Report of 3rd meeting for MEDiterranean Acoustic Surveys (MEDIAS) in the framework of European Data Collection Framework

Capo Granitola 25-26 March 2010

Steering Committee Report

The current meeting took place in Capo Granitola (Sicily) between 25 and 26 /3/2010. The aim of the meeting was a) to improve the common Protocol (as adapted in the first and second MEDIAS meetings that were held in Athens and Palma) for the Pan-Mediterranean Pelagic survey (MEDIAS) which is incorporated in the DCR framework, b) coordinate the second MEDIAS survey of 2010, and c) improve the optimization of the surveys in the different regions through a workshop on the survey design.

Participants in the meeting were representatives from all European Union countries involved in acoustic surveys in the Mediterranean (i.e. Greece, Italy, Slovenia, France and Spain) as well as representatives from the EU countries operating in the Black Sea, i.e. Bulgaria and Romania. In addition a scientist from Croatia that covers by acoustic survey the eastern part of the Adriatic Sea participated as an observer (See list of participants ANNEX I). Malta did not participate to the meeting because the respective representative had to cancel her flight.

During the first day the participants adopted the agenda of the 3rd MEDIAS Meeting (See ANNEX II). Dr. A. Machias informed the participants regarding the unavailability of Dr. Antonio Cervantes from the Directorate General for Fisheries and Maritime Affairs to attend the meeting and the reasons for this.

According to the agenda in the first day of the meeting the results of the first MEDIAS survey, the recommendation of the RCM, the impact of the absence of Greek coverage in the MEDIAS survey 2009, as well as the improvement on the MEDIAS protocol was discussed. In addition the meeting elected the new chairman of the steering committee. In the second day a workshop took place regarding the geostatistical analysis of past acoustic surveys in order to improve the harmonization of the acoustic survey design. The aim of the work of the WG is to examine and recommend possible improvements of the survey design of each region.

The summary of the common protocol adopted in the previous meeting is reported in ANNEX III.

A. Surveys held in 2009 in the framework of the MEDIterranean Acoustic Survey

In the first day of the meeting a presentation of the 2009 acoustic surveys in each area was shown in relation to the common protocol in order to define the progress done so far as well as to define the points needed further harmonization. Dr. M. Iglesias presented the Iberian coast acoustic survey, Dr. J.L. Bigot presented the Gulf of Lions acoustic survey, Dr. I. Leonori presented the Adriatic acoustic survey in the Italian and Slovenian cost, while Dr. Ticina presented the Adriatic acoustic survey in the Croatian coast. Furthermore, Dr. A. Bonanno presented the Sicilian channel and Maltese waters acoustic survey, the planned future extension of the survey in the Tyrrhenian Sea, as well as the results from a pilot survey applied in the area, according to the MEDIAS protocol funded by National resources. All the presentations are included in ANNEX IV. Furthermore, Dr. A. Machias presented the future sampling design in these areas. Finally Dr. Marina Panayotova presented the status of the small pelagics fishery in the Bulgaria as well as the 2010 planned acoustic survey in the Black Sea coasts of Bulgaria and Romania. An analytical description of the methodology that will be followed in the Black Sea regarding the MEDIAS protocol was presented and discussed.

Bulgarian and Romanian Black Sea area

Plan for pilot acoustic survey in Black Sea (Bulgarian and Romanian marine areas) was proposed to be included under MEDIAS project. The planned study will be accomplished under the Data Collection Program of Bulgaria and Romania and will be executed by a joint team from the Institute

of Oceanology - BAS (Bulgaria) and NIMRD "Grigore Antipa" (Romania) with technical and scientific support of CNR-IAMC (Italy) and VNIRO (Russia).

The survey will cover the FAO GSA 29 – Black Sea. The study area covers continental shelf and slope up to 120 - 200 m in front of Romanian and Bulgarian coasts. Total investigated area amounts approximately 9 400 nm², from which 5500 nm² are in front of Romania and 3900 nm² – in front of Bulgaria. The size of studied area in front of Romania is larger due to the peculiarities of the bottom relief and presence of wide shelf area. The total cruise track will be about 1800 nm long.

First acoustic survey is planned to be carried out in May – June 2010 and the second one - in September – November 2010. The target species will be European sprat (*Sprattus sprattus*) and Whiting (*Merlangius merlangus*). Duration of each acoustic survey will be 20 days. For the period 2011 - 2013, acoustic survey on migratory species – Anchovy (*Engraulis encrasicolus*) and Horse mackerel (*Trachurus mediterraneus*) has been planned during the summer period (June – July) in order to assess the species SSB.

The pilot survey in 2010 will be accomplished simultaneously on board of 2 vessels – RV "Akademik", which is equipped with EK60 echo sounder, but still has not operating trawling gear and RV "Steaua de mare I", which have trawling gear. The next survey will be carried out only on board of RV "Akademik" due to facilities for larger scientific staff. The echo sounder which will be used during the surveys is EK 60 (Simrad, Norway), split beam, working frequencies 38, 120, 200 KHz. The available software packages for data collection and processing are BI 60, ER 60 (Simrad, Norway) and LSSS (MAREC, Norway). The fishing gear, which will be used during the pilot survey will be the pelagic trawl of RV "Steaua de mare I" and for the next surveys – the pelagic trawl of RV "Akademik". The pelagic trawl specifications are given on Table 1.

Table 1. Characteristics of pelagic trawls, which will operate in Black Sea area.

Pelagic trawl gear	Horizontal opening	Vertical opening	Mesh size of codend
RV "Steaua de mare I"	22 m	13 m	14 mm
RV "Akademik"	20 -22 m	10 – 15 m	10 mm

Preliminary survey design for the Black Sea area (Bulgarian and Romanian coasts) has been prepared and the map is presented on Fig.1.



Figure 1. Design of pilot acoustic survey in front of Bulgarian and Romanian Black Sea area.

During the survey, a split beam echo–sounder for the echo–sampling will be used. The working frequencies for assessment are 38, while complementary frequencies will be 120 kHz & 200 kHz. The pulse duration will be 1 ms. The survey includes parallel transects, perpendicular to bathymetry and inter-transect distance of 5 nm. For this first survey a more dense design is required in order to collect more detailed information about distribution and abundance of target species. For the next surveys, the design can be adjusted according to obtained results from the first survey. Time of day for acoustic sampling will be Day time & Night time. EDSU will be set at 1 NM. Distance from the coast according to the bottom depth (min, m) will be 20 m due to research vessel "Akademik" size and depth limitations. Echo sounding depth (min, m) will be 15 m, vessel speed – 8 - 10 knots. The available software packages for post-processing are LSSS and BI60. The file format is *.raw. Calibration before each survey is also planned.

