



EastMed

Report of the EastMed Working Group on
Fisheries Data Analysis and Joint EastMed/GFCM
data preparatory meeting on round sardinella
in the eastern Mediterranean Sea

FAO HQs, Rome Italy, 21-25 October 2019

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Preface

The Project “Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean- EastMed” is executed by the Food and Agriculture Organization of the United Nations (FAO) and funded by Italy and the EC DG MARE.

The Eastern Mediterranean countries have for long lacked a cooperation framework as created for other areas of the Mediterranean, namely the FAO sub-regional projects AdriaMed, MedSudMed and CopeMed II. This made it more difficult for some countries in the region to participate fully in international and regional initiatives for cooperation on fishery research and management. Following the very encouraging experience of technical and institutional assistance provided to countries by the other FAO sub-regional Projects,

EastMed

The project was born to support the development of regional cooperation and the further development of multidisciplinary expertise necessary to formulate appropriate management measures under the FAO Code of Conduct for Responsible Fisheries and the principles of the Ecosystem Approach to Fisheries (EAF) to ensure rational, responsible and participative fisheries management

The project’s **longer-term objective** is to contribute to the sustainable management of marine fisheries in the Eastern Mediterranean, and thereby to contribute to supporting national economies and protecting the livelihoods of those involved in the fisheries sector.

The project’s **immediate objective** is to support and improve the capacity of national fishery departments in the sub-region to increase their scientific and technical information base for fisheries management and to develop coordinated and participative fisheries management plans in the Eastern Mediterranean sub-region.

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Publications

EastMed publications are issued as series of Technical Documents (GCP/INT/318/EC – 041/ITA/TD-00) and Occasional Papers (GCP/INT/318/EC –041ITA/OP-00) related to meetings, missions and research organized by or conducted within the framework of the Project.

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For bibliographic purposes this document
should be cited as follows:

EastMed, 2019. Report of the EastMed Working Group on Fisheries Data Analysis and Joint EastMed/GFCM Data preparatory meeting on round sardinella in the eastern Mediterranean Sea. GCP/INT/318/EC– 041/ITA/TD-29. Rome 2019: 22 pp.

Preparation of this document

This document is the final version of the Report of the EastMed Working Group on Fisheries Data Analysis and Joint EastMed/GFCM Data preparatory meeting on round sardinella in the eastern Mediterranean Sea, held in FAO HQs, Rome (Italy), 21–25 October 2019.

EastMed. 2019. Report of the EastMed Working Group on Fisheries Data Analysis and Joint EastMed/GFCM Data preparatory meeting on round sardinella in the eastern Mediterranean Sea. GCP/INT/318/EC-041/ITA/TD-29. Rome 2019: 22 pp.

ABSTRACT

The FAO-EastMed Working Group on Fisheries Data Analysis was held in FAO headquarters, Rome, Italy, from 21 to 25 October 2019. The objectives of the working group were to facilitate and support the analysis of fisheries and biological data collected in the Eastern Mediterranean countries, with a view to assess the status of priority stocks in the subregion. A joint session was also organized with the GFCM to support data preparation for the benchmark assessment of round sardinella (*Sardinella aurita*). The working group was attended by experts from Egypt, Lebanon, Palestine, Turkey and Cyprus. During the joint session on sardinella, experts compiled and reviewed available data sets for the assessment of the stock, including biological parameters and length frequency data. Inputs were also provided to develop a simulation framework to test the performance of different candidate data-limited assessment methods to be used in the benchmark assessment. The working group reviewed the progress made in the age reading and the definition of stock boundaries of sardinella and agreed on a roadmap until the benchmark in May 2020. During the working group experts prepared data sets for the assessment of demersal stocks, including *Mullus barbatus*, *Pagellus erythrinus*, *Saurida undosquamis*, *Nemipterus randalli* and *Lithognathus mormyrus*.

Introduction

The EastMed Working Group on Fisheries Data Analysis was held in FAO headquarters, Rome, Italy, from 21 to 25 October 2019. The WG was attended by experts from Egypt, Lebanon, Palestine, Turkey and Cyprus. The list of participants and agenda are in Annex 1 and 2.

The objectives of the working group were to facilitate and support the analysis of fisheries and biological data collected in the Eastern Mediterranean countries, with a view to assess the status of priority stocks in the subregion. As agreed during the GFCM Subregional Committee for the Eastern Mediterranean (SRC-EM) and SAC, a joint session was also organized with the GFCM to support the data preparation for the assessment of the round sardinella, *Sardinella aurita*, in Eastern Mediterranean. The joint session was run on the 21 and 22 of October and was facilitated by an external stock assessment expert, Dr Ricardo Amoroso.

