WORKING GROUP ON BIOLOGICAL PARAMETERS (WGBIOP; outputs from 2022 meeting)

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i Executive summary

The main objective of the Working Group on Biological Parameters (WGBIOP) is to review the status, issues, developments, and quality assurance of biological parameters used in assessment and management.

WGBIOP plans workshops, exchanges, and validation studies on a range of biological variables to review the quality of information supplied for stock assessment and improve quality assurance and training. The group also investigates data availability and develops documentation and methods to improve communication between data collectors and end users and continues to deliver new modules and improved functionality for the SmartDots platform.

In 2021–2022, twenty-three exchanges and three SmartDots workshops were completed. Proposed future exchanges and workshops were also reviewed and approved. The further development of the SmartDots platform includes the incorporation of the maturity, eggs, and larval identification modules into the software version. A live SmartDots demonstration of progress with the new modules was presented. Work to further develop quality assurance guidelines and review national applications of these continued. Age and maturity validation studies were reviewed and a new method for prioritizing future validation work was proposed. Progress with the Stock Identification Database (SID) was reviewed and the creation of a WGBIOP library collection continued to be pursued. The importance of identifying and documenting links between all relevant databases and document repositories was reasserted with some useful diagrams describing these relationships being produced. Work continued on improving the feedback loop between data collectors and stock assessors on the usage and quality of biological parameters in stock assessment.

Moving forward, WGBIOP aims to continue collaboration with WGALES and WGSMART on the development of the SmartDots platform, encouraging the cross-working group sharing of skills and experiences to optimize results. WGBIOP aims to improve the accessibility of its outputs through updates to SID and the creation of a library repository.

ii Expert group information

Expert group name	Working Group on Biological Parameters (WGBIOP)
Expert group cycle	Multiannual fixed term
Year cycle started	2021
Reporting year in cycle	2/3
Chairs	Maria Cristina Follesa, Italy
	Annelie Hilvarsson, Sweden
	Sally Songer, UK
Meeting venues and dates	3–7 October 2022, Gothenburg, Sweden with online option (38 participants)
	Additional meetings: 10 June 2022 and 16 November 2022, online only

1 Introduction

Working Group on Biological Parameters

The main objective of the Working Group on Biological Parameters (WGBIOP) is to review the status, issues, developments, and quality assurance of biological parameters used in assessment and management. In this mid-term year (2 out of 3), WGBIOP was held as a hybrid meeting due to the continuing challenge of COVID-19 measures, but also to ensure accessibility to as many members as possible. As with the 2020 and 2021 meetings, online plenary and subgroup meetings were spread over the year with additional intersessional work on deliverables as required.

WGBIOP reported on the exchanges and workshops which had been conducted in the year to date. All these calibration exercises were coordinated using SmartDots an online platform for sharing images and facilitating comparisons of interpretation and identification between readers and stagers. Work has continued to develop this platform, feedback from event coordinators has been compiled and the effectiveness of YouTube video tutorials evaluated. A live demonstration of the new reporting module was conducted during the WGBIOP meeting. Development of maturity, egg and larval identification modules has been funded and WGBIOP will continue to work closely with WGALES and WGSMART on the development of these.

WGBIOP reviewed and approved proposed new exchanges and workshops to be held in the coming months, where possible, WGBIOP is working to ensure that these are informed by the benchmark list.

Continued low levels of agreement in biological parameters were reported for some stocks, so an in-depth review of validation work both for age and maturity was undertaken and a revised method for identifying and prioritizing new validation studies was proposed. A need for all validation-related tasks to be assigned to one Term of Reference was identified last year and this year these activities were all included under ToR A. A new schedule for the completion of the Cooperative Research Report (CRR) handbook on maturity was agreed with the aim of submission by January 2024. Guidelines for quality assurance were reviewed and their application in national laboratories was considered.

A task force was created to discuss guidance for creating reference collections, diagrams were created showing the interrelationships between the various databases of interest to WGBIOP, and an update was given on progress with the development of SID. An afternoon of scientific presentations on current validation studies was also delivered.

To improve transparency between data collectors and stock assessors regarding which biological parameters are being used in stock assessment and how the quality of these data has been assured, work continued on the Quality Indicator table. Response rate to the questionnaire which requests data to populate this table has improved from last year, but WGBIOP continues to look for ways to improve engagement further.

2 Progress report on ToRs and workplan

2.1 ToR a. Plan and prioritize validation studies, workshops and exchange schemes on stock-related biological variables, and review the results

2.1.1 Progress during WGBIOP 2022

This ToR is a generic ToR for the group and forms part of the WGBIOP remit. This year the subgroup working on this ToR worked on the following points:

- The identification of age-related issues of stocks up for benchmark in 2023 and onwards.
- The interactive table of workshops and exchanges "WK, Ex, sg History Master Table" was updated for the current year and the format changed to allow a better view.
- The subgroup reported results from workshops and exchanges which took place in 2021 and 2022 (and earlier ones)—summaries of which are available in Annex 3.
- Drafted resolutions for workshops and exchanges endorsed by WGBIOP, to be approved by ICES, for 2022 and beyond can be found in Annex 3.
- Discussed and proposed new criteria and approaches for the prioritization of validation studies in collaboration with other ToRs.
- The current status of the Data Quality Assurance Repository discussion was resumed, and the possible contribution to the new Stock Information Database (SID) platform was discussed within the subgroup and in the plenary.

A full list of exchanges has been proposed this year for 2023 and beyond with associated coordinators. WGBIOP will track the progress of proposed exchanges and workshops, facilitating the appointment of chairs, dates, and locations for workshops to convene. Results will be presented to the WGBIOP meeting in 2023/2024 for consideration.

2.1.1.1 Identify and prioritize the need for age validation studies

The issue list of the stocks up for benchmarks in 2023 was extracted from SID. The issue lists were checked for any age-related issues, and no problems were highlighted. However, it is not entirely clear whether there are no age-related issues, or if these have not been added to the SID issue list by the stock coordinator and/or assessor.

Overall, progress has been made this year by receiving the list of the 2023 benchmarks late in April; however, there are still some concerns regarding whether an early release of this list would benefit WGBIOP for coordinating proposed events in a timely manner to meet the benchmark workshop deadlines. This issue was discussed again in plenary, and it was agreed that national coordinators should be encouraged to conduct internal and informal investigations to understand whether stock assessment working groups or stock assessors and coordinators have already identified specific issues (e.g. species, stock etc.) that will be later included in the benchmark list.

2.1.1.2 Identify and prioritize the need for maturity validation studies

During the WGBIOP 2022 meeting the format of the "Master table", where information on all age reading and maturity workshops and exchanges are compiled was discussed. The group agreed that the present format is not ideal for extracting historic data, as most statistical data are stored as links to reports. The group would like to make better use of the available information to:

- Identify stocks with inherent high uncertainty in age readings.
- Identify issues relating to changes in methods or readers.
- Support the selection of stocks that would benefit from validation of age estimates.
- Facilitating data retrieval for detection of historic patterns of uncertainty in stock assessments.

2.1.1.3 Validation of age estimation

During WGBIOP 2022, a literature review was carried out to identify publications of new age validation studies. No such studies addressing stocks assessed by ICES or in the Mediterranean were found. During the meeting, an unpublished study on Baltic plaice and flounder was presented by Dr Uwe Krumme, Thünen Institute of Baltic Sea Fisheries, Germany.

The two tables containing information about validation studies were revised during WGBIOP 2022. The following actions were taken:

- Table: Annex 4, Table 1 in WGBIOP 2021 report.

This table provides an overview of existing validation studies. The group decided to revise the table containing a complete overview of validation studies by merging the information contained in it with the Master table. This will facilitate new WG participants ability to update and search for information in future.

- Table: Annex 4, Table 2 in WGBIOP 2021 report.

This table, initiated during WGBIOP 2020, provides an overview of priorities for age validation. This table was reviewed during WGBIOP 2022, and considerable doubts arose as to what the information in the table refers to. This may be due to a change in WGBIOP participants, or a formatting problem. The group also agreed that the current table format should be updated so that it contains only species and stocks that WGBIOP recommends being age validated. The prioritization should furthermore be done based on an objective approach considering information from all historic WK and EX, survey data and other auxiliary information. A proposed protocol for this is outlined in the work program for upcoming WGBIOP meetings.

2.1.1.4 Validation of maturity estimation

During the WGBIOP 2022 meeting, a subgroup of experts met to begin to define the steps to be followed for the maturity validation process.

The main identified steps can be summarized as follows:

1. Histology should be considered the basic method for validation.
2. Regarding the timeline, the validation study should be performed following the benchmark cycle of the species. Considering the difficulty to collect the most recent information on ongoing benchmarks, the calibration/validation should start the year of the benchmark to be ready for the next one.
3. The identification of the species for which to proceed with validation study should be performed on the base of the stock assessment needs, defining if the models utilize maturity as input data and which type of data (fixed data or time-varying data). In this case, the new version of SID should be useful to get access to this information.

On the basis of the identified steps, before setting a priority level, the importance of defining the list of species that would benefit from validation studies and are scheduled to be benchmarked in near future (2022-2024) was highlighted. Information on current validation studies, including work on similar species will also be taken into account during this prioritization exercise. Reports from previous ICES Workshops and Exchanges will also be consulted, then, information on quality assurance protocols of maturity data collected at the national level for the species listed will be collated, aided by the output of the ToR b subgroup. The work will focus on scrutinizing results from previous maturity calibration exercises to detect gaps in the quality assurance of maturity parameters in stocks' studies.

These priority points supersede those defined in the last report due to the new timeline: (1) benchmark cycle (2) stock assessment needs.

2.1.1.5 Stock Information Database (SID): an update

In discussion with ToR a, the question arose as to the value of providing SID with the information on workshops and validation studies at the present time as SID is currently not active. In general, it was concluded that it would be prudent to wait until SID is live. then assess whether supplying this information will be of any value to stock assessors for use in analytical assessment. If SID is a closed repository with limited access to the wider community it may not be the most correct and useful place for information regarding ageing issues, hence this information should be shared elsewhere.

2.1.2 Workplan for 2023

The subgroup will keep reviewing those exchanges and workshops that have been delayed in the last couple of years and monitor the ongoing ones. The full list of proposed exchanges and workshops for 2022–2023 can be found in Annex 3.

2.1.2.1 Master table

The subgroup agreed to work towards modifying the table into a more user-friendly format. Possible ways of doing this will be explored intersessionally in the lead up to WGBIOP 2023.

2.1.2.2 Proposed procedure for objective method for identifying which stocks need validation

During the WGBIOP 2023 meeting, the group will work towards establishing an objective approach to identifying stocks in need of validation, in terms of the accuracy of results achieved. First steps that need to be included in these discussions have been agreed as follows:

a) Definition of threshold levels for age uncertainty (PA, CV, APE).
b) Using Master table; check for temporal trends in PA, CV and APE across all existing WK and EX.
c) If values are below the agreed threshold, then no need for validation.
d) If values are above the threshold: Check if the variability is constant over time.

For example: Age-quality test of DATRAS data.

To test the impact of temporal changes in the age reading consistency, survey data should be checked for a potential drift in age readings using the CA records from DATRAS for the stock in question. Qualitative and quantitative tests should be carried out by comparing for instance mean size for a given age class over the years and within the same area for all readers/institutes contributing data to the stock assessment. If trends of the mean sizes have the same temporal patterns for all readers, then the observed uncertainty is constant. If there are temporal trends, then age readings of readers seem to have shifted over time, or the readings of potential new readers are not properly aligned with the other readers.

e) Reference collection for monitoring the performance of age readers shows a variance in results.

In cases where thresholds are continuously exceeded (a, b) and survey data show a trend in mean size at age (d), or alternatively there is a trend in an otolith reference collection for assessing age reading performance (e), there is strong and objective reason to recommend a validation study.

2.1.2.3 Reference collections

First steps towards the establishment of otolith reference collections that are to serve as 1) Training collections and 2) Quality assurance tools for assessing temporal trends in age readings have been presented during WGBIOP 2022. This work will continue intersessionally towards WGBIOP 2023. A task force has been nominated that will work towards establishing:

- Definitions of terminology of different reference collection.
- Definition of the content and potential operational framework.
- Preparation of a case study for demonstration at WGBIOP 2023.

2.1.2.4 Maturity validation

Two case studies for 2022/2023 have been identified: the North Sea plaice (*Pleuronectes platessa*) and red mullet (*Mullus barbatus*) common species in both Atlantic and Mediterranean.

The group decided to test the steps for setting a priority level by starting with the case study of the North Sea plaice (*Pleuronectes platessa*). This stock represented an ideal case study as it will be benchmarked in 2022 and a recent maturity exchange was carried out in 2020. Moreover, the 2022 plaice maturity workshop was delayed, and following the new suggested timeline, intersessional work will be done to gather the information and start the process of calibration and validation before the next benchmark. SmartDots will be used as the main exchange area.

The validation will be performed also for red mullet, a species shared both in Atlantic and Mediterranean waters, for which a benchmark will be performed in the near future (within 2023-2024).

2.1.3 Deliverables for 2023

- Identify priority species and stocks for age validation studies.
- Update the annual prioritized overview of planned studies, workshops, and exchanges.
- Update and restructure of the Data Quality Assurance Repository with WGQUALITY.
- Adding outcomes of, and links to workshops/exchanges to SID and/or SmartDots.
- Prepare a calendar of planned workshops/exchanges in SmartDots to be provided to WGSMART.

2.2 ToR b. Improve training and quality assurance of age reading and maturity staging, and other biological parameters.

During the period 2021–2023, the goal of ToR b will be to improve training and quality assurance of age reading and maturity staging, and other biological parameters.

It is important that the biological parameters used in stock assessment are of the highest quality. Concerning this, WGBIOP will gather all the information on quality assurance and accuracy estimates of biological parameter used at institute level to evaluate if improvements can be achieved.

From the previous WGBIOP exercises, the guidelines for international calibrations on age reading and maturity staging are available from the Data Quality Assurance Repository[1] but methods, routines, and protocols for monitoring the quality of age and maturity on a national level need to be standardized. Besides, there is the need to define the assurance quality scores for maturity staging, following what has been previously done with age reading assurance quality scores.

2.2.1 Progress during WGBIOP 2022

2.2.1.1 Review the current national procedures for quality assurance (with ToR c)

Quality assurance tables were received back from 18 national laboratories. The answers regarding the implementation and handling of both age and maturity quality scores were revised. The relevant information was extracted and synthesized. Based on the answers, it was discussed that in some cases the questions requiring information on quality assurance were not accurate enough, which made the task of synthesizing challenging. However, in many cases the procedures at the different laboratories were common in many aspects and were easily translated into quality assurance guidelines both on age reading and maturity staging (Annex 4). For the proper implementation of guidelines WGBIOP should publish a list of the latest published workshop/exchanges/intercalibration reports in the ICES library repository every year to help stagers find them easily and be up to date.

It was not felt necessary to resubmit the tables to national laboratories for further update, the answers that were compiled between 2021 and 2022 were sufficient to create the first guidelines. Quality assurance management tables were edited by adding an extra sheet to the file explaining each column. The column "Laboratory" was revised to only include the name of the institute and the misinterpretation between columns C ("Individual Maturity Reader") and D ("Group of Maturity Readers") was fixed.

Both WGBIOP and WGSMART expert groups are interested in defining generic assurance quality scores that can be used for both maturity staging and age reading. This is in progress and will be a collaboration between both groups.

2.2.1.2 Outline best practice guidelines in cooperation with the RCGs

Once the codes for maturity in "MeasurementCertainty" under the ICES vocabulary server are described, they should be incorporated in the ICES vocabulary server, communicating to whoever is responsible for them. To update RCGs on this regard is also important so that they can start to be used at the regional level and incorporated in the Regional Database and Estimation System (RDBES).

2.2.1.3 Prepare guidelines for the standardization and implementation in cooperation with WGSMART and continue the monitoring of them (with ToR f)

No significant progress was made during WGBIOP 2022 in regard of this task, as priority was given to finishing the first task.

2.2.2 Workplan for 2023

- Get the descriptions for AQ scores for maturity staging and include them in the quality assurance guidelines.

[1] https://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx

- Communicate with both ICES vocabulary and RCG to incorporate AQ scores for maturity.
- To get the list of all the different statistical analyses used to date in age reading method comparison exchanges.

2.2.3 Deliverables for 2023: suggest any QA improvement detected to be implemented by the RCGs

- A sound statistical comparison on age reading methods implemented in SmartDots.

2.3 ToR c. Evaluate the quality of biological parameters: Issues and review of quality of biological parameters used in assessments

2.3.1 Progress during WGBIOP 2022

The essence of this ToR is the link between WGBIOP and the stock assessment EGs. Annually the issue lists put forward for benchmark assessments are evaluated and, where necessary, action is undertaken by WGBIOP.

In 2022, ToR c prepared various deliverables:

- Compiled responses to the issue lists of stocks that are proposed for a benchmark assessment in 2023 (Annex 5; Table 3)
- Compiled information on each stock to be benchmarked detailing existing age/maturity exchanges/workshops (Annex 5; Table 3).
- E-mailed chairs of WGs dealing with stocks to be benchmarked to inform them about the WGBIOP responses to the issue lists, the results of previous age/maturity exchanges/workshops, and the planned exchanges and workshops.
- Followed up the replies from stock coordinators and gave feedback (where it was relevant; Annex 5; Table 4)
- Reviewed the use of the Stock Information Database (SID) in delivering issues for upcoming benchmarks and provision of WGBIOP information to the assessment groups.
- Collated and summarized the responses from Stock Coordinators who filled in the Quality Indicator Table for their stocks (Annex 5; Table 5).

Identified a source of potential bias in age readings using calcified structures—different methods of age readings for one species.

2.3.1.1 Biological parameters (age and maturity) of stocks up for benchmark in 2022-2023

The issues put forward by the assessment working groups for the upcoming (2023) benchmark stocks were collated mainly from SID and the issues were discussed. If no issue list was available, biological parameters issues were sought in the Stock Annex. Moreover, the subgroup scrutinized results from previous age and maturity calibration exercises for those stocks. Any necessary response from WGBIOP was recorded in a table (Annex 5; Table 3). Most of the stocks using age in the assessment, which are going to have a benchmark in 2023 had an age exchange recently. This information was shared with the ToR a subgroup dealing with new upcoming workshops and exchanges.

The goal was to inform the working group chairs and stock coordinators about the outcome of the most recent age and maturity exchanges and workshops, and to detect gaps in the quality assurance of biological parameters. Thus, the available information was communicated to stock coordinators via e-mail and added as a comment to the Stock Rolling Issue Lists on SID. In most cases e-mails were sent to stock coordinators.

Responses from Stock Coordinators received as feedback on WGBIOP 2020 comments to issue lists were followed-up (Annex 5; Table 4).

2.3.1.2 Review of SID

ICES Stock Information Database (SID) holds annual information for all ICES stocks and is currently under development. The Rolling Issues List is one of its modules, which is designed to store all the known issues for each of the stocks in one place. This module is particularly important to ToR C, as it makes all issue lists easy to find and accessible. However, it still needs some improvement with regard to engagement from the stock assessment groups, as issue lists are available only for some stocks. Stock coordinators should be strongly encouraged to add issue lists for their stocks to that module. This is particularly important for stocks, which are going to be benchmarked.

Another useful feature of the SID Rolling Issues List is the possibility to leave a comment addressed to a stock coordinator under each issue. WGBIOP started to use this function in 2020. Comments were added under respective stocks in SID, as well as sent to the stock coordinator via e-mail. All responses to those comments were received by WGBIOP with an e-mail. There is no evidence that stock coordinators were reading the comments left in SID by WGBIOP, as none of the stock coordinators added their comment on SID. Therefore, a notification for stock coordinators once a comment is added to SID would be beneficial. If the system could send such notifications, e-mail communication with the stock coordinators could be replaced with communication via SID. The main advantage of this solution is that everyone using SID could follow the discussion.

WGBIOP would also benefit from a link to recent age and maturity exchange/workshops being added to SID under each stock. This was discussed with ToR A.

2.3.1.3 Quality Indicator Table

The aim of evaluating the quality of biological parameters, several quality indicators for biological parameters were formulated in the first 3-year term of WGBIOP (2015–2017). In the following years, a Quality Indicator table was created first in .xls format and afterwards in an interactive form to better serve the data providers. The table, covering the entire workflow from the data collection to the stock assessment model runs, has been made available on Google Drive. The link to this table has been sent out to chairs of most of ICES stock assessment Working Groups, who were asked to distribute it among the corresponding stock coordinators. WGBIOP didn’t get the responses to all stocks, therefore the table was sent out once more before WGBIOP 2022 to all Working Groups’ chairs in order to collect the information for the missing ones.

In 2022 WGBIOP received responses for 159 out of 265 stocks enquired. All of them were summed up and a qualitative evaluation of biological parameters for available stocks was performed (for details see Annex 5; Table 5).

However, for some stocks, not all questions were answered, as the stock coordinators did not have a comprehensive knowledge of input data for their stocks. It was suggested that some of the questions should be addressed to national data submitters. Not all stocks coordinators who answered the questions were aware of calibration exercises carried out for their stocks.

Although a response was only received for 60% of the stocks for which information was requested, this was higher than the 31% response rate received last year. Those answers given are useful and give a valuable insight into the quality indicators of the biological parameters used in the stock assessment process. The answers obtained for the 41 questions (in number and %) and a more detailed analysis of them is shown in Annex 5; Table 5.

In the last 2-year term we used the QI Table to collect information for ICES stocks only. During WGBIOP 2022 it was suggested that it should be extended to include the Mediterranean stocks and sent out to the GFCM Working Groups, as well.

2.3.1.4 Validation studies

Further work on a list of stocks in need of validation studies (initiated during WGBIOP 2020) was carried out together with ToRs a and b. Because it was difficult to coordinate the work intersessionally, during WGBIOP 2022 meeting all validation tasks were moved under one ToR. More details concerning validation can be found in sections 2.1.1.1 and 2.1.1.2.

2.3.1.5 Potential bias in the ageing exchanges/workshops: Calcified structure or preparation methods used by different institutes.

In terms of this task, ToR c subgroup identified a source of potential bias in age readings using calcified structures.

Using the last version of the table "Material_techniques_and_preparation_methods_by_species_and_areas_for_fish_ageing" produced by WGBIOP in 2019, the number of calcified structure (CS) and preparation methods, was analysed for each species (Figure 1 and Figure 2). Among 182 species in this table, 108 species presented two or more different preparation methods (the ageing data of 59 % of species could present a potential bias due to the different preparation method of calcified structure). This will be followed up next year.

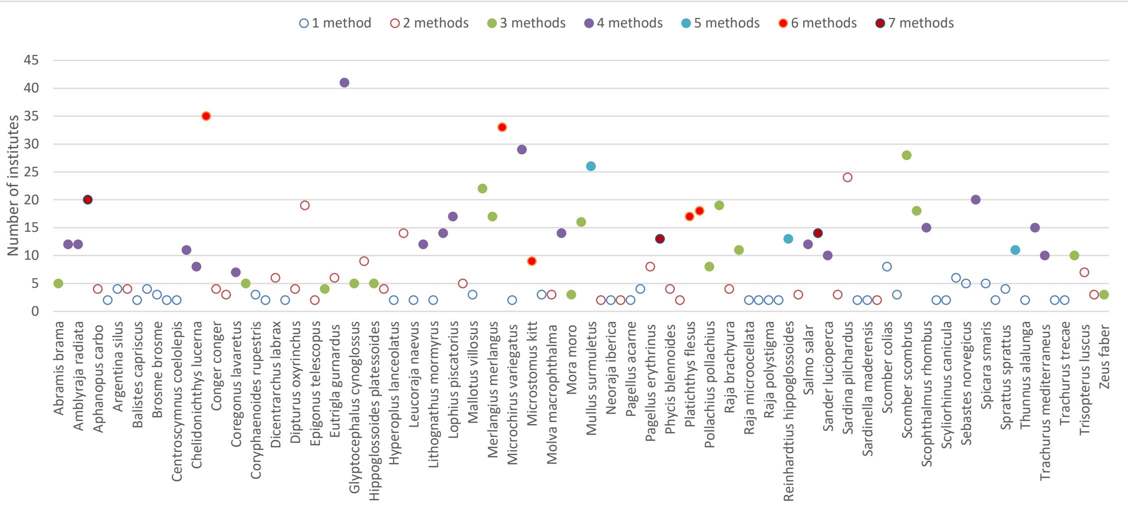

Figure 1. Number of ageing methods used by European countries, represented by the institutes, for the ageing data of each commercial species (Data extracted from WGBIOP 2019).

Among 108 species presented two or more different preparation methods, for 37 species, there is between two and four calcified structures (otoliths, vertebra, scales and illicia). For these species (i.e. *Abramis brama, Amblyraja hyperborean, Amblyraja radiate, Argyrosomus regius, Clupea harengus, Conger conger, Coregonus albula, Coregonus lavaretus, Coryphaena hippurus, Dicentrarchus labrax, Dipturus oxyrinchus, Esox Lucius, Gadus morhua, Lophius budegassa, Lophius piscatorius, Macrourus berglax, Melanogrammus aeglefinus, Merlangius merlangus, Molva molva, Mullus surmuletus, Perca fluviatilis, Platichthys flesus, Pollachius pollachius, Pollachius virens, Raja brachyuran, Raja* *clavata, Reinhardtius hippoglossoides, Rutilus rutilusn, Salmo salar, Salmo trutta, Sander lucioperca, Sarda sarda, Squalus acanthias, Thunnus thynnus, Trisopterus esmarkii, Xiphias gladius, Zeus faber)*, the potential bias of ageing data from several institutes/countries could be more significant.

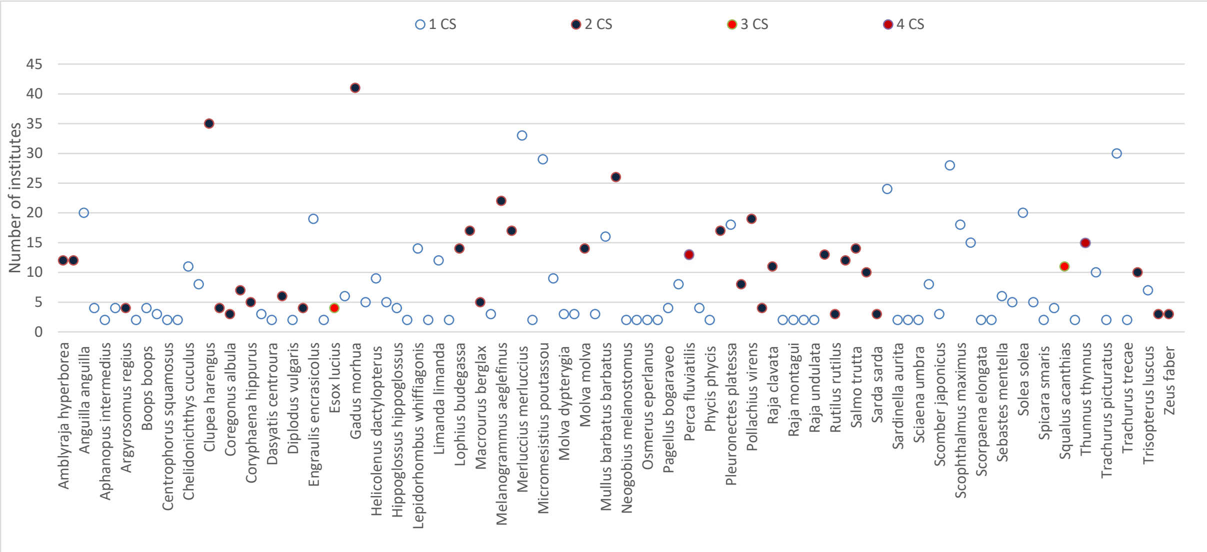

Figure 2. Number of calcified structure (CS) used by European countries, represented by the institutes, for the ageing data of each commercial species (Data extracted from WGBIOP 2019).

2.3.2 Workplan for 2023

- Continue the work with the issue lists on an annual basis and consider the feedback from stock assessment EGs.
- Communication with stock coordinators of stocks up for benchmark in 2024 regarding the results from the latest exchanges/workshops available for their stocks.
- Review the use of Stock Information Database (SID), after all functionalities are ready to use.
- Create an overview of quality and accuracy estimates of biological parameters currently used in assessments. A reminder with the Quality Indicator Table is going to be sent out again to ICES Working Group chairs in order to collect the information for the missing stocks. Moreover, the first attempt to collect information about Mediterranean stocks is going to be made by sending the table out to GFCM Working Groups.

2.3.3 Deliverables for 2023

- Annual review of the benchmark issue lists.
- Responses from Stock Coordinators
- Further analysis of the updated responses from the Quality Indicator Table.

2.4 ToR d. Investigate and develop data availability, documentation, and methods to improve identified biological parameter estimates, as input to assessment models

2.4.1 Progress during WGBIOP 2022

2.4.1.1 Implementing age error information in assessments

Work on this topic continued following the Workshop on use of Ageing and Maturity Staging Error Matrices in Stock Assessment (WKAMEMSA) held on 27–29 September 2021.

During WGBIOP, an e-mail questionnaire was sent to the coordinators of current age reading workshops and exchanges asking if error matrices were produced, sent to the stock assessors and if there were any indications that the matrices will be used in the assessment. Responses were limited but most workshops are producing an age error matrix and are supplying them to the stock assessors, e.g. for sandeel stocks, Baltic cod, and sprat. Where requested, raw data from the workshop or exchange would also be supplied (as agreed in WKAMEMSA) to estimate the errors directly in the stock assessment model. With regards to the salmon scale exchange only preliminary results are available and no age error matrix is produced at the moment.

It was indicated that there are concrete plans to implement the age error matrix into the assessment for some stocks (North Sea plaice and Northeast Atlantic mackerel) according to the coordinators. Information given by Alfonso Pérez Rodríguez from WKAMEMSA indicates that work on some case studies (Iberian sardine, blue whiting, NEA mackerel) is ongoing in cooperation with Anders Nielsen, and a meeting of WKAMEMSA members is planned for the end of October/beginning of November 2022 to address current issues.

The use of maturity error information has had less uptake, as no information on the implementation on maturity error matrices in the assessment models was available.

2.4.1.2 Roadmap for WGBIOP to work with FishBase

At WGBIOP 2021, it was proposed that WGBIOP members collect peer-reviewed literature and data from other relevant sources to update information stored on FishBase.org and fill gaps on biological parameters, for example maturity, fecundity, L50, max Lt, VBL growth parameters, and maximum age. Recognizing the scale of this ambition, WGBIOP 2022 discussed example stocks to test the idea on. Based on individual expertise, red mullet in the Mediterranean Sea and Atlantic herring in the Baltic Sea were put forward. In addition, a workshop on lemon sole (*Microstomus kitt*) maturity staging is being planned for 2024 so a review and update of the limited information on lemon sole maturity in FishBase (three records) will be suitable as part of preparation for the workshop. However, one challenge is that the maturity studies table in FishBase does not include a literature reference for each row of the table, we will need to establish if references are available at this level.

2.4.1.2.1 Models for life-history parameters for all species

Using data from FishBase, considerable developments have occurred in modelling life-history parameters for all species (Thorson, 2019) and making them accessible via the R package *FishLife*[2].

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[2] https://github.com/James-Thorson/FishLife

Therefore, WGBIOP can investigate predictions of age and length at maturity for stocks of interest and compare them to values currently being used.

2.4.1.3 Overview of quality assurance for stomach sampling

WGBIOP previously proposed the ICES Workshop on Operational Implementation of Stomach Sampling (WKOISS) to agree topics such as data storage and index calculation protocols. This was discussed with the chairs of the ISSG Regionally Coordinated Stomach Sampling. The current situation is that the regionally coordinated stomach sampling program ("pilot study") in the North Sea started sampling during IBTS Q1 2022. There is a need to address questions on the analyses of the samples and the exact protocol to follow before the next sampling period starts in Q1 in 2023. Therefore, an RCG workshop will meet online on 16 and 17 November to work on the sampling scheme and manual. This work is required at short notice and is mainly focused on the North Sea, Skagerrak and Kattegat, so is not a wider ICES workshop but it would feed into one.

Further details on the pilot study development are available from RCG NANSEA and RCG Baltic, 2022[3].

To avoid duplication, WGBIOP decided to remove the proposal for the ICES Workshop on Operational Implementation of Stomach Sampling (WKOISS). There remains support from WGBIOP and the ISSG for the topics promoted in the WKOISS terms of reference, so these can be revisited as studies develop across different regions.

2.4.1.3.1 EU Lot proposal

Also relevant to stomach sampling, a new EU Lot proposal “Food web interactions (SC10): Study on stomach content of fish to update databases and analyse possible changes in diet or food web interactions”, coordinated by DTU-Aqua, has been submitted under framework contract EASME/EMFF/2018/011. The proposal aims to improve the available scientific knowledge through (1) supporting the analysis of stomach content of collected stomachs in the Baltic and the North Sea, (2) updating stomach database in the ICES data portal and (3) conducting preliminary analysis of possible changes in trophic chains over the last decades.

2.4.1.4 Assessment information sheets for ageing events

Work continued on providing information to the coordinators of calibration events on the data (and its format) required and/or used in the assessment models. A stock assessment information sheet for age readers (as outlined in WGBIOP 2021) was supplied for the North Sea sandeel exchange. Before WGBIOP 2022, the ICES data centre supplied a full list of stock co-ordinators and stock assessors to WGBIOP to make completing these fields in the information sheet straightforward in future. The next step will be to investigate automated reporting to generate these sheets.

2.4.1.5 Links to WKBIOPTIM

The Workshop on Optimization of Biological Sampling (WKBIOPTIM) aims to provide tools for institutes to evaluate strategies for the optimization of their biological sampling programmes. WKBIOPTIM4 was held on the 15–19 November 2021 and WKBIOPTIM5 is planned for 2023. WGBIOP welcomed a presentation from Isabella Bitetto, one of the chairs, summarizing WKBIOPTIM’s work and plans.

Multiple methods are in development to evaluate if the current sampling effort for biological parameters (and associated resources) can be optimized without compromising the quality of

[3]https://www.fisheries-rcg.eu/wp-content/uploads/2022/08/2022_RCG_NANSEA_RCG_Baltic_TM_Part_III_Report_20220801_final.pdf

the final estimates. These include BioSimTool and SDTool from the STREAM project, which will be further developed in a project called STREAMline; the Fishpi4WKBIOPTIM package; SampleOptim which is being developed and applied in Portugal, and SampleReferenceLevel based on a summary statistic of “admissible dissimilarity value” (ADV) published in Wischnewski *et al.* (2020). The group is working on the development of an R package, and code from WKBIOPTIM4 is available on GitHub[4].

The methods considered are mainly based on historical sampling data and use bootstrap procedures. WGBIOP noted that **this approach focuses on reducing sampling for cases with large amounts of sampling**. Ensuring users and managers understand this focus is important. It was discussed that the methods could partially help to evaluate under sampling, but further simulation approaches are important here. Several tools are now available to simulate parts of the stock assessment process with different levels of detail: MixFishSim (Dolder *et al.,* 2020), SimSurvey (Regular *et al.,* 2020), and Stock Synthesis Management Strategy Evaluation[5] (SSMSE), so it would be worth considering how these relate to the aims of WKBIOPTIM.

Also, the number of samples required for ageing and maturity staging events remains a potential area for investigation in WKBIOPTIM.

2.4.1.6 Planning ahead for changing survey conditions

WGBIOP discussed how the quality and characteristics of surveyed sea areas are changing, for example, because of temperature, hypoxia, marine protected areas, windfarms, or conflict. The ICES survey working groups are aware of these issues, which will have implications for representative sampling by surveys and therefore the biological parameters calculated from the data collected and stock assessments. As a step in assessing the scale of these issues and developing a plan to address the potential differences in biological parameters if the surveyed areas change, WGBIOP recommends considering the best way of collating and sharing information on the changes occurring and alternative approaches to data collection in areas inaccessible to trawl surveys. Examples of expected information include data on the % of stock area accessible to survey gear, lists of alternative survey methods for inaccessible areas, information on environmental changes, and national regulations on access for windfarms. This proposal matches the remit of the Working Group on Improving use of Survey Data for Assessment and Advice, extending the scope of the Workshop on Unavoidable survey effort reduction (WKUSER, 2020; WKUSER 2, 13–17 September 2022).

Recommendation to WGISDAA and survey groups: IBTSWG, MEDITS, WGBIFS, WGFAST, WGIPS, WGSINS.

The quality and characteristics of surveyed sea areas are changing (e.g. temperature, hypoxia, MPAs, windfarms, conflicts). This has implications for representative sampling by surveys, the biological parameters calculated from the data collected and stock assessments. Therefore, WGBIOP requests that the survey groups assess the scale of this issue, collating and sharing information on the changes occurring and alternative approaches to data collection in areas inaccessible to trawl surveys, as part of developing a plan to address the potential differences in biological parameters if the surveyed areas change (ref ICES 2022e).

[4] https://github.com/ices-eg/WKBIOPTIM4

[5] https://github.com/nmfs-fish-tools/SSMSE

2.4.2 Workplan for 2023

- Implementing age error information in assessments—WGBIOP will continue to provide information about age reading exchanges to any case studies requiring it. We will review how much uptake of the information there is and monitor progress in including age errors in stock assessments.
- Biological parameters in FishBase.org—WGBIOP will trial collecting peer-reviewed literature and data from other relevant sources to update information stored on FishBase.org and fill gaps on biological parameters for specific examples, such as lemon sole, herring, and red mullet. Related to this, WGBIOP may investigate predictions of age and length at maturity for stocks of interest from the models in the R package *FishLife* and compare them to values currently being used.
- WGBIOP will produce additional examples of the stock assessment information sheets for age reading and maturity staging events, and the investigate ways to automate compiling this information.
- WGBIOP will consider the outputs of WGBIOPTIM and any implications and recommendations for WGBIOP.
- Developing the topic of how the quality and characteristics of surveyed sea areas are changing and affecting the biological parameters calculated for species in those areas will depend on the research of individual WGBIOP members.

2.4.3 Deliverables for 2023

WGBIOP ToR d will continue to investigate and develop data availability, documentation, and methods to improve identified biological parameter estimates, as input to assessment models.

Specific deliverables may be updated depending on membership of the subgroup and cross-subgroup working, proposed outputs are:

- Provision of age error information and data as required by stock assessors and updates on progress towards implementing age error information in assessments.
- Trial of collecting and providing information on biological parameters to FishBase.org for example stocks. This may include investigation of predictions of age and length at maturity for these stocks from the models in the R package *FishLife*.
- Additional examples of the stock assessment information sheets for age reading and maturity staging events.

2.5 ToR e. Across database developments combining biological parameter data collection and quality assurance of these data. Address requests for technical and statistical recommendations/advice related to biological parameters and indicators

2.5.1 Progress during WGBIOP 2022

Details of recent or recommendations received and responses agreed can be seen in Annex 6. Using the tables, with biological parameter data from the different data sources, which were prepared in 2021, flow diagrams were prepared during 2022. These diagrams show data flows between different databases and other data sources used for providing biological parameters in the assessment process. Examples were prepared of category 1 stocks Plaice in the North Sea and Skagerrak and North Sea autumn spawning herring, and category 5 stock red mullet in the North Sea (Figure 3.1a–Figure 3.1c).

- The Stock Information Database (SID) provides the meta data information of all stocks that ICES provides management advice for. WGBIOP has over the years provided input for the development of SID with regards to the biological parameters. It provides information such as which assessment model is used, which biological parameters are used, rolling issues with biological parameters and planning of benchmarks. Currently SID is still under development.
- National laboratories provide catch data to the Intercatch and/or RDBES. It should be noted that at the moment the Regional Database and Estimation System (RDBES) is still not fully in use. It is planned that in 2023 Intercatch and RDBES will run in parallel and from 2024 onwards all catch data should be available in RDBES. The data from Intercatch/RDBES can be catch (without separation of landings and discards), landings and discards. These data are either used directly in the assessments, or from these weight-at-age, number-at-age and mortality-at-age is determined.
- National laboratories also provide survey data to DATRAS, the Acoustic trawl surveys or Eggs and Larvae databases. From these databases various survey indices are calculated to be used in assessments.
- Maturity data for the estimation of maturity ogives can be taken from both the catch databases and survey databases.
- SmartDots is the tool used for calibration of age reading, maturity staging and egg and larvae identification and staging. Currently this can be used to assess errors in ageing and maturity staging. Workshop and exchanges provide error matrices, however in WKAMEMSA[6] it was agreed that the raw data of the calibrations should be provided to the stock assessors. Stock assessors prefer to estimate the errors directly in the stock assessment models.
- In the Transparent Assessment Framework (TAF) codes are stored to carry out the assessment and forecasts for each stock.

[6] ICES. 2022.Workshop on use of Ageing and Maturity Staging Error Matrices in Stock Assessment (WKAMEMSA; outputs from 2021 meeting). ICES Scientific Reports. 4:13. 54 pp. https://doi.org/10.17895/ices.pub.10052

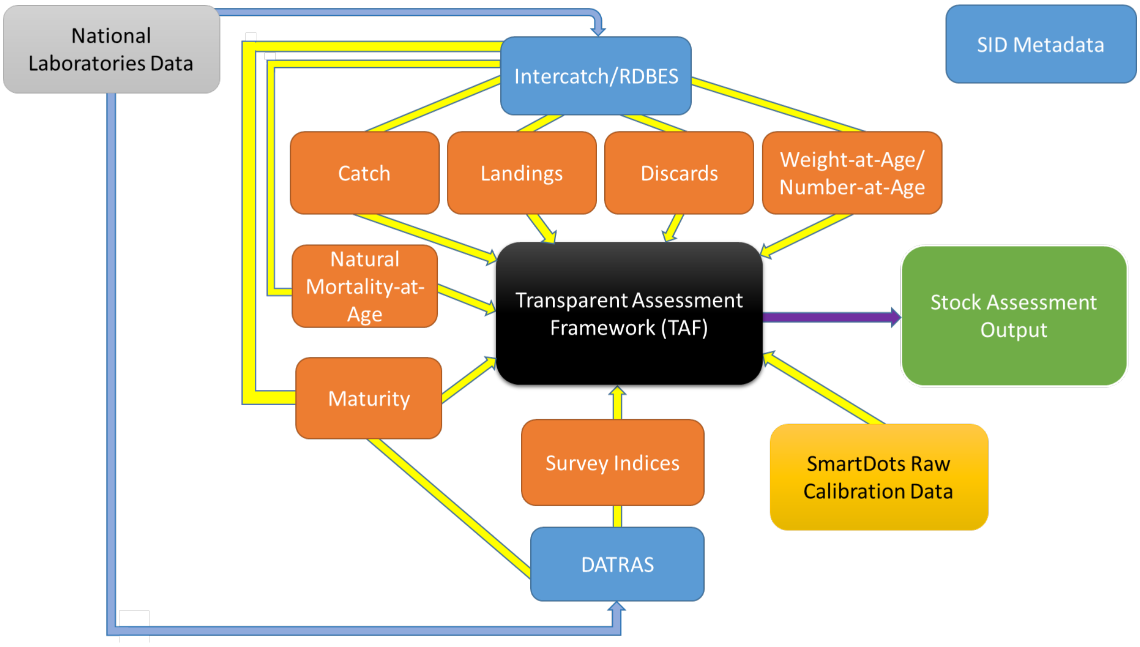


Figure 3.1a. Biological parameter data flow for the stock assessment of plaice in the North Sea and Skagerrak (PLE.27.420). Blue boxes are databases, yellow box is SmartDots, orange boxes are data, black box is the assessment in TAF. Blue arrows show the data flow from national institutes to the ICES databases, yellow lines show the data flow between databases and biological parameter estimation and the purple line shows the assessment output data.

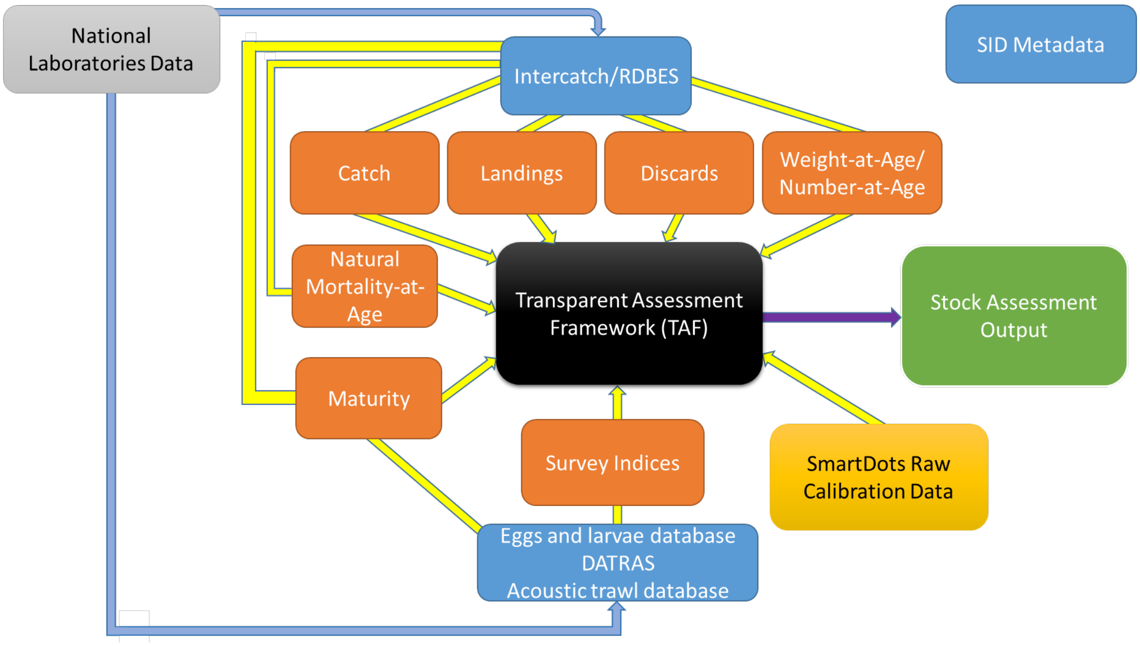


Figure 3.1b. Biological parameter data flow for the stock assessment of autumn spawning herring in the North Sea, Skagerrak and Kattegat, and eastern English Channel (HER.27.3a47d). Blue boxes are databases, yellow box is SmartDots, orange boxes are data, black box is the assessment in TAF. Blue arrows show the data flow from national institutes to the ICES databases, yellow lines show the data flow between databases and biological parameter estimation and the purple line shows the assessment output data.