The Biological and oceanographic parameters which will be measured during the acoustic survey are:

- Length frequency distribution of all fish species (TL)
- Age-Length keys for target fish species (if possible, also for non-target)
- Mean length at age
- Maturity
- Species composition of catches
- Zooplankton samples
- Temperature of sea water
- Salinity
- Dissolved oxygen

The major technical gaps for the Black Sea acoustic survey are:

• The lack of Echoview software, which is used from other countries in MEDIAS project,

•The lack of experience for echo sounder calibration procedures and in fish stock assessment by acoustic method.

•For the Black Sea fish species, the TS values have not been estimated.

B. Discussion on the recommendations of the RCM

The recommendations of the RCM for the MEDIAS survey were presented by A. Machias and were discussed by the WG. The recommendations of the RCM are presented bellow:

1 A0B - Progress on surveys (Medias, Medits, second demersal survey)

1.1 MEDIAS

MEDIAS project aims to join and harmonize the five ongoing acoustic surveys in the Mediterranean: Gulf of Lion (IFREMER), Iberian Coast (IEO), Sicilian Channel (IAMC/MCFS), Adriatic Sea (ISMAR), and Aegean Sea (HCMR). MEDIAS (together with MEDITS) is now listed as a DCF mandatory survey. According to STECF/SGRN, the survey should give information for management decisions and provide input to assessment for stocks which are managed internationally.

The conclusions of the 2nd MEDIAS co-ordination meeting (Palma de Majorca, Spain, June 2009) were presented (see Annex 15): improvement of the common survey protocol, harmonisation on the appropriate period for conducting the surveys, duration of the national surveys. Following the presentation it was stressed out that the time gaps between the surveys in the different areas of the Adriatic sea should be avoided; the justification for the gaps was the fact that the same research vessel was used in the different zones. It was also noted that Bulgaria and Romania will join the MEDIAS project, both MS having already one coordinated acoustic survey on small pelagics. Croatia attended the meeting as observer.

RCM Med&BS was pleased to be informed on the proposal of the Medias Steering Committee to enlarge the area covered by the MEDIAS survey, by including on one part the joint Black sea survey, and on the other hand Tyrrhenian and Ionian seas. The Group supported this proposal, pointing out the scientific value of such an enlargement. RCM stressed Medias steering committee to submit a detailed project as soon as possible for the new areas to cover and to adjust it considering outputs of SGRN meeting on surveys held in December 2009.

MEDIAS survey : En	nlargement of MEDIAS area covering to Tyrrhenian and
Ionian seas	
RCM Med&BS 2009	The RCM Med&BS supports the proposal by the Medias Steering
Recommendation	Committee to enlarge the area covered by the MEDIAS survey and
	recommends the Committee to present the proposal on enlargement
	to the Commission as soon as possible. RCM ask the Steering
	Committee to well precise survey protocols and duration of the 5
	national surveys conducted in the Mediterranean and of the
	Bulgarian and Romanian joint survey.
Follow-up actions	Submission of proposal on enlargement by the Medias Steering
needed	Committee to the EU Commission with in a second step.
	adjustment considering outputs of 2009 SGRN meeting on surveys
Responsible	Medias Steering Committee IM EC
persons for follow-	Medias Steering Committee, EM, EC
up actions	
Time frame	Before deadline for evaluation of the new eligible DCE surveys
(Deadline)	before deadline for evaluation of the new engible Der surveys.

RCM Med&BS was informed by the EC representative that the negotiated procedure between EC and MS teams involved in MEDIAS on the harmonisation of the acoustic data in the Mediterranean

(2002-2006 period) was well received and is being evaluated with good chance of success. The project is coordinated by HCMR (Greece). It will begin in 2010 for 24 months.

C. Conclusions of the MEDIAS Steering Committee

1. In the 3rd MEDIAS meeting the **recommendations of RCM** were presented and discussed.

A. Following to the RCM recommendations the WG concludes to the survey protocol and the duration of the 5 national surveys.

Specifically, the Ionian Sea (area 2.2) and the duration of the survey 30 days has been already incorporated in the DCF (2009 - 2010) and the survey will follow the MEDIAS protocol. The Tyrrhenian Sea survey will also follow the MEDIAS survey. The precise survey design and the duration of each survey have been included in the present MEDIAS report. The surveys will follow the adopted MEDIAS protocol.

The duration of the 8 national surveys conducted in the Mediterranean and of the Bulgarian and Romanian joint survey is presented in the Table bellow (*).

Country	Institute	Geographical area	Size of area	Duration of survey (days)
Greece	HCMR	Aegean Sea	9 000 NM ²	40
France	IFREMER	Gulf of Lions	3 300 NM ²	30
Slovenia	FRIS	Adriatic Sea (Slovenia)	117 NM ²	1
Italy	CNR-ISMAR	Adriatic Sea (Italy)	16 200 NM ²	40
Italy - Malta	CNR- IAMC	Sicily channel	2 700 NM ²	16
Spain	IEO	Iberian coast	8 829 NM ²	33
Greece	HCMR	east Ionian Sea	6 200 NM ²	30
Italy	CNR- IAMC	Tyrrhenian Sea	6 000 NM ²	30
Bulgaria Romania	Institute of Oceanology - BAS NIMRD "Grigore Antipa"	Black Sea	9 400 NM ² , (Romania 5500 NM ² Bulgaria 3900 NM ²)	60 (3 surveys 20 days each)

(*) In the Table the Croatia is not presented as is still not incorporated in DCF. The Croatian part of Adriatic Sea (surveyed area: 13,580 NM²) is covered by Institute of Oceanography and Fisheries (IOF), by a survey of 30 days.

The survey designs of Ionian and Tyrrhenian Sea that will be held in the framework of MEDIAS were presented and discussed by the WG. The concluded survey design is presented bellow.



Ionian Sea survey

Tyrrhenian Sea survey

The area covered by the MEDIAS survey is presented in the following Figure.



B. Regarding the time gaps between the surveys in the different areas of the Adriatic Sea the Steering committee notes:

The 3rd MEDIAS meeting has been already discussed the time gaps between the surveys in the different areas of the Adriatic Sea. In the framework of the Harmonization of the acoustic survey in the Mediterranean the WG will work to try to reduce the duration of the survey. A possible reduction of the duration of the survey will facilitate to minimize the time gaps between the surveys in the different areas of the Adriatic Sea. Moreover, there are three more issues regarding the time gaps between the surveys in the North and South Adriatic Sea that should be taken into account: a) the two parts of the Adriatic survey are related to different GSAs (17 and 18), each survey has a rather long historical series and the comparability all over the years should be taken into account; b) The consequences of a shift in sampling period should also be examined regarding the use of these data for VPA tuning carried out by ISMAR-CNR that is now performed in combination with Croatian data for the entire GSA 17; c) both surveys should be held in the same time period with the acoustic survey in the eastern part of the Adriatic Sea performed in Croatian waters (GSA 17), Montenegro and Albanian waters (GSA 18).