1. Joint Session on data preparatory meeting on round sardinella

Ms Morello, GFCM Secretariat, summarized the background of the data preparatory meeting. She recalled that at the 1st SRC-EM (2017) and at the 19th session of SAC experts and countries agreed to advance on the assessment of data limited stocks (DLS) and to launch a pilot study on the application of these methods in the eastern Mediterranean. A dedicated session on the provision of advice for DLS was held in the 2nd SRC-EM (2018). The SRC summarized the current knowledge on DLS assessments and management and proposed a roadmap to explore the application of these concepts to two existing DLS case studies in the eastern Mediterranean: deep water red shrimps and round sardinella. The meeting also identified the main types of data available for each case study. With regards to sardinella, a data preparatory meeting was recommended as first step in the road map towards the assessment of the stock. A data preparation meeting was held in 2018, in a joint session with the GFCM within the EastMed WG on Data Analysis. As a follow up to the meeting it was recommended that further exploration of sources of biases in data sets to be conducted before proceeding with the stock assessment. At the 2018 WGSASP further guidance were provided to countries to explore and analyse potential sources of bias in data sets. At the 21st SAC, the Committee agreed to carry out a benchmark assessment for round sardinella in the eastern Mediterranean before the 2020 SRC-EM. The Committee underlined that the timely provision and adequate preparation of data were prerequisites for holding benchmark sessions. A work plan towards the benchmark assessment was adopted. Ms Morello summarized the main points of the work plan as follows:

- Gather and collate data on catches and length frequency distributions (LFDs) for all countries (Lebanon, Egypt, Palestine, Turkey, Cyprus, Syria, Israel and Greece), as available

- Identification of potential sources of bias in datasets and strategies for the optimization and improvement of sampling schemes.
- Compilation of final data sets
- Development of a simulation framework to test the performance of different candidate data-limited assessment methods, including VIT, LB-SPR, LIME, and others.
- Decide on the best strategy for the assessment of round sardinella in view of the benchmark
- Carry out initial runs of the selected methods using the real data sets before the 2019 WGSASP with the aim of presenting proposed assessments at the benchmark session in 2020.

During the discussion it was clarified that only Egypt, Palestine, Lebanon and Turkey have ongoing biological data collection, and therefore the assessment of the stock in the Eastern Mediterranean will have to rely on data from these countries. The WG was informed that some fishery independent data exist for GSA 22 in Greece but were not yet available. Sardinella catches in GSA 22 are grouped together with other small pelagic species, and it is currently not possible to disentangle the contribution of the species to the total catches. However, catches of sardinella in GSA 22 (Greece and Turkey) are probably not substantial. In the Turkish side, sardinella is reported under *Alosa shad*, making up between 3 to 4% of the catches. Problems in the identification of the species in the catches were also noted by the other countries, precluding the use of methods that rely on catch data for the assessment. The situation in Syria is currently unknown. Capacity development actions, including basic infrastructure for biological data collection and analysis, will be needed before the country will be able to engage in the sub-regional assessment.

Countries also reported on problems in the continuity of the data collection. With the exception of Turkey, data for the 2018-2019 is incomplete because of interruptions in the data collection programs. It was clarified that the benchmark will rely on the most recently available data.

Available data for the assessment of round sardinella

Presentations delivered by participants described the available data for the assessment of the stock of sardinella.

The expert from Egypt presented the available data from 2013 to present and noted that the continuity of data collection is currently threatened by lack of financial support. Sardinella catches originate from two main fishing grounds – east and in front of Nile delta. Variations in biological data are expected to be affected by the origin of the catches by fishing grounds rather

than by fishing ports. Available catch data shows a declining trend in the catches of sardines (as a group) from 2007 to 2016. The actual percentage of sardinella in the catches is unknown but experts noted that the percentage changes according to the season and time of day. For instance, the species represented on average 40% of the catches during day time in 2017. Older data (2001 – 2002) shows variations in percentage of sardinella in the catches by season and time of day, with higher percentage in day time catches during the summer. Experts highlighted the need for on-board data collection to better evaluate the percentage of sardinella in the catches.

Regarding the possible effects of environmental conditions on sardinella catches, the effects of changes in the runoff from the Nile river and the northern lagoons need to be better investigated. However, it was noted that the major changes occurred in the 1970s following the damming of the Nile river. It is yet to be investigated if the historical patterns in catches, including the declining catches in recent years, bear any relationship with environmental regimes. It was however highlighted that the information about environmental regime shifts would have more utility if the assessment was relying on longer-time series of data, where the environmental driven changes in productivity could create bias in the assessment and affects biological reference points. As the assessment of sardinella is based on recent length data, such longer term variations in environmental conditions would be a less important issue.

Experts from Lebanon reported similar sources of bias as Egypt, specially the issue of species compositions between night and day catches. They noted that on-board data is being collected to better understand and address these sources of bias in the catches.

In Palestine, most of the catches are from purse seiners that fish at night time using lights. The fishing area is normally restricted to 6 nm, but varies from 0 to 9 nm depending on the political situation. Experts from Palestine noted that these variations in fishing area are less of an issue for sardine fisheries and are likely to affect more the catches of demersal species and other large pelagics. Similarly to Egypt, sardine catches have been declining from 2003 to 2017 in Palestine. LFD data has been collected on a monthly basis from 2014 to 2018. In 2019 data collection was interrupted for some months due to delays in receiving financial support.

Sardinella data in GSA 24 (Turkey) has been collected with the support EastMed from September 2018 to September 2019. Sampling covers purse seiners and gillnetters (trawlers catch sardinella in small quantities therefore bycatches were excluded from the sampling). Catches of purse seiners in the Mediterranean coast of Turkey are affected by regulations concerning seasons and areas as well as by the occasional movement of purse seine fleets from Black Sea to the Mediterranean and Aegean Sea (this movement normally occurs when catches of anchovy in the Black Sea are low). The available data indicates apparent differences in the species compositions and sizes by areas. In Antalya a mix of *S. aurita* and *S. maderensis* occurs, with *S. maderensis* making about 10% of the sardinella catches. Normally gillnetters catch

larger sardinellas which are used as bait. In Mersin Bay, catches of sardinella are 100% *S. aurita*. Round sardinella is mainly caught by purse seine. Fish is normally smaller than in the other two regions. In Iskenderun, 80% of the sardine catches are made of *Etrumeus* spp and other small pelagic species.