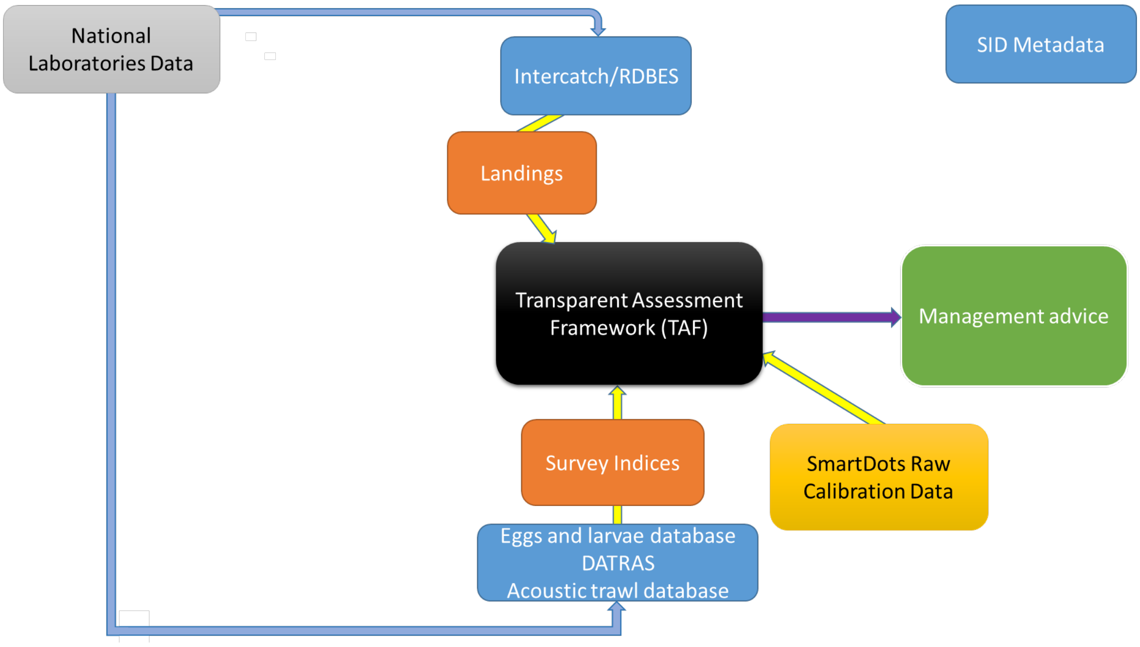


Figure 3.1c. Biological parameter data flow for the provision of advice of red striped mullet in North Sea, Bay of Biscay, southern Celtic Seas, and Atlantic Iberian waters (MUR.27.67a-ce-k89a). Blue boxes are databases, yellow box is SmartDots, orange boxes are data, black box is the assessment in TAF. Blue arrows show the data flow from national institutes to the ICES databases, yellow lines show the data flow between databases and biological parameter estimation and the purple line shows the assessment output data.

2.5.2 Workplan for 2023

- Overview of which institute provides which data in the various databases.
- Provide overview of data and outputs from SmartDots and RDBES(Intercatch)/TAF/DATRAS/SID to WGQUALITY, DIG, DSTSG and RCGs and cooperate with these groups to prepare a workplan to implement connection possibilities between these databases and platforms.
- Inform stock coordinators and assessors of the available biological parameter data, quality indicators and outputs from the various databases and platforms and where they link.

2.5.3 Deliverables for 2023

- Develop workplan with WGQUALITY, DIG, DSTSG and RCGs to implement connection possibilities between SmartDots and RDBES(Intercatch)/TAF/DATRAS/SID were necessary.

2.6 ToR f. Provide feedback and guidance on updating and development of tools for exchanges and workshops on biological parameters.

Under this ToR WGBIOP is focusing on the development of the SmartDots platform[7] to make it suitable for both age reading, maturity staging, egg and larvae identification and fecundity exchanges and workshops. In cooperation with the Working Group on SmartDots Governance

[7] http://ices.dk/data/tools/Pages/smartdots.aspx

(WGSMART) feedback from the users (mostly members of WGBIOP) are received, reviewed, and prioritized to continuously improve and develop the platform. Funding opportunities for development of SmartDots and the development of the reporting module was also part of our focus.

2.6.1 Progress during WGBIOP 2022

During WGBIOP 2022 the subgroup has focused on:

1. Compiling comments and feedback from WGBIOP exchanges and workshops and list requirements for the coming years.
2. Evaluation of the tutorial videos on the SmartDots YouTube channel.
3. Providing feedback to WGSMART
4. Running a SmartDots session at WGBIOP 2022.
5. Cooperation with WGSMART on the implementation of the R-script.
    a) Development of reporting module
    b) Modifications to age reader expertise
    c) Testing the reporting module (in progress)

2.6.1.1 Compile comments and feedback from WGBIOP workshop and exchanges

For the period September 2021–September 2022 twenty-three age reading events, two larvae events and two maturity events took place in SmartDots (see: https://smartdots.ices.dk/ViewListEvents) with seven published.

Prior to WGBIOP a request was sent out to coordinators of exchanges and workshops which took place since WGBIOP 2021 requesting feedback through the feedback website[8] on the use of SmartDots by the users and for workshop purposes. Issues were compiled, categorized, and reported to WGSMART via the WGSMART GitHub[9], for evaluation by WGSMART. The input was categorized into general feedback, and feedback towards the use of the SmartDots tutorial videos on YouTube.

Table 1. General feedback compiled from the SmartDots feedback page (or directly by e-mail).

Theme	Feedback	Comment
Area information	From WKMACHIS on sample information: instead of given FAO/ICES area location information only, which not everyone knows by heart, a more explicit information on the catch location would be very helpful.	For all sample upload files, add link to map lookup (now exists in sample upload file for Ageing).
Areas/stocks missing	As coordinator of the 423 WKARCM2_Otolith Exchange 2022 event, I would like to point out that the biggest problems I have encountered are mainly due to the fact that it is the first time I have used the platform, I have had quite a few problems, but they have been due to this, to lack of knowledge in handling. But I want to thank the enormous help that Carlos Pinto has given us. The only comment is that there are origins that are not admitted, in our case in this Exchange we work with samples from the Canary Islands 34.1.2 and Morocco 34.1.1 and it has been impossible for us to enter these origins separately, they have been entered as area 34, and we were interested in analysing these two areas separately.	

[8] https://smartdots.ices.dk/Userfeedback

[9] https://github.com/ices-eg/SmartDots/issues

Theme	Feedback	Comment
Changing colour/ brightness/ contrast on images	No possibility to change colour, brightness,or contrast on images, which is highly relevant to analysing atresia.	Concerns Fecundity and atresia module
Colour of reader's annotations for discussion	When viewing multiple readers annotations on an image for discussion purposes it is very difficult to follow which annotations belong to which readers when the colours of the dots assigned to a reader change when a second (and more) readers annotations are selected for viewing with the other annotations that were previously selected. Is it possible to assign dot colours to a reader and use them consistently from image to image?	
Output - CV table	In the CV table for advanced readers (WKARP2), there are percentages in the column 'All' but no percentages in the columns of the readers. It says in the table text that the 'All' column should contain 'CV of all advanced readers combined per modal age'. The wording (i.e. 'combined') seems unclear, and also does not explain where the percentages in the 'All' column come from, as there are no percentages for readers in the other columns.	
Output - Error matrix table (AEM)	It should be clarified in the table text or in the column headings for this table that the column headings here are modal ages, and the ages in the row headings are the age readings. Otherwise, it may be confusing, as in the other tables, modal ages are row headings, in the column furthest to the left.	
Freshwater/ salt water missing from report	There is no information about freshwater and salt water age in the report or I cannot "find" this result. Only available summarized age for a particular fish. For anadromous fish it is crucial. Maybe it is not easy to extract the information.	Has been solved in data output (.csv).
Input fields	A comment field would be good to have, especially for explaining why a sample should be discarded, or to comment on areas of interest in images.	Concerns Fecundity and atresia module
Input fields	Histological questionnaire is "No" by default. It would be helpful if it would take the marks being done on the image.	Concerns Fecundity and atresia module
Instructions / Manual	Fixing the reading line: there is limited information in either of the manuals regarding fixing the reading line, we have an internal SOP that expands on this from our experience and are wondering if something similar could be inserted in the manuals. Suggestion (cited from internal SOP): x Open SmartDots app, enter your token and pick your event. x As the delegate/event manager you must fix the reading line to each image. That line will be the same for each reader to ensure consistency of ageing process. The reading line should start in the centre of nucleus. The reading line can be adjusted to the shape of otolith; it does not have to be straight. Good practice is to extend the line beyond the edge of otolith, so it is easier to annotate in that area. Once you draw the line it must be pinned to the image by clicking on the ‘PIN’ button. As you open each image the first and only thing you can do is to draw the line. Please choose the clearest axis to facilitate optimum ageing interpretation. The colour and width of the line can be changed- by expanding ‘pencil’ button on top of the image. To draw the line, you choose the start point, click left on the mouse, draw the line, click left again if want to change direction…to finish you click left and then right. If you are not happy with the line you can delete it-first unpin it and then delete. To create new one click on ‘pencil’ again and start over.	

Theme	Feedback	Comment
Inter-reader-bias test	It has been identified the need to review the inter-bias reader test. The results from the SmartDots report, produced by the R-script code, are different from the ones produced with the Guus-Eltink spreadsheet. This is already included in the tasks to be conducted in the revision of the R-script reporting (by the SmartDots team).	
Larvae expertise	It is possible to add larvae expertise to a reader, however why do I not see this in the overview expertise table or the download of the expertise table? When will it be possible to add expertise level on eggs, and fecundity/atresia? When setting up a larvae event only a list of age readers is given to choose from. Larvae can be added as expertise to readers, so why is there no larvae readers list available when a larvae event is created?	
Measurement tools	Labels are big and showing unnecessary information, get in the way of oocytes being measured.	Concerns Fecundity and atresia module
Measurement tools	Error correction is inefficient. When deleting a measured oocyte, the annotation is not completely deleted even after hitting refresh.	Concerns Fecundity and atresia module
Measurement tools	It is necessary to start exactly in the middle to measure correctly, otherwise measurement has to be deleted and webpage needs to be refreshed. Maybe easier to start a circle from the side of an oocyte, would also be useful for broken oocytes.	Concerns Fecundity and atresia module
Measurement tools	Tools are confusing and unintuitive. For fecundity exercises, tools should have explanatory labels.	Concerns Fecundity and atresia module
Quality of images	The otoliths from area IVb had extreme number of bubbles in the epoxy, which made it very difficult to place the annotations, as the bubbles made shades on the rings. There should be a quality expectation for images used in exchanges, as we spend much time on this. We are not used to reading otoliths from images, so it is extra important for us that the images are clear.	
Setting up event	Is there a maximum number of images in an event?	
Setting up event	When a coordinator creates an event, it would be helpful if an e-mail is automatically sent to the event coordinator with the guidelines for setting up exchanges and workshops.	
SmartDots slow when images are large	SmartDots becomes very slow when the images are too large. For the current event 448 we have uploaded images with the resolution 5388x3619 with an average size of 1.5MB and it takes more than 30 sec to load the image. Also annotating the image is therefore very slow. This is independent of the local Internet connection. One suggestion would be either to define a maximum size (when reducing the resolution and size to approximately 0.5 MB it is much faster) or to allow for some sort of downloading function that one could work offline.	Only .jpg or .png files should be used.
SmartDots slow when images are large	WKAEPM tested the fecundity and atresia module. The high resolution of these images makes refreshing images take a long time.	Concerns Fecundity and atresia module
Software interface	Sample information and image icon below are too close to each other in the layout.	Concerns Fecundity and atresia module
Software interface	It would be nice to have the facility to rotate images on SmartDots. (When doing the last Horse mackerel image exchange many of the	

Theme	Feedback	Comment
	uploaded images were orientated differently to the way some of the readers read them normally.)	
Video tutorials	Names of the videos are not always intuitive. They are listed in playlists if one knows how to navigate YouTube, but for those not finding the playlists, it is difficult. E.g. SmartDots Software Setup is not installation of SmartDots, but how to find the way around using the software.	
Web page - when giving feedback	The feedback page is not being very user friendly, as suggestions could only be submitted one by one, and after one suggestion, I was redirected to the SmartDots home page only and not to the feedback page. This makes feedback a rather tedious process, if suggestion would have to be submitted one by one.	After submitting, the back arrow of the browser can be used, then the next feedback can be written over the already submitted text, and 'submit' can be pressed again.

2.6.1.2 Evaluation of the tutorial videos on the SmartDots YouTube channel

Feedback on the SmartDots video tutorials was requested from age reader coordinators and their age readers in advance of WGBIOP. Users were requested to give feedback through the feedback website[10]. The feedback received was positive and all users found the tutorials to be very clear, concise, and easy to understand and follow. A suggestion received on improving the naming of the tutorials so they are easier to find was well received and will be passed onto WGSMART.

Based on the positive feedback it was decided that the same format should be followed when providing training for the agers, stagers and ID'ers on the new maturity and ichthyoplankton modules. A 2-day online workshop for event coordinators may also involve recording training tutorials.

In 2020, the first tutorial/training videos were created an added to the SmartDots YouTube channel[11]. There are now eleven videos about the SmartDots software to help the readers using the tool, 5 videos about the SmartDots web application, two videos on reporting and one video on maturity staging.

The SmartDots channel is definitely not the most popular YouTube channel, but the target group is of course very specific. Since publishing we had in total 1540 views.

2.6.1.3 Providing feedback to WGSMART

All categorized feedback was entered into the WGSMART GitHub site[12] for evaluation by the group. The following points were discussed during WGBIOP:

It was commented that for several species, image quality is crucial. All parts of the otoliths need to be clear. In response to a recommendation from WKARP2 the group agreed that instead of a small workshop, a manual will be compiled which can be used at institutes who are photographing otoliths for calibration purposes. These guidelines will also cover photographing gonads for maturity staging and egg and larvae for species identification. The manual will be worked on intersessionally and made available in 2023. Accompanying guidelines will include ensuring

[10] https://smartdots.ices.dk/Userfeedback

[11] https://www.youtube.com/channel/UCa4bjXo-eBDfW0cm1oElWeQ

[12] https://github.com/ices-eg/SmartDots/projects/3

that experienced age readers for the specific species/stock being photographed are consulted, especially when placing the reading lines on the images.

Issues for long lived species (exchange prior to WKARDEEP3) were discussed during WGBIOP. At the moment there are no resources to develop the software in line with what is needed and considering that for many of the species age data are not being used for stock assessment purposes, it is recommended that SmartDots is not used for long lived species at the moment.

Feedback received from aging events included comments on the report, these are outlined in Table 1. Summary of the last updates and the reviews still needed for Maturity and Age R-script reporting module in SmartDots.

Feedback received from larval events included missing use of information on reader expertise in the download expertise table, making it difficult to run an exchange properly.

Feedback received from fecundity events included needs for improvement of the measurement tools, which need to be more flexible and explanatory. Also, there is a need for being able to change the settings (light, colour, brightness, contrast) of the images during reading, and to write comments.

Other general issues were to a large extent caused by readers not being aware of the functions already existing and event coordinators not providing information to the readers before the exchange or workshop (or the reader not reading the information). It is evident that clear and event-specific instructions to participants are needed, for example, regarding what should be annotated (should non-counting marks be used and how), why a reading line is included, etc. In connection to the communication, it was requested to provide an interface in languages other than English.

2.6.1.4 Running a SmartDots session at WGBIOP 2022

During WGBIOP a presentation of the New Module Development was given. Not all WGBIOP members were able to attend so the session was recorded and is available on the WGBIOP SharePoint 2022 Meeting Documents/Presentations. The following main points were outlined:

- An official request has been made from DGMARE and DEFRA UK to ICES to implement the following features in the platform: separate maturity, egg and larvae modules in the software, corresponding changes to the webAPI and webpage. All testing, documentation and user training is requested.
- The existing age reading module will serve as a template for how to further develop the maturity and egg and larvae modules. This will ensure a wider range of biological data can benefit from the quality assurance processes that the age data are currently subject to, it will further allow the standardization of procedures and data output and continue to support the ICES QAF. Streamlining the modules will allow the QA procedures for biological parameters as input to the stock assessment process to be streamlined; will make the platform more user friendly, will allow for more efficient training (manuals and tutorials); improve efficiency of the development of new features and report developments.
- Funds initially set aside for a physical workshop for coordinators will be used for report development.
- Cooperation with maturity experts within WGBIOP. Mock-ups of the new maturity module were presented, and positive feedback received. Questions on the use of more than 1 maturity scale were addressed and clarified.
- Work is underway and the maturity module is expected to be releases by the end of 2022. Updates to the age reading module will also be included in the new release.
- Cooperation with WGALES ichthyoplankton experts on data output and image requirements, incorporation of feedback from WKMACHIS and WKIDCLUP2

- Training requirements were discussed and a 2-day online meeting for training event co-ordinators will be planned for March 2023 when the modules are completed. Based on feedback from the YouTube tutorials it was agreed that this format of training will be continued for the series of 3 online training modules for the users.
- The following points were clarified for the group:
    - Fecundity and Atresia module will remain in the WebApp.
    - SmartDots@home: the possibility to have a generic version of SmartDots which individual institutes can use in their labs for internal quality assurance will not be pursued. The needs of the various institutes are too diverse to accommodate.
    - Offline version: this could still be an option in future.

2.6.1.5 Cooperation with WGSMART on implementation of R-script

(a) Development of reporting module

The new R code developed for the reporting modules (both maturity and multi-mode aging) has been tested throughout 2022. Punctual corrections for bug fixing and optimizing have been done (Table 2), and a larger official release within the ICES TAF framework is planned for early 2023. This version will incorporate feedback on the maturity module and reporting script gathered during WGBIOP2022, as well as the multi-mode aging module developed throughout the last two years.

Table 2. Summary of the last updates and the reviews still needed for Maturity and Age R-script reporting module in SmartDots.

R-script for reporting	"Issue" description	State of revision
Maturity	Sample overview R-function with more than one levels (e.g. maturity stage and sex) sometimes the R-script crashed	Concluded
Maturity	The numbers showed in the maturity report in the following text part: The average percentage agreement by modal sex category for all stagers was 0.021, with a weighted average CU of 178. Regarding the maturation staging, the percentage agreement by modal maturation stage was 0.319, and the weight average CU was 178.	Concluded
Maturity	Table X: Sex categorization table: presents the number of categorizations made per expert for each modal sex category. Issue: The whole table gives the same results for all stagers, but it is not the case when you look at the results	Concluded
Maturity	Table X: Maturity staging table presents the number of stagings made per expert stager for each modal maturity stage. Issue: The whole table gives the same results for all stagers, but it is not the case when you look at the results	Concluded
Maturity	Table X: Coefficient of unlikeability (CU) by modal sex category and by modal maturity stage Issue: the output results on those tables aren't from CU	Concluded
Maturity	Table X: Percentage agreement (PA) table Issue: the PA for all stagers here not included in the table	Concluded
Maturity	Tables formatting Issue: the last column on the tables in bold. Should not be in bold at least the last column is the total	Concluded

R-script for reporting	"Issue" description	State of revision
Maturity	Table X: Frequency bias table Issue: rounding to only 3 decimal numbers	Concluded
Maturity	Issue: Download data from the SmartDots didn't include the indication of the samples with histology and the microscopic maturity stage (validate maturity stage)	Concluded
Maturity	Produce the maturity output results with the input data from 9. (histology validation)	Ongoing
Maturity	Report tables the results from the two last stagers had been removed/not shown (e.g. EventID 398, R30BE, R32 GR)	Ongoing
Age	Sample overview R-script	Concluded
Age	Plot axes	Concluded
Age	Review and compare the report with "new/revised" from the maturity to check the needed changes	Ongoing
Age	AEMs Issue: the sum on the numbers on the output table are wrong	Concluded
Age	Inter-readers bias test	Planned to be reviewed
Age	Comparison between the old and multistage approach	Planned to be reviewed

In addition, closer cooperation has been made with TAF representatives to get active assistance on the implementation of SmartDots reporting modules within the ICES-TAF framework going forward. This will provide more flexibility in pushing new releases of the SmartDots reporting modules to the official repositories.

(b) Modifications to age reader expertise

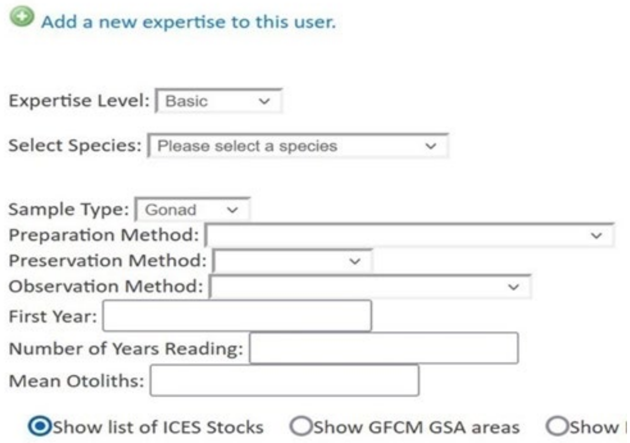
Prior to the meeting the web page for user expertise was developed. This was due to the new reporting script that can generate a report using single or multi modal age comparisons. For the latter the coordinator will have to make sure that all the age readers have inserted the necessary information into the database. For this reason, the SmartDots age skill database was extended to allow coordinators to save in the database the number of years that the reader was reading that stock and the mean number of otoliths.

These are the fields that the country coordinator must now enter for each age reader:

Expertise Level: {Basic, Advanced} *
Species: https://www.marinespecies.org/ *
Sample Type: {Gonad, Otolith, Scale, Vertebra, Illicium, Larvae, Egg} http://vocab.ices.dk/?ref=1507 *
Preservation Method: http://vocab.ices.dk/?ref=1507
Preparation Method: http://vocab.ices.dk/?ref=1511
Observation Method: http://vocab.ices.dk/?ref=1628
First year: between 1950 – 2022
Number of Years Reading: between 0-50
Mean Otoliths Read per year.
Stock or GFCM Area or ICES Area: Stock (http://vocab.ices.dk/?ref=357), GFCM Areas (http://vocab.ices.dk/?ref=1517) or ICES areas (https://vocab.ices.dk/?ref=358)*

For that the country coordinator has the form in figure xxx where the coordinator can insert the expertise of the user.

* Mandatory fields {Expertise level, Species, Sample Type and Stock Or Area}



Before this development the reader expertise for a given stock has so far been characterized by either “basic” or “advanced” and then ranked by the event coordinator, where the latter is based on whether a reader’s age estimates are used in stock assessment. With the elaboration of the multi-mode approach, finer-scale details are now required to weigh the expertise of the different readers using the number of reading years and the mean number of otoliths read annually. As such, expertise can be compared even between advanced readers, which is especially useful for weighing between different modal ages and determining the likeliness of one being “true”. With an ever-increasing number of readers each with multiple stock/method combinations and respective stats, keeping the reader expertise up to date in the SmartDots database can become cumbersome. During WGBIOP2022, it was instead discussed that reader expertise should only be updated by the country coordinator when specific readers are taking part in a new event rather than as a routine. Automated methods such as incrementally adding another year of expertise on January 1st every year were also discussed, although this would cause issues in cases where experts are on leave or not reading for a given period.

(c) Testing the reporting module (in progress)

The reporting module for maturity was tested with SmartDots events such as maturity staging exchange of Rajidae species. Feedback reported by the event coordinator and participants has been brought up during WGBIOP2022 and partially addressed in the code. Future testing will focus on wrapping the current issues and assess whether the code is ready to be pushed for production in the ICES TAF framework.

For multi-mode aging, a potential issue has been discussed during WGBIOP2022 in relation to assessment and ranking of reader expertise when multiple preparation and observation methods, each with their respective expertise, are used within a single event. As the rest of the module is almost ready for production, future testing will focus on developing possible alternative methods for determining reader expertise within an event when multiple methods are involved.

2.6.2 Workplan for 2023

- Compile comments and feedback from WGBIOP exchanges and workshops and list requirements for the coming years.
- Provide feedback to WGSMART.
- Delivery of feedback on testing the multimodal age approach to WGSMART.

- Development of the SmartDots reporting module in cooperation with Tor D and implementation of the R-script in cooperation with WGSMART.
- Input from WGBIOP on format (YouTube tutorial or online workshop) for training on new SmartDots modules, both for event coordinators and readers/maturity stagers (users).
- Tasks to be planned accordingly for the new maturity and ichthyoplankton modules.

2.6.3 Deliverables for 2023

- List of requirements for the coming year will be evaluated and provided to WGSMART.
- Presentation of the new SmartDots age, maturity and ichthyoplankton modules.
- Delivery of feedback on the reporting module to WGSMART.
- Evaluation of the tutorial videos on the SmartDots YouTube channel. Based on this evaluation, future training requirements to be proposed.
- Incorporation of recent feedback in the development of image quality guidelines for SmartDots events.

2.7 Other achievements

2.7.1.1 Scientific presentations on validation studies

A series of scientific presentations on current validations studies was delivered, these included work on: An age validation study on Baltic plaice and flounder (by Uwe Krumme), Bomb radiocarbon for age validation studies (by Allen Andrews) and Methods and age structure comparison with microchemical analyses of otoliths and scales (by Yvette Heimbrand).

2.7.1.2 CRR Handbook on maturity staging of marine species

During the WGBIOP 2022 the latest overview of the CRR: Handbook on maturity staging of marine species was presented by the editors. The drafting of the different chapters has been further delayed due to the covid situation. It was planned to be submitted by the end of 2022, but this has been postponed.

A plan for 2022–2024 was presented to finalize and submit the CRR by the beginning of 2024 as follows:

1. October 2022: Editors return comments to chapter leaders, which in turn send them to the co-authors.
2. February 2023: Editors receive revisions.
    - Further discussions between editors, chapter leaders, and authors.
3. October 2023: Present final full draft for WGBIOP comments
    - Address WGBIOP comments.
4. January 2024
    - Final submission to ICES.

2.7.1.3 Cooperation with other working groups – WGALES and WKBIOPTIM4

WGALES

A chair from WGALES presented their work during the meeting and a chair from WGBIOP presented at the WGALES meeting. Discussions were also held to decide which group should be responsible for what and where we can help each other. This collaboration may lead to some members of WGALES joining WGBIOP to increase the number of members working with ichthyoplankton with the aim of strengthening our knowledge in this field to be able to improve the quality assurance.

WKBIOPTIM4

A chair from WKBIOPTIM4 presented their work and the plans for the future. WGBIOP still wants help with sample size design for exchanges and potential other events. A recommendation is written about this.

2.7.1.4 Reference collection discussion

First steps towards the establishments of otolith reference collections that are to serve as 1) training collections and 2) Quality assurance tool for assessing temporal trends in age readings have been presented during WGBIOP 2022. This work will continue intersessionally towards WGBIOP 2023. A task force has been nominated that will work towards establishing:

- Definitions of terminology of different reference collection
- Definitions of the content and potential operational framework
- Preparation of a case study for demonstration at WGBIOP 2023

2.7.1.5 Plaice reference collection event

After the WKARP2 in December 2021 a subgroup of 4 persons have worked on creating a reference collection of plaice images in SmartDots. A short presentation was given at BIOP. Images from 2 exchanges (event 281 and event 402) were used to find the first images with 100 % agreement on ages from the 8 advanced readers of plaice in Skagerrak and the North Sea. This resulted in 45 samples, to increase the number of samples, 30 images with an 80-99% agreement from the advanced readers were re-read by the advanced readers. 10 images improved their agreement to 100% and the rest were looked at and discussed during an online meeting, this increased the number of images with a 100% agreed ages by 23 samples. In total 68 images have been added to a new event (event 409) on SmartDots.

For a reference collection on images to work in SmartDots some functions must be changed or added, and therefore a wish list was started by the subgroup:

- Marking and reuse of images in other events
- The fixed annotation lines.
- Advanced readers agreed reading annotation (shown and hidden)
- Function so that organizers/readers can select a subsample e.g. based on:
- training purposes (e.g. 100% and 80% agreement) vs. test (‘normal’ sample)
- random
- area
- quarter
- age etc.
- Reference collection nr (especially for test collections)

3 Next WGBIOP meeting

The next full WGBIOP meeting will be held in the week of 23 October 2023 in Donostia-San Sebastián, Spain.

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Annex 2: Resolutions

The **Working Group on Biological Parameters** (WGBIOP), chaired by Annelie Hilvarsson, Sweden, Maria Cristina Follesa, Italy, and Sally Songer, England, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2021	5 – 7 October ~~4-8 October~~	Remote ~~Gothenburg, Sweden~~	Interim report by 15 November to DSTSG	Was turned into online meetings divided over the year with intersessional work sessions and meeting by subgroups to complete the work for WGBIOP 2021
Year 2022	3-7 October	Gothenburg, Sweden	Interim report by TBD to DSTSG	Hybrid with intersessional online subgroup chairs meetings.
Year 2023	23-26 October	San Sebastian, Spain	Final report by TBD to DSTSG	Hybrid with intersessional online subgroup chairs meetings.

ToR descriptors

ToR	Description	Background	Science Plan Codes	Duration	Expected Deliverables
a	Plan and prioritize validation studies, workshops and exchange schemes on stock-related biological variables, and review the results.	Reviewing and prioritization of the many incoming suggestions for workshops and exchanges from EGs, WKs and other ICES related groups, e.g. planned benchmarks. It is essential to streamline this work with the ICES benchmark schedule.	3.1 and 3.2	Generic	Annual prioritized overview of planned studies, workshops and exchanges. Update and restructure of the Data Quality Assurance Repository (with ICES and WGQUALITY). Work with SID (Stock Information Database) developers to include workshop and validation study information in SID, to make this information available to the wider ICES community.

b	Improve training and quality assurance of age reading and maturity staging, and other biological parameters.	Guidelines for international calibrations are available, but methods, routines and protocols for monitoring the quality of age and maturity on national level need to be standardized. International agreed advice on targets (by stock) for accuracy of delivered biological data as input for assessments. If target isn't met a validation should be prioritized.	3.1 and 3.2	Generic	Review the current national procedures for quality assurance. Outline best practice guidelines in cooperation with the RCG's. Preparing guidelines for method standardization and inplementation in cooperation with WGSMART. Continuous monitoring of the implemented standardized guidelines. Stock-specific targets for validation and accuracy of biological parameters achieved from exchanges and workshops. Liaise with WGALES on requirements for egg and larvae quality assurance.
c	Evaluate the quality of biological parameters: Issues and review of quality of biological parameters used in assessments	It is essential that the time-series of biological parameters used in stock assessments are of the highest quality. Guidelines for quality assurance of biological parameters have been developed in WGBIOP's previous terms. WGBIOP will collate information on quality assurance and accuracy estimates of biological parameters used, in order to evaluate if improvements can be achieved.	3.1, 3.2, 5.1	3 years	Evaluation of issues put forward by the assessment WGs for benchmark species in 2021–2023. Review use of SID in delivering issue lists for upcoming benchmarks and provision of WGBIOP information to the assessment groups. Interactive quality indicator form for biological parameters used in assessments. Evaluate quality and accuracy estimates of biological parameters currently used in assessments.

d	Investigate and develop data availability, documentation and methods to improve identified biological parameter estimates, as input to assessment models.	Life-history parameters are required by expert groups on assessment, multispecies modelling, ecosystem modelling and data-limited stocks. Therefore, recent data from quality assured sources is essential. WGBIOP provides guidelines for collecting high quality data and provides links between data providers and end-users. There is a need to assess the availability and use of biological parameters, and to support incorporating age error matrices and other biological parameter quality information into assessments.	3.1, 5.2, 6.6	3 years	Document current sources of life-history parameter estimates identified by ICES/GFCM Expert Groups as critical components relevant to improvement of assessment for ICES/GFCM stocks. Identify where biological information can be updated, provide input for improving reference points. Overview of quality assurance for stomach sampling. Facilitate closer links between data providers and end-users. Liaise with WGQUALITY, benchmark groups and developers on providing and implementing age error information in assessments.

e	Across database developments combining biological parameter data collection and quality assurance of these data. Address requests for technical and statistical recommendations/advice related to biological parameters and indicators	On a regular basis WGBIOP receives requests related to (quality of) biological parameters from EGs and other related groups. Filled templates for requests sent to WGBIOP before a specified deadline will be the basis for this ToR. Requests often deal with provision of information or data on quality of biological parameters which are not easily accesible. In order to improve the accessibility of the data and the efficiency of the quality assurance processes, cross database developments are essential. This will allow for combing data from different sources, facillitating the work of WGBIOP and also supporting the ICES quality management system	3.1, 3.2 and 3.3	Generic	Each received request for technical and statistical recommendations related to biological parameters and indicators will be addressed and included in the WGBIOP work plan where appropriate. Provide input for current and developing data storage and tools. Provide a flow diagram, combining outputs from SmartDots and RDBES/TAF/DATRAS to WGQUALITY, DIG and DSTSG. This will give an overview of countries/institutes collecting biological parameter data as input for quality assurance of biological parameters.
f	Provide feedback and guidance on updating and development of tools for exchanges and workshops on biological parameters.	Based on feedback from users of these tools and end-users of results of workshops and exchanges, improvements and alterations will be suggested and evaluated.	3.1 and 4.1	Generic	Annual updates and developments of tools will be evaluated based on end-user needs. Annual overview of suggested improvements based on needs of users will be provided to governance groups (e.g. WGSMART).

Summary of the Work Plan

Year 1	Investigation data availability and quality of life-history parameters and providing links between data providers and end-users. Evaluating the quality of biological parameters used in assessments. Improving quality assurance of biological parameters provided for assessments and management processes. Providing feedback and guidance on development of tools for calibration workshops of biological parameters. Scheduling of exchanges, workshops and validation studies aligned with the benchmark cycle.

Year 2	Investigation data availability and quality of life-history parameters and providing links between data providers and end-users. Evaluating the quality of biological parameters used in assessments. Improving quality assurance of biological parameters provided for assessments and management processes. Providing feedback and guidance on development of tools for calibration workshops of biological parameters. Scheduling of exchanges, workshops and validation studies aligned with the benchmark cycle.
Year 3	Reviewing status of issues, achievements and developments concerning biological parameters and quality assurance of life-history parameters provided for assessment and management processes. Reviewing tools and database developments for providing and accesing biological parameters informatiion. Identify future needs in line with the ICES objectives and Science Plan and the wider marine environmental monitoring and management within Europe and propose a future/alternative work plan improving quality assurance of biological parameters.

Supporting information

Priority	The main objective of WGBIOP will be to support the development and quality assurance of regional and national provision of biological parameters as reliable input data to integrated ecosystem stock assessment and advice, while making the most efficient use of expert resources. As biological parameters are among the main input data for most stock assessments and mixed fishery modelling, these activities are considered to have a very high priority.
Resource requirements	None
Participants	All National Age Reader/Maturity Stager Coordinators (ICES and GFCM) will be invited. Experts relevant to the current benchmarks of the year of WGBIOP will be invited as well as relevant external experts such as statisticians or specific EG members.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	WGBIOP supports ACOM and SCICOM by promoting improvements in quality of biological parameters from fishery and survey data underpinning the integrated ecosystem assessment approach.
Linkages to other committees or groups	WGBIOP links with the SCICOM/ACOM Steering Groups: Data Science and Technology Steering Group (DSTSG) and Ecosystem Observation Steering Group (EOSG) and Working Group on the Governance of Quality Management of Data and Advice (WGQuality). It links to stock assessment EGs and benchmark assessment groups by providing input on the data quality. WGBIOP also links with, the Regional Database Steering Group (SCRDB). WGBIOP also links with WGSMART for the development of SMARTDOTS and WGALES for quality assurance of ichthyoplankton parameters.
Linkages to other organizations	Regional Coordination Groups.

Annex 3: Exchanges and workshops (ToR a)

Exchanges completed in 2021 Q4–2022

The Second Workshop on Age Reading of North Sea Plaice (Pleuronectes platessa) (WKARP2)

Workshop 2 on age reading of North Sea plaice (*Pleuronectes platessa*), (WKARP2) (ICES, 2022a; full report[13] was the first age reading workshop focusing specifically on age reading of the North Sea plaice stock (ple.27.420) in the North Sea and Skagerrak. The objectives of the workshop were: to evaluate the level of agreement between age readers for the stock by reviewing results of the 2020 North Sea Skagerrak plaice exchange in consideration of previous calibration and validation work; to standardize laboratory procedures and age reading methods applied; to provide guidelines for reliable age interpretation; to provide age error data to the stock assessment working group; to create an agreed age reference collection of otoliths.

This summary report outlines the results from Workshop 2 on Age Reading of North Sea plaice (*Pleuronectes platessa*) WKARP2 (SmartDots ID 402) that took place in December 2021. Results are based only on the advanced age readers who provide age data for stock assessment purposes.

Two age reading exercises, one exchange before the workshop (SmartDots ID 281), and one workshop exercise (ID 402) were completed using SmartDots. Age readers' annotations of growth structures and ageing results from both exercises were examined using standardized quality analyses based on an R script, presented in this report. Age reading error data has been provided to the ICES WGNSSK (Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak) which can be tested in the ple.27.420 stock assessment model. Disagreement between readers is mostly attributable to differences in the identification of the first winter ring as this can vary in width across samples collected from different areas. Results showed that estimated ages in older fish can be unreliable due to a narrowing of the annuli close to the otolith edge. Further work is required to provide guidelines for age readers about which structures should be identified as annuli. Different preparation methods are applied in national laboratories. The group concluded that reading whole and sectioned otoliths viewed under reflected light is optimal; no obvious benefit was identified from sectioning plaice otoliths from fish under the age of 6. Using images of otoliths, the reliability of the age reading results is depending on image quality. To help standardize image format, lighting, and calibration a workshop is recommended to establish a set of guidelines for image quality used in age determination.

The Workshop on Mackerel, Horse Mackerel and Hake Egg Identification and Staging (WKMACHIS)

As part of a series of workshops (WKMHMES, WKFATHOM), the Workshop on Mackerel, Horse Mackerel and Hake Egg Identification and Staging (WKMACHIS) was held in October 2021 prior to the triennial mackerel and horse mackerel egg survey. The workshop had to be held online for the first time due to the continuing COVID-19 pandemic. All egg identification and staging during the workshop were undertaken using images on the SmartDots WebApp, as opposed to real samples under microscopes. In advance of the workshop eggs were, however, sent to participants to be identified and staged under the microscope.

Most of the the workshop was spent completing two rounds of identifying and staging mackerel, horse mackerel, hake, and similar looking eggs. The results promoted discussion and highlighted specific problem areas. These discussions allowed further development of standard protocols,

[13]https://doi.org/10.17895/ices.pub.20473083

and enhancements to the species and stage descriptions. The results were reassuring and improved from the first to the second round of the exercises. However, and particularly in horse mackerel, bias in correctly identifying stage 1 eggs was higher than in previous workshops for both, experts, and non-experts. These results can almost exclusively be explained by the change in workshop methodology that saw a move from a live view of the fish eggs to images. What did not improve from first to second round was the correct discrimination between stages 1A and 1B. Because only the combined results of stages 1A and 1B are currently used, this will not negatively influence the results of the egg survey at the current design. Any move, however, towards utilizing and implementing a finer staging system should be considered with care and should certainly involve more thorough training of participants in correct egg staging.

As the mackerel and horse mackerel egg surveys are carried out once every three years, the workshop functions as a refresher for expert survey participants and as an introduction for new participants in egg analyses. It should however be realized that one week of workshop for egg identification and staging, particularly if carried out online and based on images, is not sufficient to train new participants. Institutes should ensure newcomers receive a thorough training while also allowing more experienced participants to refresh their knowledge ahead of the survey.

Again, as all previous workshops, the meeting demonstrated the importance of conducting the workshop a few months ahead of the mackerel and horse mackerel egg survey. For several valuable fish stocks in the Northeast Atlantic, the survey delivers the only fishery-independent SSB indices based on correctly identified and staged fish eggs. Ongoing discussion and training for consistency is, therefore, imperative. While many participants had problems working with images only, the use of image-based systems for (egg) analysis will become a central part of future workshops.

The Workshop on Adult Egg Production Methods Parameters estimation in Mackerel and Horse Mackerel (WKAEPM)

The Workshop on Adult Egg Production Methods Parameters estimation in Mackerel and Horse Mackerel (WKAEPM) looked at the imprecision between institutes when processing survey samples. Several protocol improvements were proposed added into the ICES Survey Protocol Manual for the AEPM and DEPM estimation of fecundity in mackerel and horse mackerel (SISP- 5). These will be in place prior to the adult parameter analysis in 2022 survey year.

A calibration exercise was carried out prior to the workshop using standard mackerel and horse mackerel egg survey (MEGS) protocols. A second exercise was conducted during the workshop using a newly developed SmartDots module. High-resolution images are essential to this work, thus in 2022 slide scanner pictures will be taken. A reference catalogue of images of early alpha atresia and POFs will be compiled and stored in SmartDots.

The desired number of gonad samples to be collected during the egg surveys, including North Sea samples, was defined. WGMEGS has requested that additional mackerel and horse mackerel female gonad samples would be collected by the Blue whiting survey, the Irish WESPAS survey and the Dutch Pelagic Fisherman's Association, PFA.

An updated version of the ICES Fecundity and Atresia database will be ready for testing at the beginning of 2022. It has been supported by the ICES Vocabulary Server. The survey protocol manual will be updated in 2024.

Horse Mackerel, Mediterranean Horse Mackerel and Blue Jack Mackerel (*T. Trachurus, T. mediterraneus* and *T. picturatus*) otolith exchange (SmartDots event: 362, 387, and 388)

An otolith exchange was conducted in 2021 for three horse mackerel species *T. Trachurus, T. mediterraneus, and T. picturatus* and 28, 14 and 18 readers participated, respectively. The results of the exchange will be discussed during the WKARHOM 4 in November 2021.

For *T. trachurus* both whole (N=249) and sliced (N=134) otoliths were read from 10 different areas (5 in the Mediterranean and 5 in the Atlantic). For whole otoliths and all readers, the weighted average percentage agreement (PA) based on modal ages for all readers is 46%, with a weighted average CV of 44% and an APE of 32%. For sliced otoliths and all readers, the weighted average percentage agreement based on modal ages for all readers is 44 %, with a weighted average CV of 22 % and an APE of 15 %. The readers had some difficulties in recognizing first ring and the edge nature, and with overlapped rings in old specimens. CV PA APE decrease for sliced otoliths; however, high differences in the modal age is observed between same sample/different preparation.

For *T. mediterraneus* 164 otoliths were read from 5 different areas (4 in the Mediterranean and 1 in the Atlantic). The weighted average percentage agreement based on modal ages for all readers is 49%, with a weighted average CV of 44% and an APE of 32%.

There were limited difficulties in recognizing first ring; difficulties increase in last rings due to not clear rings identification. There was a high presence of false rings leading to uncertainties. Furthermore, the identification of the edge nature is very difficult.

For *T. picturatus* 164 otoliths were read from 2 different areas in the Atlantic. The weighted average percentage agreement based on modal ages for all readers is 55%, with the weighted average CV of 54 % and APE of 35 %. Challenges were the limited length range, no clear pattern deposition, high presence of false rings, mainly in the first annulus, and overlapped rings in old specimens.

Baltic salmon (*Salmo salar*) scale exchange (SmartDots event: 357)

A scale exchange on age reading of Baltic salmon was held from late 2021 to early 2022. This was the first Baltic salmon exchange to evaluate the accuracy and precision in scale reading. The last Baltic salmon calibration SSRWBS (The Second Scale Reading Workshop on Baltic Salmon) in 1998 was focused mainly on comparing the scale structures of wild and reared salmon.

Nine readers from five countries participated in the exchange. Scales from 132 specimens from Baltic Sea subdivisions (SDs 25–26 and 29–32) were used.

The weighted average percentage agreement based on modal ages for all readers was 64%, with the weighted average CV of 21% and APE of 15%. When only including advanced readers in the analysis, the results improved to a PA of 82% with a CV of 12% and an APE of 5%.

Ring interpretation between readers from different countries was consistent. Better agreement was achieved in reading „sea age" than „freshwater age". Basic readers were underestimating mainly „freshwater age". They were usually omitting the first river ring. In some cases, the transitional ring (between fresh and saltwater growth) has been considered to be an annual ring. The next exchange including also Atlantic salmon can be carried out in 3–4 years.

Coordinators: Adam Lejk (Poland) and Zuzanna Mirny (Poland). The report is in preparation and will be uploaded to SmartDots when finished.

Atlantic Chub Mackerel (*Scomber colias*) Otolith Exchange 2022 (SmartDots event: 423)

Event 423 in SmartDots. Areas ICES, Mediterranean and CECAF (459 otoliths). Overall agreement was 50% for all readers, increasing to 62% for expert readers. Overall CV of 44% for all readers and 41% for expert readers.