2. The Steering committee informed that the MEDIAS survey was not performed in Aegean and Ionian Sea, because Greece did not apply the Data Collection Program in 2009 and there are bureaucratic difficulties for the application of the Program in 2010. The Steering committee assessed the impact of the absence of Greek coverage in the MEDIAS survey 2009 and concluded the followings:

The 3rd MEDIAS meeting and the MEDIAS steering committee note the importance of the Aegean Sea small pelagic stocks. The stocks of anchovy and sardine in the Aegean Sea are very important commercial stocks in the Mediterranean, taking into account the size of the stocks and the fact that these stocks are under the impact of Black Sea water.

In addition, as MEDIAS survey is a pan – Mediterranean acoustic survey and its integrity depends on the full coverage of European waters, the non implementation of the survey in Greek seas (Aegean and Ionian Sea) poses serious problem in the acoustic time series and the spatial coverage of the MEDIAS.

The 3rd MEDIAS meeting and the MEDIAS steering committee note that the non implementation of MEDIAS in the Greek Seas (Aegean Sea and Ionian Sea) in 2009 is a major gap for the survey, and presents an impediment in the assessments of anchovy and sardine stocks in these seas. The group considers that in the next RCM as well as LIAISON meeting appropriate actions should be discussed in order the coverage of the Greek seas to be ensured in 2010.

3. The WG had a detailed discussion regarding the improvement on the **harmonization of the different protocols of the acoustic surveys**.

Following the surveys presentations held in the first MEDIAS survey in 2009. The participants underlined two major improvements regarding the harmonization of the MEDIAS survey:

a) In the Iberian coast a new acoustic survey has been held in 2009 in the framework of MEDIAS in May – June. This decision greatly harmonizes the time of the survey, as all the other survey took place between May and September;

b) In the Adriatic survey a first important step for the harmonization of the survey design was performed in 2008 and 2009. This survey design will be followed there after in the framework of MEDIAS action. The survey design changed from a zig-zag shape of transect to parallel perpendicular to coast transect according to the design in all the other areas.

c) In the Croatian survey, the analysis of data was further harmonized with the other surveys by applying the Echoview software in the analysis of the data, by excluding

intertransects from data analyses and consequently adapting transect lengths, according to the MEDIAS protocol.

- **4.** The WG had a detailed discussion regarding the improvement on the **harmonization biological information** collected during the MEDIAS survey and the estimation of the parameters in the framework of the DCF.
 - **A.** The WG concluded that the **Precision level of Fish Length measurements** will be at 0.5 cm, according to DCF requirements regarding the other actions of DCF.
 - **B.** Dr. G. Basilone presented the results of the WG on the **maturity stages** of anchovy & sardine that was held in the framework of the DCF. The MEDIAS WG concluded that the protocol adopted by the WG on maturity stages will be followed by MEDIAS action to harmonize the data collected during the acoustic survey with the other respective information collected by the DCF.
 - **C.** The WG discussed regarding the necessary data that should be collected for **the age reading** of anchovy and sardine in order to calculate "number of individuals per Length class (Length Frequency distribution of the samples), and the "number of individuals per age" (Age Length keys). In the framework of this discussion three presentations were made.

Athanassios Machias presentation:

"The estimation of abundance of anchovy/sardine per length class and per age class."

From the experience gained in the HCMR we can advice the following on the estimation of the abundance of anchovy and sardine per length and age class.

First: The main sampling for all estimations and raisings to the total is a "Length distribution" of each species, representative to the population at sea/area in respect to the existing length classes as well as the contribution of each length class to the population.

Second: An Age-Length key is needed in order to estimate the number of specimens per age and raise it to the total number of samples used for the estimation of the length frequency distribution. For the estimation of the Age-Length and Maturity we do not need a sample representative to the population but representative to each Length class.

So, we need a representative Length distribution – (preferably taken ON BOARD)

For the other biological measurement – (taken at the LABORATORY). A sample not necessarily representative to the catch but a sample that covers a wide range of Length Classes is required For each Length interval (0.5 cm) we should analyze 10 specimens from each haul for the following measurements:

- Total Length
- Total weight
- Eviscerated weight
- Otoliths Age reading
- Sex
- Maturity

Based on these measurements all the necessary parameters could be estimated and raised to the population based on the Length Distribution of each species.

The experience from Aegean Sea past surveys indicates that the maintenance of the otoliths in freeze immediately after their extraction results into clearer rings for readings compared to other methodologies.

Andrea De Felice presentation

From the experience gained in the unit of population dynamics of CNR-ISMAR of Ancona on the strategies of commercial samples of Anchovy (*Engraulis encrasicolus*) and Sardine (*Sardina pilchardus*), we can advance the hypothesis of a sub-sampling for survey similar to the commercial one (*Cingolani et al.*, 1998).

Midwater trawlers provide more hauls in one fishing day, from a minimum of two to a maximum of six. The commercial box of Anchovy (or Sardine) is the sample and it represents random individuals taken from all fishing hauls, made at different depth and distance from the coast during the whole fishing day.

In the laboratory, the commercial sample (box) is processed as follows:

- 1. Length distribution of the entire commercial sample (box). The length distribution is obtained on the basis of 0.5 cm length classes.
- 2. A sub-sample is taken for age determination ensuring a minimum number of specimens required to obtain reliable Age-Length key. The number of specimens taken is 5 individuals per length class.

In general, during ISMAR CNR acoustic survey, four pelagic trawls are made each day. The results obtained have confirmed the hypothesis that it is possible to reduce the number of individuals for analysis producing a reliable Age Length key.

CURRENT SUB-SAMPLING Survey fishing day: September 21, 2009 4 hauls. Length frequency distribution taken for each haul and 10 individuals subsampling per length class

PROPOSED SUB-SAMPLING Combining together the four day hauls, we get a representative sub-sample of the fishing day, just like for the commercial sub-sample caught by midwater trawlers. Length frequency distribution taken for survey fishing day and 10 individuals sub-sampling per length class

ALTERNATIVE PROPOSAL Length frequency distribution for each haul and 5 individuals sub-sampling per length class

CONCLUSIONS AND SUGGESTIONS

We can conclude, from these results, that the sampling

effort of a survey fishing day, can be reduced obtaining a sub-sample of the combined hauls. In the sub-sample the extreme size classes are not lost and the number of individuals to be determined (age and sex) is reduced, as shown by the experience in sub-sampling commercial catches and this number of individuals is enough to obtain a reliable Age-Length key.