As a result of the presentations, the following conclusions were made:

- As concluded in previous meetings, giving the limited availability and reliability of catch data, the assessment of sardinella will have to rely on length data collected in the main fishing areas in the eastern Mediterranean. The group compiled the available data in a single database to facilitate further data exploration and analysis (Figure 1 and Annex 3).
- The continuation of data collection (biological and/or catch data, depending on the country) for stock assessment in the main fishing areas is currently exclusively dependent on external support. Suitable solutions must be found to ensure that data collection for this priority species is not interrupted.
- Improvements in catch data will require better sampling of the catches, improvements in species differentiation and if possible on-board data collection.

Potential sources of bias in the available length frequency data

With the assistance of the international consultant, participants examined the available LFDs to investigate patterns in available data and to identify any potential sources of bias. From the analysis, the following preliminary conclusions/recommendations were made:

- Importance to standardize databases for data collations across countries, including gear types and fleet segments, names and numerical entries. A standard template was proposed during the meeting to be used by countries.
- The need to adopt a standard sampling protocol and data coding that identifies the source of the samples (vessel, month, port), the total catches from the vessel and the source of the catches (fishing grounds). This will facilitate further data explorations and the raising of LFDs from samples to total. At a minimum, the name of the vessels from which catches are being sampled and the sample date/location should be recorded.
- Future sampling of sardinella for stock assessment should concentrate on the main fishing gears/fleet segments (purse seiners, lampara and gillnetters). It was recommended that at least 50 individuals be sampled per month, for each of the main gears, fleet segments and fishing grounds, when applicable.
- The analysis of joint database showed an overall consistency in length-weight data across countries (some missing weight data from Lebanon was noted and will be integrated in the common database). It was recommended that a common LW relationship be used for the

benchmark.

- Some issues were encountered when analysing LFD data from individual countries, and these are summarized below:

- Turkey: Smaller individuals not present in Turkey. Not clear if it is due to gear selectivity (mesh sizes of purse seiners slightly larger in Turkey compared to other countries) or an area effect. This will be further investigated based on available data.
- Lebanon: differences in size compositions between zones (Dora and Tripoli). Unclear if it is due to differences in environmental conditions (e.g. depth) between the two zones or perhaps time of the year of the samples taken in each of the sites. Data for 2015 was obtained in the market and it was not possible to associate the catches to fishing vessels.
- Egypt: differences in sizes between El Arish and Kafr Elsheikh possibly due to differences in the fishing grounds used by the fleets from the two localities. El Arish fleet operates mostly in eastern fishing grounds. Sampling there became unfeasible in recent years due to unstable fishing operations. Catches from all other ports seems to originate from both east and middle (in front of Delta region) fishing grounds (catches mixed and difficult to separate by fishing ground). To facilitate future analysis, it was suggested inclusion of specific question about fishing ground to skipper during sampling.
- Gaza: Sampling in 2015 and 2019 did not cover the whole year due to budget limitations.

- With regards to the procedures for raising LFD from samples to the total catches, it was highlighted the importance of verifying how the LFD of the samples are representative of the total population and how to weight the samples to the relative importance of the respective gear/fleet segment being sampled. At the moment, due to lack of data, samples are raised to the total catches according to the following assumptions and procedures:

- Egypt: equal weights among fleets but weighting by catches, ports and months.
 - Lebanon: monthly raising according to total catch data by the Ministry of Agriculture.
 - Gaza: monthly raising by total catch.
 - Turkey: data available to do raising from the vessel to the total; however, assumptions need to be made about the percentage of sardinella in the total catches of sardines.
- Experts from Egypt, Gaza and Lebanon reported the difficulty to obtain the catch data from the vessel sampled (fishers do not provide this information), unless data obtained on-board. Vessel catch data from Turkey available but not yet collated. In view of these

difficulties, it was recommended that, at a minimum, the name of the vessel should be recorded in order to assess the difference/correspondence of sizes in the catches of vessels sampled in the same month/port.

Outcomes of the age determination and intercalibration workshop

Stefano Lelli, EastMed fisheries expert, summarized the progress made with the age determination of sardinella based on otoliths, including the results of the EastMed Working Group Meeting on round sardinella, COISPA, Bari, Italy from 1-5 July 2019. With the supervision of Pierluigi Carbonara (COISPA), the working group advanced in the preparation of an “Age reading handbook of the round sardinella”, which is meant to be a practical tool for all those who are approaching the ageing of round sardinella by identifying seasonal increments in otoliths. The handbook is based on the definition of clear ageing scheme and ageing criteria and sources of bias in the ageing analysis. The working group agreed on the need to develop an annotated reference set of representative round sardinella otolith samples for training purposes and to maintain consistency. Due to the inherent difficulty in acquiring known age samples of wild fish, many groups have developed reference sets based on consensus ages accomplished by a group of experts. Accordingly, a reference set of 8 otoliths was developed among those reaching a percentage of agreement of 100% during the aging workshop held during the working group. As a follow up, the following actions were recommended by the WG:

- Handbook for aging will be distributed for review and endorsement by participants.
- EastMed and P. Carbonara (COISPA) to evaluate the current gaps in the age-length key to focus the attention of readers in each country in the near future.
- Goal to complete a minimum set of data to have a preliminary age-length key before the benchmark assessment.
- Use length modal progression in monthly LFD to corroborate growth estimates in the first year (in view of difficulties encountered in the determining first ring due to false rings).

