress in the development of sustainable fisheries at the regional level. The collection, analysis and dissemination of information on the status and trends of fisheries, ecosystems and marine environment, as well as information on IUU fishing, should account for all relevant participants (which may include, inter alia, representatives of CPCs and other riparian states, relevant international, non-governmental and civil society organizations), in the preparation, analysis and presentation of scientific advice and conclusions.

In particular, the Output 1.1 of the mentioned strategy "*Enhanced knowledge and expertise on Mediterranean and Black Sea fisheries*" will require the compilation of data and information on different fisheries-related issues. This will be achieved through the implementation of the new GFCM Data Collection Framework (GFCM_DCRF, 2016), as well as the execution of a number of actions including the realization of regional surveys at sea (e.g. acoustic surveys for pelagic species and trawl surveys for demersal fisheries). It is expected that the collection and analysis of appropriate surveys data (demersal trawling and pelagic acoustic surveys) will allow the possibility to formulate scientifically based advice for improved conservation of the stocks. From this general goal, the implementation of regional surveys at sea would aims:

(i) to contribute to the characterization of demersal and pelagic fisheries resources in the Mediterranean & Black Sea in term of population distribution (relative abundance indices) as well as demographic structures (length distributions);

(ii) to provide data for more accurate estimates of life history parameters such as mortality and growth.

(iii) to better assess the spatial occupation of the different components of the stocks (e.g. seasonal distribution, spatial segregation and community structure, reproduction and recruitment areas).

The gain in accuracy would, in turn, make also more robust the evaluation of changes in the population indicators and of the input parameters for population and community modelling.

Rationale:

More specifically, the aim of an acoustic survey is to determine species and size composition of the pelagic biomass and CTD oceanographic data. At present, acoustic surveys are conducted only in few GSAs of the Mediterranean waters, focusing on the small pelagic fish anchovies (*Engraulis encrasicolus*) and sardines (*Sardina pilchardus*). There is the urgent need to join and to harmonize the ongoing acoustic surveys in the rest of the Mediterranean Sea and Black Sea, in order to gain knowledge of biomass levels and spatial distribution of the major stocks of small pelagic fishes in all the region, and for further comparisons of the results issued from different areas.

Methodology:

The implementation of acoustic survey(s) should be associated with a multidisciplinary approach, acquiring both acoustic data and net samplings on small pelagic fish, by means of pelagic trawl. Standard methodologies and homogeneous operational protocols will be applied among participants and covering: the design of the survey, the information collected, the management of the data as far as the production of common standardized analysis of the data (existing survey protocol already used by some GFCM Countries i.e. MEDIAS, could be used as reference). The design for the acoustic sampling survey should take into account the characteristics of the spatial structures of small pelagic fish in the different GFCM sub-regions as well as the peculiarities in the topography of each area.

To carry out these surveys and depending on the area, different fishing vessels (e.g. research vessels and/or chartered fishing vessels), working during the same period, will be used. In each GFCM sub-regions, these vessels, duly equipped, should work at sea for about one month per year (i.e. summer.).

During acoustic surveys, both the biological parameters (e.g. length frequency distribution of all the caught fish species), and CTD oceanographic data (e.g. temperature, salinity, fluorescence and dissolved oxygen) should be recorded.

A coordination meeting for the implementation of scientific surveys in the Mediterranean will take place in Ljubljana on 15 May 2017, during which the protocols and the roadmap for the implementation of surveys will be discussed.

Acoustic surveys period in the eastern part of the GSA 17 (Vjekoslav Ticina)

Acoustic surveys covering eastern part of the Adriatic Sea (GSA 17) were initiated in 2002 as national Pelagic Monitoring project (PELMON) with support of Croatian Ministry of Agriculture, and thanks to good collaboration and valuable help of scientists from ISMAR-Ancona. After initial start-up survey performed in November 2002, since 2003 all following acoustic surveys on eastern part of GSA17 were harmonized in time with acoustic surveys on western part of GSA17 (i.e. performed during September) until 2014. September was chosen as survey period in accordance with period of acoustic surveys made on western part of GSA17, in order to avoid possible errors in fish biomass estimations due to fish migrations.

Since 2003, Institute of Oceanography and Fisheries (IOF) has adapted use of its human and technical resources to acoustic survey needs during September. Considering wide range of different research activities carried out by IOF (www.izor.hr), its human and technical resources are engaged in other research projects/activities also (i.e. use of r/v BIOS DVA in MEDITS etc.) and are not available for acoustic survey in other periods. Therefore, as it has been already said in previous DCF-RCM meeting (San Sebastian, 2016), IOF cannot change currently established period of acoustic survey.

If survey period is to be changed, new data series need to be initiated because new data will not be comparable with previous estimates describing situation in September. Change of survey period will cause different oceanographic properties within survey area, and consequently different spatial distribution of target species within eastern GSA17 (Tičina et al., 2000). Due to fish migrations from feeding areas toward spawning areas (Fig. 1) different abundance and biomass indices of target species within eastern and western survey areas occur since 2015, as well as different size structure of anchovy and sardine populations. Despite the fact that stock assessment models currently used will be able to use input numbers/data provided, all these changes/differences likely have adverse effects on accuracy of eventual GFCM & STECF stock assessments outputs and eventual advices.

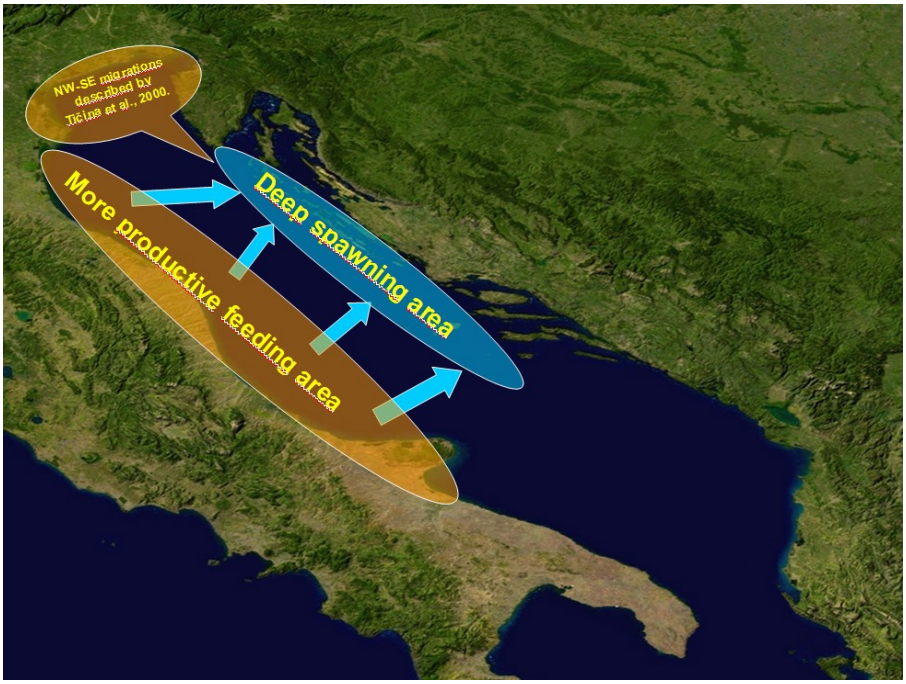


Figure 1. Sardine spawning migrations from feeding to spawning areas in the Adriatic Sea.