G. Basilone presentation



G. Basilone presented the results of the WG on the reading of the anchovy otoliths, that was held in the framework of the DCF as well as the adopted age reading protocol (for the presentation see Annex II).

Age reading protocol

- 1. First of January adopted as a birthdate: if an otolith is collected from a fish caught in the first semester of the year the age group assignment will correspond to the number of hyaline rings present. If the otolith is extracted from a fish caught in the second semester of the year the age group assigned will correspond to the hyaline rings completely formed, i.e. if the edge of the otolith is hyaline it will be not considered
- 2. First of June as a birthdate: opposed to previous
- 3. After the extraction the otoliths are washed thoroughly dried mounted and preserved in a synthetic resin or stored dried.
- 4. The observations of entire otoliths are made under reflected light using dissection microscopes with 20-25X magnification
- 5. Magnification should be increased near the otolith edge to improve the discrimination of narrow hyaline rings in older individuals.
- 6. For each otolith, the number of true hyaline rings (excluding the edge), edge type, age assigned and readability (0 good, 1 medium, 2 difficult), as well as false rings (checks) must be recorded.
- 7. If a faint ring occurs at a distance where a true ring should be expected (based on the diameter of the 1st annual ring) it could be also considered as a true ring for age assignment.
- 8. Since in the older specimens growth often slow down to such an extent that hyaline rings are very close each other, they are counted even if they are not continuous all around the otoliths
- 9. When hyaline rings are very close each other forming a cluster (two or more very close rings), generally appearing in the antirostrum, we consider them as a single ring.
- 10. Assigning 1st of January as birthdate or Assigning 1st of June as birthdate, the age of fish is underestimated or overestimated respectively. Two main conclusions can be drawn:

Overall age estimates derived from monthly samples collected all the year around are not influenced by assigning 1st of January or 1st of June as alternative birthdates. Anyway, by assigning 1st of January as birthdate of anchovy we accomplish the conventional use but not the biological data on reproductive biology, vice-versa by assigning 1st of June as birthdate.

Independently of the birthdate to be assigned for ageing purposes, it is mandatory to collect monthly samples all the year around to be sure to compensate age estimate inconsistencies. *Recommendations*

- In order to support the identification of the 1st annual ring, the otolith radius of the first hyaline ring must be measured and used as a gauge to exclude the first check in ageing older individuals
- Validation of first annulus has to be done and could be based on the micro-increment counts (daily rings);
- In order to identify when the hyaline/opaque rings are laid down, the otolith edge seasonal evolution should be followed across the year for different age classes and areas;
- Each reader in each area should regularly calibrate his age readings with the reference collection produced during this workshop; A workshop joining readers from the different areas should periodically (3 years) take place;
- This Workshop agreed that any decision concerning the use of the birthdate criterion in anchovy age assignment and its consequences in the stock assessment must be preceded by a more detailed analysis of juvenile fish otoliths and a broader discussion in other Working Groups

A strong need rises up from discussions and results of WKARA on planning a standardization meeting on the micro-increment analysis of the European anchovy otolith among Mediterranean and Atlantic partners.

Steering Committee Conclusions: The MEDIAS WG concluded that the protocol adopted by the WG on age determination will be followed by MEDIAS action to harmonize the data collected during the acoustic survey with the other respective information collected by the DCF. In addition taken into account the previous presentation concludes

- If available, otoliths from at least 5 otoliths should be collected by each length class from each haul (or from all if <5 specimens are available for given length class)
- Emphasis should be given to the age reading of the most abundant length classes, because these classes have the greatest impacts on the raising to the population as estimated by acoustics
- Emphasis should be given to collect samples for ageing from both small and big individuals.

5. The WG and Steering Committee has detailed discussion regarding the **Spanish survey** and concluded the following:

The WG discussed the results of the ECOMED Spanish survey that was held in winter 2008 in comparison to the MEDIAS survey held in summer 2009. The WG notes that these results were very important because for the first time in Mediterranean Sea the abundance, the spatial distribution and the aggregations characteristics of anchovy and sardine populations during the winter can be compared with the summer ones in the same area. These results are very important from an environmental and ecosystem approach for the management of small pelagics.

The WG underlines the fact that the Spanish participants made the greatest effort for the harmonization of the MEDIAS survey, because the ECOMED Spanish acoustic surveys have been regularly carried out in the Spanish Mediterranean waters since 1990 during the winter (November – December), while since 2009 the MEDIAS acoustic survey is being carried out in summer (June-July) according to the agreed standardized methodology.

The WG underlines the value of the past Spanish acoustic time series (from 1990) and agrees on the necessity for the standardization of the acoustic data collected in the framework of the Medias summer acoustic survey with those of the winter ECOMED surveys in order to maximize the scientific profit and minimize any deficiencies from the change in the sampling period.

For this purpose the Steering Committee proposes to the RCM examining the possibility to provide financial support to the Spain to continue the winter/Ecomed survey during the next three years period within the framework of the new DCF.

- **6.** The working group and the Steering Committee discussed the necessity of collecting environmental data along with acoustic data. This would allow the reconciliation of MEDIAS survey with the current needs of the ecosystem approach to fisheries management. Acoustic surveys have the advantage that can sufficiently integrate information at different ecosystem levels thus develop and support the environmental and ecosystem approach to fisheries management, additionally to monitoring and assessing small pelagic fish populations. During the first (2009) MEDIAS survey a first step on the harmonization concerning this issue was approved, as all countries collected CTD data according to the MEDIAS protocol. In addition the WG notes that during the Spanish, Croatian, Sicily channel, Tyrrhenian Sea and Greek surveys, zooplankton samples were collected. The WG encourages all the members of MEDIAS survey to collect zooplankton samples at least in the positions of CTD stations so that MEDIAS survey go further into an environmental approach of the fishery management.
- 7. In addition WG and Steering Committee concluded that a further important step for the harmonization of the MEDIAS survey is the inter-calibration between the research vessels used by the different Institutes. For this purpose the SC agrees that the funding of this action is necessary and should be included in the future plans for the harmonization of the survey.
- **8.** The Steering Committee concluded for the **next MEDIAS meeting to** take place in Ancona by the end of March. The three days of the meeting will be arranged as follows: one day on the results of the second MEDIAS survey and the coordination of the 2011 survey. In the next two days a WG will improve the harmonization of the survey working on the following issues of a) Biological sampling, b) Survey design c) Differences of acoustic sampling between day and night.
- **9.** The Steering Committee elected as new chair-woman of the MEDIAS action Dr. Magdalena Iglesias from IEO.