Atlantic chub mackerel (*Scomber colias*) is not yet assessed. However, the increase of the captures of this species in Portugal and Spain could lead to its assessment in the near future. Hence the importance of the realization of calibration exercises between otolith readers. In 2021, the Second Workshop on Atlantic chub mackerel (*Scomber colias*) (WKCOLIAS 2) proposes to WGBIOP 2021 an age exchange using SmartDots to be held in 2022 and a Workshop in 2023, involving both

European and African participants. The exchange was carried between June and August 2022. A total of 18 readers from 6 countries (Portugal, Spain, Italy, Greece, Tunisia, and Morocco) participated in the exchange. A total of 459 otolith images from Atlantic, Mediterranean and CECAF areas were used, covering all working areas of the participants (ICES: 27.10. a.2, 27.8.c, 27.9.a; Mediterranean: GSA09, GSA12, GSA13, GSA14, GSA22; CECAF: 34.1.1, 34.1.2).The preliminary analysis was performed for the total of areas in two groups: All readers and Advance readers. The overall agreement was very low (50%), lower than in last workshop exchange, WKARCM 2015 (60.6%). Overall CV was high (44%). The best results were obtained by advance readers (62% agreement and CV of 41%). The results show overestimation of age in young fish in some advanced readers. First analysis indicates differences in identification of first annulus and between true annuli and checks, especially in older individuals. Many new areas in this exchange need to make an analysis by area.

It was recommended the realization of a Workshop on age estimation of chub mackerel otoliths.

Coordinated by Chair(s): Carmen Hernández (CSIC-IEO, Spain) and Andreia Silva (IPMA, Portugal)

The report is in preparation and will be uploaded to SmartDots when finished.

Baltic Sprat (*Sprattus sprattus*) Otolith exchange from Baltic Sea (SD 24–29, 28.1 excluded; SmartDots event: 414 and 415)

Stefanie Haase (Thünen Institute of Baltic Sea Fisheries, Germany) and Julita Gutkowska (MIR, Poland) organized a Baltic sprat (*Sprattus sprattus*) otolith age reading exchange in spring 2022. According to age reader's preference, otoliths could be read under transmitted light (event ID 414) and reflected light (event ID 415). The event consisted of 92 otolith images. Ten age readers participated in this exchange: 6 read the images under transmitted light (3 of them are advanced), 4 read images under reflected light (all of them are advanced). Samples covered ICES SDs 24, 25, and 26 and were collected in quarter 3 and 4.

The advanced readers contributing age reading relevant to stock assessment scored a percentage agreement of 78% and 80% and a coefficient of variation of 27% and 22% under transmitted and reflected light, respectively.

There was a slightly constrained quality of some of the images, and readers normally read directly under the binocular, so that the inability to regulate acuity or tilt of the otolith of the image might have hampered the results. Age readers and coordinators wished for regular exchanges every two years, possibly alternating with herring.

Central Baltic Herring (*Clupea harengus)* Otolith exchange (ICES SD 25–29 and 32 (excluding Gulf of Riga; SmartDots event: 449)

The 2022 exchange for the central Baltic herring stock her.27.25-2932 took place via the SmartDots platform (ID 449) between May and October 2022. The exchange was organized following a request from WGBFAS and in preparation for the 2023 benchmark of the stock. Fifteen readers from nine countries took part (Denmark, Poland, Sweden, Germany, Latvia, Lithuania, Estonia and Finland); twelve ”advanced” readers (providing age data for assessment) and 3 ”basic” readers (do not provide age data for assessment). 163 otoliths images, covering ICES SD25, 26, 29 and 32 were provided by Poland and Finland and uploaded to the SmartDots platform. The aim was to include samples from all SD’s included in the stock assessment but the otoliths from SD27 were not included due to lack of resources within the lab photographing the otoliths. Images of whole otoliths from SD 25 (n=27) and SD26 (n=30) were provided by Poland. For SD 29, images of sectioned and stained and whole otoliths from the same fish (n = 24) plus additional images (n=18) of sectioned and stained otoliths were provided by Finland. For SD32, images of sectioned and stained otoliths (n=40) were provided by Finland. The aim was to cover all areas, quarters and age groups for each ICES SDs used in the stock assessment but this aim was not reached.

The analysis was carried out by ICES SD as not all readers are experienced in reading otoliths from all areas and the growth patterns observed in the otoliths vary greatly from north to south, meaning a correct interpretation by readers not experienced with samples from another SD would introduce bias in the results. For SD 25, based on advanced readers only, overall, PA was 93%, CV was 8% and relative bias -0.04. When all readers were included, overall, PA was 79%, CV was 17% and relative bias 0.00. For SD 26, based on only advanced readers only, overall, PA was 85%, CV was 9% and relative bias -0.01. When all readers were included, overall, PA was 80%, CV was 12% and relative bias -0.03.

For ICES SD 29, based on the 24 fish where results from whole and sectioned and stained otoliths from the same fish were available and based on advanced readers only, overall, PA was 89%, CV was 12% and relative bias 0.06. When all readers were included, overall, PA was 86%, CV was 17% and relative bias 0.06.

For ICES SD 32, based on only 2 advanced readers, overall, PA was 70%, CV was 7% and relative bias 0.38 (based on the ATAQCS analysis). When all readers were included, overall, PA was 83%, CV was 18% and relative bias 0.20 (based on the SmartDots analysis).

Results were presented at the data compilation meeting for the ICES benchmark workshop on Baltic Pelagic stocks (BWKBALTPEL 2023) in October 2022 and an age error matrix will be provided for exploratory purposes.

Coordinator: Julie Coad Davies (Denmark). The report is in preparation and will be uploaded to SmartDots when completed.

Western Baltic Cod (cod.27.22-24) age reading exchange (SmartDots event: 412)

This small exchange was held in preparation for WGBFAS 2022 to check the level of agreement and bias between age readers providing age data for stock assessment of cod.27.22-24. 100 images of sectioned otoliths from samples collected in ICES SD 22 and 23 across the four quarters of 2021 were taken at DTU Aqua (Denmark) and uploaded to SmartDots. Readers were provided with instructions to annotate all images, provide an age estimate and a quality score for their age estimation. The reporting module in SmartDots was used to run a standardized analysis of age reader comparison and extract a template for a full report and summary report. Results were provided to The ICES Baltic Fisheries Assessment Working Group (WGBFAS) 2022.

Based on the 3 readers providing age data for assessment from Denmark, Germany, and Sweden the percentage agreement (PA) was 97% with a coefficient of variation (CV) of 8%. This is an improvement on the 2020 results where PA was 91% for sectioned otoliths and 88% for broken otoliths with a respective CV of 17% and 18%. Age reading issues related to counting a translucent zone (TZ) at the edge in Q3 or Q4 and correct identification of the first winter ring are generally resolved. In contrast to previous exchanges only images of sectioned otoliths were provided for the readers to annotate after results from previous exchanges (2019, 2020) indicated this to be a more reliable age reading method. The material has been made available for training new age readers for this stock.

A series of age reading exchanges (2019, 2020 and 2022) and cooperation between the age reading labs providing age data for stock assessment, the stock assessor and stock coordinator for cod.27.22-24 has resulted in improved reader calibration and consequently data quality for cod.27.22-24.

WKSANDEEL 2022 Working Document on age reader calibration using SmartDots – 2022 North Sea Sandeel Otolith Exchange (SmartDots event: 424)

The results outlined in this document are based on age readers who provide age data for stock assessment purposes (advanced readers), 3 from Norway and 2 from Denmark. A set of 120 otolith images were age read by the readers in an exchange which took place using the SmartDots application (ID 424). The otolith images were previously read in 2019. The same 3 readers from Norway took part in both exchanges, whereas from Denmark only 1 reader took part in both exchanges. In 2019, the weighted average percentage agreement (PA) was 81 % and the weighted average coefficient of variation (CV) was 24 % (based on advanced readers only). In 2022, results improved, and the weighted average percentage agreement (PA) was 87 % and the weighted average coefficient of variation (CV) was 20%. Included in both the 2019 and 2022 exchanges were a subset of 40 otoliths (from SA1) with 100% agreement in the 2016 exchange (WKSAND 2016 WD). Based on only these 40 otoliths, the weighted average percentage agreement (PA) in 2019 was 85 % and the weighted average coefficient of variation (CV) was 24%. An improvement was seen in 2022 when the weighted average percentage agreement (PA) was 92 % and the weighted average coefficient of variation (CV) was 17%. In 2019 the following age reading issues were apparent; a) incorrect interpretation of the otolith edge in Q4 where some readers were counting an extra year and b) disagreement as to whether a faint innermost translucent zone (present in some otoliths) should be counted as a true winter ring or not. The former issue appears to be resolved because of repeated calibration of readers and feedback on age reading issues. The latter is a reoccurring issue (see Image Examples) which needs attention and requires otolith microstructure examination of problematic otoliths from different areas to validate whether or not this is a true winter ring. 2022 results do not show any indication that a single stock or month of capture (or age) is more difficult to read although in 2019 concerns were raised over image quality of the otoliths from san.sa.3r and san.sa.5r which were mounted in eukit and which may have contributed to the lower PA for these areas/stocks. CV at modal age 1 is highest but it should be noted that the calculation of CV depends on age and CV at modal age 0 is not calculated for this reason. Although PA at modal age 0 is high (84%) it is lower than PA at modal ages 1 (90%) and 2 (93%), indicating there are some difficulties in the correct interpretation of modal age 0 with a general pattern of positive bias in relation to modal age which is interpreted as an overestimation of age.

Golden Redfish (*Sebastes norvegicus*), area 27.1–2 and 27.561214 and Beaked Redfish (Sebastes mentella), area 21 and 27 otolith exchange (SmartDots event: 298 and 296)

- Golden redfish (*Sebastes norvegicus*): 7 age readers from Iceland, Norway, Spain, and Germany participated in the exchange of golden redfish. 128 broken and burnt otoliths were annotated. The PA was 44%, CV 22% and APE 15%. This was a slightly improvement compared to the last workshop (2008), where the results of PA were 27%, CV 23% and APE 17%. The CV in 2020/2021 increased both at lower ages (less then fifteen years) and for ages above thirty years. The internal consistency was good, with all age readers with a CV below 15%.
- Beaked redfish (Sebastes mentella): 7 age readers from Iceland, Norway, Spain, and Germany participated in the exchange of beaked redfish. 189 broken and burnt otoliths and 24 sectioned otoliths were annotated. The PA was 38%, CV 23% and APE 17%. This was a worsening compared to the last workshop (2008), and the last exchange (2011), where the results of PA were 20% and 34%, the CV 19% and 16%, and the APE 14% and 14%, respectively. The CV in 2020/2021 increased at lower ages (less than twenty-five years). The internal consistency was good, with all age readers with a CV below 16%.

Overall, the Sebastes exchange results are as expected. A CV around 22–23% is higher than the preferred 15% CV some age readers have as a limit for production ageing of Sebastes otoliths.

However, in this exchange, some challenges concerning the implementation of the exchange took place. It almost lasted a year between the first participants until the last participant received the otoliths. This resulted in faded burning for the age readers receiving the otoliths last. We also ran into some challenges regarding the SmartDots system. The Sebastes species are long-lived species, and the annuli are quite narrow towards the edge. Normally, while ageing using a stereomicroscope, magnification up to 120 times are not unusual. In SmartDots, we needed to upload two pictures for each otolith, one image for an overview of the otolith, and the second with higher magnification, consisting of many images stitched together to see the entire otolith. Even with the stitched picture, the magnification was not high enough for the oldest individuals, and the resolution was bad when trying to zoom more within the picture.

Considering the issues above, the suggestion is to arrange workshops instead of exchanges of otoliths only. In a workshop, all the age readers will have access to the same equipment and the quality of the otoliths aged will be the same for all participants. Considering this exchange, we are unsure whether the high CV is only a result of differences regarding the age determination, or if it could be due to bad quality of the otoliths for some participants.

Deep-water spp. otolith exchanges (SmartDots event: 315–321)

Black scabbardfish (*Aphanopus carbo*): 13 age readers from Portugal, Greece, Norway, Iceland, Spain, Faroe Islands and France participated in the exchange of black scabbardfish. 50 images of transverse sections were annotated. The PA was 38%, CV 23% and APE 17%. This was an improvement compared to the exchange conducted in 2018, with results of PA and CV of 37% and 26%, respectively. The CV was in 2020/2021 higher for modal ages below six years. The internal consistency varied a bit considering the CV; from 8.8% to 34.1%.

Greater forkbeard (*Phycis blennoides*): 13 age readers from Spain, France, Norway, Greece, Iceland, and Faroe Islands participated in the exchange of greater forkbeard. 50 images of transverse sections were annotated. The PA was 55%, CV 29% and APE 20%. This was an improvement compared to the exchange conducted in 2018, with results of PA and CV of 55% and 34%, respectively. The CV was in 2020/2021 higher for modal ages below two years. The internal consistency was ok, the CV varied between 11.1% to 22.3%.

Ling (*Molva molva*): 14 age readers from Norway, Iceland, Faroe Islands, Greece, France, Spain, and Denmark participated in the exchange of ling. 50 images of transverse sections and 29 images of whole otoliths were annotated. The PA was 48%, CV 18% and APE 13%. This was an improvement compared to the exchange conducted in 2018, with results of PA and CV of 46% and 22%, respectively. The CV was in 2020/2021 more or less even for all modal ages. The internal consistency varied quite a lot, with a CV between 7.1% to 34.9%.

Blue ling (*Molva dypterygia*): 13 age readers from France, Norway, Greece, Iceland, Spain, and Faroe Islands participated in the exchange of blueing. 50 images of transverse sections were annotated. The PA was 34%, CV 17% and APE 13%. The PA and CV were the same in 2020/2021 as the exchange conducted in 2018. The CV was in 2020/2021 higher for modal ages below nine years and for modal ages above twenty years. The internal consistency was very good! The CV only varied from 3.8% and 10.5%.

Greater Argentine (*Argentina silus*): 13 age readers from Norway, Iceland, Faroe Islands, Greece, Spain, and France participated in the exchange of greater Argentine. 50 images of whole otoliths were annotated. The PA was 69%, CV 9% and APE 6%. The results from 2020/2021 was just as good as the results from the exchange conducted in 2018. The CV was in 2020/2021 even for all modal ages. The internal consistency was very good as the CV only varied from 1.1% to 6.4%.

Tusk (*Brosme brosme*): 13 age readers from Iceland, Faroe Islands, Norway, Greece, Spain, and France participated in the exchange of tusk. 50 images of whole otoliths were annotated. The PA was 44%, CV 15% and APE 11%. This was a worsening compared to the exchange conducted in

2018, with results of PA and CV of 48% and 12%, respectively. The CV was in 2020/2021 more or less even for all modal ages. The internal consistency varied a bit considering the CV; from 5.8% to 20.1%.

Blackspot sea bream (*Pagellus bogaraveo*): 15 age readers from Greece, Portugal, Norway, Iceland, Italy, Spain, France, and Faroe Islands participated in the exchange of blackspot sea bream. 50 images of whole otoliths were annotated. The PA was 39%, CV 26% and APE 19%. This was an improvement compared to the exchange conducted in 2018, with results of PA and CV of 35% and 31%, respectively. The CV was in 2020/2021 higher for modal ages below or equal to four years. The internal consistency varied a bit, with a CV from 4.5% to 20.9%.

Overall, the results from the deep-water species otolith exchange are good. For six out of seven species in this exchange, the coefficient of variation (CV) shows improvement or same low level as the previous exchange. The weighted average CV for all seven species is 20%, which is not a good CV compared to other species. However, for these long-lived deep-water species, where the otoliths are not easy to age, apart from greater Argentine otoliths, a CV around 20% must be considered good.

Since many of the deep-water species often have only one age reader from each country, we would recommend arranging a workshop instead of an exchange of otoliths. In a workshop, the age readers come together, discussing the ageing of the otoliths and the species in general, with other age readers dealing with the same difficulties of other deep-water species. These encounters might improve the age reading of these difficult deep-water species considerably. If another exchange is to be implemented, it might be a good idea to invite all the age readers of deep-water species to a discussion and a review of the age reading of each species prior to the exchange.

Elasmobranch vertebrae exchange in Mediterranean and Atlantic (SmartDots event: 405, 406, 407 and 408)

During the 2020 WGBIOP meeting, it was decided to organize the first exchange at a European level concerning the age of elasmobranchs. The first steps during 2021 were to identify the countries or laboratories willing to participate and to list the associated species and samples.

Four ray species were selected for this exchange, which took place in

2022: thornback ray (Raja clavata; n=428), blonde ray (Raja brachyura; n=115), marbled electric ray (Torpedo marmorata; n=60), and longnosed skate (Dipturus oxyrinchus; n=60). The individuals were sampled between.

2010 to 2020 in four geographical areas, two in the North Atlantic Ocean (North Sea, ICES area 27.4; Eastern Channel, ICES area 27.7.d) and two in the Mediterranean Sea (Ligurian and North Tyrrhenian Seas, GSA 9; western part of Sardinia, GSA 11.1). The calcified piece used for ageing was the vertebra with two different preparation methods: with the cut vertebra and the whole vertebra unstained or stained with crystal violet. To calibrate the ageing data, eleven international readers from five European countries participated in this age reading exchange to evaluate the bias. This exchange was carried out according to the recommendations of WGBIOP with the interpretation of calibrated images of calcified pieces using the SmartDots European tool. The first bias results showed that, for each ray species, the weighted average percentage agreement based on modal ages for all readers is around 48 % (from 44% to 52% according to the species), with the weighted average coefficient of variation (CV) of 40 % (from 30% to 49% according to the

species) and average percentage error (APE) around 30 % (from 21% to 37% according to the species). The lowest bias between readers was observed for Raja clavata, which was both the main species with the largest number of specimens and the most studied species. The bias between readers increased with the age of the observed individuals and this trend was the same for all species. Finally, using the modal age, the best model of growth was fitted by species and geographical area. These growth models showed that the growth rate was very different among species. For Raja clavata, the growth rate observed in the Atlantic Ocean was higher than that observed in the Mediterranean Sea. The growth rates for *Raja brachuyra*, however, showed very close values in the Atlantic Ocean and in the Mediterranean Sea. However, it was noted that for these two species, there were vertebrae preparation methods different between Atlantic Ocean and Mediterranean Sea. Consequently, all these results from the first elasmobranch age reading exchange will need to be analysed and discussed in the future workshop.

Elasmobranch maturity exchange (SmartDots event: 398)

A maturity exchange on elasmobranch species was held during 2021-2022 using SmartDots. This was the first elasmobranch maturity exchange. Species included were *Raja clavata, Raja brachyura, Raja montagui, Raja miraletus* and *Raja polystigma*. Three advanced and ten basic stagers from five countries participated in the exchange. The WKASMSF scale without subdivisions was used and stagers were asked to determine sex and maturity. A total of 181 specimen (of which 19 specimens had histological images) from 2 areas in the North Atlantic Ocean (North Sea, ICES area 27.4; Eastern Channel, ICES area 27.7.d) and 2 areas in the Mediterranean Sea (Ligurian and North Tyrrhenian Seas, GSA 9; western part of Sardinia, GSA 11.1) were included.

For sex, the average percent agreement (PA) for all stagers was 98.9% with a coefficient of unalikeability (CU) of 0.021. When only including advanced stagers in the analysis the results improved to a PA of 99.3% with a CU of 0.015.

For maturity staging, the average percent agreement (PA) for all stagers was 81.1% with a CU of 0.319. When only including advanced stagers in the analysis the results improved to a PA of 93.4% with a CU of 0.12.

The results were very good for advanced stagers both for sex and maturity staging. Results of basic stagers was acceptable. In-lab training of basic stagers will possibly improve the maturity staging. Image quality was good and SmartDots proved to be a useful tool for organizing maturity exchanges for elasmobranch species.

There is a plan to organize a combined workshop for age and maturity determination in 2023. Pictures and fresh gonads will be included in the workshop. The aim is to compare fresh gonads with images, improve the maturity staging of (basic) stagers and including substages of the WKASMSF scale.

Coordinators: Karen Bekaert (Belgium) and Cristina Follesa (Italy). The report is in preparation and will be uploaded to SmartDots when finished. Some updates to the WGSMART R-script are needed.

Exchanges planned for 2022-2023

European anchovy (*Engraulis encrasicolus*) otolith exchange. December 2022-January 2023. Coordinators: Carmen Hernández (Spain), Ilaria Costantini and Gualterio Basilone (Italy).

Boarfish (boc.27.6-8) otolith exchange. In 2022 a small-scale exchange was established by the MI Ireland via the SmartDots platform (ID 482). The aim being to investigate the possibilities of updating the age length key and running an age-based assessment in future. Coordinator Roxanne Duncan (Ireland).

Exchanges planned for 2024 onwards

- Baltic and Atlantic Salmon (*Salmo salar*) scale exchange. Coordinators: Zuzanna Mirny and Adam Lejk (Poland) (Atlantic coordinators TBD)

- Chub mackerel (*Scomber colias*) maturity staging exchange. Coordinators: Cristina Nunes (Portugal).
- Sole (*Solea solea*) Subdivision 7.a otolith exchange. Coordinator: Karen Bekaert (Belgium), TBC.

Workshops planned for 2023 and 2024[14]

WKARMSE – Workshop on age reading and maturity stages of elasmobranch species

2022/WK/DTSG15 The **Workshop on age reading and maturity stages of elasmobranch species** (WKARMSE), chaired by Karen Bekaert, Belgium, Kélig Mahé, France and Maria Cristina Follesa, Italy, will be established and meet in Cagliari, Italy 5–9 June 2023 to:

a) Review information on age determination from vertebra and maturity staging and validation techniques on these species (Science Plan codes: 5.1, 5.2);

b) Estimate (relative) and compare accuracy and precision of elasmobranch species age and maturity staging determination in the Atlantic Ocean and Mediterranean Sea (Science Plan codes: 5.1, 5.2);

c) Identify causes of age determination and maturity staging error, and provide specific guidelines for the improvement of precision and reduction of bias between readers and la-oratories (Science Plan codes: 5.1, 5.2);

d) Elaborate on an age reading and maturity staging protocol (Science Plan codes: 5.1, 5.2);

e) Create a reference collection of vertebrae for ageing data and of gonads for maturity stag-ing (Science Plan codes: 5.1, 5.2);

f) Address the generic ToRs adopted for workshops on age calibration and maturity staging (see 'WGBIOP Guidelines for Workshops on Age Calibration') (Science Plan codes: 5.1, 5.2).

WKARMSE will report by [TBD] for the attention of DSTSG, ACOM, SCICOM, and WGBIOP.

Supporting information

Priority	Accurate age determination and maturity staging are essential features in fish stock assessment to estimate the rates of mortality, reproduction and growth. Age and sexual maturity data are provided by different countries and are estimated using international criteria, which have not yet been fully validated for elasmobranch species. There is a great necessity to continue clarifying the guidelines for age and maturity stages interpretation for these species. Two appropriate exchange programmes were therefore carried out in 2022 for ageing data from vertebra and maturity staging through inter-calibration exercises between labs. The results of these exchanges will subsequently be discussed during the WARMSE.
Scientific justification	The workshop aims to review the technical problems regarding age-reading and maturity staging, and the interaction of Elasmobranch species between the Atlantic Ocean and the Mediterranean Sea. This workshop is the first on the biology of the Elasmobranch species and also the first workshop which will integrate both ageing data and maturity staging data.
Resource requirements	No particular resource requirements will be necessary, except for the required conditions by each member to prepare the biological material for, and to carry out the exchange.

[14] The versions of the resolutions for workshops listed here have been updated from the draft versions submitted.

Participants	Considering the importance of the species in Atlantic European waters, from the Medi-terranean Sea region and in Northwest Africa, the exchange is expected to be of interest to ICES, GFCM and FAO/CECAF Member States
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory and science committees	ACOM, SCICOM.
Linkages to other groups	WGBIOP.
Linkages to other organizations	RCGs, EU DG-MARE, EU Data Collection Framework.

WKARCM2 – Workshop 2 on age reading of chub mackerel (*Scomber colias*)

2023/WK/DSTSG16 **Workshop 2 on age reading of chub mackerel (*Scomber colias*)** (WKARCM2), chaired by Andreia Silva, Portugal, and Carmen Hernández, Spain, will be established and meet in Lisbon, Portugal, 20–24 November 2023 to:

a) Review information on age determination, otolith exchanges and validation techniques on this species; (Science Plan codes: 5.1, 5.2);
b) Estimate (relative) accuracy and precision of chub mackerel age determination in the main fishing areas; (Science Plan codes: 5.1, 5.2);
c) Identify causes of age determination error and provide specific guidelines for the improvement of precision and reduction of bias between readers and laboratories; (Science Plan codes: 5.1, 5.2);
d) Elaborate on an age reading protocol; (Science Plan codes: 5.1, 5.2);
e) Create a reference collection of otoliths and a database of images of otoliths; (Science Plan codes: 5.1, 5.2);
f) Address the generic ToRs adopted for workshops on age calibration (see: WGBIOP Guidelines for Workshops on Age Calibration); (Science Plan codes: 5.1, 5.2).

WKARCM2 will report by [TBD] 2024 for the attention of WGBIOP, DSTSG, ACOM, and SCICOM.

Supporting information

Priority	Accurate age determination is an essential feature in fish stock assessment to estimate the rates of mortality and growth. Age data are provided by different countries and are estimated using international ageing criteria which have not been fully validated for chub mackerel (*Scomber colias*). There is a great necessity to continue clarifying this guideline of age interpretation for the species. An appropriate otolith exchange has taken place between June and August 2022 for inter-calibration between ageing labs. The results of this otolith exchange were presented at WGBIOP 2022 and it will subsequently be discussed during the WKARCM2.
Scientific justification	Atlantic chub mackerel (*Scomber colias*) is a middle-size fish species important in the pelagic ecosystem. Landings have increased exponentially in the last 10 –15 years in most of its Atlantic distribution, and in the ICES area, mainly around the Iberia Peninsula, where a couple of decades years ago it was considered bycatch. Catches, mainly from the purse-seine fleet, are not limited, and no formal assessment and fishing management advice have been requested in the ICES area so far, the species being assessed as a single stock in FAO/CECAF region. There is, however, concern about the stock status and exploitation levels, particularly in European waters, and

	great uncertainty and lack of information concerning stock identity, dynamics and connectivity, and its biology. Although currently age information is not used for stock status evaluation in European waters, long historical series of age data are available in several of the institutes sampling the species that could be used for advice. Preliminary analysis of the species' available data has suggested geographical differences for most of its life history parameters, and in growth patterns, that may be reflected in the otoliths' annual rings deposition among regions (WKCOLIAS2). Also, though a recent study has corroborated *S. colias* ages in Iberian waters (Navarro *et al.*, 2021), previous age calibration exercises have identified reading issues that need to be further identified and addressed (WKARCM 2015; WGBIOP 2018). The aim of this workshop is to identify the current ageing problems among readers and standardize the age reading procedures to improve the accuracy and precision in the age reading of this species.
Resource requirements	No resource requirements will be necessary, except for the required conditions by each member to prepare the biological material for, and to carry out, the exchange.
Participants	Considering the importance of the species in Atlantic European waters, from the Mediterranean Sea region and in Northwest Africa, the workshop is expected to be of interest to ICES, GFCM, and FAO/CECAF Member States
Secretariat facilities	None.
Financial	None.
Linkages to advisory and science committees	ACOM, SCICOM.
Linkages to other groups	WKCOLIAS, WGBIOP.
Linkages to other organizations	EU Data Collection Framework (DCF), Regional Coordination Groups (RCGs), EU DG-MARE.

WKMSLEM – Workshop on the maturity staging of lemon sole (*Microstomus kitt*)

2022/WK/DSTSG18 The **Workshop on the maturity staging of lemon sole (*Microstomus kitt*)** (WKMSLEM), chaired by Ingeborg de Boois, Netherlands, and Ewout Blom, Netherlands, will be established and meet in Oostende, Belgium, [TBD] June 2024 to:

a) Agree on a common maturity scale description for lemon sole (*Microstomus kitt*) across laboratories following the SMSF scale (https://vocab.ices.dk/?CodeID=201768)[15]; (Science Plan codes: 3.1);
b) Calibrate staging of lemon sole using fresh fish[16]; (Science Plan codes: 3.1);
c) Calibrate staging of lemon sole using SmartDots, following the pattern of trial-discussion-retrial[17]; (Science Plan codes: 3.1);

[15] Deliverable: Common maturity scale definition for lemon sole. Background: Even when a common scale is used, slightly different criteria to classify the maturity stages allows for a subjective interpretation. This may lead to a bias in the data that may be used in stock assessment models, or in other types of analyses. Therefore, this workshop aims at reaching an agreement on a common maturity scale to be used, and to define objective criteria to classify the separate stages of that scale.

[16] Deliverable: Overview of commonality and differences in staging from fresh fish. Background: see ToR a.

[17] Deliverable: Overview of commonality and differences in staging from pictures. Background: see ToR a.

d) Validate macroscopic maturity determination with histological analysis[18]; (Science Plan codes: 3.1);

e) Propose optimal sampling strategy to estimate accurate maturity ogives[19]; (Science Plan codes: 3.1).

WKMSLEM will report by [TBD] 2024 for the attention of WGBIOP, DSTSG, ACOM, and SCICOM.

Supporting information

Priority	High.
Scientific justification	Laboratories involved in the collection of maturity data for the various assessment working groups use different macroscopic maturity scales for the same species. To cover the same topics throughout the maturity staging workshops, the generic ToRs adopted for maturity staging workshops (see: WGBIOP 2020 Guidelines) will also be considered in the meeting.
Resource requirements	Space on SmartDots@ICES for pictures and connecting fish information. Before the workshop, the chairs will set up a sampling plan for assembling (and collecting, if needed) samples to be used during the workshop. Additional sampling will be carried out during 2023. Guidelines on how to prepare for the workshop, as well as for collecting maturity data and histological analysis for the workshop have been updated and are available in the WGBIOP 2020 Guidelines.
Participants	In view of its relevance to the DCF, the Workshop is expected to attract wide interest from ICES Member States that participate in the biological sampling of lemon sole.
Secretariat facilities	None.
Financial	None.
Linkages to advisory and science committees	ACOM, SCICOM.
Linkages to other groups	WGNSSK (the assessment working group for lemon sole), WGBEAM, IBTSWG (the survey working groups where lemon sole maturity is assessed), and WGBIOP.
Linkages to other organizations	EU Data Collection Framework (DCF), Regional Coordination Groups (RCGs), EU DG-MARE.

[18] Deliverable: Evidence-based decision on the more difficult stages after and prior to the spawning period. Background: Validation of the macroscopic maturity stage with histological analysis, mainly for stages that are normally incorrectly classified (as the 'resting' stage).

[19] Deliverable: Overview of crucial elements in sampling strategies. Background: The ecology of the species, existing surveys, and commercial sampling capacity should lead to the optimal sampling strategy to estimate accurate maturity ogives.

Annex 4: Best practice guidelines and quality status tables of age reading and maturity staging at institutes (ToR b)

BEST PRACTICE GUIDELINES FOR AGE READING

1. Update manuals used for age reading following the latest workshop reports. This can be found in the latest WGBIOP report or in the ICES library (https://ices-library.figshare.com/ - is being updated).
2. Make available written internal age readings procedures in use for each lab regarding:
   a. Preparation/processing
   b. Photographing
   c. Ageing
3. Be aware of the different kinds of quality controls
   a. Check for outliers (e.g., ALK)
   b. Routinely integrated check of "normal" readings:
      i. blind-reading: the reader does not know the previous age reading, which can be done by the same person or different people.
      ii. re-readings: it means to check the "read" age to agreeing or disagreeing, which can be done by the same person or different people.

         When disagreeing there should be a clear procedure on how to handle this reading.
      iii. Regular (monthly/annually) practice/performance exercise on a known/agreed reference collection
   c. Participation in inhouse and international workshops
4. Implement the AQ-scoring system (MeasurementCertainty) under the ICES vocabulary for all readings.
5. Calibrate all instruments used to obtain readable otoliths and follow the procedures provided above for reading data.
6. Train non-expert readers under the latest reading manuals.

BEST PRACTICE GUIDELINES FOR MATURITY STAGING

1. Update internal manuals used for maturity staging following **WKASMSF 2018 Report**/**GFCM MEDITS Manual** (provides maturity staging scales conversion tables for most of the species). It is recommended that these internal manuals should be referenced and made publicly available for quality assurance purposes.
2. For species not included in the WKASMSF 2018 report, follow the latest workshop carried out. This can be found in the latest WGBIOP report (and link to the report) or in the ICES library (https://ices-library.figshare.com/ - is being updated).
3. When in place, use generic quality assurance grading system (MeasurementCertainty for age) to evaluate the certainty of the given maturity stages.
4. Routinely organise exercises for evaluating the agreement/comparison of readings among maturity readers in your institute, following a standardised protocol in the ICES library (https://ices-library.figshare.com/ - is being updated).
5. Routinely validate maturity stages assigned macroscopically with histology with which to develop reference collections.
6. Plan to produce validated reference collections by species as an output when carrying out internal and international workshops.
7. Make validated reference collections available for all national labs.
8. Follow histologically validated macroscopic reference collection when staging the maturity.
9. Promote intra an inter-calibration maturity staging exercises by species with fresh and frozen gonads and including all maturity stages.
10. Provide maturity staging training and manuals by species with good-quality pictures of all maturity stages for onboard and market sampling.
11. Make quality control checks by plotting maturity data, i.e., length-maturity stage plot, GSI plot, etc. and crosschecking assignments among readers.

Annex 4. Table 1.A. Quality Status Of Age Reading At Institutes in 2022 (internal quality management factors 1–3).

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Age Reader how are QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Age Readers how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	Did you implement the age quality scores (AQ1, AQ2, AQ3) (https://vocab.ices.dk/?ref=1395) in your laboratory for routine age reading? If so, how do you handle AQ2 and AQ3 readings?
Belgium	ILVO–Flanders Research Institute for Agriculture, Fisheries and Food		All species are read by 2 readers which control all readings from each other. If disagreement, the otoliths are discussed. In case a reader is absent during a long time, we work with blind doubles (the reader receives some samples which he read before and ages are compared and discussed in case a different age was given). We also use samples from reference collections once a month to see if all readers still agree with each other about the model age.	Yes, AQ2 and AQ3 readings are not uploaded to international databases
Cyprus	DFMR–Department of Fisheries and Marine Research (Ministry of Agriculture of the Republic of Cyprus)	At the moment there is 1 age reader per species. Using the image analysis program perform a blind first reading (only information on the date of capture). Perform a second reading, considering information from the sample, biological information, results of the first reading, back-calculation and the growth increment between consecutive rings (which should be decreasing). Store age estimates in image analysis programme and database. Number of samples per species is about 300 from commercial fisheries.		No
Denmark	DTU Aqua–National Institute of Aquatic Resources Denmark		We have 2 readers per species, some of them carry out self-checks once a year on a set of physical otoliths (1 sample per area of approximately 50 otoliths. If time allows this is done per quarter also). All readers are trained to use SmartDots and the aim is to have all readers either complete an international exchange OR an	Yes we do. We have made a conversion from our internal QC scale to the AQ scale. AQ3 readings are not uploaded to ICES databases and are used for assessment purposes. There are very few of these otoliths.

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Age Reader how are QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Age Readers how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	Did you implement the age quality scores (AQ1, AQ2, AQ3) (https://vocab.ices.dk/?ref=1395) in your laboratory for routine age reading? If so, how do you handle AQ2 and AQ3 readings?
			internal check (with the second reader of that stock/species) once per year, these checks should include samples from all age groups and quarters. The SmartDots report is used when there are more than 2 readers. The Cefas ATAQCS excel book is used if there are only 2 readers. All otoliths where there is disagreement are discussed between readers.	
Estonia	EMI–Estonian Marine Institute (University of Tartu)	We have 1 age reader per species, for herring we have 2 age readers. Age reading is performed following instructions in relevant manuals and recommendations from relevant ICES workshops. The quality is assured by age reader.	For herring we have 2 readers who carry out self-checks at least once a year. All otoliths where disagreement exists are discussed between readers.	No
Faroe Islands	FAMRI–Faroe Marine Research Institute		When the age reader is in doubt the other age readers are consulted. The age–length relationship is investigated for all samples. Outliers are identified visually and re-read if necessary.	
Finland	Luke–Natural Resources Institute Finland	Direct or indirect validation or precision: 1) The use of tagged individuals to identify real and false annuli (usually small numbers, from a few to dozens), 2) The examination of different calcified structures from the same individuals side by side, especially a bone or scales along with mostly stained otoliths (dozens or more, 3) The environmental fit, i.e. warm and cold growing seasons affect fish recruitment and growth: do we see these effects in our fish populations when using age data (from dozens to thousands)?	Exchange of hard structures or images between readers, age readings of some samples with different methods as well, and intention to have at least two specialists in age determination per species. All parts of the previous column.	

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France	Ifremer	There are 2 readers by species but for the first reader, he identifies the age a first time during image acquisition and then checks a second time during image interpretation. This process is applied to all calcified pieces.	Each year, a blind reading is organized both two readers who are identified for each species. This exercise takes place once a year with 200 images for each species covering all sampling quarters for each main area (or stock), A report with R script applied to the data is produced.	We will start our work with SmartDots with age-quality score software in 2022 to replace TNPC
Germany	Thünen Institute of Baltic Sea Fisheries (Rostock)	Not relevant.	We aim to have at least 2 readers for each species. Regular calibration exercises are carried out between these readers.	Yes. Q2: age is used, Q3: no age is assigned/no age information is used.
Germany	Thünen Institute of Sea Fisheries (Bremerhaven)			
Greenland	Pinngortitaleriffik–Greenland Institute of Natural Resources		We have 2 readers per species (cod, mackerel, Greenland halibut and capelin) who carry out self-checks twice a year on a set of otoliths. All otoliths where there is disagreement are discussed between readers. We use "Templates for Calculating Ageing Precision" by NOAA.	AQ2 readings are used in assessment AQ3 have no age.
Greece	IMBRIW–Institute of Marine Biological Resources and Inland Waters (HCMR–Hellenic Centre for Marine Research)	We have 1–2 readers per species. Age reading is based on otolith digital images. Readings are controlled by age reader coordinators with a check of age–length key and otolith radius–length relationship for outliers. Unreadable otoliths are rejected. In some cases, we have used daily rings for the identification of the first annulus. Moreover, a machine-learning approach has also been developed for the age reading of otoliths. Furthermore, the	We have 1–2 readers per species. Age reading is based on otolith digital images. Readings are controlled by age reader coordinators following the recommendations of several workshops. In some cases we have used daily rings for the identification of the first annulus. Moreover, a machine-learning approach has also been developed for the age reading of otoliths. Furthermore, the SmartDots tool was also used in several workshops.	Yes. AQ3: not used because the otoliths are unreadable. AQ2: readings of the otoliths of this category are conducted by two readers, and if needed by the age reader coordinators

Country	Institute	**Internal Quality Management (Part 1)** If Quality Control is Managed by an Individual Age Reader how are QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Age Readers how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	Did you implement the age quality scores (AQ1, AQ2, AQ3) (https://vocab.ices.dk/?ref=1395) in your laboratory for routine age reading? If so, how do you handle AQ2 and AQ3 readings?
		SmartDots tool was also used in several workshops.		
Greece	Eels; IFR–Institute of Fisheries Research (ELGO-DIMITRA–Hellenic Agricultural Organization)	Not an Individual Age Reader	The age reading for the European Eel is performed by two different operators. External operators from Ireland and Sweden are assisting in the procedure since the methodology used is a modification of the Crack and Burn methodology described in WKAREA.	Yes, the age quality scores (AQ1, AQ2, AQ3) are implemented in our laboratory for routine age reading. The AQ2 otoliths are included in ageing estimations, while the AQ3 otoliths are excluded.
Greece	Small pelagics and demersal species; IFR–Institute of Fisheries Research (ELGO-DIMITRA–Hellenic Agricultural Organization)	Not an Individual Age Reader	The age reading is performed at least by 2 readers per species. When there is disagreement in age estimation between the two readers, a third reader gets called. More often, those readings (that need a third reading) are rejected. Unreadable otoliths are rejected too. An image photo is taken for every otolith sample. At first, a draft estimation is carried out during the shooting while the actual sample is tempered with under light and contrast adjustments. After that, image-based readings occur. Some readers have already used SmartDots for several exchanges and we are planning to train all readers and ultimately use SmartDots as our tool for age determination in general.	Yes, the age quality scores (AQ1, AQ2, AQ3) are implemented in our laboratory for routine age reading. The AQ2 otoliths are included in ageing estimations, while the AQ3 otoliths are excluded.
Ireland	MII–Marine Institute Ireland		For every species we have at least 2 age readers and for some we are training a third reader For every sample we collect either from the commercial, unwanted catch and survey, 20% of the sample is taken for QC purposes. These inter reader checks can either be on the actual samples but in 2020 we have moved toward using SmartDots for our internal QC process. As	

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Age Reader how are QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Age Readers how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	Did you implement the age quality scores (AQ1, AQ2, AQ3) (https://vocab.ices.dk/?ref=1395) in your laboratory for routine age reading? If so, how do you handle AQ2 and AQ3 readings?
			well as the 20% of every sample if necessary age readers will review other 'difficult ' otoliths.	
Italy	Large pelagics; UNIMAR			
Italy	Demersal and small pelagics; CNR–National Research Council and associated institutes[20]	YES by validation study at level of lab. For Example: Carbonara et al. 2018 A holistic approach to the age validation of *Mullus barbatus* L., 1758 in the Southern Adriatic Sea (Central Mediterranean). Scientific Reports volume 8, Article number: 13219.	YES - DCF Italian Age Working Group is ongoing to organize workshop and exchange: For example: Workshop on Age estimation of European anchovy *(Engraulis encrasicolus*) 19-21 November 2019 in Capo Granitola, Italy. Moreover for the establish the sample size were used the method implemented in MAREA project (Facchini M.T., Bitetto I., Spedicato M.T. and Kavadas S., 2019 Upgrade the methodological framework and tools for sampling optimization, implement and report case studies. Deliverable 3.3 - STREAM project), in ICES 2017 (Report of the Workshop on Optimization of Biological Sampling at Sample Level WKBIOPTIM, 20-22 June 2017, Lisbon, Portugal. ICES CM 2017/SSGIEOM:32. 150 pp) and in ICES 2019 (Report of the Workshop on Optimization of Biological Sampling WKBIOPTIM2, 29–31 May 2018. Nantes, France. ICES CM 2018/EOSG:23. 172 pp).	
Italy	European eel; Laboratory of Experimental		Readings were repeated at least three times with a reasonable time lapse by 2 or 3 different	

[20] CNR - National Research Council – IAMC, Mazara del Vallo; CNR - National Research Council – IAMC, Capo Granitola; CNR - National Research Council – IAMC, Messina; CNR - National Research Council – ISMAR, Ancona; Department of Life and Environmental Sciences University of Cagliari, Cagliari, Italy; Centro Interuniversitario Di Biologia Marina Ed Ecologia Applicata CIBM "G. Bacci", Livorno, Italy; COISPA - Stazione Sperimentale per lo Studio delle Risorse del Mare, Bari Italy; Department of Zoology - University of Bari, Bari, Italy.

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Age Reader how are QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Age Readers how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	Did you implement the age quality scores (AQ1, AQ2, AQ3) (https://vocab.ices.dk/?ref=1395) in your laboratory for routine age reading? If so, how do you handle AQ2 and AQ3 readings?
	Ecology and Aquaculture, Department of Biology, University of Rome		operators. (Multiple readings of the same operator after 2 or 3 weeks, and multiple readers).	
Poland	NMFRI–National Marine Fisheries Research Institute	We have 1 or 2 age readers per species. Age reading is performed following recommendations from relevant workshops. Age reader assures the quality himself or crosschecked by the former reader; sporadically at the fish ageing dedicated international workshops.	If age reading is performed by 2 age readers per species, quality is assured by crosscheck - simultaneously reading by the second reader; sporadically at the fish ageing dedicated international workshops.	Not currently used - under preparation.
Portugal	IPMA–Portuguese Institute for Sea and Atmosphere	Atlantic horse mackerel: Individual reader for HOM, Age reading is performed following instructions in relevant manuals and recommendations from relevant workshops. Age reader assures the quality himself. Blackspot sea bream: One individual reader. Age readings are performed following the recommendations from WKAMDEEP 2.	Exchange of hard structures or images between readers. Two specialist age readers per species in most species. Periodic internal age calibration exercises.	American plaice and cod: age quality scores not implemented; AQ2 is normally accepted - AQ3 rejected. Blue whiting the AQ scores classification has been implemented. The age readings from the otoliths assign as AQ3 are not considered for the construction of the ALKs to be applied to the stock assessment data. Blackspot sea bream: The AQ scores classification has been implemented; following the recommendations from WKAMDEEP 2.
Portugal	DOP/UAç–University of Azores, Department of Oceanography and Fisheries			
Spain	IEO–Spanish Institute of Oceanography; Malaga, Murcia and Baleares (Mediterranean area)	We have 1 reader per species doing two separate readings and if they do not match they are discarded. Then the readings are checked by age reader coordinators with the age–length	Not applicable.	Not implemented.