Reference:

Tičina, V., I. Ivančić and V. Emrić, 2000: Relation between the hydrographic properties of the northern Adriatic Sea water and sardine (*Sardina pilchardus*) population schools. Period Biol. Vol.102, Supplement 1: 181-192

Ek60 echosounder directivity model parameter calibration: comparison between two different protocols (Pilar Cordoba)

The scientific echosounder Simrad EK60 could be used for quantification of fisheries resources in marine science research surveys. They used different frequency channels (from 18 to 200 kHz), emitted by underwater sound transducers with circular aperture geometries.

Calibration is essential to obtain reliable values of TS (Target Strength) and sv (Volume Backscattering Coefficient) parameters, which are used to estimate fisheries stocks using echo volume integration. Manufacturer's calibration method (Simrad) is presented together with two new proposals for the acquisition and post-processing of calibration data (no lineal optimization of Simrad's results, and no lineal optimization with restrictions of raw data) in order to obtain more accurate results. The Spanish

MEDIAS 2015 survey calibration has been processed with three methods in order to compare the results and analyse the differences.

Summary of the joint session ICES WGACEGG/MEDIAS (Andrea De Felice)

ICES WGACEGG was held in Capo Granitola (Italy) in November 2016. The first three meeting days saw the presence of MEDIAS scientists as foreseen for this meeting every two years. There were presentations concerning acoustic surveys on small pelagic fish in the Atlantic Ocean (ICES WGACEGG) and in the Mediterranean Sea (MEDIAS), plus a series of other presentations on different aspects of acoustic surveys and eggs and larvae surveys. For what concerns MEDIAS acoustic surveys that were presented they were from eastern Ionian Sea, western Adriatic Sea and estern Adriatic Sea; moreover Daily Egg Production Method in Aegean Sea (2014) and in the Strait of Sicily (2015) were presented.

A brief overview of presentations that could be of interest for their acoustic aspects for the MEDIAS people was presented. In particular the presentations on 1) the "zikina" surface scattering layer that affects juvenile anchovy distribution (Boyra et al.), 2) potential methods to reduce bias of *in situ* TS measurements of fish (Boyra et al.) and 3) effect of Target Strength equation selection on PELGAS anchovy and sardine biomass estimates (Doray, IFREMER EMH).

As decided during the 9th MEDIAS Coordination Meeting a workshop on EchoR was asked and finally held by Mathieu Doray for the MEDIAS attendants during the meeting. Some new functionalities of the last EchoR version were illustrated. All the problems encountered by MEDIAS participants at the time of the meeting were solved, allowing the participants to go through the first three scripts completely. Anyway there remained difficulties in using the complete package of functions (all the seven scripts) for many reasons, the main one being the scarse level of documentation of EchoR functions and variables.

Summary of the issues concerning MEDIAS from Regional Coordination Meeting Med&BS-LP 2016 (Andrea De Felice)

In 2016 the Regional Coordination Meeting Mediterranean and Black Sea, Large Pelagic Fisheries was help in Pasaia (Spain) from 19 to 23 September.

The main issue concerning the MEDIAS surveys is the request from the EU to anticipate data submission from the present deadline to the 1st of March, or in particular

sensitive years, to 1st of January. A series of matters that make this request difficult to accomplish have been recalled, such as:

1. Acoustic data analyses and age determination lab procedures are time consuming, especially in very large areas;

2. There is scarse possibility to process acoustic and biologic samples in advance during the research cruise due to the fact that most of the research vessels in use in the Mediterranean Sea are quite small. All the data analyses are left while back from the cruise;

3. A proper period of time has to be foreseen for data checking and validation and eventual repetitions.

In general it has been pointed out that six months after the end of the survey must be guaranteed in order to achieve complete and reliable results.

RCM MED&BS-LP suggested that a discussion on the possible strategies to adopt in order to be able to submit MEDIAS surveys results by the 1st of January is needed at the MEDIAS Steering Committee level among all MEDIAS groups. This discussion should analyse currently available capacities in MS concerned, the possibilities and the problems of each group and to evaluate possible alternative proposals to produce MEDIAS results earlier.

A new proposal from the MEDIAS group was brought at RCM; it concerned synoptical plankton monitoring during MEDIAS acoustic surveys to be included in the Data Collection Framework.

Main identified reasons for this proposal were:

1. An index of productivity and prey availability could be achieved (ecosystem indicator for MSFD);

2. An higher level of ground truthing that could help in the discrimination between fish and plankton; these data are useful even when not at species level because for acoustic analysis the prevalent kind of plankton (fluid like, hard elastic shelled, gas bearing) is a very useful information;

3. Information on the ichthyoplankton fraction; in this way a deeper knowledge on spawning (from collected eggs) and nursery areas (from collected larvae), at least for anchovy (*Engraulis encrasicolus*), given the survey period, could be gained. This information is important for Fishery management scenarios;

4. Additional information on the pelagic ecosystem structure and function. The knowledge on zooplankton component in pelagic ecosystem is particularly important because it represent a link between the lowest trophic level and

higher trophic levels in the marine food web. This is important to apply ecosystem based management (EBM) in the future, in line with the new CFP.

Workshop on plankton removal using multifrequency analysis

Two presentations were shown during the workshop; the first one was about the use of multifrequency analysis for plankton removal while the second one concerned a summary of a training course held on board R/V "G. O. SARS" on the use of Simrad EK80 and broadband acoustics. The summaries relative to the presentations follow.

Use of multifrequency to separate fish and plankton communities (Ana Ventero)

An important issue in most acoustic surveys for mapping and assessment of aquatic organisms is the assignation of the backscattered energy to the different species present in the water column, or the so-called "echogram-scrutinizing" process. There is an ongoing need to make the acoustic identification of marine species more correct and objective and thereby reduce the uncertainty of acoustic abundance estimates.

Groups of similar species may be distinguished from other species or scattering groups (e.g. fish with swimbladder vs. zooplankton) using different frequencies. A review of the main multifrequency methods applied in the separation of pelagic communities has been exposed, as well as the way of implemented it in the post-processing software Echoview. Eventually, the Alboran case of study has been exposed, in which a multi-regression linear model have been apply in order to isolate fish from zooplankton.

Summary on EK80 training course onboard G. O. SARS (Giovanni Canduci)

Starting on the 8th of December 2016 and finishing on the 12th, a course on Wideband/broadband technologies was held on board the R/V G.O. Sars.

The instructors were: Dezhang Chu, Northwest Fisheries Science Center (NWFSC), NOAA/NMFS, USA; Lars N. Andersen, Simrad- Kongsberg Maritime, Norway; Gavin J. Macaulay, Institute of Marine Research (IMR), Norway; Egil Ona, Institute of Marine Research (IMR), Norway; Rolf J. Korneliussen, Institute of Marine Research (IMR), Norway.

On board the vessel continuously sailing, theoretical lessons were held and real time data acquisition was done.

Broadband/wideband technologies were illustrated from theory to practice, two commercial systems were shown: Edgetech and Simrad EK80.

Simrad EK80 was actively calibrated and operated from a number of platforms: dropkeel, TS-probe and a moored echosounder (WBAT).

Advances and comparisons in relation to EK60 were highlighted, the consistency of measures between EK80 and EK60 were analyzed (Demer, D. A., Andersen, L. N., Bassett, C., Berger, L., Chu, D., Condiotty, J., Cutter, G. R., et al. 2017. 2016 USA–Norway EK80 Workshop Report: Evaluation of a wideband echosounder for fisheries and marine ecosystem science. ICES Cooperative Research Re-port No. 336. 69 pp. http://doi.org/10.17895/ices.pub.2318).