Preliminary analysis of stock assessment models for round sardinella

The session started with a discussion on the utility of different types of LFDs to recover population parameters (growth, recruitment and mortality). It was noted that the type of LFD

of sardinella, where there is a clear monthly change in the LFD as individuals in the cohort grow in size, is useful to evaluate growth (especially in the first year) but not very appropriate for estimating mortality.

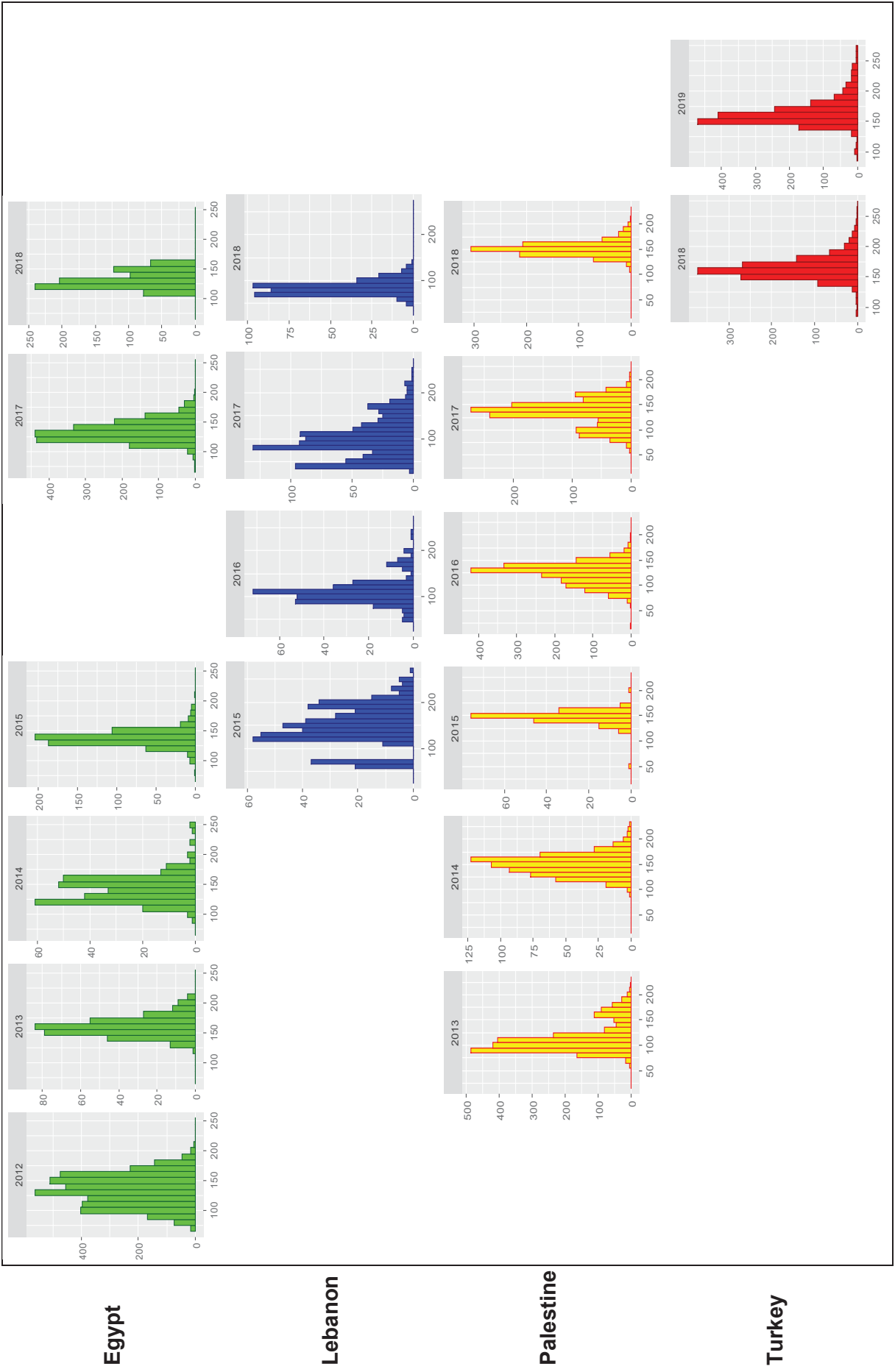


Figure 1. Plot of Length Frequency Distributions by country and years (length is expressed in mm).

In order to estimate mortality, monthly LFDs need to be integrated across months in a year. In the integration, attention needs to be given to the weighting of each monthly sample. Ideally weighting should be done according to the abundance at sea. In lack of abundance data, other abundance proxies could be explored such as total catches, % of sardinella in the catches and CPUE. The use of catches would be inadequate in some countries due to the existence of fishing closures for the main purse seine fisheries (e.g. Lebanon 1 January to 15 April, Turkey 15 April to 15 September for purse seiners and trawler in national waters).

Considering the available data, the group discussed the types of methods available for stock assessment. It was suggested the testing of at least two additional method to VIT to evaluate consistency of results, including the length-converted catch curve and length-based spawning potential ratio (LBSPR¹).