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		for outliers. Then associated otoliths are checked again and discarded.		
Spain	AZTI	Individual reader for the case of COD, HOM and grenadier (up to 2009). No internal quality control.	2 readers for ANE-PIL-MAC-MEG-ELE. Discrepancies are discussed for a final agreed age.	Not implemented.
Spain	IEO–Spanish Institute of Oceanography; Santander, Coruña, Vigo and Cádiz. ICES area and Long Distance areas: Canarias and Cadiz CECAF area.		In general, the age estimation of all species are made by two readers, or for some species by a single experienced reader. In this case, the reader performs two separate readings. In any case, the final age will be accepted when both readings coincide. In the case of discrepancy, a third age reading is made. Those otoliths that are unreadable are rejected. In addition to the age estimation, the reader assigns a value for the quality of the reading done in accordance with the "3-point classification system" recommended by WKNARC-1 and WKNARC-2 (ICES, 2011a; 2013a).	AQ2. Otoliths that are difficult to read, whose interpretation is doubtful on a 1st reading and that must be examined again. If the estimated age in the second reading is the same as in the 1st, this age is assigned as the final age of the individual. If doubts persist between the two ages, it is read a 3rd time, assigning the most frequent age of the three or leaving the age with two values (e.g. 5/4). Regarding the elaboration of the length-age keys, these otoliths whose interpretation presents doubts between two ages, are assigned as belonging to the age that presents a certain greater confidence (which is the value located in the first place of the two, ex. 5 for age 5/4); AQ3. Otoliths whose interpretation is practically impossible or very difficult, with doubts between 3 ages or more. These otoliths are excluded from further analysis.
Sweden	SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Coastal Research		Exchange of hard structures between readers, two specialists in age determination per species.	

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Age Reader how are QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Age Readers how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	Did you implement the age quality scores (AQ1, AQ2, AQ3) (https://vocab.ices.dk/?ref=1395) in your laboratory for routine age reading? If so, how do you handle AQ2 and AQ3 readings?
Sweden	SLU–Swedish University of Agricultural Science, Department of Aquatic Resources, Institute of Freshwater Research		Exchange between readers. Aiming for two experts in age determination per species but is not there yet for every species. Common documents with comments for each lake/river/sea area and species and are updated after every age determination of samples from that lake/river/sea area.	
Sweden	SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Marine Research		An internal quality control program is in place (manual in Swedish) with the main objectives of evaluating how consistent the age readers are and to identify any problems that may affect the accuracy of data delivered.	
UK	Cefas	Follow manuals and record confidence in reading age.	We have at least two readers for each species, approximately 20 readers. QC is carried out for each reader every year and we are UKAS accredited.	All reader are quality checked by another experienced reader in their stock. A random sample of 150 otoliths from that year's sample,quarters 2–3 are chosen and reread blind by another expert reader. Any readers that fall under the required agreement are investigated and supported to understand the root cause of the agreement rate.
UK	MSS–Marine Science Scotland	Use	We use only hard otoliths for QC and where possible we have 2 readers per species. A sample of approximately 70 otoliths per species/per month. These are taken from market collection samples and are read blind by each reader. Analysis is done using R script and a report is issued for each quarter of the year. For species with a single reader where possible we collaborate with other institutes.	

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Age Reader how are QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Age Readers how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	Did you implement the age quality scores (AQ1, AQ2, AQ3) (https://vocab.ices.dk/?ref=1395) in your laboratory for routine age reading? If so, how do you handle AQ2 and AQ3 readings?
Malta	Agriculture and Fisheries Regulation Division			
Slovenia	FRIS–Fisheries Research Institute of Slovenia			
Norway	IMR–Institute of Marine Research		All species are age-read by several readers, varying from 3–12 readers per species. At the IMR internal age-readings are conducted annually or biannually. All readers of the species are participating at these events. For these age-readings at least 150 individuals from the same year over several seasons are read by all readers and results are compared.	No
UK	AFBI–Agri-Food and Biosciences Institute		There are two readers for most species. We plan to implement a quality system in the next year that will use otolith images and a quality manual. A first 'blind' reading with only information on the area and date of capture is made. The biological data are then revealed and doubtful ages are checked. If the number of ages that need to be corrected exceeds 2–10 per 100 (depending on species), the whole sample is re-read. Portions of some samples are also re-read at a later date.	
Iceland	MFRI–Marine and Freshwater Research Institute		Yes, we have an internal quality control – 1 times pr. year and use the Eltink spreadsheet.	

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Age Reader how are QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Age Readers how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	Did you implement the age quality scores (AQ1, AQ2, AQ3) (https://vocab.ices.dk/?ref=1395) in your laboratory for routine age reading? If so, how do you handle AQ2 and AQ3 readings?
Latvia	BIOR–Institute of Food Safety, Animal Health and Environment			
Lithuania	Marine Research Institute, Klaipėda University	We have 1 age reader per species. Age reading is performed following instructions in relevant manuals and recommendations from relevant workshops. Age reader assures the quality themselves.		Not everyone is using this scale. AQ2 types take more time to evaluate. AQ3 are not counted at all, because it's unreadable.
Netherlands	WUR–Wageningen Marine Research	-	Yes. We aim to have at least 2 readers for each species. Regular calibration exercises are carried out between these readers. At the moment we are carrying out software development to be able to do yearly routine checks applying SmartDots@WMR, for each species at least three test sets which shall be (randomly) rotated over years.	Registering age readings in SmartDots@WMR is coupled to WMR databases. The AQ code is mandatory to be entered when reading the age sample. The AQ codes are defined as follows: AQ1 = Rings can be counted with certainty - age is assigned AQ2 = Rings can be counted with difficulty and some doubt - age is assigned AQ3 = Rings cannot be counted, the calcified structure is considered unreadable - points and age are removed so that age is not registered in the database, no age is assigned
Romania	NIMRD–National Institute for Marine Research and Development “Grigore Antipa”			
Sweden	SLU–Swedish University of Agricultural Science, Department of Aquatic Resources, Institute of Coastal Research		Exchange of hard structures between readers, two specialists in age determination per species.	

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Age Reader how are QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Age Readers how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	Did you implement the age quality scores (AQ1, AQ2, AQ3) (https://vocab.ices.dk/?ref=1395) in your laboratory for routine age reading? If so, how do you handle AQ2 and AQ3 readings?
Greenland	Pinngortitaleriffik–Greenland Institute of Natural Resources		We have 2 readers per species (cod, mackerel and capelin) who carry out self-checks twice a year on a set of otoliths. All otoliths where there is disagreement are discussed between readers. We use "Templates for Calculating Ageing Precision" by NOAA.	
Russia	AtlantNIRO–Russian Federal Research Institute of Fisheries and Oceanography (Atlantic)	Separate readings by two persons.		
Russia	PINRO–Russian Federal Research Institute Of Fisheries and Oceanography (Polar Branch)			

Annex 4. Table 1.B. Quality Status Of Age Reading At Institutes in 2022 (internal quality management factors 4–6).

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
Belgium	ILVO–Flanders Research Institute for Agriculture, Fisheries and Food	Before upload to international databases simple plots of age vs. length are produced and checked for outliers. Outliers are identified and checked in the lab. Age readings with readability score AQ2 and AQ3 are not uploaded to international databases.	Beproevingsprocedure OTL001 Werkvoorschrift WV OTL001 001 sections; Werkvoorschrift WV OTL001 002 stained sections; Werkvoorschrift WV OTL001 003 whole.	Yes, ISO 17025.

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
Cyprus	DFMR–Department of Fisheries and Marine Research (Ministry of Agriculture of the Republic of Cyprus)	Review of produced age–length keys for possible identification of outliers.	1. For the age estimation of *Mullus* species, the guidelines agreed during the Workshop on age reading of *Mullus* (WKACM, 2009) are followed, as well as the 2017 WKVALMU Recommendation on following the new ageing scheme in the Mediterranean sea is followed. 2. Carbonara, P., Follesa M.C. eds. 2018. Handbook on fish age determination: a Mediterranean experience. Studies and Reviews n. 98. General Fisheries Commission for the Mediterranean. Rome. Pp 197.	No Quality Plan in place.
Denmark	DTU Aqua–National Institute of Aquatic Resources Denmark	Before upload to international databases simple plots of age vs. length and weight are produced and checked for outliers. Outliers are identified and checked in the lab. Age readings with readability score of D (equivalent to AQ3) are not uploaded to international databases.	Manual for age determinations; holds a 1-2 page description for the majority of the species aged in the laboratory (12 species) International protocols produced at workshops are the ones we follow. We have a Danish version of the SmartDots software manual.	
Estonia	EMI–Estonian Marine Institute (University of Tartu)			
Faroe Islands	FAMRI–Faroe Marine Research Institute		Internal data quality handling book where the general otolith preparation and age reading is described (in Faroese).	
Finland	Luke–Natural Resources Institute Finland	Outliers, e.g.: Age and size in a pivot table (all specimens): are there outliers, and if there are, rechecking of them.	Raitaniemi, J., Nyberg, K. and Torvi, I. 2000. Age and growth determination of fish (In Finnish). Finnish Game and Fisheries Research Institute, Helsinki. pp. 232. Maturity of herring: The Danish manual.	New age readers practice with more experienced ones and use suitable quality control methods (column C) before they start routine age determinations.

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
France	Ifremer	Age Length Key tools are used to control among quarters of the year and with the historic database.	The preparation, age estimation, data storage and sample storage are described in detail in the following document: Mahé, K., Bellail, R., Dufour, J.L., Boiron-Leroy, A., Diméet, J., Duhamel, E., Elleboode, R., Félix, J., Grellier, P., Huet, J., Labastie, J., Le Roy, D., Lizaud, O., Manten, M.L., Martin, S., Metral, L., Nédelec, D., Vérin, Y., Badts, V., 2009. French summary of age estimation procedures. http://archimer.ifremer.fr/doc/00000/7294/	All species have two readers. Quality control checks are carried out annually on all species with two or more readers. New readers have to reach specific targets in terms of % agreement before they become primary readers.
Germany	Thünen Institute of Baltic Sea Fisheries (Rostock)	Databases use standard consistency checks (e.g. outliers); analysis of length-age diagnostics to check the consistency of the age-at-length distribution, comparison of age distributions with previous surveys, years etc.	We have a manual for herring and sprat, flatfish and cod. Additionally, we have a manual for our techniques of age reading and otolith processing. Chemically age-validated otoliths from wild Western Baltic cod are available; see McQueen *et al.* 2018. Age validation of juvenile cod in the Western Baltic Sea. ICES Journal of Marine Science, doi:10.1093/icesjms/fsy175. Krumme *et al.* 2020. Age validation of age 0-3 wild cod (*Gadus morhua*) in the western Baltic Sea through mark-recapture and tetracycline marking of otoliths. Marine Ecology Progress Series 645:141-158, DOI:10.3354/meps13380. An "Age reading guide for Western Baltic" was recently compiled and forwarded to DTU-Aqua in Denmark and SLU in Sweden.	When two age readers for a stock are available, they control a selection of readings from each other regularly. If only one age reader is available, the performance is compared to reference material and images from the manuals.
Germany	Thünen Institute of Sea Fisheries (Bremerhaven)		WKARNSC 2008 document; Sampling manual for commercial observers in German.	Reference collections for most stocks.

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
Greenland	Pinngortitaleriffik–Greenland Institute of Natural Resources		None, but in progress.	
Greece	IMBRIW–Institute of Marine Biological Resources and Inland Waters (HCMR–Hellenic Centre for Marine Research)	First, data are checked for outliers in our database for the length and the age of each species. Then, based on the age readings, an age–length key is used for outliers as well the von Bertalanffy model and the R2 of the model.	ICES Workshops, our internal manuals, Carbonara et al., 2019 (HANDBOOK ON FISH AGE DETERMINATION a Mediterranean experience) as well any related published information for each species.	We are planning to perform quality control on a subsample of each species yearly. Furthermore, we are investigating the potential automatic otolith reading using machine learning for further control.
Greece	Eels; IFR–Institute of Fisheries Research (ELGO-DIMITRA–Hellenic Agricultural Organization)	The age reading for the European Eel is performed by two different operators. External operators from Ireland and Sweden are assisting in the procedure since the methodology used is a modification of the Crack and Burn methodology described in WKAREA	The age reading for the European Eel is performed in accordance with: Workshop On Age Reading Of European And American Eel (WKAREA), Bordeaux, France. 20-24 April, 2009. Workshop On Age Reading Of European And American Eel (WKAREA2), Bordeaux, France 22-24 March 2011.	Yes. (document not specified)
Greece	Small pelagics and demersal species; IFR–Institute of Fisheries Research (ELGO-DIMITRA–Hellenic Agricultural Organization)	The first QC check is the cross-validation of the estimated age by a second reader for each sample. After that, data are uploaded on a local database and some automatic checks are performed (for example, an age-at-length test). Afterwards, additional quality checks are performed with dedicated scripts written in r language.	Carbonara, Pierluigi & Follesa, Maria & Bellodi, Andrea & Bitetto, Isabella & Capoccioni, Fabrizio & Carpentieri, Paolo & Casciaro, Loredana & Cau, Alessandro & Colella, Sabrina & Donato, Fortunata & Garibaldi, Fulvio & Lanteri, Luca & Leone, Chiara & Ligas, Alessandro & Mannini, Alessandro & Massaro, Andrea & Mulas, Antonello & Palmisano, Michele & Panfili, Monica & Spedicato, Maria Teresa. (2019). HANDBOOK ON FISH AGE DETERMINATION a Mediterranean experience / Chub mackerel workshop Final Report (2019).	Yes. (document not specified)
Ireland	MII–Marine Institute Ireland	Screening of all data is carried out before being released for stock assessment purposes, this	Manuals for age determination are held for Haddock, Whiting Plaice, Megrim, Mackerel,	Yes, all species have two readers, and quality control check are carried out on about 20% of

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
		includes length-weight regression checks for outliers, generating Age length keys and comparing against historic ALKs for the same stock.	and Blue whiting. Other manuals are in progress.	all species. New readers have to reach specific targets in terms of % agreement before they become primary readers as defined by SOP - 018 Age Reading Quality Control Quality.
Italy	Large pelagics; UNIMAR		Carbonara, P., Follesa M.C. eds. 2018. Handbook on fish age determination: a Mediterranean experience. Studies and Reviews n. 98. General Fisheries Commission for the Mediterranean. Rome. Pp 197.	
Italy	Demersal and small pelagics; CNR–National Research Council and others[21]		Carbonara, P., Follesa M.C. eds. 2018. Handbook on fish age determination: a Mediterranean experience. Studies and Reviews n. 98. General Fisheries Commission for the Mediterranean. Rome. Pp 197.	Not yet, DCF Italian Age Working Group start to implement this activity. Anyway in general at lab level each hard structure (e.g. otolith, spines, vertebra) is read by two readers and the results were evaluated in term of precision.
Italy	European eel; Laboratory of Experimental Ecology and Aquaculture, Department of Biology, University of Rome		Carbonara, P., Follesa M.C. eds. 2018. Handbook on fish age determination: a Mediterranean experience. Studies and Reviews n. 98. General Fisheries Commission for the Mediterranean. Rome. Pp 197.	
Poland	NMFRI–National Marine Fisheries Research Institute		1) Report of the second Workshop on Age Reading of Flounder (WKARFLO),6/4/2013 2) Manual for the ageing of Atlantic eel, Produced by the participants of the ICES Workshop on Age Reading for European and American Eel, 2011.	

[21] CNR - National Research Council – IAMC, Mazara del Vallo; CNR - National Research Council – IAMC, Capo Gratinola; CNR - National Research Council – IAMC, Messina; CNR - National Research Council – ISMAR, Ancona; Department of Life and Environmental Sciences University of Cagliari, Cagliari, Italy; Centro Interuniversitario Di Biologia Marina Ed Ecologia Applicata CIBM “G. Bacci”, Livorno, Italy; COISPA - Stazione Sperimentale per lo Studio delle Risorse del Mare, Bari Italy; Department of Zoology - University of Bari, Bari, Italy.

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international data-bases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Ac-cordance with a Quality Plan please provide details.
			3) ICES Report of the Workshop on Age Reading on Baltic Sprat (WKARBS), ICES CM 2008/ACOM:37. 4) Aps, R., L. Ustinova, B. Gentzen, W. Grygiel, A. Paat, Y.-O., Uder 1992. 4) Guide for the use of Baltic sprat otoliths in fisheries studies. Part I. [w:] Guide for the use of 5) Baltic sprat and herring otoliths in fisher-ies studies. Fischerei-Forsch., Sonderheft, Wis-sen. Zeit. des IfH Rostock-Marienehe: 3-17; part I.	
Portugal	IPMA–Portuguese Insti-tute for Sea and Atmos-phere		Preparation protocols of different calcified structures for age estimation are described in detail in the following document (in Portu-guese): FARIAS, I.; SOARES, E.; MORENO, A.; FERREIRA, A.L.; SILVA, A.; SERRA-PEREIRA, B.; DINIS, D.; MORAIS, D.; SILVA, D.; SANTOS, E.; MENESES, I.; FERREIRA, M.J.; LAGARTO, N.; GONÇALVES, P.; ALPOIM, R.; DORES, S.; GAR-RIDO, S.; MOURA, T.; AZEVEDO, M.M.; FIGUEIREDO, I., 2018. O Laboratório de Esclero-cronologia e os Estudos de Idade e Crescimento dos Recursos da Pesca. Relat. Cient. Téc. IPMA, nº 22 51 pp.	No Quality Plan. Quality control checks be-tween readers are carried out periodically on assesment species. For blue whiting, during the anual internal age calibration exercise the pre-cision on age classifications is determined.
Portugal	DOP/UAç–University of Azores, Department of Oceanography and Fish-eries			
Spain	IEO–Spanish Institute of Oceanography; Malaga, Murcia and Baleares (Mediterranean area)	Not applicable.	The preparation, age estimation, data storage and sample storage are described in detail in several documents and deposited in the IEO re-pository. Applying a sampling protocol for each species where the methodologies used in sam-pling, the storage and processing of data, and	No

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
			the processing and observation of skeletal parts (EP) for the allocation of age are described.: (http://www.repositorio.ieo.es/e-ieo/handle/10508/1755; http://www.repositorio.ieo.es/e-ieo/handle/10508/10536; (http://www.repositorio.ieo.es/e-ieo/handle/10508/1755; http://www.repositorio.ieo.es/e-ieo/handle/10508/10536; http://www.repositorio.ieo.es/e-ieo/handle/10508/9859; http://www.repositorio.ieo.es/e-ieo/handle/10508/10536;); Standardization of the common criteria in assigning age of each species, in order to improve the accuracy in readings: (http://www.repositorio.ieo.es/e-ieo/handle/10508/10162; http://www.repositorio.ieo.es/e-ieo/handle/10508/11122; http://www.repositorio.ieo.es/e-ieo/handle/10508/10176; http://www.repositorio.ieo.es/e-ieo/handle/10508/10177; http://www.repositorio.ieo.es/e-ieo/handle/10508/10163; http://www.repositorio.ieo.es/e-ieo/handle/10508/10178); Manual: FAO. 2002. Report of the sardine (Sardina pilchardus) otolith workshop. Kaliningrad, Russian Federation, 28–31 August 2001. Rome. 49 pp.	
Spain	AZTI	Age–length relationship	Not internal manuals, readings based on: Age reading exchange of otolith images 2018 report (SmartDots event 160) (; MEG); Report of cod otolith exchange, 1999; WKARA2 2016 (ANE); WKARHOM 2018 (HOM); WKARMAC2 2018 (MAC); WKARAS2 2019 (PIL); WKAREA3 2019, SUDOANG 2019 (EEL)	No

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
Spain	IEO–Spanish Institute of Oceanography; Santander, Coruña, Vigo and Cádiz. ICES area and Long Distance areas: Canarias and Cadiz CECAF area.		The preparation, age estimation, data storage and sample storage are described in detail in several documents and deposited in the IEO repository. Applying a sampling protocol for each species where the methodologies used in sampling, the storage and processing of data, and the processing and observation of skeletal parts (EP) for the allocation of age are described: (http://www.repositorio.ieo.es/e-ieo/handle/10508/1755; http:// www.repositorio.ieo.es/e-ieo/handle/10508/1755; http:// www.repositorio.ieo.es/e-ieo/handle/10508/10536; http:// www.repositorio.ieo.es/e-ieo/handle/10508/9858; http:// www.repositorio.ieo.es/e-ieo/handle/10508/9859; http:// www.repositorio.ieo.es/e-ieo/handle/10508/9864); Standardization of the common criteria in assigning age of each species, in order to improve the accuracy in readings: (http://www.repositorio.ieo.es/e-ieo/handle/10508/12528; http:// www.repositorio.ieo.es/e-ieo/handle/10508/12529; http:// www.repositorio.ieo.es/e-ieo/handle/10508/11122; http://www.repositorio.ieo.es/e-ieo/handle/10508/12530; http:// www.repositorio.ieo.es/e-ieo/handle/10508/12531; http://www.repositorio.ieo.es/e-ieo/handle/10508/12532; http://www.repositorio.ieo.es/e-ieo/handle/10508/12533) Manual: FAO. 2002. Report of the sardine (Sardina pilchardus) otolith workshop. Kaliningrad, Russian Federation, 28–31 August 2001. Rome. 49 pp.	Yes, we do periodically intercalibration exercises between readers. So far we have used the Eltink sheet, 2001. From this year we will use the SmartDots

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
Sweden	SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Coastal Research		Manuals for most species are available (in Swedish and/or English) describing sampling, preparation and age analysis. Routines and manuals for data storage and archives for otoliths are also available.	All species have at least two readers. Quality control check are carried out annually on assessment species and every other year on other species. New readers have to reach specific targets in terms of % agreement before they become a primary reader.
Sweden	SLU–Swedish University of Agricultural Science, Department of Aquatic Resources, Institute of Freshwater Research		Manual for preparation and age determination: ""Metodhandbok för åldersbestämning av fisk". Age estimation: Shearer. 1992. Atlantic salmon scale reading. Report of the Atlantic salmon scale reading workshop. Internal documents. Data storage: Database (access). Internal document / guide about how to input data.	Most species have at least two age readers. Intercalibration annually for eel, and salmon. Intercalibration for other species every two or three years. New readers have to reach specific targets in terms of % agreement before they become a primary reader.
Sweden	SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Marine Research		Manuals for most species are available (in Swedish and/or English) describing sampling, preparation and age analysis. Routines and manuals for data storage and archives for otoliths are also available.	Almost all species have two readers. Quality control check are carried out annually on all species with two or more readers. New readers have to reach specific targets in terms of % agreement before they become a primary reader.
UK	Cefas		Many documents stored in documents database. We have a manual for every species. We also have a manual for our techniques of age reading and otolith processing. We will also be creating age reading manuals for our tropical species.	Yes (document not specified).
UK	MSS–Marine Science Scotland		We hold manuals for herring, mackerel, anglerfish megrim and our 4 main gadoids; cod, haddock, whiting and saithe. Also in house training documentation on collection, preparation and analysis. We also hold a reference collection for our gadoid species.	Readers are expected to maintain a specific percentage agreement for each species. Feedback from the quarterly reports identifies if there is issues.

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
Malta	Agriculture and Fisheries Regulation Division			
Slovenia	FRIS–Fisheries Research Institute of Slovenia			
Norway	IMR–Institute of Marine Research		Gjøsæter, H. 1999. Procedure for selection and preparation of age material of pelagic fish. Gjøsæter, H. 1999. Procedure for age determination of *Mallotus villosus*. Gjøsæter, H. 1999. Procedure for age determination of *Clupea harengus*. Gjøsæter, H. 1999. Procedure for age determination of *Boreogadus saida*. Gjøsæter, H. 2000. Procedure for age determination of *Micromesistius poutassou*. Gjøsæter, H. 2000. Procedure for age determination of *Scomber scombrus* and *Trachurus trachurus.* Mjanger, H., Nedreaas, K., Senneset, H. and Ågotnes, P. 2000. Procedure for age de-termination of *Gadus morhua, Melanogrammus aeglefinus* and *Pollachius virens* (in Norwegian).	Gjøsæter, H. and Nedreaas, K. 1999. Procedure for quality assurance of age determination of fish. Høie. H. 2009. Procedure for quality assurance of age determination of *Gadus morhua, Melanogrammus aeglefinus* and *Pollachius virens* at the Institute of Marine Research (in Norwegian).
UK	AFBI–Agri-Food and Biosciences Institute		Sampling at sea aboard RV Corystes: pelagic fish, demersal fish, Nephrops, Scallops Sampling Nephrops & discards from commercial vessels The production of slide mounted pelagic fish otoliths for fish ageing Age determination of Irish Sea demersal fish Age determination of Scallops Age determination of Irish Sea herring Otolin System for the Embedding Sectioning and Slide Mounting of Demersal Fish Otoliths.	

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
			Sampling the N. Ireland landings of demersal fish Scale Reading: Salmonids. Freshwater Fish Processing Age Assessment of Coarse Fish by Scale Reading Ageing of Coarse Fish by Bone Reading	
Iceland	MFRI–Marine and Freshwater Research Institute			We have quality management on local Quality handbook.
Latvia	BIOR–Institute of Food Safety, Animal Health and Environment		We have started to prepare written procedures for age estimation for all the species for which we determine the age.	
Lithuania	Marine Research Institute, Klaipėda University	We do the age–length key check for illogical inputs and/or typos		
Netherlands	WUR–Wageningen Marine Research	Routine checks have been developed for internal data control. Data are checked according to these controls, and if there are issues, the people responsible for the particular sampling are contacted and asked to check and if needed correct the data. The checked and corrected data are imported into the national database at WMR. From that database, extractions are made for import primarily to DATRAS, usually after the completion of large surveys or combinations of surveys within the same season. In case problems with data are discovered, people responsible for data quality see to that routines for data validation and re-import according to internal protocols are followed on a more or less continuous basis. (See also reply to question "If Quality	<u>Fish ageing</u>: Bolle, L.J. et al. (2020) Handboek leeftijdsbepalingen (versie 3.0). CVO rapport 20.012. 119 pp. <u>Fish sampling</u>: van Damme, C. et al. (2021) CVO Handboek en protocollen voor bestandsopnamen en routinematige bemonsteringen op zee en in estuaria (Versie 15) CVO rapport 21.008. 294 pp.	Yes. The Centre for Fisheries Research (CVO), an organization structure formed within but being independent of WMR, are responsible for carrying out data collection on commission by the government. CVO has an ISO 9001:2015 certified quality management system (certificate number: 268632-2018-AQ-NLD-RvA). Quality management and quality plans, describing quality control and responsibilities at each step in the data collection and data management, are described in the following internal documents. <u>Ageing</u>: Bolle, L.J. et al. (2020) Handboek leeftijdsbepalingen (versie 3.0). CVO rapport 20.012. 119 pp. <u>Data collection (surveys)</u>: van Damme, C. et al. (2021) CVO Handboek en protocollen voor bestandsopnamen en

		Internal Quality Management (Part 2)		
Country	**Institute**	**If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details**	**Please list all institute-specific manuals that are available**	**If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.**
		Management is Carried Out in Accordance with a Quality Plan...".)		routinematige bemonsteringen op zee en in estuaria (Versie 15) CVO rapport 21.008. 294 pp. General quality management: CVO. (2020) Kwaliteitshandboek CVO (versie 11), document nummer 2.17.2.001. 33 pp.
Romania	NIMRD–National Institute for Marine Research and Development "Grigore Antipa"		Scales: preparation & reading Otoliths (whole and sectioned): preparation &reading // Carbonara, P., Follesa M.C. eds. 2018. Handbook on fish age determination: a Mediterranean experience. Studies and Reviews n. 98. General Fisheries Commission for the Mediterranean. Rome. Pp 197	Not yet.
Sweden	SLU–Swedish University of Agricultural Science, Department of Aquatic Resources, Institute of Coastal Research		Sampling - Internationally assessed species, Non internationally assessed species, Coastal sampling as part of the national and regional monitoring programmes. Preparation and age estimation: Eel - otoliths mounted, ground, stained; Eelpout - otoliths mounted & Ground; Flounder, Herring and Turbot - Sectioned otoliths, stained & mounted on custom microscope slides; Perch, Pikeperch, Vendace and Whitefish otoliths - burned & broken; Perch - operculum bone whole, Pike - wing bone whole.	All species have at least two readers. Quality control check are carried out annually on assessment species and every other year on other species. New readers have to reach specific targets in terms of % agreement before they become a primary reader.
Greenland	Pinngortitaleriffik–Greenland Institute of Natural Resources		None, but in progress.	
Russia	AtlantNIRO–Russian Federal Research Institute of Fisheries and		1) Report of the sardine (*Sardine pilchardus*) otolith workshop. FAO Fisheries Report No. 685. 2) Age Reading Manual of blue whiting. ICES (2005). Report of the Blue Whiting Otolith Ageing Workshop. 3) Kuderskaya R., 2007, On	

Country	Institute	Internal Quality Management (Part 2) If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details	Please list all institute-specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
	Oceanography (Atlantic)		the Age Determinination Method for Younger Age Groups of West African Horse Mackerel (Trachurus trecae) from the Central Eastern Atlantic. 4) Kuderskaya R., 2007, Peculiarities of the Annual Growth Rings Formation in Otoliths of the Younger Age Groups of Eastern Mackerel (Scomber japonicus) in the Canary Upwelling Area. 5) Kuderskaya R., 2004, Age determination of horse mackerel *Trachurus trachurus Linnarus* in the Central Eastern Atlantic.	
Russia	PINRO–Russian Federal Research Institute Of Fisheries and Oceanography (Polar Branch)		1) Mankevich EM. 1966. Methods of taking and reading the age samples of cod. Materialy rybokhozjaistvennikh issledovanij Severnogo basseina, Murmansk 7:53-56 (in Russian). 2) Yaragina NA, Nedreaas KH, Koloskova VP, Mjanger H, Senneset H, Zuykova NV Ågotnes P. 2009. Fifteen years of annual Norwegian–Russian cod comparative age readings. Marine Biology Research 5: 54-65. 3) Prokhorova T.A. 2010. Features of winter ring formation on otoliths of the Atlanto-Scandian (Norwegian Spring-Spawning) herring (*Clupea harengus harengus L.*). Rybnoe Khoziaystvo № 2: 52-56 (in Russian)	

Annex 4. Table 1.C. Quality Status Of Age Reading At Institutes in 2022 (evaluation of internal quality management and information on ongoing validation or method comparison studies).

		Evaluation of your Internal Quality Management			**Information on ongoing validation or method comparison studies in your lab**
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
Belgium	ILVO–Flanders Research Institute for Agriculture, Fisheries and Food	2			None
Cyprus	DFMR–Department of Fisheries and Marine Research (Ministry of Agriculture of the Republic of Cyprus)	Our level of satisfaction is 1, since we consider there is much room for improvement. We consider there should be at least 2 age readers involved per species, and we have not yet started using the benefits of SmartDots on quality evaluation.	Lack of human resources for age reading has been the biggest challenge so far.	By increasing the personnel (and/or time) involved in age reading.	None
Denmark	DTU Aqua–National Institute of Aquatic Resources Denmark	2. There is room for improvement because it is often difficult for the readers to find the time to read the QC samples. We have readers in 2 different locations so it can be difficult to check across labs when using physical samples. we also only have 1 lab with a sectioning machine. In 2022 we will have our own internal version of SmartDots and an associated otolith database.	First, time constraints and second, implementing the best methods for reading	With an internal version of SmartDots that we will adapt to our QA and data needs. This will also help us to organize our collection of otolith images and associated data. We will implement scripts for our own reporting needs.	**1.** A study comparing the sectioned and broken method for age reading cod https://smartdots.ices.dk/ViewEvent?key=269 and https://smartdots.ices.dk/ViewEvent?key=270 We have changed to the sectioned method for the western Baltic cod and hope to implement this for the Kattegat and North Sea stocks in future. **2.** Hüssy, K., Casini, M., Haase, S., Hilvarsson, A., Horbowy, J., Krüger-Johnsen, M., Krumme, U., Limburg, K. E., McQueen, K., Mion, M.,

		Evaluation of your Internal Quality Management			Information on ongoing validation or method comparison studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
					Olesen, H. J., & Radtke, K. (2020b). Tagging Baltic Cod – TABACOD. Eastern Baltic cod: Solving the ageing and stock assessment problems with combined state-of-the-art tagging methods. DTU Aqua Report no. 368-2020. National Institute of Aquatic Resources, Technical University of Denmark. 64 pp. ISBN:978-87-7481-290-6. We are co-chairing a North Sea plaice workshop (under WGBIOP) with the aim to define reader guidelines for identification of the first wr and agreement on the best reading method.
Estonia	EMI–Estonian Marine Institute (University of Tartu)	2	Develop internal age reading manuals. Moving towards having two experts for all species.	Develop internal age reading manuals. Moving towards having two experts for all species.	None
Faroe Islands	FAMRI–Faroe Marine Research Institute				
Finland	Luke–Natural Resources Institute Finland	2	Passing knowledge and skills when the readers change, new fish species or populations.		Continuous comparisons of bones and otoliths of perch (e.g.. 100 specimens), continuous comparisons of scales and otoliths of zander and whitefish (Coregonus),

		Evaluation of your Internal Quality Management			Information on ongoing validation or method comparison studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
					calibration of herring age readings between Luke (FI) and SLU (Swe).
France	Ifremer	2; satisfied but some room for improvement.			Some studies on the daily increment and on the marginal increment analyses are realized
Germany	Thünen Institute of Baltic Sea Fisheries (Rostock)	2; once the ageing of flatfish is validated, the internal and international readers´ performance can be properly assessed. Traditional ageing of Eastern Baltic cod is still a challenge.	At present there are no big challenges for internal quality management.	Age validated material from flatfish and Eastern Baltic cod.	Validation of ring pattern formation on Eastern Baltic cod; age validation of Baltic plaice, flounder, turbot and dab.
Germany	Thünen Institute of Sea Fisheries (Bremerhaven)				
Greenland	Pinngortitaleriffik–Greenland Institute of Natural Resources	2	Lack of experience.	Courses for age readers.	
Greece	IMBRIW–Institute of Marine Biological Resources and Inland Waters (HCMR–Hellenic Centre for Marine Research)	2	We are investigating the potential automatic otolith reading using machine learning for further control.	We are planning to perform quality control on a subsample of each species yearly. Furthermore, we are investigating the potential automatic otolith reading using machine learning for further control.	Daily rings have been used for the validation of the first annulus for some species and machine-learning approach has been developed for some species

		Evaluation of your Internal Quality Management			Information on ongoing validation or method comparison studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
				Train more staff on various technics	
Greece	Eels; IFR–Institute of Fisheries Research (ELGO-DIMITRA–Hellenic Agricultural Organization)	2=satisfied but some room for improvement, due to the complex life history of the species, it is quite challenging to perform age determination and to apply certain protocols.			
Greece	Small pelagics and demersal species; IFR–Institute of Fisheries Research (ELGO-DIMITRA–Hellenic Agricultural Organization)	2=satisfied but some room for improvement A number of QC checks are performed, though, we would like to establish a more specified plan.	The lack of protocols and validation studies specified for the Mediterranean stocks (since there are a lot of differences with the Atlantic ones), and the lack of human resources.	Run validation studies, enrich staff.	There are no ongoing studies at the moment.
Ireland	MII–Marine Institute Ireland	3	As we move over to SmartDots for more training and internal QC we have to update our SOPS and this is work in progress We are also critically looking at the % agreement thresholds for the different stocks to decide which is the best level to have as an internal flag to indicate if there is an issues with our ageing between readers.		None

		Evaluation of your Internal Quality Management			Information on ongoing validation or method comparison studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
Italy	Large pelagics; UNIMAR				
Italy	Demersal and small pelagics; CNR–National Research Council and others[22]	1	There are several Institute/readers involved in the fish age analysis and it is difficult to harmonize the age scheme, age criteria, preparation methods.	Organization of workshop on the species and/or group of species at level of Italian National Coordinator.	Carbonara et al. 2018 A holistic approach to the age validation of Mullus barbatus L., 1758 in the Southern Adriatic Sea (Central Mediterranean). Scientific Reports vol. 8, Article number: 13219. Basilone et al. 2020. First annulus formation in the European anchovy; a two-stage approach for robust validation. Scientific Reports vol. 10 Article number: 1079.
Italy	European eel; Laboratory of Experimental Ecology and Aquaculture, Department of Biology, University of Rome				

[22] CNR - National Research Council – IAMC, Mazara del Vallo; CNR - National Research Council – IAMC, Capo Gratinola; CNR - National Research Council – IAMC, Messina; CNR - National Research Council – ISMAR, Ancona; Department of Life and Environmental Sciences University of Cagliari, Cagliari, Italy; Centro Interuniversitario Di Biologia Marina Ed Ecologia Applicata CIBM "G. Bacci", Livorno, Italy; COISPA - Stazione Sperimentale per lo Studio delle Risorse del Mare, Bari Italy; Department of Zoology - University of Bari, Bari, Italy.

		Evaluation of your Internal Quality Management			Information on ongoing validation or method comparison studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
Poland	NMFRI–National Marine Fisheries Research Institute	2	Lack of the second reader for some species.	Training new readers.	
Portugal	IPMA–Portuguese Institute for Sea and Atmosphere				*Engraulis encrasicolus*, European anchovy (daily rings); *Sardina pilchardus*, sardine (daily rings); *Micromesistius poutassou*, blue whiting (otolith morphometric relationships); *Scomber colias*, Atlantic chub mackerel (edge type analysis, coorte analysis); *Scomber scombrus*, Atlantic mackerel (edge type analysis, marginal increment analysis).
Portugal	DOP/UAç–University of Azores, Department of Oceanography and Fisheries				
Spain	IEO–Spanish Institute of Oceanography; Malaga, Murcia and Baleares (Mediterranean area)	1	Not enough staff working on age readings.		No
Spain	AZTI	2. Monitoring of agreement percentage through time.	Developing internal age reading manuals.	Developing internal age reading manuals.	None.

		Evaluation of your Internal Quality Management			Information on ongoing validation or method comparison studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
Spain	IEO–Spanish Institute of Oceanography; Santander, Coruña, Vigo and Cádiz. ICES area and Long Distance areas: Canarias and Cadiz CECAF area.	2			Daily increment studies and analyses of the marginal increment.
Sweden	SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Coastal Research				
Sweden	SLU–Swedish University of Agricultural Science, Department of Aquatic Resources, Institute of Freshwater Research				
Sweden	SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Marine Research				
UK	Cefas				

		Evaluation of your Internal Quality Management			Information on ongoing validation or method comparison studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
UK	MSS–Marine Science Scotland	Satisfaction=3.	Time issues: Our readers have many other tasks associated with data collection therefore getting the quarterly internal exchanges completed in a timely fashion and reports produced is always challenging. Losing experienced readers who are difficult to replace.		
Malta	Agriculture and Fisheries Regulation Division				
Slovenia	FRIS–Fisheries Research Institute of Slovenia				
Norway	IMR–Institute of Marine Research	3	Differences between experienced and new readers.		No studies planned.
UK	AFBI–Agri-Food and Biosciences Institute				
Iceland	MFRI–Marine and Freshwater Research Institute				
Latvia	BIOR–Institute of Food Safety, Animal Health and Environment				

		Evaluation of your Internal Quality Management			Information on ongoing validation or method comparison studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
Lithuania	Marine Research Institute, Klaipėda University	3	So far so good.		
Netherlands	WUR–Wageningen Marine Research	3	The biggest challenge is to allow enough resources (time, money) for personnel involved in data collection to take part in Internal Quality Management.	By following the age reading handbook (Bolle *et al.,* 2020) as well as recommendations coming from for example ICES working groups and taking new issues and findings into account to improve data quality. It is often when data are used in specific studies that new questions arise, or problems with data quality are noticed. Providing channels for feedback, to check data and if relevant to improve methods etc., is essential.	None at present, except for freshwater fish species. For pikeperch (*Sander lucioperca*) and bream (*Abramis brama*), pilot projects are ongoing, also in collaboration with institutes abroad, e.g. SLU-Aqua, to compare age readings using traditional methods (scales) with otoliths.
Romania	NIMRD–National Institute for Marine Research and Development “Grigore Antipa”				
Sweden	SLU–Swedish University of Agricultural Science, Department of Aquatic Resources, Institute of Coastal Research				

		Evaluation of your Internal Quality Management			Information on ongoing validation or method comparison studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. (1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied)**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or method comparison studies in your lab**
Greenland	Pinngortitaleriffik–Greenland Institute of Natural Resources				
Russia	AtlantNIRO–Russian Federal Research Institute of Fisheries and Oceanography (Atlantic)				
Russia	PINRO–Russian Federal Research Institute Of Fisheries and Oceanography (Polar Branch)				

Annex 4. Table 2.A. Quality Status Of Maturity Reading At Institutes in 2022 (internal quality management factors 1 –3).

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Maturity Reader how are the QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Maturity Reader how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details
Spain	IEO–Spanish Institute of Oceanography; IEO-Project BIODEMER // Macroscopic maturity // Species: European hake (*M. merluccius*); Ling (*M. molva*); Pouting (*T. luscus*); John dory (*Z. faber*); red striped mullet (*M. Surmuletus*); greater forkbeard (*P. blennoides*); blackbelly rosefish (*H. dactylopterus*). Microscopic maturity: European conger eel (*C. conger*)	No	Macroscopic maturity stages are read by expert technicians as part of biological sampling.	Images of the different stages of maturity are being taken as part of tasks in routine biological sampling to have visual maturity keys for all species that will help in the correct assignment of maturity stages.
Spain	IEO–Spanish Institute of Oceanography; Atlantic demersal species	No	Maturity reading are made by two people.	
Spain	IEO–Spanish Institute of Oceanography; C.O. of Malaga, Murcia and Baleares - Mediterranean area)	We have 1 readers per species . Then the readings are checked by the coordinators for outliers. Then associated individuals are checked again and discarded.	Not applicable.	Not applicable.
Spain	IEO–Spanish Institute of Oceanography; IEO project BIOPEL macroscopic maturity pelagic species: Anchovy, sardine, mackerel,		The maturity states are assigned in the biological samples from the fleet that are carried out in different IEO laboratories and in the surveys. Therefore they are managed by a group of readers.	**No**

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Maturity Reader how are the QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Maturity Reader how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details
	chub mackerel, horse mackerel, blue whiting			
Spain	IEO–Spanish Institute of Oceanography; C.O. of Cádiz (ICES area 9.a)	In general, for all species (Nephrops, Cephalopods (*Loligo vulgaris*, *Sepia officinalis*, *Octopus vulgaris*), Anchovy, Sardine, *Scomber colias, Pagellus bogaraveo*) , the maturity estimation is performed by an individual reader.		
Spain	IEO–Spanish Institute of Oceanography; IEO_EREME project (Coruna, Vigo, and Santander institutes). EREME project collaborates with other projects such as BIOPEL and BIOPESLE to improve data quality. We work with macro and microscopic maturity in ICES areas: mackerel, horse mackerel, sardine, *Lepidorhombus boscii*, *L. wiffiagonis*, *Micromessistius potassou*, anchovy and chub mackerel and in NAFO area: greenland halibut, cod, american plaice and *Macrourus bergla.*		A maturity workshop is held annually before the surveys in NAFO to review the maturity stages and to emphasize the peculiarities of each species in that area and time of the year. This is not quality control, but it helps to improve the quality of maturity data.	
Spain	AZTI	No	Percentage of agreement amount all readers on samples of 50 individuals. A species per year.	GSI plot.