A new 38 kHz transducer was presented and used: ES38-7, it has a wider bandwidth than ES38B and the capability to work with a 35° beam angle.

The course was entirely held on a “state of the art in acoustic instruments” vessel, with a really new and well accepted formula: working in a real survey asset with such well known instructors was really worthwhile.

Workshop on CV estimation

CV estimation introduction (Marco Barra)

During the meeting, the coefficient of variation (CV), calculated by means of geostatistical simulations in Spanish and Croatian waters, was presented. The adopted procedure was similar to the one proposed by Walline (2007), based on the use of geostatistical simulations on presence/absence and strictly positive biomass values. In particular, the analysis was performed by means of a specific R script, allowing the estimation of the variogram models for both presence/absence and strictly positive density values and providing a set of ancillary output such as the statistics about occupied area and average distribution and probability maps. All the participants

agreed about the good performance of the geostatistical approach, allowing also to provide some indices related to the space occupation of analysed populations. Anyway, the modelling of variograms in some cases requires to deal with spatial anisotropy and nested spatial structures. It was then proposed, before a formal adoption of this procedure in the MEDIAS group, to provide a set of specific examples highlighting how to manage the presence of anisotropy and nested structures. Marco Barra, proposed to prepare before the next meeting specific working examples providing the R code needed to account for such special cases. Based on the provided examples all participants will test the code in different MEDIAS areas. Obtained output will be presented during the next meeting and based on the obtained results a formal adoption of the procedure in the MEDIAS group could be achieved.

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.

CV estimation: preliminary results in GSA06 (Ana Ventero)

The general objectives were, first determinate the uncertainty associated to the calculation of the anchovy and sardine biomass in the Spanish Mediterranean Sea using the R script developed by Marco Barra in the MEDIAS framework, and second evaluate the suitability of the method in order to incorporate it to our stock assessment dataflow. The GSA06 anchovy case of study was presented and the results were discussed in order to better understand the whole process and go in depth into the meaning of the script outputs. Comparisons between the calculated biomass by the R script and by our traditional method in 2015 were exposed with promising results. Finally, the main problems concerning the GSA06 area were presented: different inter-transect distances, differences in anchovy aggregation pattern, different anchovy distribution...Although our intention is apply this script as a routine, more work must be done in that way to evaluate all our time series taking into account anchovy and sardine. At last, we ask for a joined uncertainly measure in the case of having two different subareas inside a bigger area as occur in GSA06.

The group was informed that R session was aborted when CV estimation script was used on GSA17 East data. List of errors and attempts to fix them was given.

Discussion on MEDIAS contributions for ecosystem descriptors for Marine Strategy Framework Directive

Otoliths as indicator of different growth rates. Case study: GSA01 and GSA06 anchovy (Ana Ventero)

Anchovy is commercial specie that plays an important role in supporting large fisheries in the Mediterranean Sea; as a result the sustainable management of its population is essential in order to prevent the fisheries from collapsing. The GFCM has set up different management units (GSA´s) based on political considerations rather than biological factors, although as this manuscript demonstrates, for the purpose of anchovy management in the Spanish Mediterranean Sea the division of these units is indeed viable owing to the fact that GSA06 (Northern Spain) and GSA01 (Northern Alboran Sea) contain different anchovy stocks which exhibit different growth rates. The data for this study was obtained from the Mediterranean International Acoustic Survey (MEDIAS), carried out in both GSA06 and GSA01 from 2012 to 2016 during the month of June-July, coinciding with the anchovy spawning peak. Comparisons were made regarding length frequency distribution, demographic structure, growth during the first year inferred from otoliths and the condition factor of anchovy inhabiting the Spanish Mediterranean Sea (GSA01 and GSA06). Anchovies of the same age (1 year old) from GSA01 were longer that those from GSA06, as well as showing a better biological condition.

Use of sea bed acoustic data – improved knowledge on fish habitats and bottom properties (Danijela Bogner, Stipe Muslim)

The purpose of this study is to investigate usefulness of side collected echosounder data on sea bed in order describe sea bed sedimentology within acoustic survey study area. Eventually, the spatial distribution of small pelagic fish assemblages could be related to the sedimentological nature of the sea bottom as previously done by D`Elia et al. (2009) for Sicily straits. An example of preliminary results obtained is presented (Figure 1) using Echoview habitat classification modul for bottom classification in the Split Channel (midle Adriatic). Earlier, Pikelj et al. (2010) also characterized seabed surface sediment using SIMRAD EK60 echosounder bottom echograms in the western part of Istria coast. The bottom classifications obtained for different years agree well with sediment grain-size classification obtained by direct ground truthing and present three distinct classes: Class 1 – silty sediment; Class 2 – hard bottom, gravely and sandy sediment; Class 3 – clayey sediment.

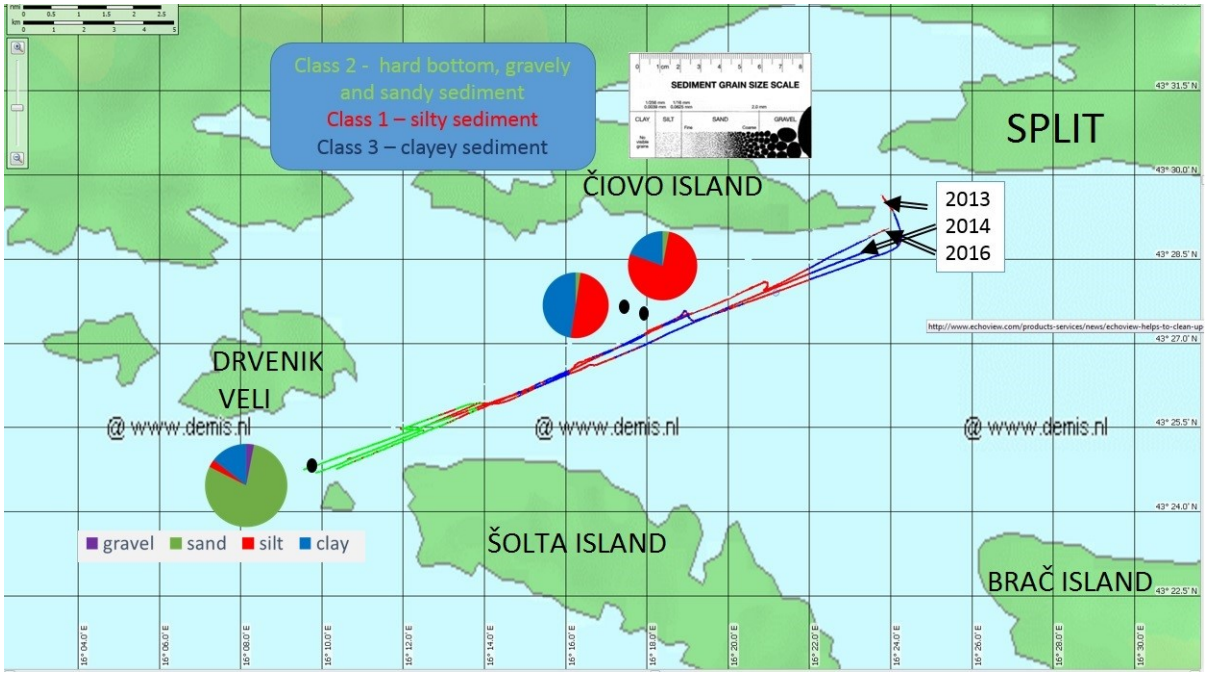


Figure 1. An example of preliminary results obtained using bottom echograms and Echoview habitat classification module for bottom classification in the Split Channel. Colored transects are showed together with granulometrical composition (gravel >2mm; sand 0.063-2mm; silt 0.004-0.063mm; clay <0.004mm) obtained by ground truthing results (pie-diagrams) at three stations (black dots).