D. Workshop on survey design

During the 3rd MEDIAS meeting in Mazara del Vallo, a workshop on acoustic survey design was held in the 26th of March 2010. Results of geostatistical analysis applied on acoustic data were presented by each area representative based on the Table that was agreed during the 2nd MEDIAS meeting in Palma de Majorca in March 2009. The presentations are included in the Annex IV, presented by the following participants:

Iberian coast by Pilar Tugores Ferra Sicily Channel by Marco Barra Gulf of Lions by Jean Luis Bigot Western Adriatic Sea by Andrea De Felice - Roberto Gramolini Eastern Adriatic by Vjekoslav Ticina Aegean Sea by Marianna Giannoulaki

The summary of the results per area along with the working group (WG) suggestions are presented below:

Spanish acoustic survey

Geostatistical analysis (i.e. omnidirectional variograms, geometric anisotropy) has been applied to late autumn Spanish acoustic surveys for the period 2004-2008. These surveys were characterized by transects perpendicular to the bathymetry with inter-transect distance at 4 nm in the most Northern and Southern parts where the continental shelf is narrow, and 8 nm in the middle part where the continental shelf is wider (Fig. 1). Acoustic sampling covers the continental shelf between 30 and 200 m depth. Geostatistical analysis has been applied on log transformed acoustic data (NASC for total pelagic, anchovy and sardine), using the gstat library of the R statistical language. Both omnidirectional variograms and geometric anisotropy were tested. Concerning the anisotropy, directional variograms were applied at (0, 45, 90, 135°), with lag width 1 nm and angle tolerance 45° that ensures sufficient number of points at each direction. Some preliminary tests on zonal anisotropy have also been done.

Omnidirectional variograms indicated a more stable range of spatial autocorrelation for sardine than for total pelagic fish and anchovy. Autocorrelation range values varied between 14 to 30 nm indicating the existence of medium to large scale spatial structure of small pelagic fish aggregations (Table 1). Moreover pronounced anisotropy was observed in both species as well as the total pelagic fish (Table 1).

Based on these results the WG suggested:

- a) No changes in the current acoustic sampling design and the inter-transect distance
- b) Further analysis to be done with a shorter lag distance, adjusted to the EDSU for the omnidirectional variograms.
- c) Analysis per stratum to be applied, with stratum defined as those areas with different inter transect distance and different extent of the continental shelf.

Gulf of Lions

Survey design for the Gulf of Lions summer surveys (July) for 2004-2008 included parallel transects perpendicular to bathymetry with 12 nm inter-transect distance. Geostatistical analysis was applied with the EVA2 software (Petitgas & Lafont 1997) on biomass estimates for anchovy and sardine. Omnidirectional empirical variograms were applied and exponential models were fitted. No anisotropy was tested. Results indicated the existence of well structured small pelagic fish aggregations. Autocorrelation range varied from 3 to 16 nm and 8 to 14 nm for anchovy and sardine respectively, indicating medium to large scale aggregations.

The WG group noted/suggested the following:

- (a) The existing survey design seems to be adjusted to the size of the small pelagic spatial aggregations
- (b) Estimates concerning the total pelagic community should be completed
- (c) Anisotropy should be examined in order to have an integrated picture for small pelagic fish aggregations in the Mediterranean.

Western Adriatic Sea acoustic survey

Acoustic data (NASC) collected in the western part of the Adriatic Sea in 2004 to 2008 during September were used. Survey design for the 2004-2007 surveys included zigzagged transects whereas for 2008 it was modified to parallel transects with 10 nm and 8 nm inter-transect distance depending on the extent of the continental shelf.

Geostatistical analysis was performed using GStat Software 2.4.1 (E. J. Pedesma) and included the following steps:

- Data exploration in order to:
- identify outliers;
- check for normality;
- data transformation and removal of the outliers;
- appropriate transformations of the geographical coordinates;
- mapping of the data to visually inspect any spatial correlations;
- Compute the experimental omnidirectional variogram and fitting of a suitable model:
- geostatistical parameters i.e range, nugget and sill determination

• examination of the spatial correlation between points that are in the same transect and between points in different transects in order to check for anisotropy

• The experimental variograms were obtained using a lag of 3704 m (2 nautical miles) and exponential model was fitted to the data of each year.

• Anisotropy was only applied to the total pelagic fish, directional models were forced to have the same nugget of the omnidirectional one, lag width 1 nm and angle tolerance 10° .

Results showed the existence of spatial aggregations of anchovy and sardine with autocorrelation range varying between 15 to 25 nm and low nugget, indicating the presence of well defined spatial structures forming medium to large scale aggregations. Directional variograms showed the existence of anisotropy.

The WG commented the following:

(a) Estimated autocorrelation range was bigger than the applied inter-transect distance during all years. Therefore, based on the results of the geostatistical analysis the alteration of the sampling design since 2008 was a good improvement, assuring less working days for the complete coverage of the surveyed area.

(b) Under current results further increase of the inter-transect distance to 12 nm seems visible. However since only one year results were presented, it was suggested to maintain the current sampling scheme and decide on the potential increase of the inter-transect distance when more years of data would be available under the current sampling scheme.

(c) Moreover, the WG noted that the effect of the day-night acoustic sampling on the estimation of the geostatistical parameters should be further examined.

Eastern Adriatic

Acoustic data (NASC) collected in the eastern part of the Adriatic Sea in 2004 to 2008 during September were used. Survey design for the eastern part of the Adriatic Sea includes parallel transects with 10 nm inter-transect distance and randomly positioned transects between islands, inside the inner sea area (Fig. 3). Geostatistical analysis was applied on log transformed NASC values for anchovy, sardine and the total pelagic community in 2008 were presented, indicating the existence of 18 to 25 nm autocorrelation range for the studied aggregations.

The WG commented/suggested that:

(a) The observed autocorrelation range is in accordance to the one found in the western part of the Adriatic, which underlines the unified behavior of the small pelagic aggregations in the area;

(b) more years of data should be analyzed and presented in the next MEDIAS meeting in order to suggest any improvements of the current survey design;

(c) anisotropy should also be examined, in order to have an integrated picture for small pelagic fish aggregations in the Mediterranean;

(d) Moreover, the WG noted that the effect of the day-night acoustic sampling on the estimation of the geostatistical parameters should be further examined.

Sicily Channel

Geostatistical analysis (i.e. omnidirectional variograms, geometric anisotropy) has been applied to acoustic surveys that were held during summer (July) in the Sicily Channel for the period 2002-2008. Sampling design consisted of parallel equidistant transects, perpendicular to the bathymetry and with an inter-transect distance of 8 to 5 nm, depending on the width of the continental shelf.

Geostatistical analysis has been applied on log transformed acoustic data (NASC for total pelagic) including the points along the intertransect, using the Variowin software (Pannatier, 1996). Both omnidirectional variograms and geometric anisotropy were tested. Concerning the anisotropy, directional variograms were applied at (0, 45, 90, 135°), with lag width 1 nm and angle tolerance 45° that ensures sufficient number of points at each direction.