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Maturity Reader how are the QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Maturity Reader how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details
Germany	Thünen Institute of Baltic Sea Fisheries (Rostock)	Not relevant.	At least 2 readers per species or species group. We use macroscopic staging only. No specific number of samples; mutual comparisons using processing of fresh fish in the lab and at sea	Databases use standard consistency checks.
Germany	Thünen Institute of Sea Fisheries (Bremerhaven)	Not relevant.	only macroscopic staging, depending on species 2–5 staging personnel, mutual comparisons are done during processing.	Databases use standard consistency checks.
Latvia	BIOR–Institute of Food Safety, Animal Health and Environment	Maturity staging is performed following instructions in relevant national manuals. The quality is assured by responsible researcher of given species. Maturity is done for cod, herring, sprat, flounder, turbot, perch and round goby.	Yes. We have at least 1–2 persons involved in maturity staging of every species.	
Estonia	EMI–Estonian Marine Institute (University of Tartu)		1–2 maturity readers per species, depends on commercial sample or survey. Using macroscopic staging only.	No
France	Ifremer	Internal Quality Management.	One group at national level.	No
Faroe Islands	FAMRI–Faroe Marine Research Institute	In general, for all species , the maturity estimation (macroscopic) is performed by an individual reader following national manuals/protocols. For pelagic species a group of four skilled persons discuss internally once or twice a year, to intercalibrate the staging procedures.		
Cyprus	DFMR–Department of Fisheries and Marine Research		Maturity staging is performed usually by 1–2 persons for every species, macroscopically,	No

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Maturity Reader how are the QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Maturity Reader how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details
	(Ministry of Agriculture of the Republic of Cyprus)		based on instruction manuals used. From commercial fisheries, maturity staging involves 5 demersal and 3 large pelagic species (all bony fish); samples collected per demersal species are around 300. In total, 6 persons are involved in maturity reading, but are not dedicated to this activity.	
Ireland	MII–Marine Institute Ireland	QC checks by individual collecting the data when an individual fish processed, again at the end of a sample. Additional QC checks by Chief scientist.	NA	Any maturity stages that are not recognized by DATRAS are removed. Maturity stage is plotted against length, outliers are investigated.
Poland	NMFRI–National Marine Fisheries Research Institute	Maturity staging of different fish species is determined by different readers who are in fact technicians attending on-board observer trips. Observers are not selected due to target fish species to be exploited in a given fishing trip. To be flexible in choosing observers (their availability) all technicians were trained by experienced staff to estimate maturity of all possible fish species.	Not carried out so far.	No
Belgium	ILVO–Flanders Research Institute for Agriculture, Fisheries and Food		No QC in place on a routine basis, but participation in maturity workshops and exchanges when appropriate.	No
Portugal	IPMA–Portuguese Institute for Sea and Atmosphere	In general, macroscopic maturity assignation is carried out by a single reader (usually an experienced one), but several readers perform maturity assignation for the same species (e.g. at different geographical locations in Portugal). Internal training and/or calibration exercises take place periodically. Microscopic	No QC checks are carried out by a group of readers.	Maturity data from individuals sampled from commercial fleet (i.e. at-market and at-sea sampling) goes through QC checks after being registered in the national database (e.g. scale used for species*sex, length-maturity stage plots). Maturity data from Portuguese bottom

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Maturity Reader how are the QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Maturity Reader how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details
		maturity estimation is performed by an individual reader for all species. *Loliginidae* and *Ommastrephidae*: no microscopic evaluation is performed.		trawl surveys (PT-IBTS) are checked by each species coordinator.
UK	Cefas	No	We don't have a specific team dedicated to this but we have training in place and carry out QC during every survey.	
Italy	University of Cagliari; COISPA	Maturity staging is performed following instructions in Follesa, M.C., Carbonara, P., eds. 2019. Atlas of the maturity stages of Mediterranean fishery resources. Studies and Reviews n. 99. Rome, FAO. 268 pp. The quality is assured by responsible researcher of given species. Maturity is done for a lot of bony fish, elasmobranchs, Crustaceans and Cephalopods.	Yes	
Greece	IMBRIW–Institute of Marine Biological Resources and Inland Waters (HCMR–Hellenic Centre for Marine Research)	No	Maturity stages are assigned in the biological samples carried out in the laboratories and also on board. Although there is a group of people involved in maturity staging, some of them are specialized to different species or taxa.	We conduct random microscopic checks on a number of maturity samples to verify the maturity staging. This procedure is also applied if the identification of the maturity stage is uncertain.
Greece	IFR–Institute of Fisheries Research (ELGO-DIMITRA–Hellenic Agricultural Organization)	Not an Individual Maturity Stager.	For every biological sample there are at least 2 Maturity Stagers.	First, QC check is performed by crosschecking the two (at least) Maturity Stagings. Since maturity is evaluated macroscopically in our lab, we conduct random microscopic checks on a number of maturity samples to verify the accuracy of the maturity staging. After that, data are uploaded on a local database and

Country	Institute	Internal Quality Management (Part 1) If Quality Control is Managed by an Individual Maturity Reader how are the QC checks carried out ? Please provide details on the number of samples included, what analysis is used, frequency, image based or not.	If Quality Control is Managed by a Group of Maturity Reader how are the QC checks carried out? Please provide details on the number read and samples included, what analysis is used, frequency, image based or not.	If you conduct routine QC checks on your data before it is uploaded to the international databases please provide some details
				some automatic checks are performed. Finally, quality assessment is conducted.
Netherlands	WUR–Wageningen Marine Research	No	We have multiple readers by species, but there is no QA workplan.	
Finland	Luke–Natural Resources Institute Finland	With herring, a manual with photographs (DTU Aqua, Denmark) is used.	In the surveys, different maturity readers have the chance to discuss about their interpretations. Some workshops between readers have taken place (not recently, though).	
Denmark	DTU Aqua–National Institute of Aquatic Resources Denmark	In general, for all species , the maturity estimation (macroscopic and microscopic) is performed by an individual reader following national manuals/protocols.	No	
Sweden	SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Marine Research; SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Coastal Research	No QC in place on a routine basis but Intercalibration workshop in spring each year with fresh and frozen gonads including all maturity stagers. Whole mount is used sometimes to validate the stages but only in the lab not surveys.		
Norway	IMR–Institute of Marine Research			

Annex 4. Table 2.B. Quality Status Of Maturity Reading At Institutes in 2022 (internal quality management factors 4–6).

		Internal Quality Management (Part 2)		
Country	**Institute**	**Are you using any kind of grading system to evaluate the certainty of the given reproductive organs stage or to evaluate the mature or immature state of a fish? If so, which grading system do you use and how?**	**Please list all institute specific manuals that are available**	**If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.**
Spain	IEO–Spanish Institute of Oceanography; IEO-Project BIODEMER // Macroscopic maturity // Species: European hake (*M. merluccius*); Ling (*M. molva*); Pouting (*T. luscus*); John dory (*Z. faber*); red striped mullet (*M. Surmuletus*); greater forkbeard (*P. blennoides*); blackbelly rosefish (*H. dactylopterus*). Microscopic maturity: European conger eel (*C. conger*)		European hake, Greater forkbeard, Pouting and Ling (WKMSGAD, 2013); John dory and Striped red mullet (BIOSDEF project); Blackbelly rosefish (Mendoça *et al*., 2006); European conger eel (we can identify two main groups: immature or mature).	
Spain	IEO–Spanish Institute of Oceanography; Atlantic demersal species			
Spain	IEO–Spanish Institute of Oceanography; C.O. of Malaga, Murcia and Baleares - Mediterranean area)	No grading system.	We follow the manuals produced by the different WKs by species.	
Spain	IEO–Spanish Institute of Oceanography; IEO project BIOPEL macroscopic maturity pelagic	We are not using any kind of grading system.	The preparation, mature stage assignation, data storage and sample storage are described	

Country	Institute	Internal Quality Management (Part 2) Are you using any kind of grading system to evaluate the certainty of the given reproductive organs stage or to evaluate the mature or immature state of a fish? If so, which grading system do you use and how?	Please list all institute specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
	species: Anchovy, sardine, mackerel, chub mackerel, horse mackerel, blue whiting		in detail in several documents and deposited in the IEO repository.	
Spain	IEO–Spanish Institute of Oceanography; C.O. of Cádiz (ICES area 9.a)		The manuals for maturity scales can be find in: Anchovy/ Sardine/ Mackerel: Workshop for small pelagic maturity (WKSPMAT2009), Nephrops: Report of the Workshop on crustacean maturity stages (WKMSC2009), Loligo/Octopus/ Sepia: Report of the Workshop on Sexual Maturity Staging of Cephalopods (WKMSCEPH2010), *Pagellus bogaraveo*: Holden & Rett , adapted to hermaphrodite species (Holden, M.J. and D.F.S. Raitt. – 1974. Manual of fisheries science. Part 2. Methods of resource investigation and their application. FAO Fish. Tech. Rep., (115): Rev. 1, 214 pp.).	
Spain	IEO–Spanish Institute of Oceanography; IEO_EREME project (Coruna, Vigo, and Santander institutes). EREME project collaborates with other projects such as BIOPEL and BIOPESLE to improve data quality. We work with macro and microscopic maturity in ICES areas: mackerel, horse mackerel, sardine,		EREME provide photographic maturity manuals and based on the ICES maturity workshop reports. Pictures are taken in the area and time when sampling is carried out. The macroscopic maturity stages are validated with histology. For those species (such as halibut or cod) that have a wide size range, each maturity stage is illustrated with different sized females. Those manuals are distributed to homogenize readers. EREME have also protocols for histological slide readings for cod , Greenland halibut, *Macrourus berglax*'s and mackerel to homogenize different readers.	The EREME project plans to provide histologically validated photographic maturity manuals for all ICES and NAFO species and to hold a maturity workshop before the PELACUS survey (pelagic fish) and the DEMERSALES survey (demersal fish) in which the maturity stages of each species and their particularities will be recalled.

Country	Institute	Internal Quality Management (Part 2) Are you using any kind of grading system to evaluate the certainty of the given reproductive organs stage or to evaluate the mature or immature state of a fish? If so, which grading system do you use and how?	Please list all institute specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
	Lepidorhombus boscii, *L. wiffiagonis*, *Micromessistius potassou*, anchovy and chub mackerel and in NAFO area: greenland halibut, cod, american plaice and *Macrourus bergla*			
Spain	AZTI	No grading system.	Not internal manuals, staging based on: WALSH 1990; BIOSDEFF 1998; WKMSHM 2007; WKSPMAT 2008; WKMSGAD 2013.	No
Germany	Thünen Institute of Baltic Sea Fisheries (Rostock)	no grading system in place. Maturity determination follows the scales given in the relevant ICES reports and manuals (e.g. Manual for the BITS, BASS, BIAS etc).	Image collections, peer-reviewed publications on maturity of fish from the Baltic Sea, ICES reports.	A "quality plan" is not used.
Germany	Thünen Institute of Sea Fisheries (Bremerhaven)	no grading system in place. Maturity determination follows the scales given in the relevant ICES reports and manuals (e.g. Manual for the IBTS, MEGS etc).	Image collections, ICES reports, peer-reviewed publications.	A "quality plan" is not used.
Latvia	BIOR–Institute of Food Safety, Animal Health and Environment		All national manuals are based on Kisilevich 6 grade scale.	
Estonia	EMI–Estonian Marine Institute (University of Tartu)	No	Using Kiselevich 6-grade scale (e.g. shown in BITS manual).	None
France	Ifremer	No grading system to evaluate the quality of maturity data.	Manuals of IBTS, EVHOE and MEDITS surveys.	

Country	Institute	Internal Quality Management (Part 2) Are you using any kind of grading system to evaluate the certainty of the given reproductive organs stage or to evaluate the mature or immature state of a fish? If so, which grading system do you use and how?	Please list all institute specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
Faroe Islands	FAMRI–Faroe Marine Research Institute			
Cyprus	DFMR–Department of Fisheries and Marine Research (Ministry of Agriculture of the Republic of Cyprus)	No	Medits Instruction Manuals; Follesa, M.C., Carbonara, P., eds. 2019. Atlas of the maturity stages of Mediterranean fishery resources. Studies and Reviews n. 99. Rome, FAO. 268 pp.; ICCAT manual (https://www.iccat.int/Documents/SCRS/Manual/CH4/CH4_8-ENG.pdf)	A "quality plan" is not used.
Ireland	MII–Marine Institute Ireland		Institute-specific, not published.	NA
Poland	NMFRI–National Marine Fisheries Research Institute	Not currently used - under preparation.	BITS Manuals; Guidebook for Baltic cod (*Gadus morhua callarias* L, 1758) gonad's maturity determination according to modified Maier's 8-stage scale. Working Paper on the ICES Workshop on Maturity Ogive estimation for Stock Assessment [WKMOG] in Lisbon,;Portugal, 3–6 June 2008. Guidebook for the Baltic sprat (*Sprattus sprattus balticus*, Schneider, 1904) gonad's maturity determination according to modified Maier's 8-stage scale. Working Paper on the ICES Workshop on Maturity Ogive estimation for Stock Assessment [WKMOG] in Lisbon, Portugal, 3–6 June 2008.	Not carried out.
Belgium	ILVO–Flanders Research Institute for Agriculture, Fisheries and Food	Not yet but we are planning to do so.	ICES reports are used.	No

Country	Institute	Internal Quality Management (Part 2) Are you using any kind of grading system to evaluate the certainty of the given reproductive organs stage or to evaluate the mature or immature state of a fish? If so, which grading system do you use and how?	Please list all institute specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
Portugal	IPMA–Portuguese Institute for Sea and Atmosphere	No grading system is being used at present to evaluate the certainty of a given reproductive organs stage.	All manuals for sexual maturity assignation used have been compiled in the WKASMSF 2018 report. A manual including all maturity scales in usage at IPMA is currently being elaborated. An internal manual for histology processing is available at IPMA.	No Quality Plan exists.
UK	Cefas		Use national manuals, descriptions and keys.	
Italy	University of Cagliari; COISPA		Follesa, M.C., Carbonara, P., eds. 2019. Atlas of the maturity stages of Mediterranean fishery resources. Studies and Reviews n. 99. Rome, FAO. 268 pp.	
Greece	IMBRIW–Institute of Marine Biological Resources and Inland Waters (HCMR–Hellenic Centre for Marine Research)	No	ICES maturity scales from various reports, MEDITS protocols, Follesa et al 2019 (ATLAS ON THE MATURITY STAGES OF MEDITERRANEAN FISHERY RESOURCES), and Nikolsky maturity scale.	Microscopic examination of gonads is used as well as length at maturity curve is checked for outliers.
Greece	IFR–Institute of Fisheries Research (ELGO-DIMITRA–Hellenic Agricultural Organization)	No grading system has been used till present to evaluate the certainty of the given reproductive organs stage or to evaluate the mature or immature state of a fish.	Follesa, Maria & Carbonara, Pierluigi & Agus, Blondine & Basilone, Gualtiero & Bellodi, Andrea & Bottari, Teresa & Cannas, Rita & Capezzuto, Francesca & Carpentieri, Paolo & Cau, Alessandro & Colella, Sabrina & Casciaro, Loredana & Cuccu, Danila & Donnaloia, Marilena & Gancitano, Vita & Gaudio, Palma & Maiorano, Porzia & Mancusi, Cecilia & Mannini, Alessandro & Lanteri, Luca. (2019). ATLAS ON THE MATURITY STAGES OF MEDITERRANEAN FISHERY RESOURCES.	We always use the same macroscopic scale for staging (Nicolsky 1976 for Bony fish, ICCAT scale for Big pelagic, Buellens *et al.*, 1977 for European eel, WKMSCEPH 2010 for Cephalopods, WKMSC for crustaceans and MEDITS scale for survey samples). We use an agreed reference manual per species. There are at least two stagers for every sample. Random microscopic checks are performed. A posteriori quality assessment is conducted, based on the analysis of the relevant data (regression model on maturity data to calculate Lm).

Country	Institute	Internal Quality Management (Part 2) Are you using any kind of grading system to evaluate the certainty of the given reproductive organs stage or to evaluate the mature or immature state of a fish? If so, which grading system do you use and how?	Please list all institute specific manuals that are available	If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.
Netherlands	WUR–Wageningen Marine Research	No	Internal handbooks for surveys, discards and commercial sampling contain information on how to assess maturity; ICES reports.	Not yet, in 2021 we are running a project to prepare an internal handbook for QA of maturity.
Finland	Luke–Natural Resources Institute Finland		Herring manual by DTU Aqua, Denmark. With other species, national short manuals with text only.	
Denmark	DTU Aqua–National Institute of Aquatic Resources Denmark		All maturity manuals for gadoids, flatfish, pelagics are being updated in 2019/2020 to follow the new revised WKMATCH maturity scale. Stages verified histologically. Protocols for reading histological sections are available for cod and herring (mackerel under prep.)	None
Sweden	SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Marine Research; SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Coastal Research		Modified Danish manual (gadoids and pelagics), WKMSSPDF Manual (Flatfish). Manuals will be updated to follow the new SMSF maturity scale.	None
Norway	IMR–Institute of Marine Research	No	All maturity manuals for gadoids, flatfish, pelagics are being updated in 2019/2020 to follow the new revised WKMATCH maturity scale. Stages verified histologically. Protocols for reading histological sections are available for cod and herring (mackerel under prep.);	None

Country	Institute	**Internal Quality Management (Part 2)** **Are you using any kind of grading system to evaluate the certainty of the given reproductive organs stage or to evaluate the mature or immature state of a fish? If so, which grading system do you use and how?**	**Please list all institute specific manuals that are available**	**If Quality Management is Carried Out in Accordance with a Quality Plan please provide details.**
			Mjanger *et al.*, 2019. Handbook for sampling fish, crustaceans and other invertebrates.	

Annex 4. Table 2.C. Quality Status Of Maturity Reading At Institutes in 2022 (evaluation of internal quality management and information on ongoing validation or method comparison studies).

		Evaluation of Internal Quality Management			Ongoing validation or methodological studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. 1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or methodological studies in your lab**
Spain	IEO–Spanish Institute of Oceanography; IEO-Project BIODEMER // Macroscopic maturity // Species: European hake (*M. merluccius*); Ling (*M. molva*); Pouting (*T. luscus*); John dory (*Z. faber*); red striped mullet (*M. Surmuletus*); greater forkbeard (*P. blennoides*); blackbelly rosefish (*H. dactylopterus*). Microscopic maturity: European conger eel (*C. conger*)	2		Continue to take pictures of different states of maturity in biological samplings. Build a complete manual with images of the entire maturation process by species	
Spain	IEO–Spanish Institute of Oceanography; Atlantic demersal species				
Spain	IEO–Spanish Institute of Oceanography; C.O. of Malaga, Murcia and Baleares - Mediterranean area)	3; Not enough staff working on maturity readings.			

		Evaluation of Internal Quality Management			Ongoing validation or methodological studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. 1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or methodological studies in your lab**
Spain	IEO–Spanish Institute of Oceanography; IEO project BIOPEL macroscopic maturity pelagic species: Anchovy, sardine, mackerel, chub mackerel, horse mackerel, blue whiting	2		Microscopic and macroscopic validation would be very useful, but currently we do not have sufficient technical means or personnel.	
Spain	IEO–Spanish Institute of Oceanography; C.O. of Cádiz (ICES area 9.a)				
Spain	IEO–Spanish Institute of Oceanography; IEO_EREME project (Coruna, Vigo, and Santander institutes). EREME project collaborates with other projects such as BIOPEL and BIOPESLE to improve data quality. We work with macro and microscopic maturity in ICES areas: mackerel, horse mackerel, sardine, *Lepidorhombus boscii*, *L. wiffiagonis*, *Micromessistius potassou*, anchovy and chub	2	In ICES area, one species maturity data are taken in different laboratories located along the Galician and Cantabrian coasts. It is important to provide protocols and manuals to help homogenize the collection of maturity data of all species.	Working on completing the existing maturity manuals as there are maturity stages for which we have not yet obtained samples. On the other hand, to elaborate maturity manuals for all species.	

Country	Institute	Evaluation of Internal Quality Management Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. 1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied	What are the biggest challenges you have with your Internal Quality Management?	How do you think you could improve your Internal Quality Management?	Ongoing validation or methodological studies in your lab Please provide any information on ongoing validation or methodological studies in your lab
	mackerel and in NAFO area: greenland halibut, cod, american plaice and *Macrourus bergla*				
Spain	AZTI	2; Monitoring of agreement percentage through time	Be up to date with decisions and changes made at species level understand the reproductive cycle of each species.	Developing maturity reading refence catalogue along with histological validation.	Internal maturity staging exercise on Horse Mackerel during November 2020.
Germany	Thünen Institute of Baltic Sea Fisheries (Rostock)	3; Reason: consistent results and relatively high internal agreement between readers	At present there are no big challenges.	Possibly increase standardization of internal comparisons; ensure clearer and more transparent in-house documentation of procedures and documentation/presentation of the outcomes to the staff; develop R routines to compare readers performance on a routine basis.	No ongoing studies in the field of maturity research.
Germany	Thünen Institute of Sea Fisheries (Bremerhaven)	3; Reason: consistent results and relatively high internal agreement between readers	At present there are no big challenges.	Possibly increase standardization of internal comparisons; ensure clearer and more transparent in-house documentation of procedures and documentation/presentation of the outcomes to the staff; develop R routines to compare readers performance on a routine basis.	No ongoing studies in the field of maturity research.

		Evaluation of Internal Quality Management			Ongoing validation or methodological studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. 1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or methodological studies in your lab**
Latvia	BIOR–Institute of Food Safety, Animal Health and Environment				
Estonia	EMI–Estonian Marine Institute (University of Tartu)	2	With ICES assessed stocks no big challenges. Readers can discuss and compare their estimates in the surveys where they participate together annually. Would benefit from specific manuals for other species (e.g. pikeperch).	Set up maturity events on SmartDots to inter- and intracalibrate (ICES stocks). Develop manuals for regionally important stocks.	None.
France	Ifremer	1	To qualify the data.	Develop the histological approach to better qualify the macroscopic approach.	A PhD thesis started in September 2020 on the histological approach applied to 4 species (striped-red mullet, blue withing and 2 species of megrim, this work follows that already carried out on plaice.
Faroe Islands	FAMRI–Faroe Marine Research Institute	2	Maturity stages for mackerel can be problematic during the spawning season, difficult to determine between prespawning and spawning (the gonad can be pre in the front and spawning in the rear end).		
Cyprus	DFMR–Department of Fisheries and Marine Research (Ministry of	Our level of satisfaction with our Internal Quality Management is 2. There is room for improvement,	We do not validate maturity stages assigned macroscopically with histology. We do not perform	Routinely take pictures of different maturity stages by species sampled covering the whole sampling	None.

Country	Institute	Evaluation of Internal Quality Management Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. 1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied	What are the biggest challenges you have with your Internal Quality Management?	How do you think you could improve your Internal Quality Management?	Ongoing validation or methodological studies in your lab Please provide any information on ongoing validation or methodological studies in your lab
	Agriculture of the Republic of Cyprus)	e.g. Establishment of routine exercises among maturity readers for evaluating the agreement among them and identifying possible quality issues.	exercises for evaluating agreement among maturity readers.	period and identify cases with no clear (macroscopically) maturity staging. Histological validation would improve our internal Quality Management, but at the moment there are limitations for developing this approach.	
Ireland	MII–Marine Institute Ireland	2	We do not routinely validate maturity stages assigned by eye (macroscopically) with histology.	Histological validation would be useful but this requires a lot of resources, which we currently allocate to more high-priority work.	None.
Poland	NMFRI–National Marine Fisheries Research Institute	1	at sea sampling mainly on fishing boats/cutters	establishing a dedicated maturity determination group, more samples elaborated in the Lab	No studies performed.
Belgium	ILVO–Flanders Research Institute for Agriculture, Fisheries and Food	1	Lack of time to check each other scores. Lots of samples must be processed in the lab, so the scoring process is rather fast. No ability to check afterwards the given score again.	It will be good to have some ideas on how other labs handle this.	None.
Portugal	IPMA–Portuguese Institute for Sea and Atmosphere	2=satisfied but some room for improvement.	In maturity scales validation: 1) For some species, biological sampling not carried out regularly, covering the whole reproductive cycle, samples only available from annual surveys (ex: Anglers); 2) For some species, not all maturity stages	Priority should be given to microscopically validate the maturity scales in usage.	Ongoing maturity stage validation studies using histology for several species (*Engraulis encrasicolus*, *Micromesistius poutassou*, *Scomber scombrus*, *Scomber colias*,

Country	Institute	Evaluation of Internal Quality Management			Ongoing validation or methodological studies in your lab
		Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. 1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied	What are the biggest challenges you have with your Internal Quality Management?	How do you think you could improve your Internal Quality Management?	Please provide any information on ongoing validation or methodological studies in your lab
			available in samples collected (ex: *Nephrops norvegicus*, *Scomber colias*); 3) Insufficient human resources and laboratory availability to process histologically the gonad samples to clarify/validate maturity assignment doubts in due time; In internal maturity stages calibration: logistically challenging for the maturity readers of the same species working geographically distant.		*Trachurus picturatus*, *Nephrops norvegicus*, *Lepidorhombus boscii*)
UK	Cefas				
Italy	University of Cagliari; COISPA				
Greece	IMBRIW–Institute of Marine Biological Resources and Inland Waters (HCMR–Hellenic Centre for Marine Research)	2	To conduct histological studies.	Using histological sections.	Validation is performed indirectly by comparing the macroscopic stages with GSI data.
Greece	IFR–Institute of Fisheries Research (ELGO-DIMITRA–Hellenic Agricultural Organization)	2=satisfied but some room for improvement: need for international and interlaboratory scale so all training and reference can apply	Lack of equipment and lack of human resources.	Maturity workshops for training, validation studies, enrich stuff.	There are no ongoing studies at present.

		Evaluation of Internal Quality Management			Ongoing validation or methodological studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. 1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or methodological studies in your lab**
		easier, need for validation studies in Mediterranean.			
Netherlands	WUR–Wageningen Marine Research	1; currently we do not have a plan in place, but in 2021 we will prepare a QA internal handbook.			We had some specific projects in the past, but with the new internal handbook and QA workplan we will implement the preparation of validation as well.
Finland	Luke–Natural Resources Institute Finland	2	With ICES assessed stocks, no big challenges: readers are able to discuss and compare their estimates in the surveys where they participate together annually.	By continuing comparisons, also with calibrations.	
Denmark	DTU Aqua–National Institute of Aquatic Resources Denmark	2	Maturity stagers generally work individually and maturity stage on fresh fish on surveys. No follow-up.	Set up maturity events on SmartDots to inter- and intracalibrate.	All maturity manuals for gadoids, flatfish, pelagics are being updated in 2019/2020 to follow the new revised WKMATCH maturity scale. Stages are verified histologically.
Sweden	SLU–Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Marine Research; SLU–Swedish University of Agricultural Sciences, Department of Aquatic	2	We do not routinely validate maturity stages assigned by eye (macroscopically) with histology. Lack of time for quality check due to the huge amount of samples to be processed.	Set up maturity events on SmartDots to inter- and intracalibrate. Verified Stages histologically.	All maturity manuals for gadoids, flatfish, pelagics have been updated in 2021 to follow the new revised SMSF maturity scale.

		Evaluation of Internal Quality Management			Ongoing validation or methodological studies in your lab
Country	**Institute**	**Please indicate your level of satisfaction with your Internal Quality Management and reasons for this. 1=not satisfied, much room for improvement; 2=satisfied but some room for improvement; 3=satisfied**	**What are the biggest challenges you have with your Internal Quality Management?**	**How do you think you could improve your Internal Quality Management?**	**Please provide any information on ongoing validation or methodological studies in your lab**
	Resources, Institute of Coastal Research				
Norway	IMR–Institute of Marine Research				

Annex 5: Additional information (ToR c)

Annex 5. Table 3. Benchmarked ICES stocks and WGBIOP comments and actions.

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
2023	her.27.25-2932	Herring (Clupea harengus) in subdivisions 25–29 and 32, excluding the Gulf of Riga (central Baltic Sea)	WKBALTPEL	jgutkowska@mir.gdynia.pl, ssmolinski@mir.gdynia.pl, mikaela.bergenius.nord@slu.se, massimiliano.cardinale@slu.se	Age	Age reading quality needs improvement	Comparison of age readings. Reference otolith collection is needed.	· The last age calibration for herring was an otolith exchange in 2016. The results are as follows: PA S1: 88–94%; S2: 52–85%; S3: 52–81%, S4: 87 – 96%, CV S1: 1.9–7.5%; S2: 1.9–7.5%; S3: 11–20%, S4: 4.0 – 8.1%, *S1-S3 - whole otoliths from SD 26 *S4 - sliced and stained otoliths from SD 30 and 32 · An age reading exchange is ongoing on SmartDots (event no 449).	Inform the stock coordinator about the results of the 2022 exchange.
					Maturity	_	_	The constant maturity ogive is used in the assessment.	No WGBIOP action required.

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
2023	her.27.28	Herring (Clupea harengus) in Subdivision 28.1 (Gulf of Riga)	WKBALTPEL	ivars.putnis@bior.lv, Tiit.Raid@ut.ee, kristiina.hommik@ut.ee	Age	_	_	The last age calibration for GoR herring was a workshop (WKARBH) in 2008. PA and CV for 3 different sample sets for all readers were as follows: 76,3% and 8.7; 79,8% and 10.0; 83,2% and 12.8 and for expert readers PA was 91.5% and CV 5.7	Inform the stock coordinator about the results
					Maturity	_	_	As no special surveys on herring maturity are performed in the Gulf of Riga it was decided to use the same maturity ogives as in previous years	No WGBIOP action required.
2023	spr.27.22-32	Sprat (Sprattus sprattus) in subdivisions 22–32 (Baltic Sea)	WKBALTPEL	olavi.kaljuste@slu.se, horbowy@mir.gdynia.pl	Age	_	_	The last age reading exchange was in 2022 (SmartDots event no 414/415). The results for advanced readers are as follows: Transmitted light: PA: 78%, CV: 27% Reflected light: PA: 80%, CV: 22%	Inform the stock coordinator about the results

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
					Maturity	A simplified approach for maturity estimates analysis did not suggest the need to change the maturity parameters used so far. Maturities estimated in 2002 are still kept in the present assessment.	_	· The last maturity calibration workshop was in 2011 - WKMSHS (Workshop on Sexual Maturity Staging of Herring and Sprat).	No WGBIOP action required.
2023	bss.27.4bc7ad-h	Sea bass (Dicentrarchus labrax) in divisions 4.b–c, 7.a, and 7.d–h (central and southern North Sea, Irish Sea, English Channel, Bristol Channel, and Celtic Sea)	WKSEA BASS	gwladys.lambert@cefas.co.uk, Mickael.Drogou@ifremer.fr, timothy.earl@cefas.co.uk	Age	_	_	The last calibration exercise for bass in 27.7d was a Workshop on Age reading of Sea bass 2 (WKARDL2) in 2021 (Smartdots event 343). The results were as follows: For the scales PA=80%, CV=7%. For sectioned and stained otoliths PA=88% and CV=6%.	Inform the stock coordinator about the results.
					Maturity	_	_	Collection of maturity data is difficult as few adult sea bass are caught in surveys that are typically landed whole and are extremely expensive to purchase.	No WGBIOP action required.

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
2023	bss.27.8ab	Sea bass (Dicentrarchus labrax) in divisions 8.a–b (northern and central Bay of Biscay)	WKSEA BASS	Mathieu.Woillez@ifremer.fr, Mickael.Drogou@ifremer.fr, lisa.readdy@cefas.co.uk	age	An age reader change occurred since 2018. It resulted in biased age–length keys data in the recent years, affecting the reliability of the assessment when included.	A sensitivity analysis has been run in WGBIE 2021 to account for a reader change. It consisted in implementing 2 age error definitions in the assessment model and in disaggregating conditional age–length keys data and ghost age composition data according to readers. Results have been presented and reported in WGBIE 2021. Inter-calibration data between age readers (available). conditional age–length keys and age composition data disaggregated according to readers.	· No recent age calibration for this particular stock. · The last calibration exercise for bass in 27.7d - a Workshop on Age reading of Sea bass 2 (WKARDL2) in 2021 (Smartdots event 343). The results were as follows: For the scales, PA= 80%, CV=7%. For sectioned and stained otoliths, PA=88%, CV=6%.	Inform the stock coordinator about the results.
					maturity	_	_	Maturity data are derived from samples of French fishery around the Bay of Biscay coast (very few sea bass adults are taken in surveys and were generally unsexed before 2009).	No WGBIOP action required.

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
2023	cod.21.1	Cod (Gadus morhua) in NAFO Subarea 1, inshore (West Greenland cod)	WKGRCOD	AnRe@natur.gl	age	_	_	· No recent age calibration, although age is used in the assesment · The last age validation workshop was in 2013: Report of the Workshop on Age Validation Studies of Gadoids (WKAVSG).	No WGBIOP action required.
					maturity	Due to large variation between years regarding number of maturity samples - some years with little or no sampling - it is not possible to generate a year specific maturity ogive.	The maturity ogive for the period 1976–2006 was set constant to the estimated 1987 ogive. For the remaining period (2007–2016) the maturity ogive was fixed at the 2007–2016 estimates.	_	No WGBIOP action required.
2023	cod.21.1a-e	Cod (Gadus	WKGR COD	AnRe @natur.gl		*no issue list available*			

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
					age	-	-	No biological sampling (i.e. length measurement and otoliths) were taken from the fishery in 2020 and 2021. Survey trends are basis for advice. Zero advice have been given for several decades. Data on spawning indicate stock is reproducing and spawning stock is established. Genetic data suggest large migration and mixing with the inshore cod stock (cod.21.1)	No WGBIOP action required.
					maturity	-	-		
2023	cod.2127.1f14	Cod (Gadus morhua) in ICES Subarea 14 and NAFO Division 1.F (East Greenland, South Greenland)	WKGRCOD	AnRe@natur.gl		*no issue list available*			
					age	During exploration of the survey data for the analytical assessment, it became clear that a substantial discrepancy between the German and the Greenland age-readings of cod otoliths exists. That became obvious, because mean weight-at-age data from both surveys differed systemically between German mean-weights-at-age, which were always considerably	To investigate the issue a workshop on age reading of cod in Greenland was arranged with par-ticipants from the Greenland Institute of Natural Resources and the Thünen Institute of Sea Fisheries in Germany. The Icelandic Marine and Freshwater Research Institute hosted the workshop that was held January 8-9, 2019, Reykjavik, Iceland.	A workshop in 2019 identified wrong age-readings in the German survey, but even after age-readings in the German survey have been corrected the difference in mean weight-at-age persist. In addition, several inconsistencies in survey calculations have been identified in the German survey. A dedicated workshop prior to the benchmark to identify and solve these data	No WGBIOP action required.

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
						higher than the Greenlandic ones.	The cause for the discrepancy was identified as the German Institute not reading the last wintering on the edge of the otolith.	issues is strongly recommended.	
					maturity	Due to lack of data it is not possible to generate a year specific maturity ogive	The maturity ogive is based on 1557 samples with maturity information on collections made in the spawning season april and may. The majority of the maturity information is based on a survey in 2009 and on extensive sampling from commercial experimental fishery in 2007.	_	No WGBIOP action required.
2023	ghl.27.1-2	Gre en- lan	WK NO RT :	el- var. hall		*no issue list available*			

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
					age	Although age readings are available for some years there is no agreement on which age-reading methodology should be used, and these data are thus not suitable for inclusion in an assessment model.	_	Lack of agreement on age reading methodology precludes using age-based data for the assessment. An exchange on SmartDots (eventID 436) is running,	Inform the stock coordinator about the exchange results when available.
					maturity	At present in the analytical assessment ogives are calculated based on data from all EggaNor surveys since 2000.	_	_	No WGBIOP action required.
2023	ghl.27.561214	Greenland halibut (Reinhardtius hippoglossoides) in subareas 5, 6, 12, and 14 (Iceland and Faroes grounds, West of Scotland, North	WKNORTH	jbo@aqua.dtu.dk		*no issue list available*			
					age	Considerable ageing problems are still unsolved, it seems that present ageing underestimates the current age of fish more than a few years old (Albert 2007). Therefore since 2001 no age readings of otoliths were available from the main fishing areas. Otoliths are still being sampled	A new method has been agreed upon and cooperation between institutes has been initiated on age calibration. With respect to this stock Iceland has now progressed so far that an ALK is available for the 6 previous years. The Greenland institute of Natural Resources has also initiated age	Ageing problems caused the rejection of an age based assessment model. An exchange no 436 on SmartDots is running,	Inform the stock coordinator about the exchange results when available.

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
						in hope that this problem will be solved in future.	reading. With an ALK some years back and assumptions on constant growth initial exercises with age-based assessment models should be conducted.		
					maturity	_	_	Maturity is not used in the assesment	No WGBIOP action required.
2023	reg.27.561214	Golden redfish (Sebastes norvegicus) in subareas 5, 6, 12, and 14 (Iceland and Faroes grounds, West of Scotland, North of Azores, East of Greenland)	WKNORTH	kristjan.kristinsson@hafogvatn.is		*no issue list available*			
					Age	_	_	An exchange is ongoing in Smartdots (event no 296), PA and CV from age readers, reading for assessment from most recent EX/WK was 47% and 24%	Inform the stock coordinator about the results.
					Maturity	_	_	No maturity calibration available for this stock A knife-edge maturity-at-age 15 (age 15 as 100% mature) has been used for this stock.	Maturity calibration need to be proposed?
2023	sal.nac.all	Salmon	WKSALMO	martha.rob		*no issue list available*			

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
					Age	_	_	Age is not used in the assessment	No WGBIOP action required.
					Maturity	_	_	No need to be collected – all returning adults are mature	
2023	sal.neac.all	Salmon (Salmo salar) in Northeast Atlantic and Arctic Ocean	WKSALMON	dennis.ensing@afbini.gov.uk		*no issue list available*			
					Age	_	_	Age is not used in the assesment	No WGBIOP action required.
					Maturity	_	_	No need to be collected – all returning adults are mature	
2023	sal.wgc.all	Salmon (Salmo salar) in Subarea 14 and NAFO Division 1 (east and west of	WKSALMON	tim.sheehan@noaa.gov		*no issue list available*			
					Age	_	_	Age is not used in the assesment	No WGBIOP action required.
					Maturity	_	_	No need to be collected – all returning adults are mature	

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
2023	pol.27.67	Pollack (Pollachius pollachius) in subareas 6–7 (Celtic Seas and the English Channel)	WKMSYSPiCT2	paul.bouch@marine.ie	Age	Age data has never been provided. Four years of age data are available from Ireland (2016 onwards)	Collect age and biological data, request age data by gear/quarter from other Member Countries	The last otolith exchange was in 2016, PA=91.6%, CV=3.8%; APE= 0.8%	Inform the stock coordinator about the results.
					Maturity	_	_	data category 4; no maturity data are used	No WGBIOP action required.
2023	pol.27.89a	Pollack (Pollachius pollachius) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters)	WKMSYSPiCT2	paz.sampedro@ieo.csic.es	Age		_	The last otolith exchange was in 2016, PA=74.5%, CV=14.9%; APE= 1.9% age is not used in assessment	Inform the stock coordinator about the results
					Maturity	_	_	Maturity not used in assessment and no maturity calibration available for this stock.	No WGBIOP action required.
2023	whg.27.89a	Whiting (Mer-	WKMSYSPiC T2	youen.vermard	Age	_	_	No age based assesment	

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
					Maturity	Little information about maturity is currently available	National labs in France, Spain and Portugal to provide all individual biological parameters to assess if some maturity ogive can be derived for this stock	Maturity not used in assessment.	No WGBIOP action required.
2023	ane.27.8	Anchovy (Engraulis encrasicolus) in Subarea 8 (Bay of Biscay)	WKABM	lcitores@azti.es, libaibarriaga@azti.es	Age	_	_	The last age calibration was a workshop - WKARA3 on Age estimation of European anchovy (Engraulis encrasicolus) October 2021 Chairs: Gualtiero Basilone & Andrés Uriarte in Mazara del Vallo (Sicily, IT). Results: PA for Bay of Biscay = 91%, Strait of Sicily = 86% The next exchange - WKARA 4. no 455 is ongoing on SmartDots.	Inform the stock coordinator about the exchange. Stock coordinator has been informed
					Weight at age	In the last year anchovy weight at age has shown a decrease, this may contradict the constant growth assumption in the assessment model.	Review the assumption of constant growth-rate parameter along time.	_	No WGBIOP action required.

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
					Natural mortality	In the past benchmark natural mortality was set at 0.8 for age 1 and 1.2 for ages 2+. Do these values need to be revised according to any potential new information as e.g. the paper (Uriarte et al. 2016)?	Update analysis on Natural Mortality (Uriarte et al. 2016) according to new dataseries (if any) and to the most recent information from last surveys. For the natural mortality the same input as for the assessment suffices to review the issue. Ecological models on the trophic webs in the Bay of Biscay may provide information to infer Natural Mortality on anchovy	_	
2023	boc.27.6-8	Boarfish (Capros aper) in subareas 6–8 (Celtic Seas, English Channel, and Bay of Biscay)	WKABM	Roxanne.Duncan@Marine.ie	Age and weight at age	Estimate catch, maturity and weight at age based on data from the catch sampling programme (2010 - present) and the WASPAS acoustic survey (2011- present).	Updating of 2010 ALK with annual estimates. Calculation of annual catch-at-age, maturity and weight at age and age-disaggregated biomass survey estimates. Ageing of otolith library.	No age determination since 2012. The material is being collected continuously. There is a need to retrain age readings - an event on SmartDots is going to be set up in order to let the age readers to retrain and calibrate age readings.	No WGBIOP action required.
					Maturity	_	_	No maturity based assessment	

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
2023	mur.27.3a47d	Striped red mullet (Mullus surmuletus) in Subarea 4 and divisions 7.d and 3.a (North Sea, eastern English Channel,	WKABM	Raphael.Girardin@ifremer.fr	Age	_	_	Age readings on this species comes from France. There is no need for an exchange, as the internal calibrations are sufficient.	No WGBIOP action required.
					Maturity	_	_	No maturity based assessment	
2023	rjc.27.3a47d	Thornback ray (Raja clavata) in Subarea 4and in divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and eastern English Channel)	WKELASMO	Jurgen.Batsleer@wur.nl, katinka.bleeker@wur.nl	Age	_	_	At the last age reading calibration (SmartDots event no 408) started in 2021 and completed in 2022, the results were as follows: PA=52%, CV=30%, APE=21% An age reading workshop is planned for 2023.	Inform the stock coordinator about the exchange.
					Maturity	_	_	The last maturity exchange (no 398 on Smartdots) was in 2021. The results for advanced stagers were as follows: by sex category: PA=99.3%, by maturity stage: PA=93.4%	

Benchmark year	Stock code	Species/ stock	Proposed WK	Stock lead e-mail	Biological parameter	Issue (source: issue lists/stock annex)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
2023	rjh.27.4c7d	Blonde ray (Raja brachyura) in divisions 4.c and 7.d (southern North Sea and eastern English Channel)	WKELASMO	Jurgen.Batsleer@wur.nl, katinka.bleeker@wur.nl	Age	_	_	An exchange (no 405 on Smartdots) started in 2021 and was completed in 2022. At the last age reading calibration the results were as follows: CV:49%, PA:44% & APE:37% An age reading workshop is planned for 2023.	Inform the stock coordinator about the exchange.
					Maturity	_	_	The last maturity exchange (no 398 on Smartdots) was in 2021. The results for advanced stagers were as follows: by sex category: PA=99.3%, by maturity stage: PA=93.4%	
2023	rjm.27.3a47d	Spotted ray (Raja montagui) in Subarea 4and divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and eastern English	WKELASMO	Jurgen.Batsleer@wur.nl, katinka.bleeker@wur.nl	Age	_	_	Age is not used in the assesment	No WGBIOP action required.
					Maturity	_	_	The last maturity exchange (no 398 on Smartdots) was in 2021. The results for advanced stagers were as follows: by sex category: PA=99.3%, by maturity stage: PA=93.4%	Inform the stock coordinator about the exchange.

Annex 5. Table 4. Replies from stock coordinators in 2021.

Species/stock	Biological parameters	Replied to WGBIOP	Advice taken onboard/considered	Replies	Follow-up WGBIOP	Feedback
sal.27.22-31	age	no	no		Inform on the report on SmartDots (eventID 357) once available	
cap.27.1-2	age	yes	yes	S.C. took note of the information	look for the latest age exchange report	
cap.27.2a514	age	no	no			
cod.27.7a	age, maturity	no	no			
ple.27.7fg	age	yes	yes	S.C. took note of the information		
ple.27.420	age, maturity	no	no		inform on the report on SmartDots (eventID 282) once available	
had.27.46a20	age, maturity	no	no		inform on the report on SmartDots (eventID 235) once available	
her.27.6a7bc	age, maturity	no	no			
reb.27.5a14	age	no	no		inform on the report on SmartDots (eventID 298) once available	
ghl.27.1-2	age, maturity	no	no			
ghl.27.561214	age	no	no			

Species/stock	Biological parameters	Replied to WGBIOP	Advice taken onboard/considered	Replies	Follow-up WGBIOP	Feedback
cod.21.1 and cod.21.1a-e	age, maturity	no	no			
rjc.27.8	age, maturity	yes	yes	The availability and quality of age data is an issue for the stock. Thanks in advance to Karen, Maria and Kélig to let me know about any progress on age and maturity relevant to the stock.	inform about results of an ex and on the reports on SmartDots (eventID 398 maturity, eventID 408 - age) once available	
rju.27.7de	maturity	no*	no		inform about results of an ex and on the report on SmartDots (eventID 398) once available	
ldb.27.8c9a	age	no	no			

Species/stock	Biological parameters	Replied to WGBIOP	Advice taken onboard/considered	Replies	Follow-up WGBIOP	Feedback
meg.27.7b-k8abd	age, maturity	no	no	Have you analysed the maturity stages also? We have realized that different maturity scales are used in different institutes and then a conversion of them is done. Could be possible to consider a maturity workshop for Megrim (Lepidorhombus whiffiagonis) in divisions 7.b-k, 8.a-b, and 8.d?	• inform on the report on SmartDots (eventID 355) once available • ask if a maturity workshop is still needed	We went to a data compilation workshop and benchmark during January 2022. Several maturity stage data were provided by different countries, and also an histological maturity ogive from Spanish Institute. After reviewing the available information, we agreed on using the histological maturity ogive for females only, as they are the most important genre in the reproduction process. Therefore we already have an updated maturity ogive for the stock. So, as we already have an updated assessment for the stock, and despite I t would be nice to have an exchange, and seen the problems to have a coordinator, I can say that now it is not a priority for us.
meg.27.8c9a	age	no	no		Report on SmartDots is available: https://smartdots.ices.dk/sampleImages/2020/277/SmartDots_Report_Event_277.pdf	
her.27.25-2932	age	no	no		inform on the report on SmartDots (eventID 449) once available	

Species/stock	Biological parameters	Replied to WGBIOP	Advice taken on-board/considered	Replies	Follow-up WGBIOP	Feedback
spr.27.22-32	age	no	no		inform on the report on SmartDots (eventID 415) once available	

* the e-mail address to a stock coordinator was not valid, the correct one is: Loic.Baulier@ifremer.fr

Annex 5.Table 5. A. Quality indicators by stock–WGBIOP 2020 answers . Part 1: Sampling Design, Stock Identity, Methods and Definitions.