Literature:

D`Elia M, Patti B, Sulli A, Tranchida G, Bonanno A, Basilone G, Giacalone G, Fontana I, Genovese S, Guisande C, Mazzola S. 2009. Distribution and spatial structure of pelagic fish schools in relation to the nature of the seabed in the Sicily Straits (Central Mediterranean). Marine Ecology. 30: 151-160.

Pikelj K, Bogner D, Tičina V, Muslim S. 2010. Characterization of the seabed surface sediments off the western Istrian coast (Northern Adriatic) using a quantitative echosounder. 4. Hrvatski geološki kongres. 33-34.

Workshop on Age estimation of European anchovy (Engraulis encrasicolus) (WKARA2) (Gualtiero Basilone)

Date: 28 November-2 December 2016

Venue: [Pasaia], [Spain]

Chair(s): Gualtiero Basilone, [Italy], Begoña Villamor and Andres Uriarte (Spain).

The Working Group on biological parameters (WGBIOP) that met in September 2015, recommended the realization of a Workshop on Age Reading of European Anchovy to discuss the results of a previous exchange and the development of validation studies in this species (ICES, 2015). The Workshop on Age Reading of European Anchovy (WKARA2) chaired by Andrés Uriarte, Spain, Begoña Villamor, Spain and Gualtiero Basilone, Italy, was held in Pasaia, Guipuzcoa (Spain) from 28 November to 2 December 2016. Five countries took part in this workshop (Spain, Italy, Croatia, Greece, and Tunisia), with a total of 16 participants from 9 laboratories [(IEO (Santander, Cadiz and Malaga), AZTI, IAMC-CNR, IOF, ELGO, HCMR and INSTM]. One reader from COISPA (Italy) participated by WebEx. Fourteen of the participants to this workshop are readers for the assessment of anchovy. In total 17 areas/stocks were analysed (4 from the Atlantic area and 13 from Mediterranean Sea).

The aim of this workshop was to review the information on age determination, discuss the results of the previous exchange (2014), review the validation methods existing on these species, clarify the interpretation of annual rings, and update the age reading protocol and a reference collection of well-defined otoliths.

This workshop was preceded by an otolith exchanges (2014). Age validation studies, in the Bay of Biscay were presented and preliminary validation studies in Division 9a, Alboran Sea and Strait of Sicily areas were presented, as well as a compilation of age validation studies of this species in the literature (Tor a). There are several areas/stocks in which validations for the anchovy annual age determination have been not done yet. The provision of age validation studies should be carried out for all anchovy stocks, and especially those that are assessed analytically.

After the presentation of readings results from Exchange (mean agreement percentage of 66%; mean CV of 58%) and the precision of age estimation, the participants identified the sources of bias in the interpretation of the anchovy age. A detail presentation of typical otoliths by regions and the several interpretations and age determinations annotated during the 2014 Exchange exercise was made. This served to illustrate the several sources of discrepancies (Tor c). This corroborated that there were major discrepancies in the interpretation of otoliths and in the understanding of the growth pattern of anchovy otoliths between areas and readers. For this reason it was felt that before solving the current discrepancies there was no need to run a new exercise of age determination among the attendees to evaluate any progress during the workshop.

The workshop proceeded next with a more detailed and joint discussion on the growth patterns shown by otoliths from the different areas. This common examination and discussion of otoliths by areas allowed finding out the major reasons for discrepancies in age determination among readers and a better understanding of the pattern of otolith growth increments by areas to improve the guidelines for their interpretation (Tor b). Such an exercise served to propose a set of otoliths for the collections of agreed aged otoliths (Tor d).

The discussions on examples among the set of otoliths which generated the discrepancies in the age determination lead to conclude that there were two major sources of disagreements: a) Divergent otolith interpretation: different interpretations of the marks, growth bands and edges through their conformity with the expected growth pattern of the anchovies, seasonal formation of the otolith by ages and most common checks, and b) wrong application of the age allocation Rules: it was corroborated during the workshop that for the birthdate first July (or first June) in some cases the age determination rule was not being correctly applied during the first half of the year (from January to June). In addition it was observed during the workshop that the written rule for the age reading protocol for the birth date at the middle of the year was not clear enough for the age assignation in the first semester. Accordingly, the written rules for age assignation have been updated to assure a better understanding of their inherent logic.

The group was satisfied with the discussion carried out on their respective otoliths by regions and there was a general feeling that progress had been achieved towards a common understanding the growth pattern of anchovy otoliths across all regions as reflected in the report. Furthermore, at the end of the exercise attendees had the impression that differences in growth patterns among areas were not as relevant as originally presumed. The potential for a final evaluation of progress in the agreements in age determination was left for a later step, proposing a small exchange for 2018.

Changes in age composition would be substantial in several areas towards younger ages if, as presumed, correct interpretation of otoliths would lead to reduce the number of admitted true winter translucent zones. Noticeable changes may occur in regions around Thyrrenian, Ionian, Sicily, Aegean Sea, and in 9a (Central area), for which area readers produced oldest age compositions than the other readers in the 2014 exchange, but also this may happen in the Adriatic and Tunisian waters, as realized during this workshop.

In summary, following the workshop discussions there has been a progressive change in the perception of the growth pattern applicable to these anchovy otoliths in many areas which led to some revisions of the otolith interpretation and assigned ages, by which growth at ages 0 and 1 are far prominent than at older ages and the occurrence of checks was more frequently admitted. Furthermore, there have been evidences that the age determination rules have in some instances been inconsistently applied. All these evidences led to conclude on the need to review past age determinations. Although this task should be delayed until running the 2018 exchange to be sure that all the readers apply the protocol and the current criteria of this workshop coherently, since current criteria would change the otoliths interpretation and the age determination in many areas. In addition, for the Mediterranean regions the convenience of midyear birthdates was put in question compared with simplicity of the conventional birthdates at first of January (as they are in the northern hemisphere).

As a corollary of the former statements, Intercalibration exercises by areas (for the different countries taking part in ageing reading on the same stocks) are still required. This becomes compulsory for regions where several countries exploit the same stock.
Finally, this Workshop adopted a common protocol for all areas in order to standardize the anchovy age assignments and to improve the coherence of the age estimates and an agreed collection of otoliths by areas were produced and upload to the Age Readers Forum.

Terms of Reference for the “MEDIAS 2018”

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;
- Discussion on calibration procedure;
- To report each group workflow from raw data to biomass estimation in order to define a possible script for acoustic data elaboration benefitting of what is already available in EchoR;
- Discussion on plankton monitoring survey design;
- To present the last tests on CV estimation routine in R and evaluate official adoption for MEDIAS surveys;
- To work on Marine Strategy Framework Directive for ecosystem descriptors and to evaluate the contribution of MEDIAS;
- To update the common work on the tentative Special Issue of a Journal;

Conclusions and decisions of the MEDIAS Steering Committee

In the 10th MEDIAS meeting the results of the acoustic surveys carried out in 2016 were presented by participants of six out of seven countries working in MEDIAS: Spain, Greece, Italy, Malta, Slovenia and Croatia. Moreover, results from the surveys carried out in 2016 by Romania in the Black Sea were also presented. The survey in the Gulf of Lion was not presented due to the fact that the colleague from IFREMER was not able to participate to the meeting. Also Greek scientists could not participate to the meeting, so their presentation was read and commented by the other attendants.