Results indicated the existence of spatial aggregations with autocorrelation range varying from 10 to 26 nm. Anisotropy was also evident, with smaller autocorrelation range to be systematically estimated in the 0° and 135° direction.

The WG noted/commented the following:

(a) Although the WG recognised the possibility of altering the existing survey design by increasing the inter-transect distance, however it underlined the need for further work to be done also on anchovy and sardine aggregations in order to advise on this.

(b) Moreover, the WG noted that the effect of the day-night acoustic sampling on the estimation of the geostatistical parameters should be further examined.

Aegean Sea

Geostatistical analysis (i.e. omnidirectional variograms, geometric anisotropy) has been applied to acoustic surveys that were held during early summer (June) in the Aegean Sea for the period 2004-2008. Due to the peculiar topography of the Aegean Sea, which is consisted of closed gulfs and open areas connected with each other with narrow passages, the survey design is differentiated between sub-areas. Parallel transects perpendicular to bathymetry with 10 nm inter-transect distance are applied in open areas and zigzagged transects are held inside the gulfs. Geostatistical analysis has been applied separately per sub-area on log transformed acoustic data (NASC for total pelagic, sardine and anchovy) using both the Variowin (Pannatier, 1996) and the EVA2 (Petitgas and Lafont, 1997) software. Both omnidirectional variograms and geometric anisotropy were tested. Concerning the anisotropy, directional variograms were applied at (0, 45, 90, 135°), with lag width 1 nm and angle tolerance 22.5° and 45° that ensured sufficient number of points at each direction.

Results indicated the existence of well structured spatial aggregations with autocorrelation range that varied between years and areas. The autocorrelation range varied from 4 to 28 nm for anchovy and from 3 to 28 nm for sardine depending on the sub-area indicating the existence of medium to large scale spatial aggregations. High variability was observed between years. Greater autocorrelation range was estimated in larger areas like Thracian Sea and Thermaikos gulf. These values were generally close or greater than the applied inter-transect distance in these sub-areas. Moreover larger aggregations were estimated for anchovy compared to sardine. Anisotropy was also evident.

The WG noted/commented the following:

(a) The peculiar topography of Aegean Sea limits the application of other potential survey design other than zigzag.

(b) The variability in the estimated geostatistical parameters should be examined in terms of the area topography as well as the annual variability in density and abundance.

General comments-Suggestions

The WG suggested no alterations on existing survey design to be applied in the MEDIAS survey and that further work should be done in order to advice on this.

The WG suggested:

• the application of (a) Indicator variograms and (b) Percentile variograms on available acoustic data, in order to obtain an idea on how the spatial aggregations structure change depending on density;

• the effect of day-night sampling on the geostatistical characteristics of small pelagic spatial aggregations should be examined;

• the possibility of applying transitive geostatistics for the estimation of the coefficient of variation of the surveys;

• moreover, it was suggested that attempts should be made to simulate data and apply different survey design to each survey;

• Concerning the Black Sea surveys and the applied survey design, it was suggested that the acoustic data of the 2010 surveys should be analysed in terms of their spatial characteristics in order to examine any possible alterations in their survey design that could reduce survey time and adequate coverage of the surveyed area;

• Underlined the need for the transfer of the experience and the results from the AcousMed project to the entire scientific community of the MEDIAS surveys;

• Noted the need to ask for the support of an external advisor on survey design during the next MEDIAS meeting.



Fig. 1. Acoustic Survey design in Spanish Mediterranean waters



Fig. 2 Acoustic Survey design in the western Adriatic Sea up to 2007 (left panel) and in 2008 and 2009 (right panel).



Fig. 3. Acoustic Survey design in the Eastern Adriatic Sea (Croatian waters). – i.e. Eastern part of GSA 17: 30 parallel transects in the open sea area in 43°-223° direction up to mid-line, and randomly positioned transects in channel area (inner sea).

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Fig. 4. Acoustic Survey design in the Sicily Channel.



Fig. 5. Acoustic Survey design in the Aegean Sea.

Table 1. Geostatistical and density parameters calculated per species and area (ECOMED acoustic surveys - 2004-2008)

		Om	nidirect ⁄ariogra	ional m			Aı	Anisotropy - ran (nm)		ange
Area		Range			Density ⁽¹⁾	Density ⁽²⁾				
(GSA: 06)	Year	(nm)	Sill	Nugget	(NASC/NM ²)	(NASC/nm ²)	0 °	45°	90°	135°
Pelagics	2004	22	2.13	4.05	290	153	16	3	7	11
	2005	18	2.98	3.19	289	139	25	14	10	13
	2006	18	2.15	3.31	275	179	14	6	11	15
	2007	34	2.09	4.31	263	202	4	4	12	12
	2008	14	1.56	3.85	355	140	4	2	7	7
Anchovy	2004	26	1.17	1.36	122	45	16	-	7	24
	2005	36	0.80	1.20	63	25	4	61	9	9
	2006	32	1.18	0.97	27	12	30	29	9	14
	2007	20	0.74	0.72	65	20	13	-	10	14
	2008	40	0.53	1.60	66	14	11	-	3	9
Sardine	2004	20	1.36	2.28	148	70	12	25	6	11
	2005	19	2.47	1.05	85	38	21	25	13	20
	2006	17	2.27	1.60	68	40	21	14	11	13
	2007	23	1.39	1.51	87	48	5	13	18	29
	2008	20	0.89	0.49	75	24	17	23	15	21

⁽¹⁾ In the area effectively occupied (A_{EO}) (A_{EO} : n° samples NASC>0 x a). ⁽²⁾ In the area covered by the survey (A_C) (A_C : n° samples x a).

a: inter-transect distance

Table 2. Geostatistical analysis results for the Gulf of Lions (PELMED acoustic surveys – 2004-2008)

		Omnid	irectional	Variogram	Density		Anis	sotrop	У
Area (GSA: 07)	Year	Range	Sill	Nugget	(NASC/NM ²)	0°	45°	90°	135°
Pelagics	2004								
	2005								
	2006								
	2007								
	2008								
Anchovy	2003	14	160	70	8.48				
	2004	3	140	2	7.74				
	2005	16	1250	400	10.26				
	2006	11	90	560	7.90				
	2007	11	15	85	4.31				
	2008								
Sardine	2003	12	3300	7500	33.16				
	2004	8	17000	50000	70.30				
	2005	14	370000	200000	173.49				
	2006	12	3000	12000	29.58				
	2007	8	1000	9200	27.71				
	2008								

		Omn	idirecti	onal		Anisot	ropy	
Area (Western Adriatic Sea, GSA 17)	Year	Range (NM)	Sill	Nugett	0	45	90	135
Pelagics	2004	21	5.49	1.51	19	7.3	12.6	11.7
	2005	16	4.1	0.6	20.8	23.7	12.7	8.5
	2006	15	4.29	0.64	11.1	9.15	13.8	13.8
	2007	15.5	10	2.7	7.3	10.6	7	8.1
	2008	22	8.1	1.98	18.1	11.6	13.6	13
Anchovy	2004	25	5.6	1				
	2005	19	4.1	0.6				
	2006	25	5.1	0.1				
	2007	19	9.8	3.4				
	2008	23.7	6.8	2.6				
Sardine	2004	21.5	5.3	0.7				
	2005	21.5	2.4	0.24				
	2006	23.75	5.2	0.5				
	2007	19.7	4.9	1				
	2008	20	6.2	0.3				

Table 3. Geostatistical analysis results for the western Adriatic Sea

Table 4. Geostatistical analysis results for the Sicily Channel.