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
NIPAG	*Pandalus borealis*	pra.27.4a	0. Quality of biological data not evaluated	N	Y	1. No mixing	0. No overview table	0. No overview table	0. No comparisons between labs	3. Estimated indirectly	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	2. Staging year-round				
NWWG	*Mallotus villosus*	cap.27.2a514																
NWWG	*Gadus morhua*	cod.21.1																

			Sampling design			Stock ID	Methods and definitions												
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
NWWG	*Gadus morhua*	cod.21.1a-e																
NWWG	*Gadus morhua*	cod.2127.1f14																
NWWG	*Gadus morhua*	cod.27.5a																

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
NWWG	*Gadus morhua*	cod.27.5b1	0. Quality of biological data not evaluated	N	Y	1. No mixing	0. No overview table	1. Overview table available	1. No differences	4. Estimated directly	0. No overview table	1. Overview table available	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	2. Careful selection of a type of ogive	2. International database correct	1. Preliminary analyses of sex-specific issues	3. Estimated

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
NWWG	*Gadus morhua*	cod.27.5b2	0. Quality of biological data not evaluated	N	Y	1. No mixing	0. No overview table	1. Overview table available	1. No differences	4. Estimated directly	0. No overview table	1. Overview table available	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	2. Careful selection of a type of ogive		1. Preliminary analyses of sex-specific issues	1. Assumed
NWWG	*Reinhardtius hippoglossoides*	ghl.27.561214																

			Sampling design			Stock ID	Methods and definitions												
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
NWWG	*Melanogrammus aeglefinus*	had.27.5a	0. Quality of biological data not evaluated	N	Y	1. No mixing	0. No overview table	1. Overview table available	1. No differences	4. Estimated directly	0. No overview table	1. Overview table available	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	2. Careful selection of a type of ogive	2. International database correct	1. Preliminary analyses of sex-specific issues	1. Assumed
NWWG	*Melanogrammus aeglefinus*	had.27.5b																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
NWWG	*Clupea harengus*	her.27.5a																
NWWG	*Pollachius virens*	pok.27.5a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
NWWG	*Pollachius virens*	pok.27.5b	0. Quality of biological data not evaluated	N	Y	2. Mixing exists: not accounted for	1. Overview table available	1. Overview table available	1. No differences	4. Estimated directly	0. No overview table	1. Overview table available	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	2. Careful selection of a type of ogive		1. Preliminary analyses of sex-specific issues	1. Assumed
NWWG	*Sebastes mentella*	reb.2127.dp																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
NWWG	*Sebastes mentella*	reb.2127.sp																
NWWG	*Sebastes mentella*	reb.27.14b																
NWWG	*Sebastes mentella*	reb.27.5a14																
NWWG	*Sebastes norvegicus*	reg.27.561214																

			Sampling design			Stock ID	Methods and definitions											
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
WGBAST	*Salmo salar*	sal.27.22-31																
WGBAST	*Salmo salar*	sal.27.32																
WGBAST	*Salmo trutta*	trs.27.22-32																
WGBFAS	*Scophthalmus rhombus*	bll.27.22-32																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Gadus morhua*	cod.27.21	1. Preliminary analysis of quality of biological data	Y	N/A	3. Mixing exists: accounted for, not validated	0. No overview table	1. Overview table available	1. No differences	4. Estimated directly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGBFAS	*Gadus morhua*	cod.27.22-24																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Gadus morhua*	cod.27.24-32																
WGBFAS	*Limanda limanda*	dab.27.22-32	1. Preliminary analysis of quality of biological data	Y	Y	1. No mixing	0. No overview table	1. Overview table available	0. No comparisons between labs	4. Estimated directly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions										
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Platichthys flesus*	fle.27.2223	1. Preliminary analysis of quality of biological data	Y	Y	1. No mixing	0. No overview table	1. Overview table available	0. No comparisons between labs	4. Estimated directly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Platichthys spp*	bwq.27.2425	1. Preliminary analysis of quality of biological data	Y	Y	2. Mixing exists: not accounted for	0. No overview table	1. Overview table available	0. No comparisons between labs	4. Estimated directly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Platichthys spp*	bwq.27.2628	1. Preliminary analysis of quality of biological data	Y	N/A	2. Mixing exists: not accounted for	0. No overview table	1. Overview table available	0. No comparisons between labs	4. Estimated directly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGBFAS	*Platichthys solemdali*	bwp.27.2729-32	0. Quality of biological data not evaluated	Y	Y	2. Mixing exists: not accounted for	0. No overview table	1. Overview table available	0. No comparisons between labs	4. Estimated directly						2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Clupea harengus*	her.27.25-2932	1. Preliminary analysis of quality of biological data	Y	Y	3. Mixing exists: acounted for, not validated	0. No overview table	0. No overview table	2. Differences between labs are known but ingnored	1. Assumed	0. No overview table	0. No overview table	1. Differences between labs are known but ingnored	2. Staging year-round	2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Clupea harengus*	her.27.28	1. Preliminary analysis of quality of biological data	Y	Y	6. Mixing exists: markers study and good spatio-temporal coverage of mixing	1. Overview table available	0. No overview table	1. No differences	4. Estimated directly	0. No overview table	0. No overview table	1. Differences between labs are known but ingnored	2. Staging year-round	2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGBFAS	*Clupea harengus*	her.27.3031																
WGBFAS	*Pleuronectes platessa*	ple.27.21-23																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Pleuronectes platessa*	ple.27.24-32	2. Detailed analysis of the quality of biological data	Y	Y	2. Mixing exists: not accounted for	0. No overview table	1. Overview table available	2. Differences between labs are known but ingnored	4. Estimated directly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGBFAS	*Solea solea*	sol.27.20-24																

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Sprattus sprattus*	spr.27.22-32	1. Preliminary analysis of quality of biological data	Y	Y	0. No evidence	1. Overview table available	1. Overview table available	1. No differences		0. No overview table	0. No overview table	1. Differences between labs are known but ingnored	2. Staging year-round	2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	4. Assessed (SMS key runs, ...)

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBFAS	*Scophthalmus maximus*	tur.27.22-32	1. Preliminary analysis of quality of biological data	Y	Y	1. No mixing	0. No overview table	1. Overview table available	0. No comparisons between labs	4. Estimated directly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBIE	*Lophius budegassa*	ank.27.78abd	2. Detailed analysis of the quality of biological data	N/A	N/A	2. Mixing exists: not accounted for				3. Estimated indirectly	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	2. Careful selection of a type of ogive		1. Preliminary analyses of sex-specific issues	3. Estimated
WGBIE	*Lophius budegassa*	ank.27.8c9a																

			Sampling design			Stock ID	Methods and definitions											
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
WGBIE	*Dicentrarchus labrax*	bss.27.8ab																
WGBIE	*Dicentrarchus labrax*	bss.27.8c9a																
WGBIE	*Merluccius merluccius*	hke.27.3a46-8abd	0. Quality of biological data not evaluated	N	N	2. Mixing exists: not accounted for	0. No overview table	0. No overview table	0. No comparisons between labs	1. Assumed	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	2. Staging year-round	3. Selection of type of ogive based on thorough analysis of all options	1. Potential errors in international database	1. Preliminary analyses of sex-specific issues	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBIE	*Brosme brosme, Merluccius merluccius*	hke.27.8c9a			Y	0. No evidence				3. Estimated indirectly	2. Overview table complete and up-to-date	2. Overview table complete and up-to-date		1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)			2. Detailed analysis of sex-specific issues	
WGBIE	*Lepidorhombus boscii*	ldb.27.7b-k8abd																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBIE	*Lepidorhombus boscii*	ldb.27.8c9a																
WGBIE	*Lepidorhombus whiffiagonis*	meg.27.7b-k8abd	0. Quality of biological data not evaluated	N	N/A	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs	1. Assumed	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	2. Staging year-round	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGBIE	*Lepidorhombus whiffiagonis*	meg.27.8c9a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBIE	*Lophius piscatorius*	mon.27.78abd																
WGBIE	*Lophius piscatorius*	mon.27.8c9a	0. Quality of biological data not evaluated	N	N/A	2. Mixing exists: not accounted for	0. No overview table	0. No overview table	0. No comparisons between labs	3. Estimated indirectly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	3. Selection of type of ogive based on thorough analysis of all options	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Com-mercial Sam-pling	Spatial Cover-age	Mixing Ratio	Struc-ture	Prepa-ration	Birthdate & "Scheme"	Growth	Struc-ture	Prepa-ration	Scaling	Timing	Ogive	Coding	Sex-specific Param-eters	M
WGBIE	*Nephrops norvegicus*	nep.fu.2324																
WGBIE	*Nephrops norvegicus*	nep.fu.25																
WGBIE	*Nephrops norvegicus*	nep.fu.2627																

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBIE	*Nephrops norvegicus*	nep.fu.2829	0. Quality of biological data not evaluated	N	N/A	0. No evidence				2. Extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGBIE	*Nephrops norvegicus*	nep.fu.30																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBIE	*Nephrops norvegicus*	nep.fu.31																
WGBIE	*Pleuronectes platessa*	ple.27.89a																
WGBIE	*Pollachius pollachius*	pol.27.89a	0. Quality of biological data not evaluated	N	N/A	2. Mixing exists: not accounted for	0. No overview table	0. No overview table	0. No comparisons between labs	2. Extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	2. Staging year-round	3. Selection of type of ogive based on thorough analysis of all options	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGBIE	*Solea solea*	sol.27.8ab																
WGBIE	*Solea solea*	sol.27.8c9a	0. Quality of biological data not evaluated	N	N/A	2. Mixing exists: not accounted for	0. No overview table	0. No overview table	0. No comparisons between labs	2. Extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	2. Staging year-round	3. Selection of type of ogive based on thorough analysis of all options	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGBIE	*Merlangius merlangus*	whg.27.89a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Lophius budegassa, Lophius piscatorius*	anf.27.3a46	0. Quality of biological data not evaluated	N	N													
WGCSE	*Dicentrarchus labrax*	bss.27.4bc7ad-h	0. Quality of biological data not evaluated	N	N	2. Mixing exists: not accounted for	0. No overview table	0. No overview table	0. No comparisons between labs		0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	1. Potential errors in international database	2. Detailed analysis of sex-specific issues	1. Assumed

			Sampling design			Stock ID	Methods and definitions												
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Dicentrarchus labrax*	bss.27.6a7bj																
WGCSE	*Gadus morhua*	cod.27.6a																
WGCSE	*Gadus morhua*	cod.27.6b																
WGCSE	*Gadus morhua*	cod.27.7a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Gadus morhua*	cod.27.7e-k																
WGCSE	*Melanogrammus aeglefinus*	had.27.6b																
WGCSE	*Melanogrammus aeglefinus*	had.27.7a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Melanogrammus aeglefinus*	had.27.7b-k	2. Detailed analysis of the quality of biological data	Y	Y	2. Mixing exists: not accounted for			1. No differences 2. Differences between labs are known but ingnored	4. Estimated directly					2. Careful selection of a type of ogive	2. International database correct		3. Estimated
WGCSE	*Lepidorhombus*	lez.27.4a6a																
WGCSE	*Lepidorhombus*	lez.27.6b																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Nephrops norvegicus*	nep.27.6aoutFU																
WGCSE	*Nephrops norvegicus*	nep.27.7outFU																
WGCSE	*Nephrops norvegicus*	nep.fu.11																
WGCSE	*Nephrops norvegicus*	nep.fu.12																

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Nephrops norvegicus*	nep.fu.13																
WGCSE	*Nephrops norvegicus*	nep.fu.14																
WGCSE	*Nephrops norvegicus*	nep.fu.15																
WGCSE	*Nephrops norvegicus*	nep.fu.16																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Nephrops norvegicus*	nep.fu.17																
WGCSE	*Nephrops norvegicus*	nep.fu.19																
WGCSE	*Nephrops norvegicus*	nep.fu.2021																
WGCSE	*Nephrops norvegicus*	nep.fu.22																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Trisopterus esmarkii*	nop.27.6a																
WGCSE	*Pleuronectes platessa*	ple.27.7a	0. Quality of biological data not evaluated	N	Y	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs		0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	1. Potential errors in international database	2. Detailed analysis of sex-specific issues	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Pleuronectes platessa*	ple.27.7bc																
WGCSE	*Pleuronectes platessa*	ple.27.7e																
WGCSE	*Pleuronectes platessa*	ple.27.7fg																
WGCSE	*Pleuronectes platessa*	ple.27.7h-k																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Pollachius pollachius*	pol.27.67																
WGCSE	*Ammodytes*	san.27.6a																
WGCSE	*Solea solea*	sol.27.7a	0. Quality of biological data not evaluated	N/A	N/A	1. No mixing	0. No overview table	1. Overview table available	1. No differences 2. Differences between labs are known but ingnored		0. No overview table	0. No overview table	1. Differences between labs are known but ingnored		3. Selection of type of ogive based on thorough analysis of all options			1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Solea solea*	sol.27.7bc																
WGCSE	*Solea solea*	sol.27.7e																
WGCSE	*Solea solea*	sol.27.7fg	0. Quality of biological data not evaluated	N/A	N/A	1. No mixing	0. No overview table	1. Overview table available	1. No differences 2. Differences between labs are known but ingnored		0. No overview table	0. No overview table	1. Differences between labs are known but ingnored		3. Selection of type of ogive based on thorough analysis of all options			1. Assumed

EG	Species	Stock	Sampling design: All			Stock ID: All	Methods and definitions: Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Solea solea*	sol.27.7h-k																
WGCSE	*Merlangius merlangus*	whg.27.6a																
WGCSE	*Merlangius merlangus*	whg.27.6b																

			Sampling design			Stock ID	Methods and definitions												
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGCSE	*Merlangius merlangus*	whg.27.7a	1. Preliminary analysis of quality of biological data	Y	Y	2. Mixing exists: not accounted for	0. No overview table	0. No overview table	0. No comparisons between labs	4. Estimated directly	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	3. Estimated
WGCSE	*Merlangius merlangus*	whg.27.7b-ce-k																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Beryx*	alf.27.nea																
WGDEEP	*Argentina silus*	aru.27.123a4	1. Preliminary analysis of quality of biological data	Y	Y	1. No mixing	1. Overview table available	1. Overview table available	3. Differences clearly documented and considered in data compilation	4. Estimated directly	1. Overview table available	1. Overview table available	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	2. Careful selection of a type of ogive	1. Potential errors in international database	2. Detailed analysis of sex-specific issues	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
WGDEEP	*Argentina silus*	aru.27.5a14	2. Detailed analysis of the quality of biological data	Y	Y	1. No mixing	0. No overview table	0. No overview table	3. Differences clearly documented and considered in data compilation	4. Estimated directly	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	3. Selection of type of ogive based on thorough analysis of all options	2. International database correct	2. Detailed analysis of sex-specific issues	1. Assumed
WGDEEP	*Argentina silus*	aru.27.5b6a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Argentina silus*	aru.27.6b7-1012	0. Quality of biological data not evaluated	N	N	0. No evidence	0. No overview table	0. No overview table	1. No differences									
WGDEEP	*Molva dypterygia*	bli.27.5a14	0. Quality of biological data not evaluated	N/A	Y	2. Mixing exists: not accounted for	0. No overview table	0. No overview table	0. No comparisons between labs	4. Estimated directly	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	1. Potential errors in international database	0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Molva dypterygia*	bli.27.5b67																
WGDEEP	*Molva dypterygia*	bli.27.nea	0. Quality of biological data not evaluated	Y	N	2. Mixing exists: not accounted for	0. No overview table	0. No overview table	0. No comparisons between labs		0. No overview table	0. No overview table	0. No chronicle (standard scale) available			1. Potential errors in international database	0. Sex-specific issues not evaluated	1. Assumed
WGDEEP	*Aphanopus carbo*	bsf.27.nea																
WGDEEP	*Phycis blennoides*	gfb.27.nea																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Molva molva*	lin.27.1-2																
WGDEEP	*Molva molva*	lin.27.3a4a6-91214																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Molva molva*	lin.27.5a	2. Detailed analysis of the quality of biological data	Y	Y	1. No mixing	0. No overview table	0. No overview table	3. Differences clearly documented and considered in data compilation	4. Estimated directly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	3. Selection of type of ogive based on thorough analysis of all options	2. International database correct	2. Detailed analysis of sex-specific issues	1. Assumed
WGDEEP	*Molva molva*	lin.27.5b																

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Hoplostethus atlanticus*	ory.27.nea																
WGDEEP	*Macrourus berglax*	rhg.27.nea																
WGDEEP	*Coryphaenoides rupestris*	rng.27.1245a8914ab																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Coryphaenoides rupestris*	rng.27.3a	1. Preliminary analysis of quality of biological data	N/A	Y	1. No mixing	1. Overview table available	1. Overview table available	0. No comparisons between labs		1. Overview table available	1. Overview table available	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)		1. Potential errors in international database		1. Assumed
WGDEEP	*Coryphaenoides rupestris*	rng.27.5a10b12ac14b																

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Coryphaenoides rupestris*	rng.27.5b6712b	0. Quality of biological data not evaluated	Y	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs	2. Extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available			2. International database correct	0. Sex-specific issues not evaluated	2. Extrapolated
WGDEEP	*Pagellus bogaraveo*	sbr.27.10																
WGDEEP	*Pagellus bogaraveo*	sbr.27.6-8																
WGDEEP	*Pagellus bogaraveo*	sbr.27.9																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Trachyrincus scabrus*	tsu.27.nea																
WGDEEP	*Brosme brosme*	usk.27.1-2																
WGDEEP	*Brosme brosme*	usk.27.12ac																
WGDEEP	*Brosme brosme*	usk.27.3a45b6a7-912b																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGDEEP	*Brosme brosme*	usk.27.5a14	2. Detailed analysis of the quality of biological data	Y	Y	1. No mixing	0. No overview table	0. No overview table	3. Differences clearly documented and considered in data compilation	4. Estimated directly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	3. Selection of type of ogive based on thorough analysis of all options	2. International database correct	2. Detailed analysis of sex-specific issues	1. Assumed
WGDEEP	*Brosme brosme*	usk.27.6b																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEEL	*Anguilla anguilla*	ele.2737.nea	1. Preliminary analysis of quality of biological data	N	N	1. No mixing	0. No overview table	0. No overview table	1. No differences							2. International database correct	1. Preliminary analyses of sex-specific issues	2. Extrapolated
WGEF	*Squatina squatina*	agn.27.nea																
WGEF	*Cetorhinus maximus*	bsk.27.nea																
WGEF	*Centrophorus squamosus, Centroscym-*	cyo.27.nea																

EG	Species	Stock	Sampling design: All			Stock ID: All	Methods and definitions: Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Squalus acanthias*	dgs.27.nea																
WGEF	*Galeorhinus galeus*	gag.27.nea																
WGEF	*Centrophorus squamosus*	guq.27.nea																
WGEF	*Lamna nasus*	por.27.nea																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Rajidae*	raj.27.1012																
WGEF	*Rajidae*	raj.27.3a47d																
WGEF	*Rajidae*	raj.27.67a-ce-h																
WGEF	*Rajidae*	raj.27.89a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Rostroraja alba*	rja.27.nea																
WGEF	*Dipturus batis*	rjb.27.3a4																
WGEF	*Dipturus batis*	rjb.27.67a-ce-k																
WGEF	*Dipturus batis*	rjb.27.89a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Raja clavata*	rjc.27.3a47d																
WGEF	*Raja clavata*	rjc.27.6																
WGEF	*Raja clavata*	rjc.27.7afg																
WGEF	*Raja clavata*	rjc.27.7e																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Raja clavata*	rjc.27.8																
WGEF	*Raja clavata*	rjc.27.9a																
WGEF	*Raja microocellata*	rje.27.7de																
WGEF	*Raja microocellata*	rje.27.7fg																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Leucoraja fullonica*	rjf.27.67																
WGEF	*Raja brachyura*	rjh.27.4a6																
WGEF	*Raja brachyura*	rjh.27.4c7d																
WGEF	*Raja brachyura*	rjh.27.7afg																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Raja brachyura*	rjh.27.7e																
WGEF	*Raja brachyura*	rjh.27.9a																
WGEF	*Leucoraja circularis*	rji.27.67																
WGEF	*Raja montagui*	rjm.27.3a47d																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Com-mercial Sam-pling	Spatial Cover-age	Mixing Ratio	Struc-ture	Prepa-ration	Birthdate & "Scheme"	Growth	Struc-ture	Prepa-ration	Scaling	Timing	Ogive	Coding	Sex-specific Param-eters	M
WGEF	*Raja monta-gui*	rjm.27.67bj																
WGEF	*Raja monta-gui*	rjm.27.7ae-h																
WGEF	*Raja monta-gui*	rjm.27.8																
WGEF	*Raja monta-gui*	rjm.27.9a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Com-mercial Sam-pling	Spatial Cover-age	Mixing Ratio	Struc-ture	Prepa-ration	Birthdate & "Scheme"	Growth	Struc-ture	Prepa-ration	Scaling	Timing	Ogive	Coding	Sex-specific Param-eters	M
WGEF	*Leucoraja naevus*	rjn.27.3a4																
WGEF	*Leucoraja naevus*	rjn.27.678abd																
WGEF	*Leucoraja naevus*	rjn.27.8c																
WGEF	*Leucoraja naevus*	rjn.27.9a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Amblyraja radiata*	rjr.27.23a4																
WGEF	*Raja undulata*	rju.27.7bj																
WGEF	*Raja undulata*	rju.27.7de																
WGEF	*Raja undulata*	rju.27.8ab																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Raja undulata*	rju.27.8c																
WGEF	*Raja undulata*	rju.27.9a																
WGEF	*Dalatias licha*	sck.27.nea																
WGEF	*Mustelus asterias*	sdv.27.nea																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Galeus melastomus*	sho.27.67																
WGEF	*Galeus melastomus*	sho.27.89a																
WGEF	*Scyliorhinus canicula*	syc.27.3a47d																
WGEF	*Scyliorhinus canicula*	syc.27.67a-ce-j																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGEF	*Scyliorhinus canicula*	syc.27.8abd																
WGEF	*Scyliorhinus canicula*	syc.27.8c9a																
WGEF	*Scyliorhinus stellaris*	syt.27.67																
WGEF	*Alopias*	thr.27.nea																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGHANSA	*Engraulis encrasicolus*	ane.27.8	2. Detailed analysis of the quality of biological data	Y	Y	0. No evidence	2. Overview table complete and up-to-date	2. Overview table complete and up-to-date	1. No differences	4. Estimated directly	2. Overview table complete and up-to-date	2. Overview table complete and up-to-date	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	3. Estimated
WGHANSA	*Engraulis encrasicolus*	ane.27.9a_southcomponent	2. Detailed analysis of the quality of biological data	Y	N	0. No evidence	2. Overview table complete and up-to-date	2. Overview table complete and up-to-date	1. No differences	4. Estimated directly	2. Overview table complete and up-to-date	2. Overview table complete and up-to-date	2. Chronicle (standard scale) clearly documented	2. Staging year-round	2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	3. Estimated

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
													and considered in data compilation					
		ane.27.9a_westcomponent	2. Detailed analysis of the quality of biological data	N/A	N	0. No evidence	0. No overview table	1. Overview table available	1. No differences 2. Differences between labs are known but ingnored	N	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	no	2. International database correct	0. Sex-specific issues not evaluated	Not estimated

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGHANSA	*Trachurus trachurus*	hom.27.9a	0. Quality of biological data not evaluated	N	N	2. Mixing exists: not accounted for	2. Overview table complete and up-to-date	2. Overview table complete and up-to-date	1. No differences 2. Differences between labs are known but ingnored	3. Estimated indirectly	1. Overview table available	1. Overview table available	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGHANSA	*Trachurus picturatus*	jaa.27.10a2	0. Quality of biological data not evaluated	Y	Y	0. No evidence	1. Overview table available	1. Overview table available	0. No comparisons between labs	3. Estimated indirectly	1. Overview table available	1. Overview table available	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round		2. International database correct	4. No sexual dimorphism occurs	3. Estimated

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGHANSA	*Sardina pilchardus*	pil.27.7	0. Quality of biological data not evaluated	N	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs		0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive		0. Sex-specific issues not evaluated	

			Sampling design			Stock ID	Methods and definitions											
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
WGHANSA	*Sardina pilchardus*	pil.27.8abd	yes	no	no		yes	only France is doing ageing	very consistent. Age reading is easy on this stock	estimated by the model but von Bertalanffy parameters, alometric relationships can be estimated every year	only France is providing those data	only France is providing those data	N/A	survey, 2^{nd} quarter	no	Not relevant	no	Estimated by model (Gislason)

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGHANSA	*Sardina pilchardus*	pil.27.8c9a	2. Detailed analysis of the quality of biological data	Y	Y	0. No evidence	2. Overview table complete and up-to-date	2. Overview table complete and up-to-date	1. No differences	4. Estimated directly	1. Overview table available	2. Overview table complete and up-to-date	2. Chronicle (standard scale) clearly documented and considered in data compilation	2. Staging year-round	2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	3. Estimated
WGNAS	*Salmo salar*	sal.21.2-5	0. Quality of biological data not evaluated															

			Sampling design			Stock ID	Methods and definitions												
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
WGNAS	*Salmo salar*	sal.2127.1a-f14	0. Quality of biological data not evaluated	N/A	N/A	6. Mixing exists: markers study and good spatio-temporal coverage of mixing	0. No overview table	0. No overview table	0. No comparisons between labs	1. Assumed	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)			0. Sex-specific issues not evaluated	2. Extrapolated

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNAS	*Salmo salar*	sal.27.nea	0. Quality of biological data not evaluated	N/A	N/A	3. Mixing exists: accounted for, not validated	0. No overview table	0. No overview table	0. No comparisons between labs	1. Assumed	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)			0. Sex-specific issues not evaluated	2. Extrapolated

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Scophthalmus rhombus*	bll.27.3a47de	0. Quality of biological data not evaluated	N/A	N/A	0. No evidence	0. No overview table	1. Overview table available	1. No differences 2. Differences between labs are known but ingnored		0. No overview table	0. No overview table						
WGNSSK	*Gadus morhua*	cod.27.47d20	2. Detailed analysis of the quality of biological data	N/A	Y	3. Mixing exists: accounted for, not validated									2. Careful selection of a type of ogive		0. Sex-specific issues not evaluated	4. Assessed (SMS key runs, ...)

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Limanda limanda*	dab.27.3a4	1. Preliminary analysis of quality of biological data	N/A	N	0. No evidence	1. Overview table available	2. Overview table complete and up-to-date	1. No differences		0. No overview table	0. No overview table	0. No chronicle (standard scale) available					
WGNSSK	*Platichthys flesus*	fle.27.3a4	1. Preliminary analysis of quality of biological data	N/A	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs		0. No overview table	0. No overview table	0. No chronicle (standard scale) available					
WGNSSK	*Eutrigla gurnardus*	gug.27.3a47d																

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Melanogrammus aeglefinus*	had.27.46a20	2. Detailed analysis of the quality of biological data	N/A	N	2. Mixing exists: not accounted for	1. Overview table available				0. No overview table	0. No overview table		1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	2. Careful selection of a type of ogive		1. Preliminary analyses of sex-specific issues	4. Assessed (SMS key runs, ...)

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Microstomus kitt*	lem.27.3a47d	0. Quality of biological data not evaluated	N/A	N/A	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs	1. Assumed	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Mullus surmuletus*	mur.27.3a47d	1. Preliminary analysis of quality of biological data	N/A	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs		0. No overview table	0. No overview table		2. Staging year-round	2. Careful selection of a type of ogive		1. Preliminary analyses of sex-specific issues	3. Estimated

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Nephrops norvegicus*	nep.27.4outFU	0. Quality of biological data not evaluated	N	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs	2. Extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGNSSK	*Nephrops norvegicus*	nep.fu.10																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Nephrops norvegicus*	nep.fu.3-4																
WGNSSK	*Nephrops norvegicus*	nep.fu.32	0. Quality of biological data not evaluated	N	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs	2. Extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	2. Extrapolated

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Nephrops norvegicus*	nep.fu.33	0. Quality of biological data not evaluated	N	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs	2. Extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGNSSK	*Nephrops norvegicus*	nep.fu.34																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Nephrops norvegicus*	nep.fu.5	0. Quality of biological data not evaluated	N	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs	2. Extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1=good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Nephrops norvegicus*	nep.fu.6	0. Quality of biological data not evaluated	N	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs	3. Estimated indirectly	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGNSSK	*Nephrops norvegicus*	nep.fu.7																

EG	Species	Stock	Sampling design			Stock ID	Methods and definitions											
			All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Nephrops norvegicus*	nep.fu.8																
WGNSSK	*Nephrops norvegicus*	nep.fu.9																

			Sampling design			Stock ID	Methods and definitions										
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
WGNSSK	*Trisopterus esmarkii*	nop.27.3a4	1. Preliminary analysis of quality of biological data	Y	Y	0. No evidence	1. Overview table available	0. No overview table	3. Differences clearly documented and considered in data compilation	3. Estimated indirectly	0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	3. Selection of type of ogive based on thorough analysis of all options	2. International database correct	2. Detailed analysis of sex-specific issues	3. Estimated

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Pleuronectes platessa*	ple.27.420	2. Detailed analysis of the quality of biological data	N/A	N					4. Estimated directly					2. Careful selection of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed
WGNSSK	*Pleuronectes platessa*	ple.27.7d	1. Preliminary analysis of quality of biological data	N/A	Y	4. Mixing exists: markers study as a baseline	0. No overview table	0. No overview table	1. No differences		0. No overview table			2. Staging year-round	1. Careless use of a type of ogive	2. International database correct	0. Sex-specific issues not evaluated	3. Estimated

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Pollachius virens*	pok.27.3a46	1. Preliminary analysis of quality of biological data	Y	Y	2. Mixing exists: not accounted for	0. No overview table		1. No differences		0. No overview table	0. No overview table	2. Chronicle (standard scale) clearly documented and considered in data compilation	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	3. Selection of type of ogive based on thorough analysis of all options	2. International database correct	0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Pollachius pollachius*	pol.27.3a4	0. Quality of biological data not evaluated	N/A	N/A	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs		0. No overview table	0. No overview table	0. No chronicle (standard scale) available			2. International database correct	0. Sex-specific issues not evaluated	

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Solea solea*	sol.27.4	1. Preliminary analysis of quality of biological data	N/A	N/A	3. Mixing exists: accounted for, not validated	0. No overview table	1. Overview table available	0. No comparisons between labs	2. Extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	1. Careless use of a type of ogive		0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			**Stock ID**	**Methods and definitions**											
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
WGNSSK	*Solea solea*	sol.27.7d	1. Preliminary analysis of quality of biological data	N/A	N/A	2. Mixing exists: not accounted for	0. No overview table	1. Overview table available	1. No differences 2. Differences between labs are known but ingnored		0. No overview table	0. No overview table	1. Differences between labs are known but ingnored		3. Selection of type of ogive based on thorough analysis of all options			1. Assumed
WGNSSK	*Scophthalmus maximus*	tur.27.3a	0. Quality of biological data not evaluated	N/A	N/A	2. Mixing exists: not accounted for	0. No overview table	0. No overview table	0. No comparisons between labs		0. No overview table	0. No overview table	0. No chronicle (standard scale) available				0. Sex-specific issues not evaluated	3. Estimated

			Sampling design			Stock ID	Methods and definitions											
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
WGNSSK	*Scophthalmus maximus*	tur.27.4	1. Preliminary analysis of quality of biological data	N/A	N/A	2. Mixing exists: not accounted for	0. No overview table	1. Overview table available	1. No differences	extrapolated	0. No overview table	0. No overview table	0. No chronicle (standard scale) available	1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)			0. Sex-specific issues not evaluated	1. Assumed
WGNSSK	*Merlangius merlangus*	whg.27.3a				2. Mixing exists: not accounted for	0. No overview table	1. Overview table available	0. No comparisons between labs		0. No overview table						0. Sex-specific issues not evaluated	

			Sampling design			Stock ID	Methods and definitions											
EG	**Species**	**Stock**	**All**			**All**	**Age**			**Growth**	**Maturity**					**Sex**	**All**	**Natural Mortal.**
			Survey Design	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**	**Coding**	**Sex-specific Parameters**	**M**
WGNSSK	*Merlangius merlangus*	whg.27.47d	2. Detailed analysis of the quality of biological data	N/A	Y	2. Mixing exists: not accounted for	1. Overview table available	1. Overview table available	0. No comparisons between labs		0. No overview table			1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3 =bad, Q4=moderate)	3. Selection of type of ogive based on thorough analysis of all options		0. Sex-specific issues not evaluated	1. Assumed

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGNSSK	*Glyptocephalus cynoglossus*	wit.27.3a47d	1. Preliminary analysis of quality of biological data	N	N	0. No evidence	0. No overview table	0. No overview table	0. No comparisons between labs		0. No overview table	0. No overview table	0. No chronicle (standard scale) available				0. Sex-specific issues not evaluated	1. Assumed
WGWIDE	*Capros aper*	boc.27.6-8																
WGWIDE	*Chelidonichthys cuculus*	gur.27.3-8																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGWIDE	*Clupea harengus*	her.27.1-24a514a																
WGWIDE	*Trachurus trachurus*	hom.27.2a4a5b6a7a-ce-k8																
WGWIDE	*Trachurus trachurus*	hom.27.3a4bc7d																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGWIDE	*Scomber scombrus*	mac.27.nea	2. Detailed analysis of the quality of biological data	N/A	Y	3. Mixing exists: accounted for, not validated	1. Overview table available	1. Overview table available	1. No differences		0. No overview table	0. No overview table	1. Differences between labs are known but ingnored	2. Staging year-round				1. Assumed
WGWIDE	*Mullus surmuletus*	mur.27.67a-ce-k89a																

			Sampling design			Stock ID	Methods and definitions											
EG	Species	Stock	All			All	Age			Growth	Maturity					Sex	All	Natural Mortal.
			Survey Design	Design Commercial Sampling	Spatial Coverage	Mixing Ratio	Structure	Preparation	Birthdate & "Scheme"	Growth	Structure	Preparation	Scaling	Timing	Ogive	Coding	Sex-specific Parameters	M
WGWIDE	*Micromesistius poutassou*	whb.27.1-91214	1. Preliminary analysis of quality of biological data	N/A	Y	2. Mixing exists: not accounted for	1. Overview table available	0. No overview table			0. No overview table	0. No overview table	0. No chronicle (standard scale) available	2. Staging year-round				1. Assumed

Annex 5. Table 5.B Quality indicators by stock–WGBIOP 2020 answers. Part 2: Data Collection and Validation.

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
NIPAG	*Pandalus borealis*	pra.27.4a								
NWWG	*Mallotus villosus*	cap.27.2a514								
NWWG	*Gadus morhua*	cod.21.1								
NWWG	*Gadus morhua*	cod.21.1a-e								
NWWG	*Gadus morhua*	cod.2127.1f14								
NWWG	*Gadus morhua*	cod.27.5a								
NWWG	*Gadus morhua*	cod.27.5b1	2. Estimated	2. Estimated	0. No validation study			0. No validation study		
NWWG	*Gadus morhua*	cod.27.5b2	2. Estimated	2. Estimated	0. No validation study			0. No validation study		

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
NWWG	*Reinhardtius hippoglossoides*	ghl.27.561214								
NWWG	*Melanogrammus aeglefinus*	had.27.5a	2. Estimated	2. Estimated	0. No validation study			0. No validation study		
NWWG	*Melanogrammus aeglefinus*	had.27.5b								
NWWG	*Clupea harengus*	her.27.5a								
NWWG	*Pollachius virens*	pok.27.5a								
NWWG	*Pollachius virens*	pok.27.5b	2. Estimated	2. Estimated	0. No validation study			0. No validation study		
NWWG	*Sebastes mentella*	reb.2127.dp								
NWWG	*Sebastes mentella*	reb.2127.sp								

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
NWWG	*Sebastes mentella*	reb.27.14b								
NWWG	*Sebastes mentella*	reb.27.5a14								
NWWG	*Sebastes norvegicus*	reg.27.561214								
WGBAST	*Salmo salar*	sal.27.22-31								
WGBAST	*Salmo salar*	sal.27.32								
WGBAST	*Salmo trutta*	trs.27.22-32								
WGBFAS	*Scophthalmus rhombus*	bll.27.22-32								
WGBFAS	*Gadus morhua*	cod.27.21	2. Estimated	2. Estimated	0. No validation study			2. Validation maturity criteria based on histology available		

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGBFAS	*Gadus morhua*	cod.27.22-24								
WGBFAS	*Gadus morhua*	cod.27.24-32								
WGBFAS	*Limanda limanda*	dab.27.22-32	2. Estimated	0. Not estimated	0. No validation study			0. No validation study		
WGBFAS	*Platichthys flesus*	fle.27.2223	2. Estimated	0. Not estimated	0. No validation study			0. No validation study		
WGBFAS	*Platichthys spp*	bwq.27.2425	2. Estimated	0. Not estimated	0. No validation study			0. No validation study		
WGBFAS	*Platichthys spp*	bwq.27.2628	2. Estimated	2. Estimated	1. Only one method with major limitations			0. No validation study		
WGBFAS	*Platichthys solemdali*	bwp.27.2729-32	2. Estimated	0. Not estimated	1. Only one method with major limitations			0. No validation study		
WGBFAS	*Clupea harengus*	her.27.25-2932	2. Estimated	0. Not estimated	1. Only one method with major limitations	not estimated	not estimated	0. No validation study		

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGBFAS	*Clupea harengus*	her.27.28	2. Estimated	0. Not estimated	1. Only one method with major limitations			0. No validation study		
WGBFAS	*Clupea harengus*	her.27.3031								
WGBFAS	*Pleuronectes platessa*	ple.27.21-23								
WGBFAS	*Pleuronectes platessa*	ple.27.24-32	2. Estimated	0. Not estimated	0. No validation study			0. No validation study		
WGBFAS	*Solea solea*	sol.27.20-24								
WGBFAS	*Sprattus sprattus*	spr.27.22-32	2. Estimated	0. Not estimated	1. Only one method with major limitations			0. No validation study		
WGBFAS	*Scophthalmus maximus*	tur.27.22-32	2. Estimated	0. Not estimated	0. No validation study			0. No validation study		
WGBIE	*Lophius budegassa*	ank.27.78abd	2. Estimated	0. Not estimated					No	No

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGBIE	*Lophius budegassa*	ank.27.8c9a								
WGBIE	*Dicentrarchus labrax*	bss.27.8ab								
WGBIE	*Dicentrarchus labrax*	bss.27.8c9a								
WGBIE	*Merluccius merluccius*	hke.27.3a46-8abd	0. Not estimated	0. Not estimated	0. No validation study					
WGBIE	*Brosme brosme, Merluccius merluccius*	hke.27.8c9a	2. Estimated					1. Validation by histology available		
WGBIE	*Lepidorhombus boscii*	ldb.27.7b-k8abd								
WGBIE	*Lepidorhombus boscii*	ldb.27.8c9a								

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGBIE	*Lepidorhombus whiffiagonis*	meg.27.7b-k8abd	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		
WGBIE	*Lepidorhombus whiffiagonis*	meg.27.8c9a								
WGBIE	*Lophius piscatorius*	mon.27.78abd								
WGBIE	*Lophius piscatorius*	mon.27.8c9a	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		
WGBIE	*Nephrops norvegicus*	nep.fu.2324								
WGBIE	*Nephrops norvegicus*	nep.fu.25								
WGBIE	*Nephrops norvegicus*	nep.fu.2627								
WGBIE	*Nephrops norvegicus*	nep.fu.2829	2. Estimated	2. Estimated				0. No validation study		

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGBIE	*Nephrops norvegicus*	nep.fu.30								
WGBIE	*Nephrops norvegicus*	nep.fu.31								
WGBIE	*Pleuronectes platessa*	ple.27.89a								
WGBIE	*Pollachius pollachius*	pol.27.89a	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		
WGBIE	*Solea solea*	sol.27.8ab								
WGBIE	*Solea solea*	sol.27.8c9a	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		
WGBIE	*Merlangius merlangus*	whg.27.89a								
WGCSE	*Lophius budegassa, Lophius piscatorius*	anf.27.3a46								

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGCSE	*Dicentrarchus labrax*	bss.27.4bc7ad-h	2. Estimated	0. Not estimated	0. No validation study	NO	NO	0. No validation study	Unknown	Unknown
WGCSE	*Dicentrarchus labrax*	bss.27.6a7bj								
WGCSE	*Gadus morhua*	cod.27.6a								
WGCSE	*Gadus morhua*	cod.27.6b								
WGCSE	*Gadus morhua*	cod.27.7a								
WGCSE	*Gadus morhua*	cod.27.7e-k								
WGCSE	*Melanogrammus aeglefinus*	had.27.6b								
WGCSE	*Melanogrammus aeglefinus*	had.27.7a								

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGCSE	*Melanogrammus aeglefinus*	had.27.7b-k	2. Estimated	2. Estimated						
WGCSE	*Lepidorhombus*	lez.27.4a6a								
WGCSE	*Lepidorhombus*	lez.27.6b								
WGCSE	*Nephrops norvegicus*	nep.27.6aoutFU								
WGCSE	*Nephrops norvegicus*	nep.27.7outFU								
WGCSE	*Nephrops norvegicus*	nep.fu.11								
WGCSE	*Nephrops norvegicus*	nep.fu.12								
WGCSE	*Nephrops norvegicus*	nep.fu.13								
WGCSE	*Nephrops norvegicus*	nep.fu.14								

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGCSE	*Nephrops norvegicus*	nep.fu.15								
WGCSE	*Nephrops norvegicus*	nep.fu.16								
WGCSE	*Nephrops norvegicus*	nep.fu.17								
WGCSE	*Nephrops norvegicus*	nep.fu.19								
WGCSE	*Nephrops norvegicus*	nep.fu.2021								
WGCSE	*Nephrops norvegicus*	nep.fu.22								
WGCSE	*Trisopterus esmarkii*	nop.27.6a								
WGCSE	*Pleuronectes platessa*	ple.27.7a	2. Estimated	0. Not estimated	0. No validation study	NO	NO	0. No validation study	Unknown	Unknown

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGCSE	*Pleuronectes platessa*	ple.27.7bc								
WGCSE	*Pleuronectes platessa*	ple.27.7e								
WGCSE	*Pleuronectes platessa*	ple.27.7fg								
WGCSE	*Pleuronectes platessa*	ple.27.7h-k								
WGCSE	*Pollachius pollachius*	pol.27.67								
WGCSE	*Ammodytes*	san.27.6a								

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGCSE	*Solea solea*	sol.27.7a	2. Estimated		0. No validation study			0. No validation study		
WGCSE	*Solea solea*	sol.27.7bc								
WGCSE	*Solea solea*	sol.27.7e								
WGCSE	*Solea solea*	sol.27.7fg	2. Estimated		0. No validation study			0. No validation study		
WGCSE	*Solea solea*	sol.27.7h-k								
WGCSE	*Merlangius merlangus*	whg.27.6a								
WGCSE	*Merlangius merlangus*	whg.27.6b								
WGCSE	*Merlangius merlangus*	whg.27.7a	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGCSE	*Merlangius merlangus*	whg.27.7b-ce-k								
WGDEEP	*Beryx*	alf.27.nea								
WGDEEP	*Argentina silus*	aru.27.123a4	2. Estimated	2. Estimated	0. No validation study			0. No validation study		
WGDEEP	*Argentina silus*	aru.27.5a14	2. Estimated	0. Not estimated	1. Only one method with major limitations			0. No validation study		
WGDEEP	*Argentina silus*	aru.27.5b6a								
WGDEEP	*Argentina silus*	aru.27.6b7-1012								
WGDEEP	*Molva dypterygia*	bli.27.5a14	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		
WGDEEP	*Molva dypterygia*	bli.27.5b67								
WGDEEP	*Molva dypterygia*	bli.27.nea	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGDEEP	*Aphanopus carbo*	bsf.27.nea								
WGDEEP	*Phycis blennoides*	gfb.27.nea								
WGDEEP	*Molva molva*	lin.27.1-2								
WGDEEP	*Molva molva*	lin.27.3a4a6-91214								
WGDEEP	*Molva molva*	lin.27.5a	2. Estimated	0. Not estimated	1. Only one method with major limitations			0. No validation study		
WGDEEP	*Molva molva*	lin.27.5b								
WGDEEP	*Hoplostethus atlanticus*	ory.27.nea								
WGDEEP	*Macrourus berglax*	rhg.27.nea								

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGDEEP	*Coryphaenoides rupestris*	rng.27.1245a8914ab								
WGDEEP	*Coryphaenoides rupestris*	rng.27.3a	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		
WGDEEP	*Coryphaenoides rupestris*	rng.27.5a10b12ac14b								
WGDEEP	*Coryphaenoides rupestris*	rng.27.5b6712b	1. Not estimated but extrapolated	2. Estimated	0. No validation study	No	No	0. No validation study	No	No
WGDEEP	*Pagellus bogaraveo*	sbr.27.10								
WGDEEP	*Pagellus bogaraveo*	sbr.27.6-8								
WGDEEP	*Pagellus bogaraveo*	sbr.27.9								
WGDEEP	*Trachyrincus scabrus*	tsu.27.nea								

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGDEEP	*Brosme brosme*	usk.27.1-2								
WGDEEP	*Brosme brosme*	usk.27.12ac								
WGDEEP	*Brosme brosme*	usk.27.3a45b6a7-912b								
WGDEEP	*Brosme brosme*	usk.27.5a14	2. Estimated	0. Not estimated	1. Only one method with major limitations			0. No validation study		
WGDEEP	*Brosme brosme*	usk.27.6b								
WGEEL	*Anguilla anguilla*	ele.2737.nea	0. Not estimated	2. Estimated	1. Only one method with major limitations	No	No	1. Validation by histology available		
WGEF	*Squatina squatina*	agn.27.nea								
WGEF	*Cetorhinus maximus*	bsk.27.nea								
WGEF	*Centrophorus*	cyo.27.nea								

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
	squamosus, Centroscymnus coelolepis									
WGEF	*Squalus acanthias*	dgs.27.nea								
WGEF	*Galeorhinus galeus*	gag.27.nea								
WGEF	*Centrophorus squamosus*	guq.27.nea								
WGEF	*Lamna nasus*	por.27.nea								
WGEF	*Rajidae*	raj.27.1012								
WGEF	*Rajidae*	raj.27.3a47d								
WGEF	*Rajidae*	raj.27.67a-ce-h								
WGEF	*Rajidae*	raj.27.89a								