During the session the performance of the length-converted catch curve method was tested against simulated data of a sardinella population with growth and mortality parameters as in Table 1. Perfect sampling was tested, as a caveat and a way to emphasize that the simulation needs to be expanded to test performance. Preliminary simulations tested the capacity of catch curves to reconstruct Z values under equilibrium assumptions in recruitment and under different scenarios for growth. Sampling was done assuming perfect information and no recruitment variability. It was also tested the effects of different weighting procedures (equal weighting, weighting by number and by biomass). The simulation testing demonstrated the capacity of the method to recover the original parameters under these conditions. The type of weighting produced had a minor effect on the mortality estimates (Figure 2).

Further testing was done with the catch curve method applied to the LFDs of individual countries. When available, the estimates were compared to those obtained by VIT. Catch curve produced higher Z values compared to VIT. Simulation data was also used to test VIT. VIT was able to recover the values of Z of the simulated populations under different weighting procedures.

¹ Hordyk A., Ono K., Valencia S., Loneragan N., Prince J. 2015b. A novel length-based empirical estimation method of spawning potential ratio (SPR), and tests of its performance, for small-scale, data-poor fisheries. *ICES Journal of Marine Science*, 72: 217–231.

Table 1. Parameters of the simulated population of round sardinella.

| Parameters | Simulated population |
|-----------------------|------------------------|
| M (natural mortality) | 1.1 year ⁻¹ |
| a (LxW relationship) | 6.016529e-06 |
| b (LxW relationship) | 3.05 |
| T max | 5 years |
| Linf | 252 mm |
| K | 0.67 |
| t0 | 0 |

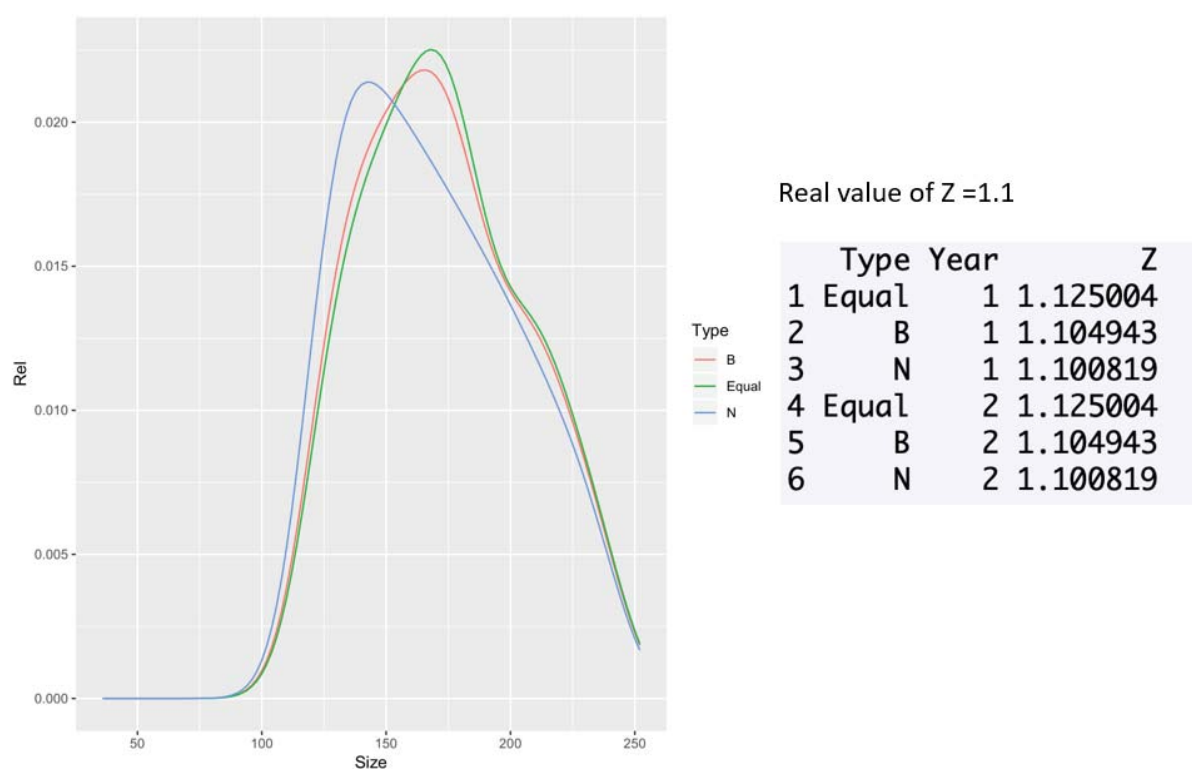


Figure 1. Length frequency distributions sampled from a simulated population with known total mortality ($Z=1.1$. year⁻¹) under equilibrium assumptions in recruitment, using of different weighting procedures (Equal = equal weighting, B = weighting by biomass and N = by number).

During discussions the following recommendations were made in view of further simulations and testing of assessment methods among countries:

- the need to adopt the same methods for estimating natural mortality (e.g. Gislason's method).
- the group agreed to use a common length weight relationship based on all datasets.
- simulation testing of the assessment methods need to be expanded considering: F changing with time; trends in recruitment variability and sampling errors.
- all the methods need to be tested against types of weighting used to group annual data: equal weight by month/gear/zone; weight proportional to abundance in weight and number; percentage of sardine in the catch.

Participants were also introduced to a third method: LBSPR. The method used life history parameters and observed catch data to estimate F/M and %SPR.