Area (Sicily		Omnidirec	tional V	ariogram	Density	Anisotropy					
Channel, GSA: 16)	Year	Range (km)	Sill%	Nugget%	(NASC/NM ²)	0°	45°	90°	135°		
Pelagics	2002	48980	43,2	56.8	111,6327	22285.5	63810	71725	78234.7		
	2003	41633	51,6	48,4	204,9398	41600	79603.7	89466.7	18900		
	2004	42648	54,6	45,4	189,0484	20421	38400	28635	21125.3		
	2005	41633	30,4	69,6	279,4766	15265.1	58776	23467.7	62042.7		
	2006	26122.7	45,7	54,3	143,2335	22080.3	29386.7	51296	27573.2		
	2007	17964.5	53,6	46,4	134,099	12734.8	18366	19669	76533.3		
	2008	27712.9	53,42	46,57	141,9627	19101.3	29050	42655	25631		
Anchovy	2002										
	2003										
	2004										
	2005										
	2006										
	2007										
	2008										
Sardine	2002										
	2003										
	2004										
	2005										
	2006										
	2007										
	2008										

Table 5. Geostatistical and density parameters calculated per species and sub-area in Aegean Sea. Due to the topography of the area, analysis was applied and presented separately per sub-area.

Area (GSA:22. East		Omnidir	ectional V	ariogram	Density		Aniso	tropy	-
Thracian Sea)	Year	Range	Range Sill% N		(NASC/NM ²)	0°	45°	90°	135°
Pelagics	2004	14.5	64.0	36.0	833.15	19.0	13.5	16.0	13.8
	2005	10.8	61.1	38.9	335.02	11.0	8.5	11.0	11.8
	2006	14.2	57.1	42.9	130.71	8.5	10.7	14.6	8.2
	2007								
	2008	15.6	45.8	54.2	1629.72	20	13.5	13.5	15.6
Anchovy	2004	7.7	22.2	77.8	204.75	8	22	8	22
	2005	15.8	50.4	49.5	68.64	11.5	13.5	13.5	11.5
	2006	14.4	48.5	51.5	91.98	8.5	14.5	10.5	12.5
	2007								
	2008	12.8	32.3	67.7	79.75	?	13.5	11.8	14
Sardine	2004	7.5	22.2	77.8	68.64	19.8	6	21	7.5
	2005	9.5	62.84	37.16	130.26	9.5	7.5	9.5	5.8
	2006	14	51.8	48.2	130.71	14.5	15.5	12	14
	2007								
	2008	22.50	40.4	59.6	63.11	22.5	3.5	11.5	15.5

Area (CSA·22 West		Omnidii	ectional V	Variogram	Density		Anisotropy				
Thracian Sea)	Year	Range	Sill	Nugget	(NASC/NM ²)	0°	45°	90°	135°		
Pelagics	2004	15.9	10.54	89.46	546.33	22.5	11.5	13.5	27.5		
_	2005	20.8	40.89	59.1	448.24	19.3	27.5	22.5	21		
	2006	20.8	63.6	36.4	95.85	15.5	12	21.5	20.5		
	2007										
	2008	21.5	30.7	69.3	1429.60	14	16	23	23.8		
Anchovy	2004	21.0	24.7	75.3	207.72	8	8	16	14		
	2005	20.0	47.0	53.0	179.32	16	11.5	13	14		
	2006	22.0	39.6	60.4	299.52	14	13.8	11	17.5		
	2007										
	2008	22.2	40.8	59.2	91.67	3.5	17.5	17.5	25		
Sardine	2004	19	77	23	163.86	12.2	12.5	14	16		
	2005	4.0	7.2	92.8	179.32	19	16.2	15.5	15		
	2006	9.5	49.4	50.6	95.85	6	11	9	11		
	2007										
	2008	13.2	29.0	71.0	41.27	19	2??	11.5	12		

		Omnidi	rectional V	ariogram	Density		Anis	otropy	
Area (GSA: 22 Thermaikos Gulf)	Year	Range	Sill	Nugget	(NASC/NM ²)	0°	45°	90°	135°
Pelagics	2004	24	57.2	42.7	590.38	22	21	22.5	21.5
	2005	6.5	59.9	40.1	267.86	5	8.5	12	6.5
	2006	21.8	56.7	43.3	201.64	15	15.8	20.2	21.8
	2007								
	2008	20.8	36.7	63.3	774.02	21	21	19.5	19
Anchovy	2004	16.0	53.6	46.4	118.51	18.5	18.5	21	20.5
	2005	32.0	67.0	33.0	216.47	20	20	17	20
	2006	15.5	61.6	38.4	249.96	16	14.5	11.2	17
	2007								
	2008	17	25.1	74.9	16.27	13	9.5	13.5	3.8
Sardine	2004	28	65.0	35.0	91.23	25	26	23	20.5
	2005	3.0	12.1	87.9	216.47	14.5	19.5	14.9	19
	2006	6.8	30.05	69.94	201.64	11.5	5.5	7.5	7.5
	2007								
	2008	3.9	31.7	68.5	52.00	19.5	7.5	9.8	3.5

		Omnidi	rectional V	ariogram	Density		Aniso	otropy	
Area (GSA: 22. North Evoikos Gulf)	Year	Range	Sill	Nugget	(NASC/NM ²)	0°	45°	90°	135°
Pelagics	2004	11.7	70.16	29.85	2310.59	11	13	10.8	9.8
	2005	7.1	33.46	66.54	134.79	8.5	7	6.8	8.8
	2006	6.9	45.9	54.1	433.83	6.9	6.9	3.5	8.5
	2007								
	2008	11.2	83.6	16.4	2160.18	13.5	9	9.5	15.5
Anchovy	2004	12.0	20.5	79.5	93.07	11.6	13	10.2	8.7
	2005	7.0	15.0	85.0	1469.83	10.5	6	9	13
	2006	7.8	47.66	52.34	580.18	11.5	7.5	5.9	9.5
	2007								
	2008	4.1	44.0	56.0	109.10	10	9.7	10.5	15.5
Sardine	2004	13.16	52.90	47.10	41.71	11.6	10	10.2	17.6
	2005	3.0	39.4	60.6	1469.83	12	14.5	20	14
	2006	13.5	29.0	71.0	433.83	13.5	7.2	12.8	17.5
	2007								
	2008	11.7	83.2	16.8	346.96	10	9.8	10	14.5