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGEF	*Rostroraja alba*	rja.27.nea								
WGEF	*Dipturus batis*	rjb.27.3a4								
WGEF	*Dipturus batis*	rjb.27.67a-ce-k								
WGEF	*Dipturus batis*	rjb.27.89a								
WGEF	*Raja clavata*	rjc.27.3a47d								
WGEF	*Raja clavata*	rjc.27.6								
WGEF	*Raja clavata*	rjc.27.7afg								
WGEF	*Raja clavata*	rjc.27.7e								
WGEF	*Raja clavata*	rjc.27.8								

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGEF	*Raja clavata*	rjc.27.9a								
WGEF	*Raja microocellata*	rje.27.7de								
WGEF	*Raja microocellata*	rje.27.7fg								
WGEF	*Leucoraja fullonica*	rjf.27.67								
WGEF	*Raja brachyura*	rjh.27.4a6								
WGEF	*Raja brachyura*	rjh.27.4c7d								
WGEF	*Raja brachyura*	rjh.27.7afg								
WGEF	*Raja brachyura*	rjh.27.7e								
WGEF	*Raja brachyura*	rjh.27.9a								

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGEF	*Leucoraja circularis*	rji.27.67								
WGEF	*Raja montagui*	rjm.27.3a47d								
WGEF	*Raja montagui*	rjm.27.67bj								
WGEF	*Raja montagui*	rjm.27.7ae-h								
WGEF	*Raja montagui*	rjm.27.8								
WGEF	*Raja montagui*	rjm.27.9a								
WGEF	*Leucoraja naevus*	rjn.27.3a4								
WGEF	*Leucoraja naevus*	rjn.27.678abd								
WGEF	*Leucoraja naevus*	rjn.27.8c								

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGEF	*Leucoraja naevus*	rjn.27.9a								
WGEF	*Amblyraja radiata*	rjr.27.23a4								
WGEF	*Raja undulata*	rju.27.7bj								
WGEF	*Raja undulata*	rju.27.7de								
WGEF	*Raja undulata*	rju.27.8ab								
WGEF	*Raja undulata*	rju.27.8c								
WGEF	*Raja undulata*	rju.27.9a								
WGEF	*Dalatias licha*	sck.27.nea								
WGEF	*Mustelus asterias*	sdv.27.nea								

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGEF	*Galeus melastomus*	sho.27.67								
WGEF	*Galeus melastomus*	sho.27.89a								
WGEF	*Scyliorhinus canicula*	syc.27.3a47d								
WGEF	*Scyliorhinus canicula*	syc.27.67a-ce-j								
WGEF	*Scyliorhinus canicula*	syc.27.8abd								
WGEF	*Scyliorhinus canicula*	syc.27.8c9a								
WGEF	*Scyliorhinus stellaris*	syt.27.67								
WGEF	*Alopias*	thr.27.nea								

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGHANSA	*Engraulis encrasicolus*	ane.27.8	2. Estimated	0. Not estimated	2. Several complementary age validation methods showing similar results	NA	NA	2. Validation maturity criteria based on histology available	NA	NA
WGHANSA	*Engraulis encrasicolus*	ane.27.9a_southcomponent	0. Not estimated	0. Not estimated	1. Only one method with major limitations	no	no	0. No validation study	no	no
		ane.27.9a_westcomponent	0. Not estimated	0. Not estimated	0. No validation study	no	no	1. Validation by histology available	yes	no
WGHANSA	*Trachurus trachurus*	hom.27.9a	2. Estimated	2. Estimated	0. No validation study			2. Validation maturity criteria based on histology available	no	no
WGHANSA	*Trachurus picturatus*	jaa.27.10a2	2. Estimated	2. Estimated	0. No validation study	NA	NA	0. No validation study	NA	NA
WGHANSA	*Sardina pilchardus*	pil.27.7	2. Estimated	0. Not estimated	0. No validation study			0. No validation study		
WGHANSA	*Sardina pilchardus*	pil.27.8abd	Estimated	Not relevant	Ageing is easy for this stock	unknown	unknown	unknown	unknown	unknown

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGHANSA	*Sardina pilchardus*	pil.27.8c9a	2. Estimated	2. Estimated	2. Several complementary age validation methods showing similar results	NA	NA	1. Validation by histology available	No	No
WGNAS	*Salmo salar*	sal.21.2-5								
WGNAS	*Salmo salar*	sal.2127.1a-f14	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		
WGNAS	*Salmo salar*	sal.27.nea	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		
WGNSSK	*Scophthalmus rhombus*	bll.27.3a47de			0. No validation study			0. No validation study		
WGNSSK	*Gadus morhua*	cod.27.47d20	0. Not estimated	0. Not estimated						
WGNSSK	*Limanda limanda*	dab.27.3a4	0. Not estimated	0. Not estimated	0. No validation study					
WGNSSK	*Platichthys flesus*	fle.27.3a4	0. Not estimated	0. Not estimated	0. No validation study					

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGNSSK	*Eutrigla gurnardus*	gug.27.3a47d								
WGNSSK	*Melanogrammus aeglefinus*	had.27.46a20	0. Not estimated	0. Not estimated						
WGNSSK	*Microstomus kitt*	lem.27.3a47d	2. Estimated	0. Not estimated	0. No validation study	NA	NA	0. No validation study	NA	NA
WGNSSK	*Mullus surmuletus*	mur.27.3a47d	2. Estimated	0. Not estimated	2. Several complementary age validation methods showing similar results			0. No validation study		
WGNSSK	*Nephrops norvegicus*	nep.27.4outFU	0. Not estimated	0. Not estimated	0. No validation study	No data	No data	0. No validation study	No data	No data
WGNSSK	*Nephrops norvegicus*	nep.fu.10								
WGNSSK	*Nephrops norvegicus*	nep.fu.3-4								
WGNSSK	*Nephrops norvegicus*	nep.fu.32	1. Not estimated but extrapolated	2. Estimated	0. No validation study	No age data	No age data	0. No validation study	No histological study	Not available

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGNSSK	*Nephrops norvegicus*	nep.fu.33	0. Not estimated	0. Not estimated	0. No validation study	No data	No data	0. No validation study	No data	No data
WGNSSK	*Nephrops norvegicus*	nep.fu.34								
WGNSSK	*Nephrops norvegicus*	nep.fu.5	0. Not estimated	0. Not estimated	0. No validation study	No data	No data	0. No validation study	No data	No data
WGNSSK	*Nephrops norvegicus*	nep.fu.6	0. Not estimated	2. Estimated	0. No validation study	No data	No data	0. No validation study	No data	No data
WGNSSK	*Nephrops norvegicus*	nep.fu.7								
WGNSSK	*Nephrops norvegicus*	nep.fu.8								
WGNSSK	*Nephrops norvegicus*	nep.fu.9								
WGNSSK	*Trisopterus esmarkii*	nop.27.3a4	0. Not estimated	0. Not estimated	2. Several complementary age validation methods showing similar results	available in recent age reading report	avaiable in recent age reading report	0. No validation study	Yes, evaluated in scientific peer reviewed papers	yes, evaluated in scientific peer reviewed literature

EG	Species	Stock	Data Collection: Maturity	Data Collection: Sex	Validation: Age			Validation: Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGNSSK	*Pleuronectes platessa*	ple.27.420	2. Estimated	0. Not estimated	1. Only one method with major limitations	avaiable in recent age reading exchange workshop report	avaiable in recent age reading report	0. No validation study		
WGNSSK	*Pleuronectes platessa*	ple.27.7d	2. Estimated	0. Not estimated		available in recent age reading exchange workshop report	available in recent age reading report	0. No validation study		
WGNSSK	*Pollachius virens*	pok.27.3a46	2. Estimated	0. Not estimated	1. Only one method with major limitations	Not available		0. No validation study	Not evaluated	Not evaluated
WGNSSK	*Pollachius pollachius*	pol.27.3a4			0. No validation study			0. No validation study	Not evaluated	Not evaluated
WGNSSK	*Solea solea*	sol.27.4								
WGNSSK	*Solea solea*	sol.27.7d	2. Estimated		0. No validation study			0. No validation study		
WGNSSK	*Scophthalmus maximus*	tur.27.3a		0. Not estimated						

			Data Collection		Validation					
EG	Species	Stock	Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGNSSK	*Scophthalmus maximus*	tur.27.4	0. Not estimated	0. Not estimated	0. No validation study			0. No validation study		
WGNSSK	*Merlangius merlangus*	whg.27.3a	0. Not estimated	0. Not estimated	1. Only one method with major limitations			0. No validation study		
WGNSSK	*Merlangius merlangus*	whg.27.47d	2. Estimated	0. Not estimated	0. No validation study			0. No validation study		
WGNSSK	*Glyptocephalus cynoglossus*	wit.27.3a47d	2. Estimated	0. Not estimated	0. No validation study			0. No validation study		
WGWIDE	*Capros aper*	boc.27.6-8								
WGWIDE	*Chelidonichthys cuculus*	gur.27.3-8								
WGWIDE	*Clupea harengus*	her.27.1-24a514a								

EG	Species	Stock	Data Collection		Validation					
			Maturity	Sex	Age			Maturity		
			Length/age at Maturity	Sex Ratio	Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Maturity Error Matrix
WGWIDE	*Trachurus trachurus*	hom.27.2a4a 5b6a7a-ce-k8								
WGWIDE	*Trachurus trachurus*	hom.27.3a4b c7d								
WGWIDE	*Scomber scombrus*	mac.27.nea	0. Not estimated	0. Not estimated	1. Only one method with major limitations			0. No validation study		
WGWIDE	*Mullus surmuletus*	mur.27.67a-ce-k89a								
WGWIDE	*Micromesistius poutassou*	whb.27.1-91214	0. Not estimated	0. Not estimated	1. Only one method with major limitations			0. No validation study		

Annex 5. Table 5.C. Quality indicators by stock–WGBIOP 2020 answers. Part 3: Calibration.

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
NIPAG	*Pandalus borealis*	pra.27.4a										
NWWG	*Mallotus villosus*	cap.27.2a514										

[23] When was the last exchange that included age readers from major data contributors?

[24] Measure for accuracy in relation to modal age (Quantitative estimate; evaluation stock-specific).

[25] Measure for precision (Quantitative estimate; evaluation stock-specific).

[26] Percentage agreement between age readers (Quantitative estimate; evaluation stock-specific).

[27] Probability distribution of repeated measurements relative to modal age (Quantitative estimate; evaluation stock-specific).

[28] When was the last exchange that included maturity readers from major data contributors?

[29] Measure for accuracy in relation to modal maturity (Quantitative estimate; evaluation stock-specific).

[30] Measure for precision (Quantitative estimate; evaluation stock-specific).

[31] Percentage agreement between maturity readers (Quantitative estimate; evaluation stock-specific).

[32] Probability distribution of repeated measurements relative to modal maturity (Quantitative estimate; evaluation stock-specific).

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
NWWG	*Gadus morhua*	cod.21.1										
NWWG	*Gadus morhua*	cod.21.1a-e										
NWWG	*Gadus morhua*	cod.2127.1f14										
NWWG	*Gadus morhua*	cod.27.5a										
NWWG	*Gadus morhua*	cod.27.5b1	0. No exchange					0. No exchange				
NWWG	*Gadus morhua*	cod.27.5b2	0. No exchange					0. No exchange				
NWWG	*Reinhardtius hippoglossoides*	ghl.27.561214										
NWWG	*Melanogrammus aeglefinus*	had.27.5a	4. Exchange recently, good results					0. No exchange				

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
NWWG	*Melanogrammus aeglefinus*	had.27.5b										
NWWG	*Clupea harengus*	her.27.5a										
NWWG	*Pollachius virens*	pok.27.5a										
NWWG	*Pollachius virens*	pok.27.5b	0. No exchange									
NWWG	*Sebastes mentella*	reb.2127.dp										
NWWG	*Sebastes mentella*	reb.2127.sp										
NWWG	*Sebastes mentella*	reb.27.14b										
NWWG	*Sebastes mentella*	reb.27.5a14										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
NWWG	*Sebastes norvegicus*	reg.27.561214										
WGBAST	*Salmo salar*	sal.27.22-31										
WGBAST	*Salmo salar*	sal.27.32										
WGBAST	*Salmo trutta*	trs.27.22-32										
WGBFAS	*Scophthalmus rhombus*	bll.27.22-32										
WGBFAS	*Gadus morhua*	cod.27.21	4. Exchange recently, good results	-0.08	*20.3*	82.1		3. Exchange long time ago and good results				
WGBFAS	*Gadus morhua*	cod.27.22-24										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGBFAS	*Gadus morhua*	cod.27.24-32										
WGBFAS	*Limanda limanda*	dab.27.22-32	0. No exchange					0. No exchange				
WGBFAS	*Platichthys flesus*	fle.27.2223	1. Exchange long time ago and poor results					0. No exchange				
WGBFAS	*Platichthys spp*	bwq.27.2425	1. Exchange long time ago and poor results			70,4%		0. No exchange				
WGBFAS	*Platichthys spp*	bwq.27.2628	1. Exchange long time ago and poor results					1. Exchange long time ago and poor results				
WGBFAS	*Platichthys solemdali*	bwp.27.2729-32	1. Exchange long time ago and poor results									

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	**Relative Bias[24]**	**CV or APE[25]**	**% Agreement[26]**	**Relative Age Error Matrix[27]**	**Exchange/ Workshop[28]**	**Relative Bias[29]**	**CV or APE[30]**	**% Agreement[31]**	**Relative Maturity Error Matrix[32]**
WGBFAS	*Clupea harengus*	her.27.25-2932	4. Exchange recently, good results	S1: ±0.00–0.24; S2: ±0.04–0.49; S3: ±0.02–0.52	**CV** S1: 1.9–7.5%; S2: 1.9–7.5%; S3: 11–20%	S1: 88–94%; S2: 52–85%; S3: 52–81%,		1. Exchange long time ago and poor results				
WGBFAS	*Clupea harengus*	her.27.28	5. Exchange recently, very good results			95%		0. No exchange				
WGBFAS	*Clupea harengus*	her.27.3031										
WGBFAS	*Pleuronectes platessa*	ple.27.21-23										
WGBFAS	*Pleuronectes platessa*	ple.27.24-32	1. Exchange long time ago and poor results					0. No exchange				

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
WGBFAS	*Solea solea*	sol.27.20-24										
WGBFAS	*Sprattus sprattus*	spr.27.22-32	3. Exchange long time ago and good re-sults					0. No ex-change				
WGBFAS	*Scoph-thalmus maximus*	tur.27.22-32	0. No ex-change					0. No ex-change				
WGBIE	*Lophius bude-gassa*	ank.27.78abd						0. No ex-change				
WGBIE	*Lophius bude-gassa*	ank.27.8c9a										
WGBIE	*Dicen-trarchus labrax*	bss.27.8ab										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGBIE	*Dicentrarchus labrax*	bss.27.8c9a										
WGBIE	*Merluccius merluccius*	hke.27.3a46-8abd										
WGBIE	*Brosme brosme, Merluccius merluccius*	hke.27.8c9a										
WGBIE	*Lepidorhombus boscii*	ldb.27.7b-k8abd										
WGBIE	*Lepidorhombus boscii*	ldb.27.8c9a										
WGBIE	*Lepidorhombus whiffiagonis*	meg.27.7b-k8abd	2. Exchange recently, poor results					0. No exchange				

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGBIE	*Lepidorhombus whiffiagonis*	meg.27.8c9a										
WGBIE	*Lophius piscatorius*	mon.27.78abd										
WGBIE	*Lophius piscatorius*	mon.27.8c9a	1. Exchange long time ago and poor results					3. Exchange long time ago and good results				
WGBIE	*Nephrops norvegicus*	nep.fu.2324										
WGBIE	*Nephrops norvegicus*	nep.fu.25										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGBIE	*Nephrops norvegicus*	nep.fu.2627										
WGBIE	*Nephrops norvegicus*	nep.fu.2829						0. No exchange				
WGBIE	*Nephrops norvegicus*	nep.fu.30										
WGBIE	*Nephrops norvegicus*	nep.fu.31										
WGBIE	*Pleuronectes platessa*	ple.27.89a										
WGBIE	*Pollachius pollachius*	pol.27.89a	0. No exchange					0. No exchange				
WGBIE	*Solea solea*	sol.27.8ab										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGBIE	*Solea solea*	sol.27.8c9a	0. No exchange					0. No exchange				
WGBIE	*Merlangius merlangus*	whg.27.89a										
WGCSE	*Lophius budegassa, Lophius piscatorius*	anf.27.3a46										
WGCSE	*Dicentrarchus labrax*	bss.27.4bc7ad-h	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
WGCSE	*Dicentrarchus labrax*	bss.27.6a7bj										
WGCSE	*Gadus morhua*	cod.27.6a										
WGCSE	*Gadus morhua*	cod.27.6b										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
WGCSE	*Gadus morhua*	cod.27.7a										
WGCSE	*Gadus morhua*	cod.27.7e-k										
WGCSE	*Melano-grammus aeglefi-nus*	had.27.6b										
WGCSE	*Melano-grammus aeglefi-nus*	had.27.7a										
WGCSE	*Melano-grammus aeglefi-nus*	had.27.7b-k	4. Exchange recently, good re-sults									
WGCSE	*Lepi-dorhom-bus*	lez.27.4a6a										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGCSE	*Lepidorhombus*	lez.27.6b										
WGCSE	*Nephrops norvegicus*	nep.27.6aoutFU										
WGCSE	*Nephrops norvegicus*	nep.27.7outFU										
WGCSE	*Nephrops norvegicus*	nep.fu.11										
WGCSE	*Nephrops norvegicus*	nep.fu.12										
WGCSE	*Nephrops norvegicus*	nep.fu.13										
WGCSE	*Nephrops norvegicus*	nep.fu.14										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
WGCSE	*Nephrops norvegi-cus*	nep.fu.15										
WGCSE	*Nephrops norvegi-cus*	nep.fu.16										
WGCSE	*Nephrops norvegi-cus*	nep.fu.17										
WGCSE	*Nephrops norvegi-cus*	nep.fu.19										
WGCSE	*Nephrops norvegi-cus*	nep.fu.2021										
WGCSE	*Nephrops norvegi-cus*	nep.fu.22										
WGCSE	*Trisopte-rus es-markii*	nop.27.6a										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGCSE	*Pleuronectes platessa*	ple.27.7a	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
WGCSE	*Pleuronectes platessa*	ple.27.7bc										
WGCSE	*Pleuronectes platessa*	ple.27.7e										
WGCSE	*Pleuronectes platessa*	ple.27.7fg										
WGCSE	*Pleuronectes platessa*	ple.27.7h-k										
WGCSE	*Pollachius pollachius*	pol.27.67										
WGCSE	*Ammodytes*	san.27.6a										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
WGCSE	*Solea solea*	sol.27.7a	0. No ex-change					3. Ex-change long time ago and good re-sults	stage 2 = 0.26 stage 5 = -0.90 (fresh fish, sole in gen-eral, not linked to a certain stock)	not availa-ble	82% (fresh fish)	not availa-ble
WGCSE	*Solea solea*	sol.27.7bc										
WGCSE	*Solea solea*	sol.27.7e										
WGCSE	*Solea solea*	sol.27.7fg	0. No ex-change					3. Ex-change long time ago and good re-sults	stage 2 = 0.26 stage 5 = -0.90 (fresh fish, sole in gen-eral, not linked to a certain stock)	not availa-ble	82% (fresh fish)	not availa-ble

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
WGCSE	*Solea solea*	sol.27.7h-k										
WGCSE	*Merlangius merlangus*	whg.27.6a										
WGCSE	*Merlangius merlangus*	whg.27.6b										
WGCSE	*Merlangius merlangus*	whg.27.7a	0. No exchange					0. No exchange				
WGCSE	*Merlangius merlangus*	whg.27.7b-ce-k										
WGDEEP	*Beryx*	alf.27.nea										
WGDEEP	*Argentina silus*	aru.27.123a4	4. Exchange recently, good results					3. Exchange long time ago and good results				

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
WGDEEP	*Argen-tina silus*	aru.27.5a14	4. Exchange recently, good re-sults					0. No ex-change				
WGDEEP	*Argen-tina silus*	aru.27.5b6a										
WGDEEP	*Argen-tina silus*	aru.27.6b7-1012										
WGDEEP	*Molva dypter-ygia*	bli.27.5a14	0. No ex-change					0. No ex-change				
WGDEEP	*Molva dypter-ygia*	bli.27.5b67										
WGDEEP	*Molva dypter-ygia*	bli.27.nea	4. Exchange recently, good re-sults		*cv=3.9*	48%		0. No ex-change				
WGDEEP	*Aphano-pus carbo*	bsf.27.nea										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGDEEP	*Phycis blennoides*	gfb.27.nea										
WGDEEP	*Molva molva*	lin.27.1-2										
WGDEEP	*Molva molva*	lin.27.3a4a6-91214										
WGDEEP	*Molva molva*	lin.27.5a	4. Exchange recently, good results					0. No exchange				
WGDEEP	*Molva molva*	lin.27.5b										
WGDEEP	*Hoplostethus atlanticus*	ory.27.nea										
WGDEEP	*Macrourus berglax*	rhg.27.nea										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGDEEP	*Coryphaenoides rupestris*	rng.27.1245a8914ab										
WGDEEP	*Coryphaenoides rupestris*	rng.27.3a	3. Exchange long time ago and good results		*cv=11.2*	30%		0. No exchange				
WGDEEP	*Coryphaenoides rupestris*	rng.27.5a10b12ac14b										
WGDEEP	*Coryphaenoides rupestris*	rng.27.5b6712b	0. No exchange	No	No	No	No	0. No exchange	No	No	No	No
WGDEEP	*Pagellus bogaraveo*	sbr.27.10										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGDEEP	*Pagellus bogaraveo*	sbr.27.6-8										
WGDEEP	*Pagellus bogaraveo*	sbr.27.9										
WGDEEP	*Trachyrincus scabrus*	tsu.27.nea										
WGDEEP	*Brosme brosme*	usk.27.1-2										
WGDEEP	*Brosme brosme*	usk.27.12ac										
WGDEEP	*Brosme brosme*	usk.27.3a45b6a7-912b										
WGDEEP	*Brosme brosme*	usk.27.5a14	4. Exchange recently, good results					0. No exchange				

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
WGDEEP	*Brosme brosme*	usk.27.6b										
WGEEL	*Anguilla anguilla*	ele.2737.nea	2. Exchange recently, poor results		*cv=39%*	40		0. No ex-change	A mature eel was never caught			
WGEF	*Squatina squatina*	agn.27.nea										
WGEF	*Cetorhi-nus maxi-mus*	bsk.27.nea										
WGEF	*Cen-trophorus squamo-sus, Cen-troscym-nus coelolepis*	cyo.27.nea										
WGEF	*Squalus acanthias*	dgs.27.nea										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGEF	*Galeorhinus galeus*	gag.27.nea										
WGEF	*Centrophorus squamosus*	guq.27.nea										
WGEF	*Lamna nasus*	por.27.nea										
WGEF	*Rajidae*	raj.27.1012										
WGEF	*Rajidae*	raj.27.3a47d										
WGEF	*Rajidae*	raj.27.67a-ce-h										
WGEF	*Rajidae*	raj.27.89a										
WGEF	*Rostroraja alba*	rja.27.nea										
WGEF	*Dipturus batis*	rjb.27.3a4										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGEF	*Dipturus batis*	rjb.27.67a-ce-k										
WGEF	*Dipturus batis*	rjb.27.89a										
WGEF	*Raja clavata*	rjc.27.3a47d										
WGEF	*Raja clavata*	rjc.27.6										
WGEF	*Raja clavata*	rjc.27.7afg										
WGEF	*Raja clavata*	rjc.27.7e										
WGEF	*Raja clavata*	rjc.27.8										
WGEF	*Raja clavata*	rjc.27.9a										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGEF	*Raja microocellata*	rje.27.7de										
WGEF	*Raja microocellata*	rje.27.7fg										
WGEF	*Leucoraja fullonica*	rjf.27.67										
WGEF	*Raja brachyura*	rjh.27.4a6										
WGEF	*Raja brachyura*	rjh.27.4c7d										
WGEF	*Raja brachyura*	rjh.27.7afg										
WGEF	*Raja brachyura*	rjh.27.7e										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
WGEF	*Raja brachy-ura*	rjh.27.9a										
WGEF	*Leucoraja circularis*	rji.27.67										
WGEF	*Raja montagui*	rjm.27.3a47d										
WGEF	*Raja montagui*	rjm.27.67bj										
WGEF	*Raja montagui*	rjm.27.7ae-h										
WGEF	*Raja montagui*	rjm.27.8										
WGEF	*Raja montagui*	rjm.27.9a										
WGEF	*Leucoraja naevus*	rjn.27.3a4										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGEF	*Leucoraja naevus*	rjn.27.678abd										
WGEF	*Leucoraja naevus*	rjn.27.8c										
WGEF	*Leucoraja naevus*	rjn.27.9a										
WGEF	*Amblyraja radiata*	rjr.27.23a4										
WGEF	*Raja undulata*	rju.27.7bj										
WGEF	*Raja undulata*	rju.27.7de										
WGEF	*Raja undulata*	rju.27.8ab										
WGEF	*Raja undulata*	rju.27.8c										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
WGEF	*Raja un-dulata*	rju.27.9a										
WGEF	*Dalatias licha*	sck.27.nea										
WGEF	*Mustelus asterias*	sdv.27.nea										
WGEF	*Galeus melasto-mus*	sho.27.67										
WGEF	*Galeus melasto-mus*	sho.27.89a										
WGEF	*Scyliorhi-nus ca-nicula*	syc.27.3a47d										
WGEF	*Scyliorhi-nus ca-nicula*	syc.27.67a-ce-j										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGEF	*Scyliorhinus canicula*	syc.27.8abd										
WGEF	*Scyliorhinus canicula*	syc.27.8c9a										
WGEF	*Scyliorhinus stellaris*	syt.27.67										
WGEF	*Alopias*	thr.27.nea										
WGHANSA	*Engraulis encrasicolus*	ane.27.8	5. Exchange recently, very good results	NA	NA	NA	NA	3. Exchange long time ago and good results	NA	NA	NA	NA
WGHANSA	*Engraulis encrasicolus*	ane.27.9a_southcomponent	5. Exchange recently, very good results	y	*y*	y	no	0. No exchange	no	no	no	no

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
		ane.27.9a_westcomponent	5. Exchange recently, very good results	y	*y*	y	no	0. No ex-change	no	no	no	no
WGHANSA	*Trachurus trachurus*	hom.27.9a	4. Exchange recently, good results					0. No ex-change				
WGHANSA	*Trachurus picturatus*	jaa.27.10a2	2. Exchange recently, poor results	NA	sections: 36,0-168,8% whole: 69,85%	sections: 35,3-79,3% whole: 56,3%	Not available	0. No ex-change	NA	NA	NA	NA
WGHANSA	*Sardina pilchardus*	pil.27.7	0. No ex-change					0. No ex-change				
WGHANSA	*Sardina pilchardus*	pil.27.8abd	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGHANSA	*Sardina pilchardus*	pil.27.8c9a	5. Exchange recently, very good results	NA	*CV=20 %, APE=22 % (expert readers)*	80% (expert readers)	NA	0. No exchange	No	No	No	No
WGNAS	*Salmo salar*	sal.21.2-5										
WGNAS	*Salmo salar*	sal.2127.1a-f14	0. No exchange					0. No exchange				
WGNAS	*Salmo salar*	sal.27.nea	0. No exchange					0. No exchange				
WGNSSK	*Scophthalmus rhombus*	bll.27.3a47de	5. Exchange recently, very good results	-0.01 (advanced readers, stained sections)	*CV = 8% APE = 1% (advanced readers, stained sections)*	95% (advanced readers, stained sections)	available in SmartDots report	3. Exchange long time ago and good results	stage 2 = -0.26 stage 3 = -0.67 (fresh samples, brill in general, not linked to a certain stock)	not available	94% (fresh samples, expert stagers)	not available

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGNSSK	*Gadus morhua*	cod.27.47d20	3. Exchange long time ago and good results	74%	*39.80%*			3. Exchange long time ago and good results	69-77%			
WGNSSK	*Limanda limanda*	dab.27.3a4	4. Exchange recently, good results									
WGNSSK	*Platichthys flesus*	fle.27.3a4	0. No exchange									
WGNSSK	*Eutrigla gurnardus*	gug.27.3a47d										
WGNSSK	*Melanogrammus aeglefinus*	had.27.46a20										
WGNSSK	*Microstomus kitt*	lem.27.3a47d	0. No exchange	NA	*NA*	NA	NA					

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGNSSK	*Mullus surmuletus*	mur.27.3a47d	0. No exchange					0. No exchange				
WGNSSK	*Nephrops norvegicus*	nep.27.4outFU	0. No exchange	No data	*No data*	No data	No data	0. No exchange	No data	No data	No data	No data
WGNSSK	*Nephrops norvegicus*	nep.fu.10										
WGNSSK	*Nephrops norvegicus*	nep.fu.3-4										
WGNSSK	*Nephrops norvegicus*	nep.fu.32	0. No exchange	No age data	*No age data*	No age data	No age data	0. No exchange	Not available	Not available	Not available	Not available
WGNSSK	*Nephrops norvegicus*	nep.fu.33	0. No exchange	No data	No data	No data	No data	0. No exchange	No data	No data	No data	No data
WGNSSK	*Nephrops norvegicus*	nep.fu.34										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGNSSK	*Nephrops norvegicus*	nep.fu.5	0. No exchange	No data	*No data*	No data	No data	0. No exchange	No data	No data	No data	No data
WGNSSK	*Nephrops norvegicus*	nep.fu.6	0. No exchange	No data	*No data*	No data	No data	0. No exchange	No data	No data	No data	No data
WGNSSK	*Nephrops norvegicus*	nep.fu.7										
WGNSSK	*Nephrops norvegicus*	nep.fu.8										
WGNSSK	*Nephrops norvegicus*	nep.fu.9										
WGNSSK	*Trisopterus esmarkii*	nop.27.3a4	4. Exchange recently, good results	avaiable in recent age reading exchange	*avaiable in recent age reading exchange*	avaiable in recent age reading exchange workshop report	avaiable in recent age reading exchange workshop report	0. No exchange	published in scientific peer reviewed literature	published in scientific peer reviewed literature	No data	No data

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
				workshop report	*workshop report*							
WGNSSK	*Pleuronectes platessa*	ple.27.420	4. Exchange recently, good results	avaiable in recent age reading exchange workshop report	avaiable in recent age reading exchange workshop report	avaiable in recent age reading exchange workshop report	avaiable in recent age reading exchange workshop report	0. No exchange				
WGNSSK	*Pleuronectes platessa*	ple.27.7d	3. Exchange long time ago and good results	available in recent age reading exchange workshop report	available in recent age reading report	available in recent age reading exchange workshop report	available in recent age reading report	0. No exchange				
WGNSSK	*Pollachius virens*	pok.27.3a46	4. Exchange recently, good results	-0.04 (reflected light) to -0.08	*CV = 6.2%*	85.90%		1. Exchange long time ago and			75% females, 65% males	

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Work-shop[23]	Relative Bias[24]	CV or APE[25]	% Agree-ment[26]	Relative Age Error Matrix[27]	Exchange/ Work-shop[28]	Relative Bias[29]	CV or APE[30]	% Agree-ment[31]	Relative Maturity Error Ma-trix[32]
				(trans-mitted light)				poor re-sults			(WKMSGAD 2013)	
WGNSSK	*Pol-lachius pol-lachius*	pol.27.3a4	0. No ex-change	No age data	No age data	No age data	No age data	0. No ex-change	No data	No data	No data	No data
WGNSSK	*Solea solea*	sol.27.4										
WGNSSK	*Solea solea*	sol.27.7d	4. Exchange recently, good re-sults	-0.27	*CV = 9% and APE=5 % (ex-pert read-ers)*	80%	available in SmartDots report	3. Ex-change long time ago and good re-sults	stage 2 = 0.26 stage 5 = -0.90 (fresh fish, sole in gen-eral, not linked to a certain stock)	not availa-ble	82%	not availa-ble
WGNSSK	*Scoph-thalmus maximus*	tur.27.3a										

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGNSSK	*Scophthalmus maximus*	tur.27.4	4. Exchange recently, good results	0.09	*CV = 17%*	78%	available in smartdots report for event 216	3. Exchange long time ago and good results	stage 1: 0.6, stage 2: -0.29	not available	94 % fresh staging; 79 % image-based staging	not available
WGNSSK	*Merlangius merlangus*	whg.27.3a						0. No exchange				
WGNSSK	*Merlangius merlangus*	whg.27.47d	4. Exchange recently, good results	-0.04	*CV=14.9%*	69.50%		0. No exchange				
WGNSSK	*Glyptocephalus cynoglossus*	wit.27.3a47d	0. No exchange					0. No exchange				
WGWIDE	*Capros aper*	boc.27.6-8										

EG	Species	Stock	Calibration: Age: Exchange / Workshop[23]	Age: Relative Bias[24]	Age: CV or APE[25]	Age: % Agreement[26]	Age: Relative Age Error Matrix[27]	Maturity: Exchange/ Workshop[28]	Maturity: Relative Bias[29]	Maturity: CV or APE[30]	Maturity: % Agreement[31]	Maturity: Relative Maturity Error Matrix[32]
WGWIDE	*Chelidonichthys cuculus*	gur.27.3-8										
WGWIDE	*Clupea harengus*	her.27.1-24a514a										
WGWIDE	*Trachurus trachurus*	hom.27.2a4a5 b6a7a-ce-k8										
WGWIDE	*Trachurus trachurus*	hom.27.3a4bc7 d										
WGWIDE	*Scomber scombrus*	mac.27.nea	2. Exchange recently, poor results	-0.03 (all ICES divs)	*CV=30.4 (all ICES divs)*	66.5% (all ICES divs)	Calculated using results from 2018 age reading workshop. Will be discussed at the next benchmark for mackerel.	2. Exchange recently, poor results	Stage 1:0.66, Stage 2:0.89, Stage 3:-0.08, Stage 4:-1.57 (WKMSMAC 2 2015)		61.40%	

EG	Species	Stock	Calibration									
			Age					Maturity				
			Exchange / Workshop[23]	Relative Bias[24]	CV or APE[25]	% Agreement[26]	Relative Age Error Matrix[27]	Exchange/ Workshop[28]	Relative Bias[29]	CV or APE[30]	% Agreement[31]	Relative Maturity Error Matrix[32]
WGWIDE	*Mullus surmuletus*	mur.27.67a-ce-k89a										
WGWIDE	*Micromesistius poutassou*	whb.27.1-91214	2. Exchange recently, poor results	-0.14	*CV=26*	66%	Available for the all ICES areas combined (stock distribution whole area) and by stock component (southern component areas considering only the readers that read the otoliths from the southern areas and the same for the northern component)	0. No exchange				

Annex 5. Table 5.D. Quality indicators by stock–WGBIOP 2020 answers. Part 4: Stock Assessment and General comments.

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
NIPAG	*Pandalus borealis*	pra.27.4a							
NWWG	*Mallotus villosus*	cap.27.2a514							
NWWG	*Gadus morhua*	cod.21.1							

[33] Any related information/ suggestion/ comment for the specific stock.

[34] Is the stock assessment model age-structured?

[35] Variance structure can directly be incorporated into stochastic stock assessment models.

[36] Is maturity function used in stock assessment model?

[37] Variance structure can directly be incorporated into stochastic stock assessment models.

[38] Sensitivity runs will show effects of different biological data sets (e.g. age) on the assessment outcomes in terms of key parameters such as fishing mortality (F) and spawning stock biomass (SSB).

[39] Use of new parameters could improve stock assessments. Has the potential of new parameters been considered or included in the data compilation and input to stock assessment?

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
NWWG	*Gadus morhua*	cod.21.1a-e							
NWWG	*Gadus morhua*	cod.2127.1f14							
NWWG	*Gadus morhua*	cod.27.5a							
NWWG	*Gadus morhua*	cod.27.5b1	2. Age structure used in assessment	1. Error matrix not used in assessment	4. Yearly maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
NWWG	*Gadus morhua*	cod.27.5b2	1. Age structure not used in assessment						
NWWG	*Reinhardtius hippoglossoides*	ghl.27.561214							
NWWG	*Melanogrammus*	had.27.5a	2. Age structure used in assessment	1. Error matrix not used in assessment	4. Yearly maturity ogive at age or	1. Error matrix not used in assessment	3. Numerous sensitivity runs	2. New parameters used in assessment	

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
	aeglefinus				length in assessment		with alternative datasets tested		
NWWG	*Melanogrammus aeglefinus*	had.27.5b							
NWWG	*Clupea harengus*	her.27.5a							
NWWG	*Pollachius virens*	pok.27.5a							
NWWG	*Pollachius virens*	pok.27.5b	2. Age structure used in assessment						
NWWG	*Sebastes mentella*	reb.2127.dp							
NWWG	*Sebastes mentella*	reb.2127.sp							

EG	Species	Stock	Stock Assessment: Age		Stock Assessment: Maturity		Stock Assessment: All	Stock Assessment: New Parameters	General comments[33]
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
NWWG	*Sebastes mentella*	reb.27.14b							
NWWG	*Sebastes mentella*	reb.27.5a14							
NWWG	*Sebastes norvegicus*	reg.27.561214							
WGBAST	*Salmo salar*	sal.27.22-31							
WGBAST	*Salmo salar*	sal.27.32							
WGBAST	*Salmo trutta*	trs.27.22-32							
WGBFAS	*Scophthalmus rhombus*	bll.27.22-32							
WGBFAS	*Gadus morhua*	cod.27.21	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or	1. Error matrix not used in assessment	1. No alternative input	1. New parameters not used in assessment	

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
					length in assessment		datasets produced		
WGBFAS	*Gadus morhua*	cod.27.22-24							
WGBFAS	*Gadus morhua*	cod.27.24-32							
WGBFAS	*Limanda limanda*	dab.27.22-32	1. Age structure not used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGBFAS	*Platichthys flesus*	fle.27.2223	1. Age structure not used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGBFAS	*Platichthys spp*	bwq.27.2425	1. Age structure not used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGBFAS	*Platichthys spp*	bwq.27.2628	1. Age structure not used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGBFAS	*Platichthys solemdali*	bwp.27.2729-32	1. Age structure not used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment			
WGBFAS	*Clupea harengus*	her.27.25-2932	2. Age structure used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGBFAS	*Clupea harengus*	her.27.28	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGBFAS	*Clupea harengus*	her.27.3031							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGBFAS	*Pleuronectes platessa*	ple.27.21-23							
WGBFAS	*Pleuronectes platessa*	ple.27.24-32	2. Age structure used in assessment	1. Error matrix not used in assessment	4. Yearly maturity ogive at age or length in assessment	1. Error matrix not used in assessment	3. Numerous sensitivity runs with alternative datasets tested	1. New parameters not used in assessment	
WGBFAS	*Solea solea*	sol.27.20-24							
WGBFAS	*Sprattus sprattus*	spr.27.22-32	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGBFAS	*Scophthalmus maximus*	tur.27.22-32	1. Age structure not used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
WGBIE	*Lophius budegassa*	ank.27.78abd	1. Age structure not used in assessment		2. Knife-edge maturity-at-age or length in assessment	1. Error matrix not used in assessment	3. Numerous sensitivity runs with alternative datasets tested	1. New parameters not used in assessment	As stock coordinator, I am not in a position to answer many of these questions; at assessment working groups we cannot evaluate the quality of the data we receive in detail; during benchmark (data compilation) workshops we investigate the data in more detail but not usually to the extent that we can answer the questions posed here. Data submitters would be in a better position to answer someof these questions for the data provided on behalf of their country. Also note that many of the stocks listed here have length-based assessments so there will not be coherent answers for age data.
WGBIE	*Lophius budegassa*	ank.27.8c9a							
WGBIE	*Dicentrarchus labrax*	bss.27.8ab							
WGBIE	*Dicentrarchus labrax*	bss.27.8c9a							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGBIE	*Merluccius merluccius*	hke.27.3a46-8abd	1. Age structure not used in assessment		3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGBIE	*Brosme brosme, Merluccius merluccius*	hke.27.8c9a							
WGBIE	*Lepidorhombus boscii*	ldb.27.7b-k8abd							
WGBIE	*Lepidorhombus boscii*	ldb.27.8c9a							
WGBIE	*Lepidorhombus whiffiagonis*	meg.27.7b-k8abd	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGBIE	*Lepidorhombus whiffiagonis*	meg.27.8c9a							
WGBIE	*Lophius piscatorius*	mon.27.78abd							
WGBIE	*Lophius piscatorius*	mon.27.8c9a	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGBIE	*Nephrops norvegicus*	nep.fu.2324							
WGBIE	*Nephrops norvegicus*	nep.fu.25							
WGBIE	*Nephrops norvegicus*	nep.fu.2627							

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
WGBIE	*Nephrops norvegicus*	nep.fu.2829			2. Knife-edge maturity-at-age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Stock in Category 3. Length-based assessment methods used by sex (LBI, MLZ)
WGBIE	*Nephrops norvegicus*	nep.fu.30							
WGBIE	*Nephrops norvegicus*	nep.fu.31							
WGBIE	*Pleuronectes platessa*	ple.27.89a							
WGBIE	*Pollachius pollachius*	pol.27.89a	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Stock in category 5, assessment based on catch information (by now)
WGBIE	*Solea solea*	sol.27.8ab							

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
WGBIE	*Solea solea*	sol.27.8c9a	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Stock in category 3, lenght-based
WGBIE	*Merlangius merlangus*	whg.27.89a							
WGCSE	*Lophius budegassa, Lophius piscatorius*	anf.27.3a46							
WGCSE	*Dicentrarchus labrax*	bss.27.4bc7ad-h	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGCSE	*Dicentrarchus labrax*	bss.27.6a7bj							

EG	Species	Stock	Stock Assessment: Age: Variance Structure[34]	Stock Assessment: Age: Error Matrix[35]	Stock Assessment: Maturity: Variance Structure[36]	Stock Assessment: Maturity: Error Matrix[37]	Stock Assessment: All: Sensitivity Analysis[38]	Stock Assessment: New Parameters: New Parameters[39]	General comments[33]
WGCSE	*Gadus morhua*	cod.27.6a							
WGCSE	*Gadus morhua*	cod.27.6b							
WGCSE	*Gadus morhua*	cod.27.7a							
WGCSE	*Gadus morhua*	cod.27.7e-k							
WGCSE	*Melanogrammus aeglefinus*	had.27.6b							
WGCSE	*Melanogrammus aeglefinus*	had.27.7a							
WGCSE	*Melanogrammus aeglefinus*	had.27.7b-k	2. Age structure used in assessment		3. Fixed maturity ogive at age or length in assessment		1. No alternative input datasets produced		

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGCSE	*Lepidorhombus*	lez.27.4a6a							
WGCSE	*Lepidorhombus*	lez.27.6b							
WGCSE	*Nephrops norvegicus*	nep.27.6aoutFU							
WGCSE	*Nephrops norvegicus*	nep.27.7outFU							
WGCSE	*Nephrops norvegicus*	nep.fu.11							
WGCSE	*Nephrops norvegicus*	nep.fu.12							
WGCSE	*Nephrops norvegicus*	nep.fu.13							

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
WGCSE	*Nephrops norvegicus*	nep.fu.14							
WGCSE	*Nephrops norvegicus*	nep.fu.15							
WGCSE	*Nephrops norvegicus*	nep.fu.16							
WGCSE	*Nephrops norvegicus*	nep.fu.17							
WGCSE	*Nephrops norvegicus*	nep.fu.19							
WGCSE	*Nephrops norvegicus*	nep.fu.2021							
WGCSE	*Nephrops norvegicus*	nep.fu.22							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGCSE	*Trisopterus esmarkii*	nop.27.6a							
WGCSE	*Pleuronectes platessa*	ple.27.7a	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Unsure on history of age and maturity data
WGCSE	*Pleuronectes platessa*	ple.27.7bc							
WGCSE	*Pleuronectes platessa*	ple.27.7e							
WGCSE	*Pleuronectes platessa*	ple.27.7fg							
WGCSE	*Pleuronectes platessa*	ple.27.7h-k							
WGCSE	*Pollachius*	pol.27.67							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
	pollachius								
WGCSE	*Ammodytes*	san.27.6a							
WGCSE	*Solea solea*	sol.27.7a	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGCSE	*Solea solea*	sol.27.7bc							
WGCSE	*Solea solea*	sol.27.7e							
WGCSE	*Solea solea*	sol.27.7fg	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGCSE	*Solea solea*	sol.27.7h-k							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGCSE	*Merlangius merlangus*	whg.27.6a							
WGCSE	*Merlangius merlangus*	whg.27.6b							
WGCSE	*Merlangius merlangus*	whg.27.7a	2. Age structure used in assessment	1. Error matrix not used in assessment	2. Knife-edge maturity-at-age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 1 stock
WGCSE	*Merlangius merlangus*	whg.27.7b-ce-k							
WGDEEP	*Beryx*	alf.27.nea							
WGDEEP	*Argentina silus*	aru.27.123a4	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 3 stock

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
WGDEEP	*Argentina silus*	aru.27.5a14	2. Age structure used in assessment	1. Error matrix not used in assessment	4. Yearly maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	2. New parameters used in assessment	Category 1 stock
WGDEEP	*Argentina silus*	aru.27.5b6a							
WGDEEP	*Argentina silus*	aru.27.6b7-1012							Category 3, very data-limited
WGDEEP	*Molva dypterygia*	bli.27.5a14	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 3 stock
WGDEEP	*Molva dypterygia*	bli.27.5b67							
WGDEEP	*Molva dypterygia*	bli.27.nea	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 5 stock