EchoR

The outcome of the last EchoR workshop, held during the joint session with the MEDIAS group at last ICES WGACEGG meeting, was reported. All the problems reported at the workshop were solved but only 3 scripts out of 7 could actually be run completely by MEDIAS groups. There has been a discussion on the possible future use of EchoR. Due to the fact that the adaptation of acoustic and biological data from each MEDIAS area is quite complicated and time consuming and the crucial point is the preparation of the data in the EchoR format, a specific session in which every group should present his workflow from acoustic raw data to estimated biomass will be undertaken during next MEDIAS Coordination Meeting. In this way it will be possible to define which R scripts are useful to the MEDIAS community and it will be possible to use part of the EchoR scripts to this aim, adding other scripts for where needed. The organization of a one week training course on EchoR could be also useful after the workflows definition.

Survey period

The discussion on survey period focused on the Adriatic Sea case in which the acoustic surveys in eastern and western side are conducted in two different periods since 2015. CNR-ISMAR anticipated survey period from September to June in western GSA 17 in order to get ready to anticipate acoustic survey results. There is the clear tendency for future requests of MEDIAS results by the beginning of the following year by both GFCM and EU. In fact according to recommendation GFCM/40/2016/3 “The SAC shall suggest alternative solutions to ensure the availability of hydroacoustic survey results of the previous year not later than 31 January of a given year”. Moreover, at last RCM Med&BS-LP in 2016 EU representatives reported the intention to anticipate the data call for MEDIAS survey results by the 1st of March of the following year, and in particular sensitive years, by the 1st of January.

CNR-ISMAR reports the advantages that the period change in western GSA 17 from September to June have brought. First of all it will be possible to give survey results on

time in January of the following year respect to the survey. Moreover in June weather conditions are better and there are more light hours, allowing the conduction of acoustic prospection during daytime only. Conducting the survey in GSA 17 in June allowed also the conjunction with the survey in GSA 18, already held in July in the past, thus generating a unique consecutive survey and reducing by half the time at sea needed for the embark and tests of the instrumentation, calibration time and ship transfers. The survey period is now in line with most of the other MEDIAS surveys: Iberian Sea, Aegean Sea, Gulf of Lion, Sicily Channel.
IOF is keeping September as survey period since this period was set at the beginning of acoustic monitoring in eastern Adriatic Sea (2003) in coordination with the western acoustic survey. Moreover there are technical difficulties in changing the period of the survey, as ship availability and personnel availability, and concerns about data comparability.
As a general scientific remark, taking into account the fact that MEDIAS surveys are aimed at estimating anchovy and sardine biomass, all MEDIAS groups, except the Croatian group, agree to identify as the ideal period to conduct acoustic surveys June-July, when anchovy spawning peak occurs in the Mediterranean Sea and when sardine recruitment can be monitored.

Possible ways to anticipate survey results submission

In general MEDIAS group remarks the fact that six months after the end of the survey at sea have to be respected in order to produce good quality results. After this premise, each of the MEDIAS group was asked to give the most feasible deadline that could be respected for survey results submission maintaining a proper data quality. In summary this was the situation, given personnel and ship capacities:
IEO can produce survey results by the end of February of the following year. Survey is carried out in June-July. The main difficulty in anticipating more results submission is related to the limited number of scientists working on this subject.
CNR-ISMAR can give survey results by the end of January of the following year thanks to the fact that is now conducting the survey in June-July both in GSA 17 and in GSA 18.
IOF can produce survey results by the end of March of the following year due to the fact that data processing for this large area requires much time and due to the fact that is not possible to anticipate the survey because the research vessel is not available. IOF is carrying out the survey in September.
CNR-IAMC can give survey results by the end of February of the following year due to the fact that survey at sea ends by the end of August.
IFREMER can produce survey results by the end of December of the same year; the acoustic survey is held in July.
There seem to be two possible use of acoustic survey results anticipation:

- one is that these data submitted in advance allow their inclusion on time at the SAC meeting of the following year in May, since some time is needed for the data to be useful in that forum;
- the other possibility is that some countries may be able to provide acoustic survey results by November of the same year in order to have fresh information and possibly a short-term forecasting added to the normal stock assessment.

In any case MEDIAS group identifies the strong need to be informed on the exact way in which the eventual anticipation of acoustic survey results will be beneficial for management advisory processes both at EU level and at GFCM level. MEDIAS group wishes that the time between MEDIAS data submission and data use in stock assessment working groups could be reduced, but at the same time is concerned that data could arrive to the GFCM before the UE that is the official commitment. A possible solution in this sense could be to anticipate GFCM Working Group on Stock Assessment of Small Pelagic Species (WG SASP) from November to April.

CV estimation

The script for CV estimation related to acoustic survey biomass estimations developed by Marco Barra and based on Walline (2007) has been tested in most of the areas. There is still something to fix in the script and some more tests to be performed by some of the MEDIAS groups; in the following months an improved version of the script will be released together with a manual of instructions. Presumably next year this script will be officially adopted as CV estimation procedure for biomass estimates in MEDIAS.

MEDIAS proposals

MEDIAS group agrees to continue submitting its proposals at RCM meetings, but evaluate also the possibility to look for other ways to proceed with the proposals with specific projects at various levels or under the umbrella of GFCM activities.

MEDIAS group is proposing the building of a **common database** through a specific project, based on the past decisions concerning the common format of the database during AcousMed project and during some of the previous MEDIAS Coordination Meetings. Another proposal is the introduction of a **plankton monitoring** activity synoptical with MEDIAS acoustic surveys to be added to the DCRF to improve the knowledge useful for acoustic signals discrimination (mainly fish from plankton) and to improve ecosystem knowledge by adding information on small pelagic fish preys in an ecosystem approach perspective. See Annex B for further details.

Anchovy and sardine age determination

The group discussed on the possibility to have an intercalibration among MEDIAS countries for both anchovy and sardine otolith age reading. As recommended during

the last "Workshop on Age estimation of European anchovy (*Engraulis encrasicolus*) (WKARA2)" in San Sebastian (Spain), 28 November-2 December 2016, the inter-calibration exercises by areas (for the different countries taking part in otolith age reading on the same stocks) are required. This becomes compulsory for regions where several countries exploit the same stock.

Most of Mediterranean statistical catch at age models are based on the age structure. These models estimate the biomass and numbers at each age, and allow scientists working on stock assessment to examine the potential effects of continuing removals from those populations. For this reason, the exact age determination of small pelagic is one of the most important elements in the study of their population dynamics. It forms the basis for calculations leading to a knowledge of the growth, mortality, recruitment and other fundamental parameters of their populations.

The group discussed on the possibility to move anchovy birthdate to the 1st of January, as it is for sardine. At the moment some countries have the birthdate in June, others in July and this can generates a mismatch between the calendars associated to a birthdate convention at the middle of the year and that of the assessment running from January to December.

Another important matter of discussion was the importance of using age reading experts for the otolith readings. The group agreed that only expert staff will be needed for the interpretation of the otoliths.