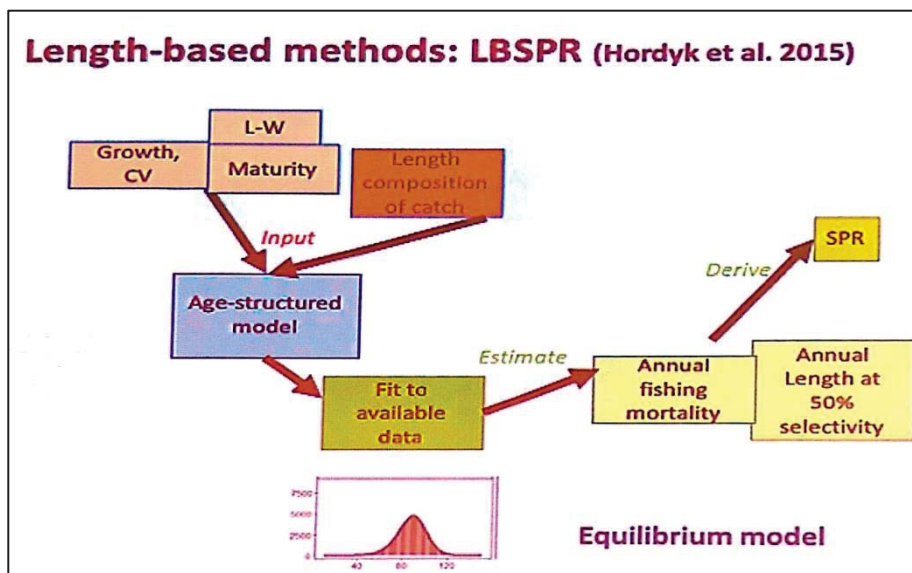


Figure 3. Rational model of LBSPR (Hordyk et al. 2015) including inputs, outputs and major assumptions.

It was noted that VIT can also calculate spawning potential ratio (%SPR). Due to the lack of time LBSPR could not be explored in depth. Further training in the use of the method is required. The group also recommended the use of length-based integrated mixed effects (LIME²) in the benchmark assessment to address non-equilibrium conditions.

Update on the work regarding stock boundaries of sardinella in Eastern Mediterranean (FISHBONE)

² Rudd M. B., Thorson J. T. 2018. Accounting for variable recruitment and fishing mortality in length-based stock assessments for data-limited fisheries. Canadian Journal of Fisheries and Aquatic Sciences, 75: 1019–1035.

The group reported the progress in the sampling activities related to the definition of the structure of the transboundary population of round sardinella in the Eastern Mediterranean. Sampling is ongoing in Cyprus and Lebanon (completed in the south (tissue, otoliths and pictures); still missing the north). In Egypt and Turkey, samples of tissues, otoliths and pictures were finalized. Otoliths were delivered to the task coordinator whereas samples of tissues are waiting to be processed in Turkey and waiting to be shipped to Italy in Egypt. In Palestine, samples, tissue and otoliths were completed but no pictures were taken.

Videos on the sampling protocol to be followed for otolith and genetic samples extraction were prepared and can be used in future as webinars. Progress on the compilation of oceanographic data were provided by the task coordinator.

Roadmap until the bench mark assessment (April 2020)

In terms of next steps towards the benchmark assessment, the group recommended the following:

- *Aging:*
 - o Gaps and next steps for age reading to be prepared by EastMed and circulated by November 2019.
 - o Preliminary age-length key by the benchmark.
- *FishBone:*
 - o to meet again during the WGSASP to take stock of the analysis of sample quality.
 - o Analysis will begin in first quarter of 2020.
 - o Preliminary results of the analysis by the benchmark.
- *Stock assessment*
 - o Finalization of the simulation testing of the different methods, with assistance of international consultant, by the benchmark.
 - o Testing of methods by participants, using national data sets, including VIT, Catch curve, LBSPR and LIME. During the testing, check the effects of pooling data by months, years, fishing zones, applying different weighting to the samples. Further training in the use of LBSPR and LIME needs to be done before the benchmark. A workable version of LIME needs to be produced for this purpose.
 - o Present progress made in data preparation and model testing during the WGSASP. The presentation should mention the types of methods being

proposed to be used and the additional indicators that are produced by these methods (e.g. %SPR).

2. Data preparation and stock assessment of demersal stocks

The WG covered also the assessment of demersal stocks of Egypt, Palestine Lebanon and Cyprus (Table 2). During the session, experts presented available data and preliminary results of assessment runs, followed by open discussions and suggestions from the group on assumptions, methods and recommendations for further analyses. The group worked particularly on the preparation of catch at length data, using appropriate raising factors, and also on the analysis of length frequency data for the estimation of growth parameters.

Table 2. Demersal stocks covered during the WG.

| Country | Stocks to assess | GSA | Data series and purposes | Models |
|-----------|-----------------------------------------------------------------------------|-----------|------------------------------------------------------|---------------|
| Cyprus | <i>Pagellus erythrinus</i> ; <i>Boops boops</i> <i>Spicara smaris</i> | 25 | Comparisons between the two models using past data. | A4A and LBSPR |
| Egypt | <i>Metapenaeus stebbingi</i> ; <i>Mullus surmuletus</i> | 26 | Comparisons with past assessments performed with VIT | LBSPR |
| Palestine | <i>Saurida undosquamis</i> <i>Nemipterus randalli</i> | 27 | 2016-2018 | VIT |
| Lebanon | <i>Pagellus erythrinus</i> ; <i>Lithognathus mormyrus</i> | 27 | 2015-2018 | VIT and LBSPR |
| Turkey | <i>Mullus barbatus</i> | 22 and 24 | 2018-2019 | LBSPR |