ANNEX I List of participants

Name	e-mail	Country	
Athanassios Machias	amachias@ath.hcmr.gr	Greece	HCMR
Marianna Giannoulaki	marianna@her.hcmr.gr	Greece	HCMR
Magdalena Iglesias	magdalena.iglesias@ba.ieo.es	Spain	IEO
Pilar Tugores Ferra	pilar.tugores@ba.ieo.es	Spain	IEO
María Ángeles Peña Saenz	marian.pena@ba.ieo.es	Spain	IEO
Jean-Louis Bigot	Jean.Louis.Bigot@ifremer.fr	France	IFREMER
Tomaz Modic	tomaz.modic@zzrs.si	Slovenia	FRIS
Iole Leonori	i.leonori@ismar.cnr.it	Italy	CNR-ISMAR
Andrea DeFelice	a.defelice@ismar.cnr.it	Italy	CNR-ISMAR
Fabio Campanella	f.campanella@an.ismar.cnr.it	Italy	CNR-ISMAR
Angelo Bonanno	angelo.bonanno@iamc.cnr.it	Italy	CNR- IAMC
Bernardo Patti	bernardo.patti@cnr.it	Italy	CNR- IAMC
Gualtiero Basilone	gualtiero.basilone@iamc.cnr.it	Italy	CNR- IAMC
Marco Barra	marco.barra@iamc.cnr.it	Italy	CNR- IAMC
Luca Caruana	luca.caruana@iamc.cnr.it	Italy	CNR- IAMC
Marina Panayotova	mpanayotova@io-bas.bg	Bulgaria	Institute of Oceanology-BAS
Martina Georgieva	martina.georgieva@iara.government.bg	Bulgaria	National Agency of Fisheries &
Valodea Maximov	maxi@alpha rmri ro	Romania	National Institute for Marine
	vova maximov@vahoo.com	1101110110	Research & Development
	<u>·····</u>		"Grigore Antipa"
Gheorghe Radu	<u>gpr@alpha.rmri.ro</u>	Romania	National Institute for Marine
			Research & Development
			"Grigore Antipa"
Roberta Pace(*)	roberta.mifsud@gov.mt	Malta	MKRA
Vjekoslav Tičina	ticina@izor.hr	Croatia	Institute of Oceanography &
			Fisheries (IOF)

(*) Roberta Pace, (<u>roberta.mifsud@gov.mt</u>) from Malta, did not participate in the meeting because of the cancelling of her flight

ANNEX II

Agenda of the 3rd MEDIAS Meeting in the framework of European Data Collection Regulation Capo Granitola 25-26 /3/2010

Thursday 25/3/2010

9:00 - 9:15: Opening of the meeting –welcome of the participants.

9:15-9:30: Presentation of the Iberian survey

9:30 – 9:45: Presentation of the Gulf of Lions survey

9:45-10:00: Presentation of the Adriatic survey

10:00-10:15: Presentation of Croatian survey

10:15 -10:40: Presentation of the Sicilian channel survey and Tyrrhenian Sea

10:40-10:45: Presentation of the Aegean Sea survey

10:45 - 11:05: Presentation of Black Sea survey

11:05-11:30: Coffee break

11:30 – 11:45: continuation and completion of the previous session

11:45 - 12:00: General discussion

12:00 – 12:30: Discussion on the recommendations of the RCM

12:30 – 13:00: Assess the impact of the absence of Greek coverage in the MEDIAS survey 2009

13:00 - 14:00 Lunch

14:00 – 14:30: Fish length measurement precision level

14:30 – 15:00: Sampling procedure for anchovy and sardine age determination (CNR- IAMC

- 15:00 15:30 : Maturity stages reference scale for anchovies and sardines (CNR-IAMC)
- 15:30 16:30 : Adoption a protocol for aging and maturity stage of species

16:00 – 16:30: Coffee break

16: 30 – 15:00 : Other issues

15:00 - 15:30: Election of new chairman

15: 30 – 18:00 : Discussion – adoption of the report

Friday 2/6/09

Working group on Survey design

[The work was based on the analyses and the fill of the table we have decided in the 2nd MEDIAS meeting]

9:00 – 11:00: Presentations of the work applied in each area 11:00-11:30: Coffee break 11:30 – 13:00. Discussion on the work that should be applied 13:00 – 14:00 Lunch 14:00 – 18:00: Working on the data.

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ANNEX III

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 HD	Should be reported		
Poriod of survey	Should be reported		
Feho counder poremeters	Should be reported		
Echo sounder parameters	Salit hoom		
Echo sounder			
Grand Lange Stranger (LHL)	38 120, 200 demending en susilekilite		
Complementary frequencies (kHz)	120, 200 depending on availability.		
Pulse duration (ms)	1 IIIS Chould be reported		
Beam Angles (degrees)	Should be reported		
Athw. Beam Angle,			
Alog. Beam Angle			
Ping rate	Maximum depending on depth		
Calibration (No per survey)	A calibration report should be given (Annex III)		
	One calibration per survey		
Threshold for acquisition (dB)			
Threshold for assessment (dB)	-70 to -60 (reported)		
Survey design			
Transects design	Perpendicular to the coastline/bathymetry, otherwise		
	depending on topography		
	The survey design should be reported.		
Inter-transect distance (NM)	Max <=12 NM.		
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	At least 20 m bottom depth, minimum 10 m of echo-		
(min, m)	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)	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	v Total fish NASC per EDSU		
	v Anchowy Sardine NASC per EDSU		
	Anchovy, Salutte NASC per EDSU		
	v Androvy, Salume Diomass per EDSU		
	v Anchovy, Saruine Numbers per EDSU		
	v Ancnovy, Sardine Number/age and per length class		
	v Anchovy, Sardine Biomass/age and per length		
	class		

Maps and charts	 v Point maps of total fish NASC v Point maps of target species in NASC/mile; biomass / mile. v Catch compositions of the hauls, pies charts indicating biomass per species. 	
Fish sampling	indicating bioinass per species	
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	
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 area. Minimum variables: T, S	

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

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

ANNEX IV

Presentations of the 3rd MEDIAS meeting

(Presented in separate pdf files)