Common format for MEDIAS presentations

It was decided to report the following information for all the survey presentations at the next MEDIAS Coordination Meetings:

- GSA number and general information on the GSA; map and general information on the acoustic survey
- Type of echosounder and frequencies in use
- Calibration results
- Survey design
- Number of nautical miles effectively processed for biomass estimation
- Biomass estimation results in tons by GSA and graphs in terms of biomass density
- Headline length of the pelagic net, sidelines dimensions, mesh size
- CTD stations map
- Biomass per length classes (0.5 cm) and per age classes in tons
- Graphs of Age Length Keys
- Maps of anchovy and sardine spatial distribution
- Map with pie charts reporting percentages in weight of anchovy, sardine and other species

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

Journal Special Issue

The discussion about a possible Special Issue of a Journal dedicated to papers from the MEDIAS group has been resumed. First of all a group of Guest Editors was defined; Dr. Vjekoslav Ticina, Dr. Andrea De Felice and Dr. Magdalena Iglesias gave their availability. Scientists from IFREMER and HCMR, absent at this meeting, will be also asked for availability to be Guest Editors. The following steps will be to decide tentative titles for papers from each group based on the draft document prepared last year by CNR-IAMC. After that it was decided to contact "Mediterranean Marine Science" as first option and eventually "Hydrobiologia" as second chance.

MEDIAS website

It was pointed out the need for an update of some acoustic tracks of the surveys visualized in the map on the website. MEDIAS group considers the development of the MEDIAS website highly linked to the development of MEDIAS common database, for this reason this issue could be included in an eventual specific project for the setup of the MEDIAS common database.

MEDIAS handbook

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 2018".

Finally, the Steering Committee concluded for the 11th MEDIAS meeting to take place in Ancona, Italy, in the period 20-22 March 2018.

Possible future expansions of the MEDIAS project

CNR-ISMAR and CNR-IAMC have referred their interest to cover respectively GSA 19 (western Ionian Sea) and GSA 11 (Sardinia) by acoustic survey. Purpose would be to ask for the inclusion in the MEDIAS project of these new areas in order to fill the existing gaps for Italian seas; in the meanwhile possibilities to carry out these surveys with specific projects, waiting for inclusion in the MEDIAS, will be explored.

Annex I: List of participants

Name	e-mail	Country	Institution
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Annex II: Institutions Acronyms

FRIS: Fisheries Research Institute of Slovenia. Ljubljana, Slovenia

HCMR: Hellenic Center of Marine Research, Greece

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

CNR-ISMAR: Consiglio Nazionale delle Ricerche. Istituto di Scienze Marine. 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 10th MEDIAS Coordination Meeting (Mediterranean International Acoustic surveys)

Palma de Mallorca, Spain, 4-6 April 2017

Draft Agenda

Tuesday 04/04/2017

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

09.30-09.50: Presentation of the Adriatic survey in the eastern part of GSA17 (Vjekoslav Tičina et al.)

09.50-10.10: Presentation of the Adriatic survey (Iole Leonori, Andrea De Felice, Giovanni Canduci, Ilaria Biagiotti, Ilaria Costantini, Sara Malavolti)

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

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

10.50-11.10: Presentation of the acoustic surveys 2016 in the GSAs 15 and 16 (Angelo Bonanno, Gualtiero Basilone, Marco Barra, Simona Genovese, Rosalia Ferreri, Roberta Mifsud, Reno Micallef)

11.10-11.40: *Coffee break*

11.40-12.00: Presentation of the acoustic surveys on small pelagics biomass estimation in GSAs 9 and 10 (Angelo Bonanno, Gualtiero Basilone, Marco Barra, Simona Genovese, Rosalia Ferreri)

12.00-12.20: Presentation of Romania survey in the Black Sea (Valodia Maximov, Gheorghe Radu, Simion Nicolaev)

12.20-12.40: Presentation: "EK60 echosounder directivity model parameter calibration: comparison between two different protocols" (Pilar Córdoba)

12.40-13.00: Presentation: "Summary of joint session WGACEGG/MEDIAS 2016" (Andrea De Felice)

13.00-14.30: *Lunch break*

14.30-16.00: Discussion on survey period (foreseen in last MEDIAS report)

Presentation: “Acoustic surveys period in the eastern part of the GSA 17” (Vjekoslav Ticina)

16.00-16.30: *Coffee break*

16.30-16.45: Presentation: “The implementation of acoustic pelagic survey(s) in the context of the GFCM mid-term strategy” (GFCM Secretariat)

16.45-18.30: Discussion on possible ways to anticipate the submission of MEDIAS survey results (RCMMed&BS suggestion)

Presentation: “Summary of issues concerning MEDIAS group from RCM Med&BS meeting 2016” (Andrea De Felice)

Wednesday 05/04/2017

09.00-11.00: Workshop on plankton removal using multifrequency analysis

Presentation: “Use of multifrequency to separate fish and plankton communities” (Ana Ventero)

11.00-11.30: *Coffee break*

11.30-13.00: Workshop on plankton removal using multifrequency analysis

Presentation: “Summary on EK80 training course onboard G. O. SARS” (Giovanni Canduci)

13.00-14.30: *Lunch break*

14.30-16.00: Work progress on CV estimation

Presentations:”CV script introduction” (Marco Barra)

“CV estimation: preliminary results in GSA06” (Ana Ventero) (based on the use of the Marco Barra’s script)

“CV estimation: first experiences from GSA17-east” Tea Juretić (based on the use of the Marco Barra’s script)

16.00-16.30: *Coffee break*

16.30-17.30: Discussion on MEDIAS contributions for ecosystem descriptors for Marine Strategy Framework Directive

Presentation: “Otoliths as indicator of different growth rates. Case study: GSA01 and GSA06 anchovy” (Ana Ventero)

Presentation:“Use of sea bed acoustic data” (Danijela Bogner)

MEDIAS website: comments, suggestions, approval

17.30-18.30: General discussion and revision of the common MEDIAS protocol

Presentation: “WKARA2 main findings and recommendations in anchovy age determination and assignment” (Gualtiero Basilone)

Thursday 06/04/2017

09.00-10.00: Decision on a common format for the presentation of survey results

10.00-11.00: Discussion on MEDIAS proposals: common database, zooplankton monitoring

11.00-11.30: *Coffee break*

11.30-13.00: Update on the tentative Special Issue of a Journal

13.00-14.30: *Lunch break*

14.30-16.00: Terms of reference for the next meeting (2018)

16.00-16.30: *Coffee break*

16.30-17.30: Draft report and 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). NM = nautical miles

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	CNR-ISMAR/FRIS	Adriatic Sea (Slovenia)	117 NM^2	1*
Italy	CNR-ISMAR	Adriatic Sea (Italy)	13200 NM^2	40
Italy	CNR-IAMC	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

* There is an agreement between Italy and Slovenia to extend the Italian acoustic survey in Slovenian waters

** This area includes both Sicily Channel and Maltese waters (GSA 15) due to an agreement between Italy and Malta

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:

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

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.