Savaş Kılıç from Turkey presented the red mullet data collected from the commercial fisheries along the Turkish coasts of the Aegean (GSA 22) and Mediterranean (GSA 24) Seas collected with the support of EastMed between September 2018 and September 2019. Data came from six different ports (provinces) representing six bays and mainly from two major sources: gillnet and trawl fisheries. While the time spread of data from gillnet fisheries covered all 13 months, the trawl fisheries data were not available from May to September due to annual temporal closure of trawl and purse seine fisheries in Turkish territorial waters between 15 April and 1

September in GSA 22 and between 15 April and 15 September in GSA 24. As the contributions of gillnet and trawl fisheries to the total landing are dissimilar, length frequency data from different gears needed to be raised to get a more accurate information. When the total monthly catches from the collection ports (only in GSA 24 for the time being) were available, length frequencies from trawl fisheries were weighted with appropriate monthly raising factors. The new arranged length frequency data were then used to extract the preliminary estimates of the growth parameters of the VB Model. With the preliminary growth parameter estimates, length converted catch curve analysis was attempted to get estimates of total mortality coefficient. Furthermore, some trial runs with LBSPR were also attempted during the working group.

Available data from 2015 to 2018 for *Pagellus erythrinus* and *Lithognathus mormyrus* in GSA 27 was presented by Myriam Lteif from Lebanon. Virtual population analysis was run for both species for the new data (2018) and data of the four years combined (2015-2018). The values of F_{curr} for both species did not show consistency throughout the 4 years. In fact, for *Lithognathus mormyrus*, there was a problem with sampling in 2017, where four months (February to May) were not represented. In addition, there was an issue with the catch data of 2015 for both species (probable overestimation of catches). The VPAs of 2015 will be run again on VIT using the updated catch data for raising. A Length-Based Spawning Potential Ratio (LBSPR) model was also run for both species; however, the group did not advise running it for both species because the method is based on a logistic selectivity, which is not the case for the gillnet fishery of these species. As a result, only VPA (VIT) results will be presented at the working group for demersal species after amending the catch data of 2015.

Participants from GSA 26 and GSA 27 (Egypt and Palestine) worked on updating the preliminary assessment of *Saurida undosquamis* from Palestine using the data of 2018 and presented an assessment for the recent year 2018 as well as the merged data of 2016, 2017 and 2018 together, using LCA generated in VIT software. In addition, GSA 26 participants tried LBSPR as an alternative assessment method to compare the results obtained from VIT throughout the past years for *Metapenaeus stebbingi* and *Mullus surmuletus*.

Ioannis Thasitis from Cyprus originally planned to perform an analytic stock assessment of *Mullus barbatus* using a statistical catch at age model (a4a). The demonstration of various new methodological approaches from the external consultant, in addition to some issues with the a4a code, shifted the workflow towards helping other members of the group in problem solving for implementing the LBSPR analysis. Following the successful running of LBSPR, the model was applied to three previously assessed stocks in GSA 25 (*Pagellus erythrinus*; *Boops boops* and *Spicara smaris*). Upon completion of the assessments a comparison of the LBSPR results was made against the fully analytic assessments previously validated during GFCM WGSAD and it was found to show similar results.

3. Conclusions and closure of the meeting

In the final day of the working group, a plenary session was held, where experts briefly presented the advances made during the week and the plan of work to complete the assessments and analysis to be submitted to the GFCM Working Groups on Stock Assessment (WGSA). The group praised the use of alternative length-based methods (such as LBSPR) to the more data-limited fisheries and stressed again interest in using other data-limited models like LIME in the future. Both LBSPR and LIME produce SPR indicators which are not currently dealt with in the GFCM WGSA. The group recommended that the use of such indicators should be discussed in the WGSA, with a view to complement the current assessment and management advice framework, which is based on biomass and F indicators and reference points.

The meeting was closed on Friday 25 October 2019.

Annex 1. List of participants

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Annex 2. Agenda of the FAO EastMed WG on Fisheries Data Analysis, 21 – 25 October 2019, FAO HQ, Rome.

Joint Session with GFCM on data preparation for the assessment of round sardinella, 21-22 October 2019

Monday 21 October 10:30 – 17:30 (Canada Room A356)

1. Opening and arrangements of the meeting

- Welcome addresses and introduction of participants
- Adoption of the agenda and appointment of the chair

2. General overview of objectives and expected outcomes (including objectives and expected results of the upcoming benchmark assessment of round sardinella) (*EastMed/GFCM Secretariat*)

3. Available data for the assessment of round sardinella

Review of available data for the assessment of round sardinella and definition of management/assessment units

- Presentation of available data by country (*presentations by participants*)
- Data exploration to identify possible sources of bias: presentation of the results of the work done during the intersession on the identification of possible biases in data (*Participants/EastMed*)
- Outcomes of the age determination and intercalibration workshop (*EastMed*): presentation and endorsement of the handbook on the age determination of *Sardinella aurita* (*EastMed*)
- FISHBONE project: status of the art by Country and next steps to be taken (*EastMed*)

4. Determination of appropriate assessment methodologies

Preliminary analysis of stock assessment models for round sardinella – simulation testing (*Ricardo Amoroso*)

5. Data collation

Collation of data according to the assessment/management units determined above

Tuesday 22 October 09:00 – 17:00 (Canada Room A356)

Collation of data according to the assessment/management units determined above (cont'd)

Presentation of preliminary results obtained from Countries' datasets (*Ricardo and participants*)
EastMed Working Group on Fisheries Data Analysis

Wednesday 23 October 09:00 – 17:00 (Room D838)

Presentation of available data for the assessment of other species by Country

- Palestine: *Saurida undosquamis*
- Lebanon: *Pagellus erythrinus*; *Lithognathus mormirus*
- Egypt: *Metapenaeus stebbingi*; *Mullus surmuletus*
- Turkey: *Mullus barbatus*; *Saurida undosquamis* (1 month only)
- Cyprus: *Mullus barbatus*, if possible update *Pagellus erythrinus*

Data preparation and preliminary assessment of the stocks

Thursday 24 October 09:00 – 17:00 (Espace Gabon A025)

Preliminary assessment of the stocks (cont'd)

Friday 25 October 09:00 – 13:00 (Espace Gabon A025)

Presentation of the preliminary assessments

Closure of the meeting

Annex 3. Available length measurements for round sardinella in Eastern Mediterranean countries.

a) Number of countries with length frequency samples by month/year.

| Month | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|-------|------|------|------|------|------|------|------|------|
| 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 2 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| 4 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |
| 5 | 1 | 1 | 0 | 1 | 2 | 3 | 1 | 1 |
| 6 | 1 | 2 | 1 | 2 | 2 | 3 | 1 | 1 |
| 7 | 1 | 1 | 0 | 1 | 2 | 3 | 2 | 1 |
| 8 | 1 | 2 | 1 | 1 | 2 | 3 | 1 | 1 |
| 9 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 1 |
| 10 | 1 | 2 | 1 | 1 | 2 | 2 | 4 | 0 |
| 11 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 0 |
| 12 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 0 |

b) detailed sampling coverage by month

| Egypt | | | | | | | | | |
|--------------|-------------|------------|------------|------------|------|-------------|------------|------|-------------|
| Month | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
| 1 | 758 | | | | | | | | 758 |
| 2 | 542 | | 61 | | | | | | 603 |
| 3 | 221 | | | | | | | | 221 |
| 4 | 207 | 50 | | 134 | | | | | 391 |
| 5 | 226 | | | | | 457 | | | 683 |
| 6 | 118 | 74 | | 165 | | 180 | | | 537 |
| 7 | 188 | | | | | 247 | | | 435 |
| 8 | 663 | 86 | 157 | 199 | | 159 | | | 1264 |
| 9 | 259 | | | 120 | | 300 | 300 | | 979 |
| 10 | 260 | 60 | | | | | 510 | | 830 |
| 11 | 300 | | | | | 240 | | | 540 |
| 12 | 131 | 60 | 78 | | | 270 | | | 539 |
| Total | 3873 | 330 | 296 | 618 | | 1853 | 810 | | 7780 |
| Palestine | | | | | | | | | |
| Month | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
| 1 | | | 98 | 66 | | | 166 | | 330 |
| 2 | | | | 68 | 62 | 178 | 66 | | 374 |
| 3 | | | 55 | 50 | | | 85 | | 190 |
| 4 | | 52 | 86 | | 134 | 88 | 33 | | 393 |

| | | | | | | | | | |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| 5 | | 111 | | | 191 | 160 | 133 | | 595 |
| 6 | | 51 | 84 | | 69 | 97 | 96 | | 397 |
| 7 | | 112 | | | 200 | 80 | 95 | | 487 |
| 8 | | 731 | | | 545 | 152 | | | 1428 |
| 9 | | 599 | 94 | | 124 | | 92 | | 909 |
| 10 | | 406 | 55 | | 194 | 510 | 99 | | 1264 |
| 11 | | 92 | 76 | | 172 | 227 | 46 | | 613 |
| 12 | | 270 | 57 | | 168 | | | | 495 |
| Total | | 2424 | 605 | 184 | 1859 | 1492 | 911 | | 7475 |
| | | | | | | | | | |
| Lebanon | | | | | | | | | |
| Month | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
| 1 | | | | | | 99 | | | 99 |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | 57 | | | 57 |
| 5 | | | | 36 | 29 | 45 | | | 110 |
| 6 | | | | 63 | 99 | 310 | | | 472 |
| 7 | | | | 58 | 12 | 361 | 264 | | 695 |
| 8 | | | | | 154 | 28 | 3 | | 185 |
| 9 | | | | | | 28 | | | 28 |
| 10 | | | | 66 | 11 | 60 | 5 | | 142 |
| 11 | | | | 68 | 2 | | 88 | | 158 |
| 12 | | | | 176 | | 25 | | | 201 |
| Total | | | | 467 | 332 | 1013 | 360 | | 2172 |
| | | | | | | | | | |
| Turkey | | | | | | | | | |
| Month | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
| 1 | | | | | | | | 252 | 252 |
| 2 | | | | | | | | 255 | 255 |
| 3 | | | | | | | | 189 | 189 |
| 4 | | | | | | | | 135 | 135 |
| 5 | | | | | | | | 74 | 74 |
| 6 | | | | | | | | 82 | 82 |
| 7 | | | | | | | | 159 | 159 |
| 8 | | | | | | | | 219 | 219 |
| 9 | | | | | | | 294 | 321 | 615 |
| 10 | | | | | | | 439 | | 439 |
| 11 | | | | | | | 349 | | 349 |
| 12 | | | | | | | 234 | | 234 |
| Total | | | | | | | 1316 | 1686 | 3002 |