<table>
<tr><td rowspan="14">Good Environmental Status indicators</td><td rowspan="3">Spatial/temporal strata</td><td>Spatial strata</td><td colspan="5">GSA</td></tr>
<tr><td colspan="5">Acoustic survey</td></tr>
<tr><td>Time periods</td><td colspan="5">Season (Summer/Autumn depending on the area)</td></tr>
<tr><td rowspan="4">Taxonomic levels</td><td>Community</td><td colspan="5">Pelagic fish (Species composition, occurrence in pelagic hauls)</td></tr>
<tr><td rowspan="3">Target Species</td><td rowspan="3">Adult</td><td colspan="4">Anchovy</td></tr>
<tr><td colspan="4">Sardine (for Mediterranean)</td></tr>
<tr><td colspan="4">Sprat (for Black Sea)</td></tr>
<tr><td rowspan="7">Indicators</td><td rowspan="7">Biodiversity</td><td rowspan="6">Species</td><td rowspan="2">Population size</td><td rowspan="2">Acoustic estimates</td><td colspan="2">Total biomass & abundance estimates for target species</td></tr>
<tr><td colspan="2">Estimation error (CV) (i.e. as agreed based on a common estimation procedure, see ToRs)</td></tr>
<tr><td rowspan="2">Population condition</td><td>Biomass & abundance estimate per size/age</td><td colspan="2">Anchovy, Sardine, Sprat (Black Sea)</td></tr>
<tr><td>Recruitment index</td><td colspan="2">Sardine (i.e. Number at Age 0 of the population based on summer surveys)</td></tr>
<tr><td rowspan="2">Habitats</td><td rowspan="2">Habitat condition</td><td rowspan="2">Hydrological condition</td><td>Temperature (i.e. SST: average at 10m, estimated as the interpolated mean value for the whole area)</td></tr>
<tr><td>Salinity (i.e. SSS: average at 10m, estimated as the interpolated mean value for the whole area))</td></tr>
<tr><td rowspan="2">Community</td><td rowspan="2">Fish Community condition</td><td>Community Synthesis</td><td colspan="2">Total pelagic fish NASC</td></tr>
<tr><td colspan="3">Species composition (i.e. percentage in terms of weight of pelagic trawls per hour)*</td></tr>
<tr><td rowspan="2">Age and size distribution</td><td colspan="4">95% percentile of the population length distribution for the target species</td></tr>
<tr><td colspan="4">Proportion of fish larger than L50 (length at first maturity estimated based on collected data or defined based on literature)</td></tr>
</table>

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. Common format for presentations at MEDIAS Coordination Meetings

- GSA number and general information on the GSA; map and general information on the acoustic survey
- Type of echosounder and frequencies in use
- Calibration results
- Survey design
- Number of nautical miles effectively processed for biomass estimation
- Biomass estimation results in tons by GSA and graphs in terms of biomass density
- Headline length of the pelagic net, sidelines dimensions, mesh size
- CTD stations map
- Biomass per length classes (0.5 cm) and per age classes in tons
- Graphs of Age Length Keys
- Maps of anchovy and sardine spatial distribution
- Map with pie charts reporting percentages in weight of anchovy, sardine and other species

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

12. 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

MEDIAS group proposals: 1) MEDIAS database

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

The Common Database structure for 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)

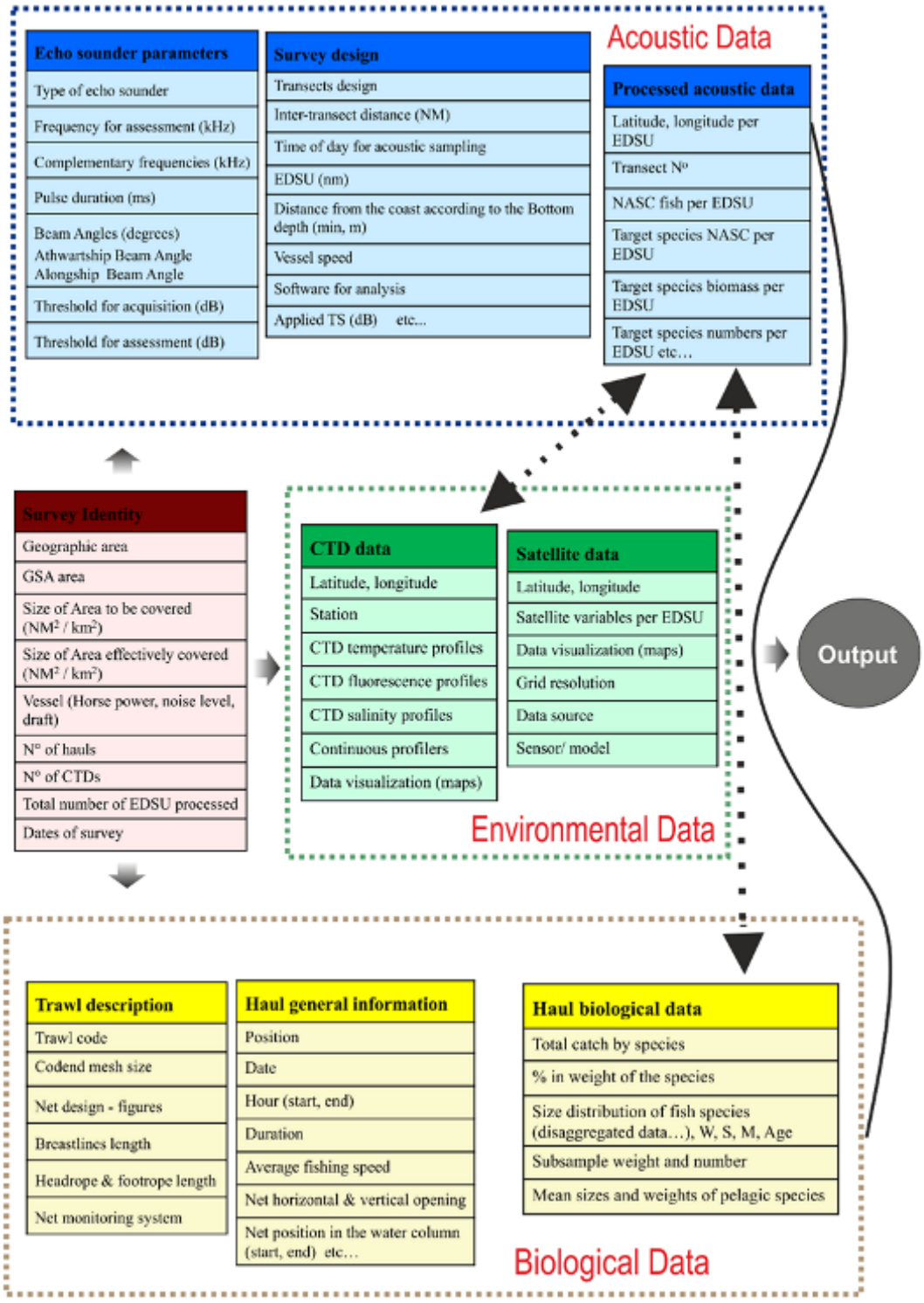

Figure B1. General outline of a database for acoustic surveys.

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 Nº
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.

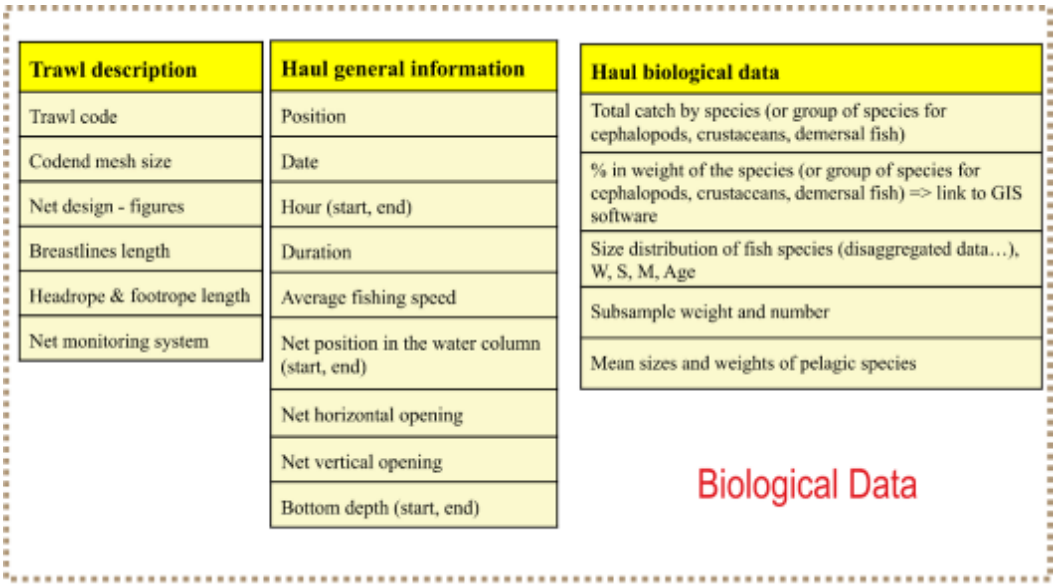

Figure B4. Fields associated with input info on Biological Data related to acoustic surveys

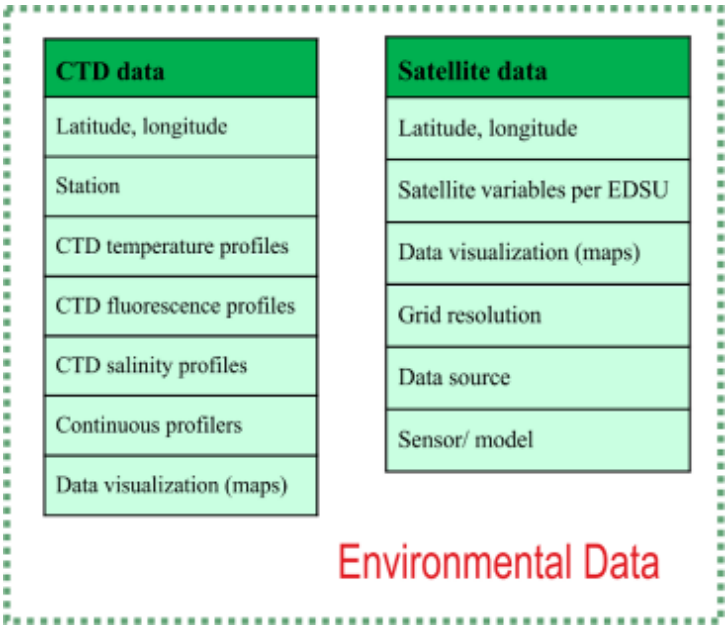

Figure B5. Fields associated with input info on Environmental Data related to acoustic surveys

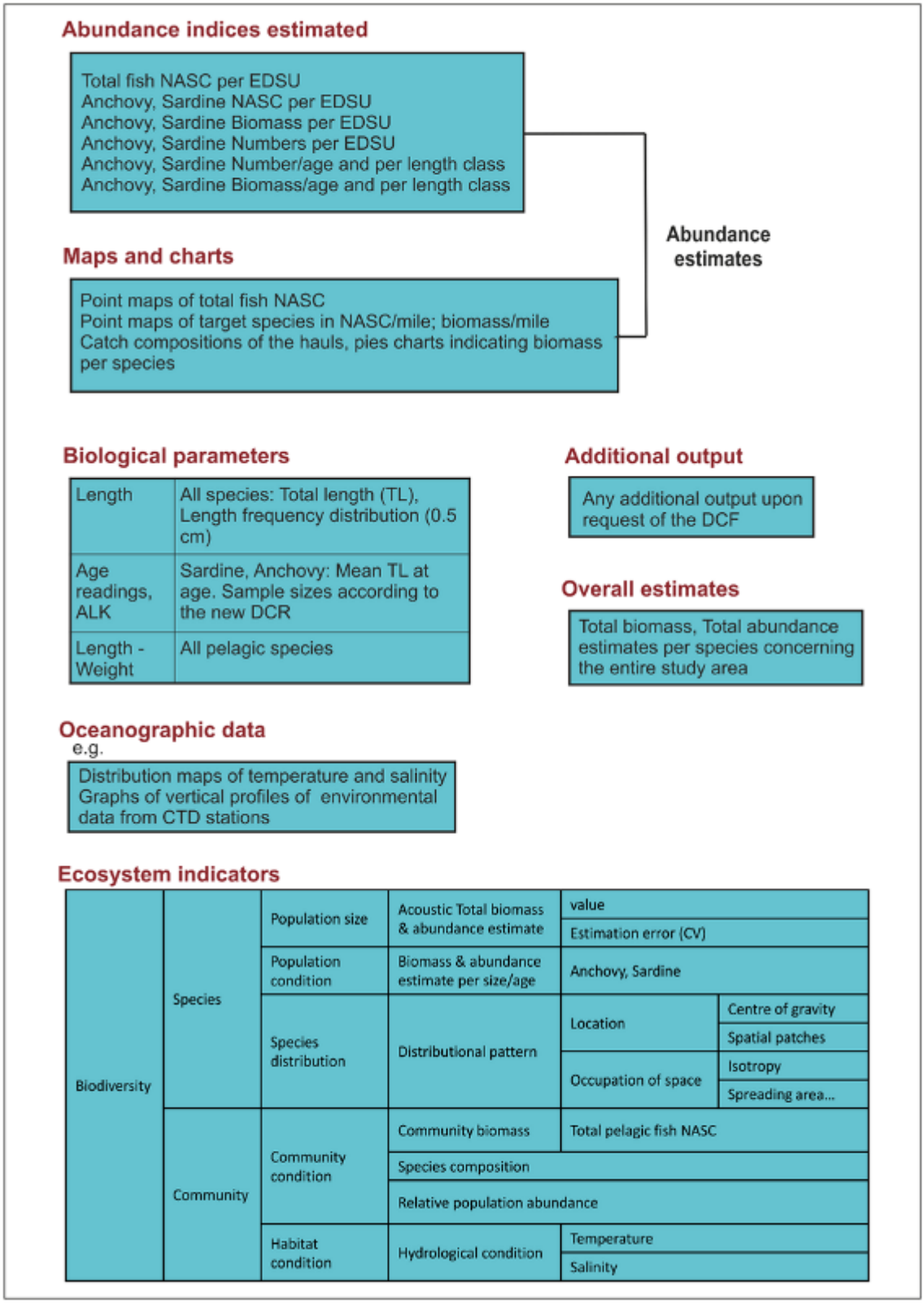

Figure B6. Fields associated with potential acoustic database output.

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.

2) Mesozooplankton sampling synoptic with acoustic survey

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

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

The analysis on plankton can also give information on the ichthyoplankton fraction; in this way a deeper knowledge on spawning (from collected eggs) and nursery areas (from collected larvae), at least for anchovy (Engraulis encrasicolus), given the survey period, could be gained.

This fact would potentially allow the possibility to explore new management scenarios in the Mediterranean Sea, eventually based on local closures in correspondence of spawning and nursery areas.

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

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

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

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