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGDEEP	*Aphanopus carbo*	bsf.27.nea							
WGDEEP	*Phycis blennoides*	gfb.27.nea							
WGDEEP	*Molva molva*	lin.27.1-2							
WGDEEP	*Molva molva*	lin.27.3a4a6-91214							
WGDEEP	*Molva molva*	lin.27.5a	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	2. New parameters used in assessment	Category 1 stock
WGDEEP	*Molva molva*	lin.27.5b							
WGDEEP	*Hoplostethus atlanticus*	ory.27.nea							

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
WGDEEP	*Macrourus berglax*	rhg.27.nea							
WGDEEP	*Coryphaenoides rupestris*	rng.27.1245a8914ab							
WGDEEP	*Coryphaenoides rupestris*	rng.27.3a	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 3 stock; 2/3 rule and no reference points set.
WGDEEP	*Coryphaenoides rupestris*	rng.27.5a10b12ac14b							
WGDEEP	*Coryphaenoides rupestris*	rng.27.5b6712b	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 5 stock

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGDEEP	*Pagellus bogaraveo*	sbr.27.10							
WGDEEP	*Pagellus bogaraveo*	sbr.27.6-8							
WGDEEP	*Pagellus bogaraveo*	sbr.27.9							
WGDEEP	*Trachyrincus scabrus*	tsu.27.nea							
WGDEEP	*Brosme brosme*	usk.27.1-2							
WGDEEP	*Brosme brosme*	usk.27.12ac							
WGDEEP	*Brosme brosme*	usk.27.3a45b6a7-912b							

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
WGDEEP	*Brosme brosme*	usk.27.5a14	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	2. New parameters used in assessment	Category 1 stock
WGDEEP	*Brosme brosme*	usk.27.6b							
WGEEL	*Anguilla anguilla*	ele.2737.nea	1. Age structure not used in assessment		1. No maturity information in assessment		1. No alternative input datasets produced	2. New parameters used in assessment	category 3 stocks with assessment mostly based on time-series of recruitment. As such, no stock assessment model currently used and biometric data are rarely used. Growth/maturity/sex-ratio are is highly variable in space. Recent WKFEA workshop promotes the development of spatial model in which biometric data would be highly relevant
WGEF	*Squatina squatina*	agn.27.nea							
WGEF	*Cetorhinus maximus*	bsk.27.nea							
WGEF	*Centrophorus*	cyo.27.nea							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
	squamosus, Centroscymnus coelolepis								
WGEF	*Squalus acanthias*	dgs.27.nea							
WGEF	*Galeorhinus galeus*	gag.27.nea							
WGEF	*Centrophorus squamosus*	guq.27.nea							
WGEF	*Lamna nasus*	por.27.nea							
WGEF	*Rajidae*	raj.27.1012							
WGEF	*Rajidae*	raj.27.3a47d							
WGEF	*Rajidae*	raj.27.67a-ce-h							
WGEF	*Rajidae*	raj.27.89a							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGEF	*Rostroraja alba*	rja.27.nea							
WGEF	*Dipturus batis*	rjb.27.3a4							
WGEF	*Dipturus batis*	rjb.27.67a-ce-k							
WGEF	*Dipturus batis*	rjb.27.89a							
WGEF	*Raja clavata*	rjc.27.3a47d							
WGEF	*Raja clavata*	rjc.27.6							
WGEF	*Raja clavata*	rjc.27.7afg							
WGEF	*Raja clavata*	rjc.27.7e							
WGEF	*Raja clavata*	rjc.27.8							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGEF	*Raja clavata*	rjc.27.9a							
WGEF	*Raja microocellata*	rje.27.7de							
WGEF	*Raja microocellata*	rje.27.7fg							
WGEF	*Leucoraja fullonica*	rjf.27.67							
WGEF	*Raja brachyura*	rjh.27.4a6							
WGEF	*Raja brachyura*	rjh.27.4c7d							
WGEF	*Raja brachyura*	rjh.27.7afg							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGEF	*Raja brachyura*	rjh.27.7e							
WGEF	*Raja brachyura*	rjh.27.9a							
WGEF	*Leucoraja circularis*	rji.27.67							
WGEF	*Raja montagui*	rjm.27.3a47d							
WGEF	*Raja montagui*	rjm.27.67bj							
WGEF	*Raja montagui*	rjm.27.7ae-h							
WGEF	*Raja montagui*	rjm.27.8							
WGEF	*Raja montagui*	rjm.27.9a							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGEF	*Leucoraja naevus*	rjn.27.3a4							
WGEF	*Leucoraja naevus*	rjn.27.678abd							
WGEF	*Leucoraja naevus*	rjn.27.8c							
WGEF	*Leucoraja naevus*	rjn.27.9a							
WGEF	*Amblyraja radiata*	rjr.27.23a4							
WGEF	*Raja undulata*	rju.27.7bj							
WGEF	*Raja undulata*	rju.27.7de							
WGEF	*Raja undulata*	rju.27.8ab							
WGEF	*Raja undulata*	rju.27.8c							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGEF	*Raja undulata*	rju.27.9a							
WGEF	*Dalatias licha*	sck.27.nea							
WGEF	*Mustelus asterias*	sdv.27.nea							
WGEF	*Galeus melastomus*	sho.27.67							
WGEF	*Galeus melastomus*	sho.27.89a							
WGEF	*Scyliorhinus canicula*	syc.27.3a47d							
WGEF	*Scyliorhinus canicula*	syc.27.67a-ce-j							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGEF	*Scyliorhinus canicula*	syc.27.8abd							
WGEF	*Scyliorhinus canicula*	syc.27.8c9a							
WGEF	*Scyliorhinus stellaris*	syt.27.67							
WGEF	*Alopias*	thr.27.nea							
WGHANSA	*Engraulis encrasicolus*	ane.27.8	2. Age structure used in assessment	1. Error matrix not used in assessment	2. Knife-edge maturity-at-age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGHANSA	*Engraulis encrasicolus*	ane.27.9a_southcomponent	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	this is a category 3 stock component, but stock biomass indicators and (relative) biomass-based reference points are derived from a Gadget model

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Age – Error Matrix[35]	Maturity – Variance Structure[36]	Maturity – Error Matrix[37]	All – Sensitivity Analysis[38]	New Parameters – New Parameters[39]	General comments[33]
		ane.27.9a_west component	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment		1. New parameters not used in assessment	this is a category 3 stock component; no analytical assessment, survey trend
WGHANSA	*Trachurus trachurus*	hom.27.9a	1. Age structure not used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	1. No alternative input datasets produced
WGHANSA	*Trachurus picturatus*	jaa.27.10a2		1. Error matrix not used in assessment		1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGHANSA	*Sardina pilchardus*	pil.27.7	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGHANSA	*Sardina pilchardus*	pil.27.8abd		2. Error matrix used in assessment		2. Error matrix used in assessment	yes	yes, also a switch from age based to length based structure in SS3	

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGHANSA	*Sardina pilchardus*	pil.27.8c9a	2. Age structure used in assessment	1. Error matrix not used in assessment	4. Yearly maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGNAS	*Salmo salar*	sal.21.2-5							
WGNAS	*Salmo salar*	sal.2127.1a-f14	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	2. New parameters used in assessment	Tried my best to fit information to this table, but salmon stock assessment is a bit of a different kettle of fish.
WGNAS	*Salmo salar*	sal.27.nea	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	2. New parameters used in assessment	
WGNSSK	*Scophthalmus rhombus*	bll.27.3a47de	1. Age structure not used in assessment		1. No maturity information in assessment		1. No alternative input datasets produced	1. New parameters not used in assessment	Category 3 stock without quantitative assessment. Fields left blank means not applicable for this stock.

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGNSSK	*Gadus morhua*	cod.27.47d20	2. Age structure used in assessment	1. Error matrix not used in assessment	4. Yearly maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced		Category 1 assessment
WGNSSK	*Limanda limanda*	dab.27.3a4							Category 3 stock without quantitative assessment. Fields left blank means not applicable for this stock.
WGNSSK	*Platichthys flesus*	fle.27.3a4							Category 3 stock without quantitative assessment. Fields left blank means not applicable for this stock.
WGNSSK	*Eutrigla gurnardus*	gug.27.3a47d							Category 3 stock without quantitative assessment. Fields left blank means not applicable for this stock.
WGNSSK	*Melanogrammus aeglefinus*	had.27.46a20	2. Age structure used in assessment	1. Error matrix not used in assessment	2. Knife-edge maturity-at-age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced		Category 1 assessment. Benchmark set for early 2022
WGNSSK	*Microstomus kitt*	lem.27.3a47d	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input	1. New parameters not used in assessment	

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
							datasets produced		
WGNSSK	*Mullus surmuletus*	mur.27.3a47d	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Since 2021 stock was downgraded to category 5 due to the lack of age (only one country sampling) and size sampling.
WGNSSK	*Nephrops norvegicus*	nep.27.4outFU	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 5 stock without quantitative assessment
WGNSSK	*Nephrops norvegicus*	nep.fu.10							
WGNSSK	*Nephrops norvegicus*	nep.fu.3-4							
WGNSSK	*Nephrops norvegicus*	nep.fu.32	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Data limited stock with no quantitative assessment. Fishery has decreased

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
WGNSSK	*Nephrops norvegicus*	nep.fu.33	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 4 stock without quantitative assessment
WGNSSK	*Nephrops norvegicus*	nep.fu.34							
WGNSSK	*Nephrops norvegicus*	nep.fu.5	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 4 stock without quantitative assessment
WGNSSK	*Nephrops norvegicus*	nep.fu.6	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 1 stock with quantitative assessment based on a separable cohort analysis, with MSY proxy of 35% of virgin spawners per recruit
WGNSSK	*Nephrops norvegicus*	nep.fu.7							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGNSSK	*Nephrops norvegicus*	nep.fu.8							
WGNSSK	*Nephrops norvegicus*	nep.fu.9							
WGNSSK	*Trisopterus esmarkii*	nop.27.3a4	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	3. Numerous sensitivity runs with alternative datasets tested	2. New parameters used in assessment	
WGNSSK	*Pleuronectes platessa*	ple.27.420	2. Age structure used in assessment	1. Error matrix not used in assessment	2. Knife-edge maturity-at-age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGNSSK	*Pleuronectes platessa*	ple.27.7d	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGNSSK	*Pollachius virens*	pok.27.3a46	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Some fields left blank as no information readily available
WGNSSK	*Pollachius pollachius*	pol.27.3a4							No stock assessment for pollack
WGNSSK	*Solea solea*	sol.27.4	2. Age structure used in assessment	1. Error matrix not used in assessment	2. Knife-edge maturity-at-age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGNSSK	*Solea solea*	sol.27.7d	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Some fields are left blank (or I filled in N/A) because not applicable.
WGNSSK	*Scophthalmus maximus*	tur.27.3a	1. Age structure not used in assessment		1. No maturity information in assessment				Category 3 stock assessed with a surplus production model

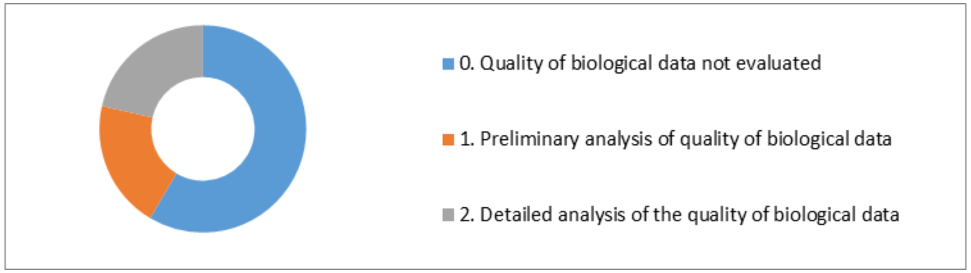
EG	Species	Stock	Stock Assessment: Age		Stock Assessment: Maturity		Stock Assessment: All	Stock Assessment: New Parameters	General comments[33]
			Variance Structure[34]	**Error Matrix[35]**	**Variance Structure[36]**	**Error Matrix[37]**	**Sensitivity Analysis[38]**	**New Parameters[39]**	
WGNSSK	*Scophthalmus maximus*	tur.27.4							
WGNSSK	*Merlangius merlangus*	whg.27.3a	1. Age structure not used in assessment	1. Error matrix not used in assessment	1. No maturity information in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 3 stock assessed with surplus production model and advice based on trends of estimated relative biomass
WGNSSK	*Merlangius merlangus*	whg.27.47d	2. Age structure used in assessment	1. Error matrix not used in assessment	4. Yearly maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	
WGNSSK	*Glyptocephalus cynoglossus*	wit.27.3a47d	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment	1. No alternative input datasets produced	1. New parameters not used in assessment	Category 1 stock with a SAM assessment using a biomass survey index and total landings until 2008 and age specific information from 2009 onward
WGWIDE	*Capros aper*	boc.27.6-8							

EG	Species	Stock	Stock Assessment: Age – Variance Structure[34]	Stock Assessment: Age – Error Matrix[35]	Stock Assessment: Maturity – Variance Structure[36]	Stock Assessment: Maturity – Error Matrix[37]	Stock Assessment: All – Sensitivity Analysis[38]	Stock Assessment: New Parameters – New Parameters[39]	General comments[33]
WGWIDE	*Chelidonichthys cuculus*	gur.27.3-8							
WGWIDE	*Clupea harengus*	her.27.1-24a514a							
WGWIDE	*Trachurus trachurus*	hom.27.2a4a5b6a7a-ce-k8							
WGWIDE	*Trachurus trachurus*	hom.27.3a4bc7d							
WGWIDE	*Scomber scombrus*	mac.27.nea	2. Age structure used in assessment	1. Error matrix not used in assessment	4. Yearly maturity ogive at age or length in assessment	1. Error matrix not used in assessment	3. Numerous sensitivity runs with alternative datasets tested	1. New parameters not used in assessment	
WGWIDE	*Mullus surmuletus*	mur.27.67a-ce-k89a							

EG	Species	Stock	Stock Assessment						General comments[33]
			Age		Maturity		All	New Parameters	
			Variance Structure[34]	Error Matrix[35]	Variance Structure[36]	Error Matrix[37]	Sensitivity Analysis[38]	New Parameters[39]	
WGWIDE	*Micromesistius poutassou*	whb.27.1-91214	2. Age structure used in assessment	1. Error matrix not used in assessment	3. Fixed maturity ogive at age or length in assessment	1. Error matrix not used in assessment		1. New parameters not used in assessment	

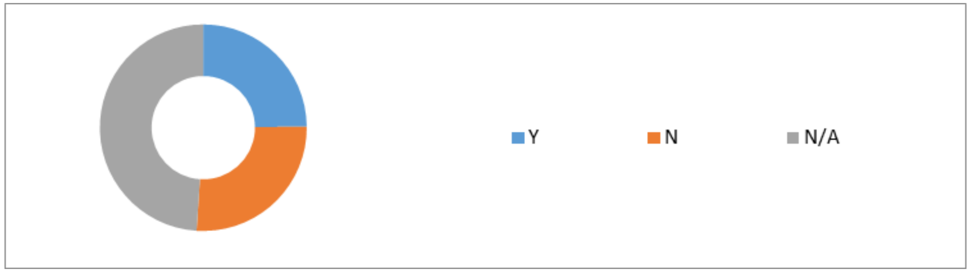
Annex 5. Table 5.E. Quality indicators by stock–WGBIOP 2022 answers. Part 5: Summary Table–Corrected Answers and Figures.

Sampling Design_All_Survey Design		
Were possible weaknesses of the survey design critically assessed?	n	%
0. Quality of biological data not evaluated	83	59
1. Preliminary analysis of quality of biological data	28	20
2. Detailed analysis of the quality of biological data	30	22
Total	14 1	100

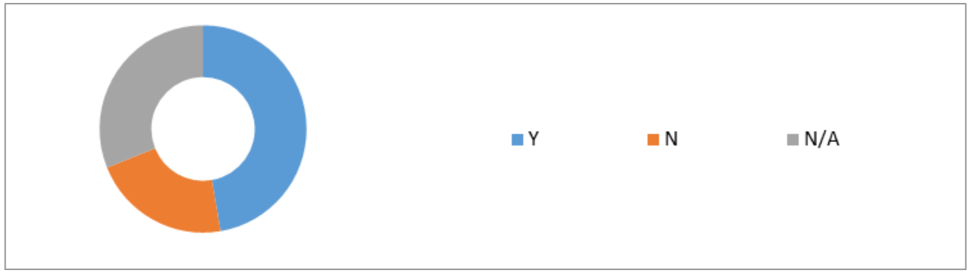


Sampling Design_All_Design Commercial Sampling		
Has the quality of (national) sampling schemes used to collect biological material been thoroughly evaluated? (Refer to annual evaluation of national work plans by STECF)	**n**	**%**
Y	36	25
N	38	26
N/A	71	49

Total	14 5	100

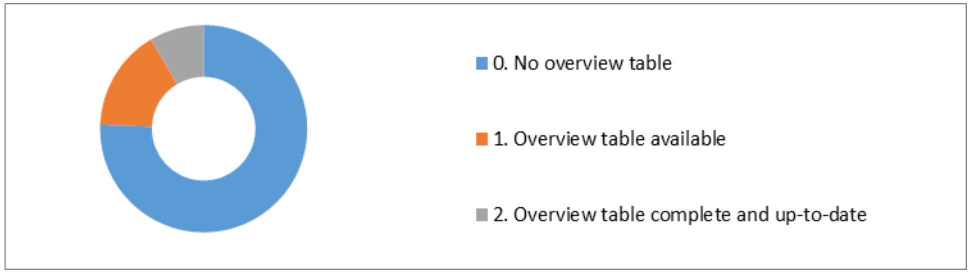


Sampling Design_All_Spatial Coverage **Is the full range of the stock covered by biological sampling? (E.g. evaluate distribution maps of national VMS tracks and commercial samples)**	**n**	**%**
Y	70	47
N	32	22
N/A	46	31
Total	14 8	100



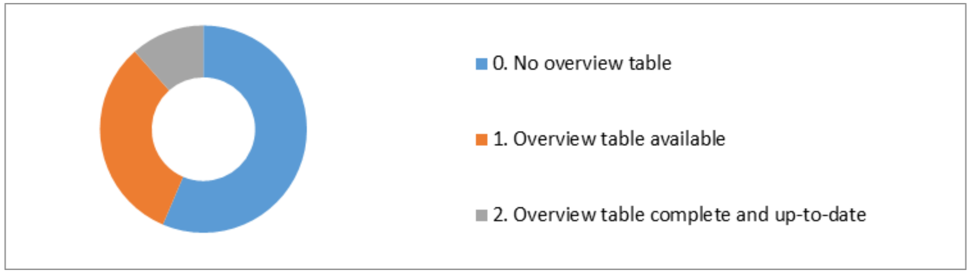
Stock Identity_All_Mixing Ratio **Is there any evidence of mixing? What methods are used to identify stock components? How reliable are spatio-temporal patterns in mixing resolved?**	**n**	**%**
0. No evidence	79	54
1. No mixing	20	14
2. Mixing exists: not accounted for	30	21
3. Mixing exists: accounted for, not validated	6	4
4. Mixing exists: markers study as a baseline	1	1
5. Mixing exists: markers study and poor spatio-temporal coverage f mixing	1	1
6. Mixing exists: markers study and good spatio-temporal coverage of mixing	8	6
Total	143	100

Methods and Definitions_Age_Structure		
Documentation of different structures used by country and stock	**n**	**%**
0. No overview table	62	76
1. Overview table available	13	16
2. Overview table complete and up-to-date	7	9
Total	82	100

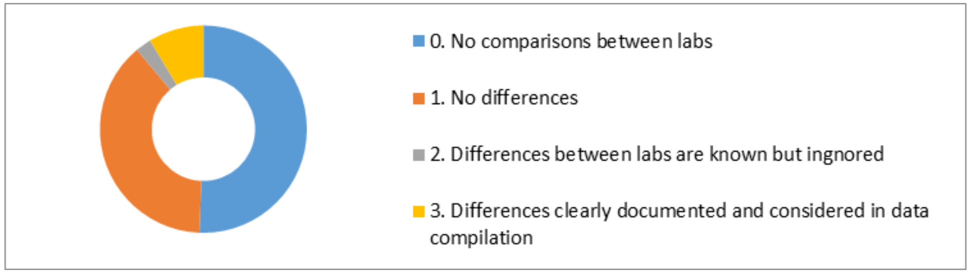


Methods and Definitions_Age_Preparation		
Documentation of different preparation techniques used by country and stock	**n**	**%**
0. No overview table	44	56

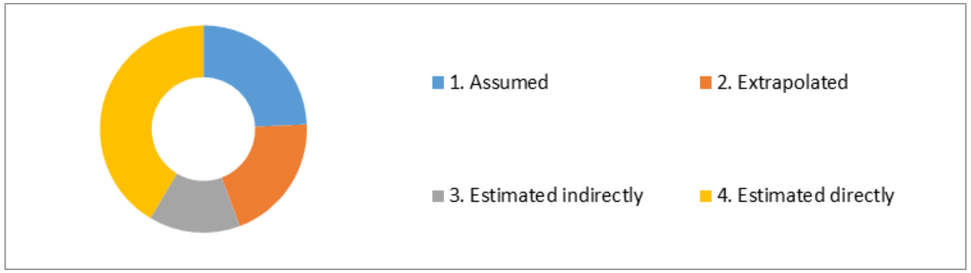
1. Overview table available	25	32
2. Overview table complete and up-to-date	9	12
Total	78	100



Methods and Definitions_Age_Birthdate & "Scheme" **Consistency in the definition of the birthdate *(usually January 1st)* and in the interpretation of the seasonality in deposition of opaque and translucent material *(the "scheme")***	**n**	**%**
0. No comparisons between labs	41	51
1. No differences	31	38
2. Differences between labs are known but ingnored	2	2
3. Differences clearly documented and considered in data compilation	7	9
Total	81	100

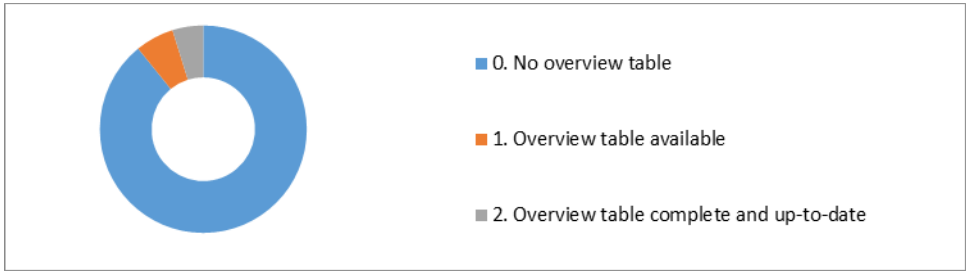


Methods and Definitions_Growth_Growth		
Growth parameters are used in assessments (e.g. Nephrops). On what information are growth parameters based? Estimated by direct or indirect methods (e.g. tagging studies), extrapolated (from neighbouring regions), or assumed?	**n**	**%**
1. Assumed	17	24
2. Extrapolated	14	20
3. Estimated indirectly	10	14
4. Estimated directly	29	41
Total	70	100

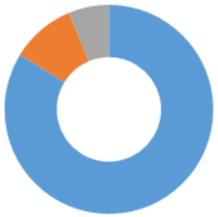


Methods and Definitions_Maturity_Structure

Documentation of different structures used by country and stock	n	%
0. No overview table	74	89
1. Overview table available	5	6
2. Overview table complete and up-to-date	4	5
Total	83	100



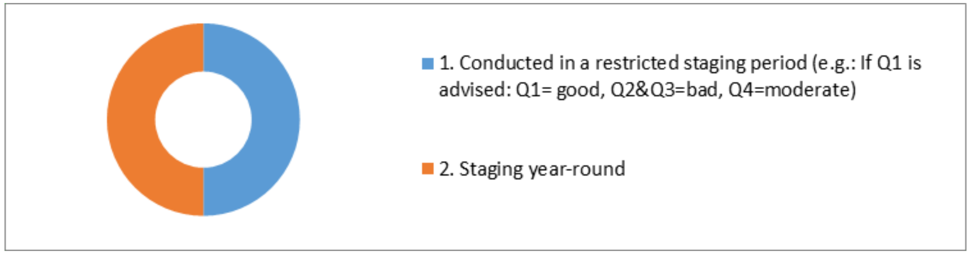
Methods and Definitions_Maturity_Preparation		
Documentation of different preparation techniques used by country and stock	**n**	**%**
0. No overview table	67	84
1. Overview table available	8	10
2. Overview table complete and up-to-date	5	6
Total	80	100



Methods and Definitions_Maturity_Scaling		
Do differences between countries exist(ed)? Have different national maturity scales been successfully merged into one international standard?	**n**	**%**
0. No chronicle (standard scale) available	51	64
1. Differences between labs are known but ingnored	10	13
2. Chronicle (standard scale) clearly documented and considered in data compilation	19	24
Total	80	100

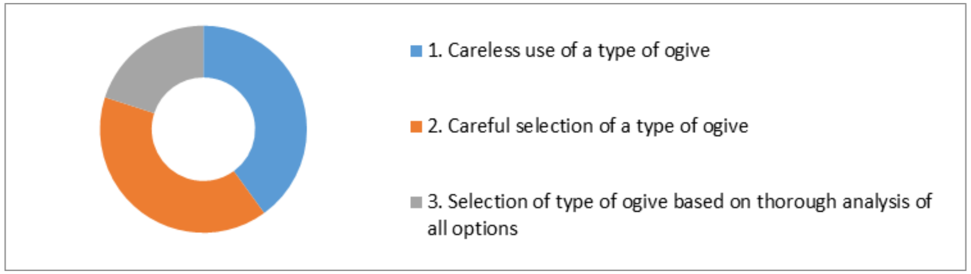
Methods and Definitions_Maturity_Timing

Is the maturity staging conducted during the whole year or only during a specified period of the year?	n	%
1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3=bad, Q4=moderate)	36	50
2. Staging year-round	36	50
Total	72	100

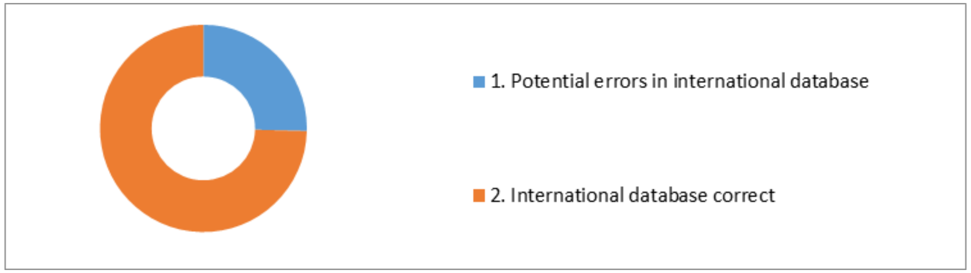


Methods and Definitions_Maturity_Ogive

If sufficient maturity data are available, then spatially and/or temporally varying ogives can be considered	n	%
1. Careless use of a type of ogive	26	40
2. Careful selection of a type of ogive	26	40
3. Selection of type of ogive based on thorough analysis of all options	13	20
Total	65	100

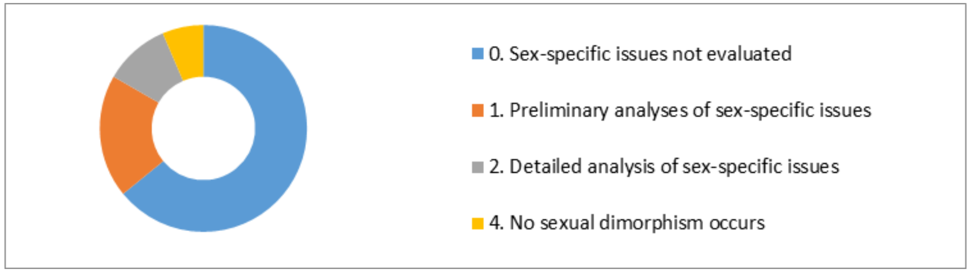


Methods and Definitions_Sex_Coding		
Different countries use different coding for male and female in their national databases. This should be standardized before the data are submitted to ICES/GFCM, but there is a risk of errors.	**n**	**%**
1. Potential errors in international database	16	25
2. International database correct	47	75
Total	63	100



Methods and Definitions_All_Sex-specific Parameters

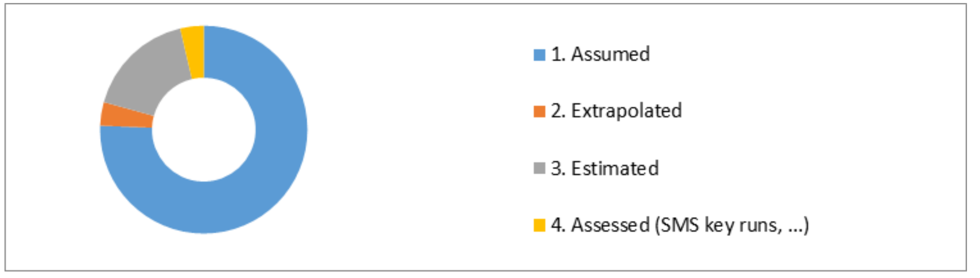
Sexual dimorphism occurs in many species, but sex-specific parameters are only applicable in sex-specific stock assessments. Is sex-specific information available and needed? Are the sample sizes per strata representative enough to allow sex-specific conclusions?	n	%
0. Sex-specific issues not evaluated	50	64
1. Preliminary analyses of sex-specific issues	15	19
2. Detailed analysis of sex-specific issues	8	10
4. No sexual dimorphism occurs	5	6
Total	78	100



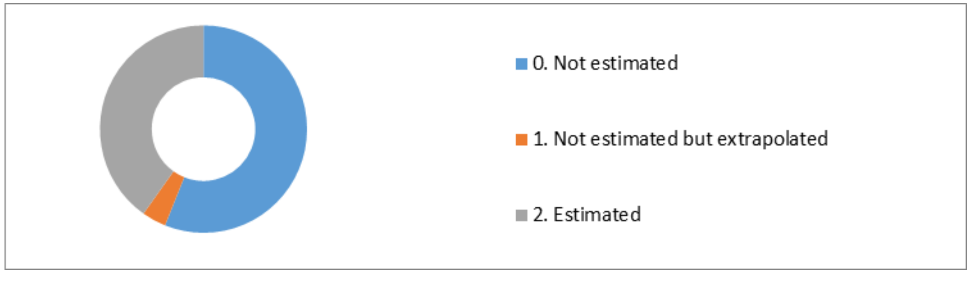
Methods and Definitions_Natural Mortality_M

On what information is the value for natural mortality based? Estimated (based on predator–prey studies), extrapolated from neighbouring regions or assumed?	n	%
1. Assumed	62	76
2. Extrapolated	3	4
3. Estimated	14	17
4. Assessed (SMS key runs, ...)	3	4

Total	82	100

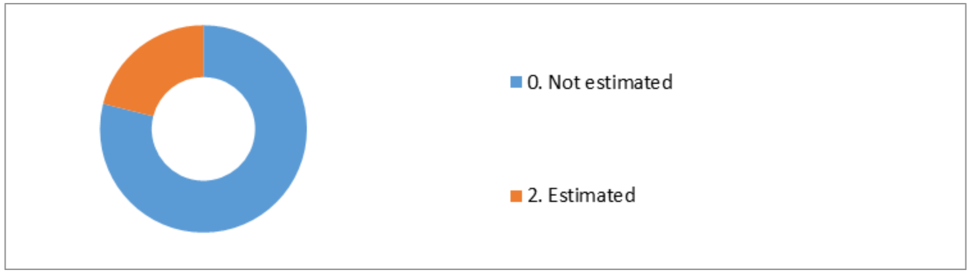


Data Collection_Maturity_Length/age at Maturity		
Was length/age at maturity estimated or extrapolated from neighbouring stocks?	**n**	**%**
0. Not estimated	74	56
1. Not estimated but extrapolated	5	4
2. Estimated	53	40
Total	132	100

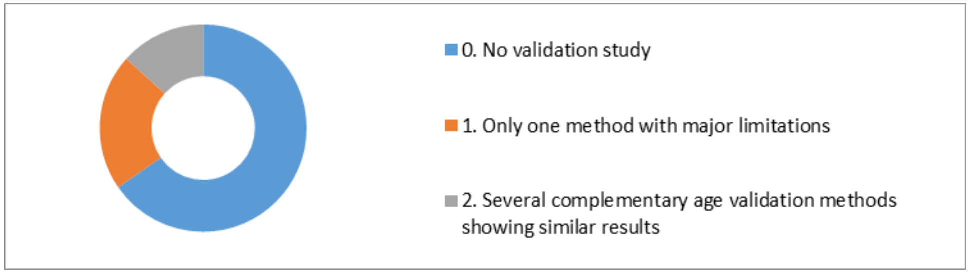


Data Collection_Maturity_Sex Ratio

Was sex ratio estimated or extrapolated from neighbouring stocks?	**n**	**%**
0. Not estimated	101	79
2. Estimated	27	21
Total	128	100



Validation_Age_Age Validation **Is there an age validation study available? (What was the method of age validation?)**	**n**	**%**
0. No validation study	49	65
1. Only one method with major limitations	16	21
2. Several complementary age validation methods showing similar results	10	13
Total	75	100

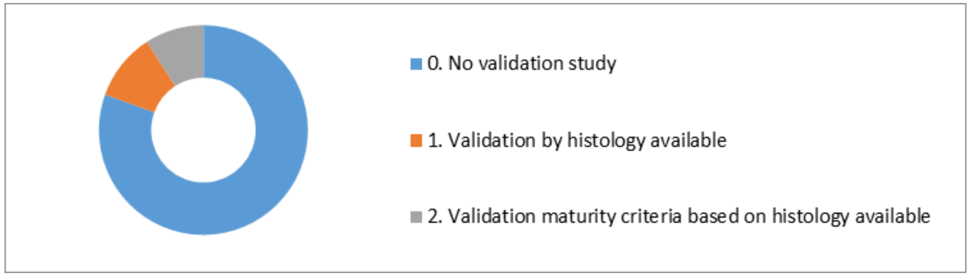


Validation_Age_Absolute Bias Measure for accuracy in relation to true age (seldom available) (Quantitative estimate; evaluation stock-specific)	n	%
available in recent age reading exchange workshop report	3	13
Not available	21	88
Total	24	100

Validation_Age_Absolute Age Error Matrix Probability distribution of repeated measurements relative to true age (Quantitative estimate; evaluation stock-specific)	n	%
available in recent age reading report	3	13
Not available	20	87

Total	23	100

Validation_Maturity_Maturity Validation Were gonad stages compared with macroscopic and histological methods?	n	%
0. No validation study	62	81
1. Validation by histology available	8	10
2. Validation maturity criteria based on histology available	7	9
Total	77	100

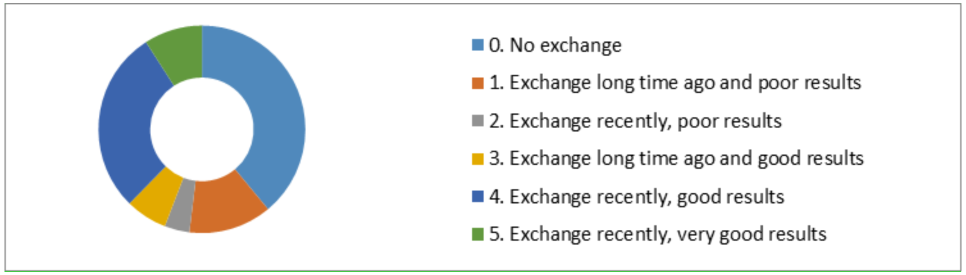


Validation_Maturity_Absolute Bias Measure for accuracy in relation to true maturity (histological analysis) (Quantitative estimate; evaluation stock-specific)	n	%

Yes	2	8
No	22	92
Total	24	100

Validation_Maturity_Absolute Maturity Error Matrix		
Probability distribution of repeated measurements relative to true maturity (Quantitative estimate; evaluation stock-specific)	**n**	**%**
Yes	1	4
No	23	96
Total	24	100

Calibration_Age_Exchange / Workshop When was the last exchange that included age readers from major data contributors?	n	%
0. No exchange	30	39
1. Exchange long time ago and poor results	10	13
2. Exchange recently, poor results	3	4
3. Exchange long time ago and good results	5	6
4. Exchange recently, good results	22	29
5. Exchange recently, very good results	7	9
Total	77	100



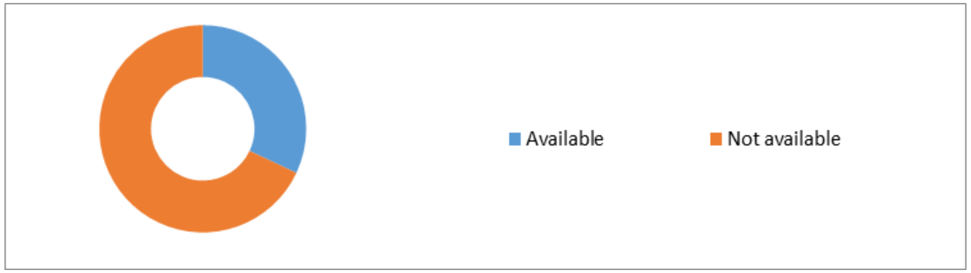
Calibration_Age_Relative Bias Measure for accuracy in relation to modal age (Quantitative estimate; evaluation stock-specific)
Most (6/9) of the Age_Relative Bias of the stocks lower than ± 0.1

Calibration_Age_CV or APE				
Measure for precision (Quantitative estimate; evaluation stock-specific)				
Mean CV of 17% and range 4-39% from 12 stocks				
	20	16	4	39
	8			
	10			
	17			
	6			
	8			
	9			
	14			
	11			
	15			
	20			
	26			
	4			
	30			
	39			

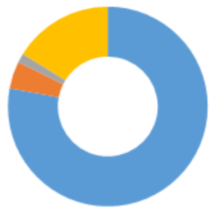
Calibration_Age_% Agreement				
Percentage agreement between age readers (Quantitative estimate; evaluation stock-specific)				
Mean agreement of 70% and range 30-95% from 14 stocks				
30		70	30	95
48				
66				
70				
78				
80				
86				
95				
40				
82				
67				
70				
80				
95				

Calibration_Age_Relative Age Error Matrix

Probability distribution of repeated measurements relative to modal age (Quantitative estimate; evaluation stock-specific)	n	%
Available	8	32
Not available	17	68
Total	25	100

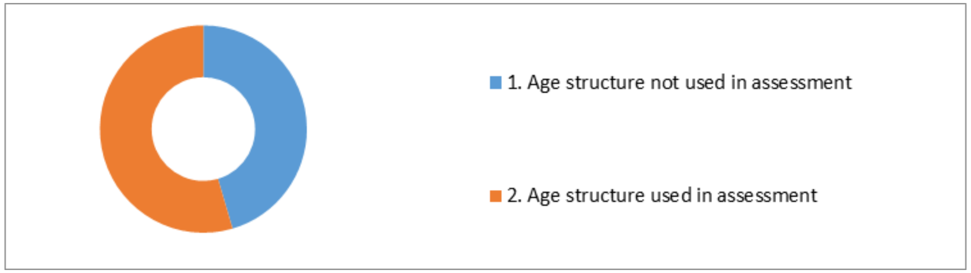


Calibration_Maturity_Exchange/Workshop When was the last exchange that included maturity readers from major data contributors?	n	%
0. No exchange	53	78
1. Exchange long time ago and poor results	3	4
2. Exchange recently, poor results	1	1
3. Exchange long time ago and good results	11	16
Total	68	100

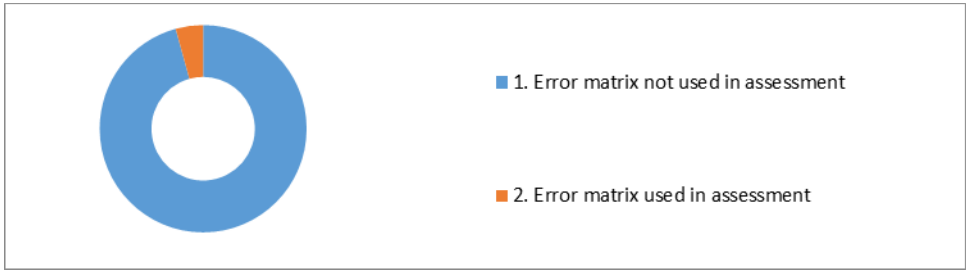


Calibration_Maturity_Relative Bias		
Measure for accuracy in relation to modal maturity (Quantitative estimate; evaluation stock-specific)	**n**	
Answers with values	7	Highly variable relative bias values depending on the maturity stage
Calibration_Maturity_CV or APE		
Measure for precision (Quantitative estimate; evaluation stock-specific)	**n**	
Answers with values	1	
Calibration_Maturity_% Agreement		
Percentage agreement between maturity readers (Quantitative estimate; evaluation stock-specific)	**n**	
Answers with values	7	Values between 61-94%
Calibration_Maturity_Relative Maturity Error Matrix		
Probability distribution of repeated measurements relative to modal maturity (Quantitative estimate; evaluation stock-specific)	**n**	
No values available		
Stock Assessment_Age_Variance Structure		

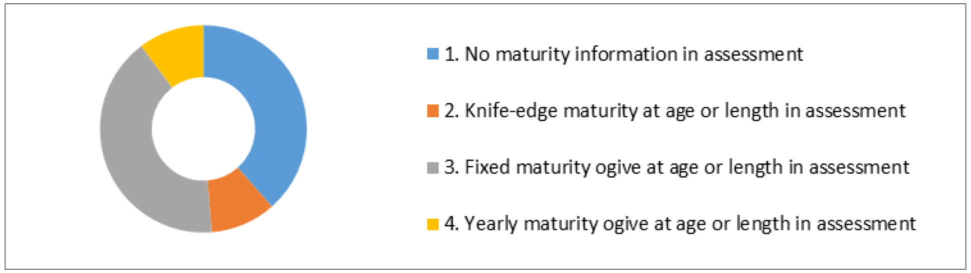
Is the stock assessment model age-structured?	n	%
1. Age structure not used in assessment	35	45
2. Age structure used in assessment	42	55
Total	77	100



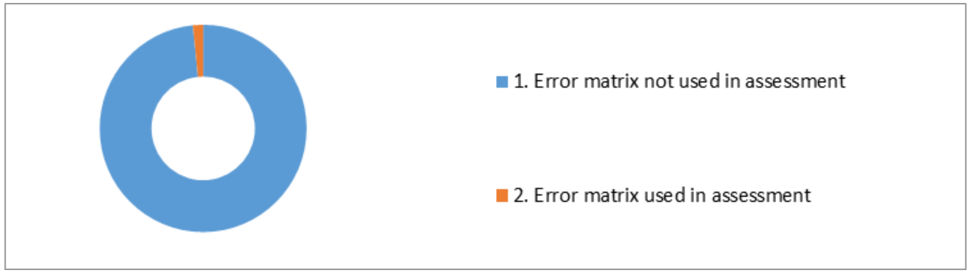
Stock Assessment_Age_Error Matrix Variance structure can directly be incorporated into stochastic stock assessment models	n	%
1. Error matrix not used in assessment	67	96
2. Error matrix used in assessment	3	4
Total	70	100



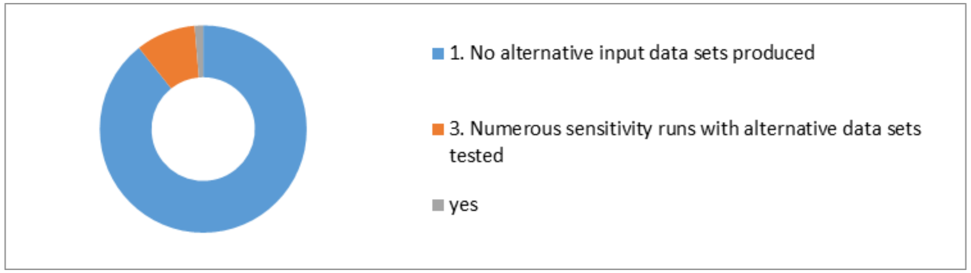
Stock Assessment_Maturity_Variance Structure		
Is maturity function used in stock assessment model?	**n**	**%**
1. No maturity information in assessment	30	38
2. Knife-edge maturity-at-age or length in assessment	8	10
3. Fixed maturity ogive at age or length in assessment	32	41
4. Yearly maturity ogive at age or length in assessment	8	10
Total	78	100



Stock Assessment_Maturity_Error Matrix		
Variance structure can directly be incorporated into stochastic stock assessment models	**n**	**%**
1. Error matrix not used in assessment	62	98
2. Error matrix used in assessment	1	2
Total	63	100



Stock Assessment_All_Sensitivity Analysis		
Sensitivity runs will show effects of different biological datasets (e.g. age) on the assessment outcomes in terms of key parameters such as fishing mortality (F) and spawning-stock biomass (SSB)	**n**	**%**
1. No alternative input datasets produced	67	89
3. Numerous sensitivity runs with alternative datasets tested	7	9
yes	1	1
Total	75	100



Stock Assessment_New Parameters_New Parameters

Use of new parameters could improve stock assessments. Has the potential of new parameters been considered or included in the data compilation and input to stock assessment?	n	%
1. New parameters not used in assessment	53	87
2. New parameters used in assessment	8	13
Total	61	100

Annex 5. Table 5.F. Quality indicators by stock–WGBIOP 2022 answers. Part 6: Summary Table–Summary of Results.

Summary of Quality Indicators Table questionnaire
1. Sampling Design
Regarding the survey design, the quality of the biological data were not evaluated in almost half of the stocks. Related to commercial sampling design, the quality of (national) sampling schemes used to collect biological material has been thoroughly evaluated in a quarter of the stocks. Regarding spatial coverage, the full range of 47% of the stocks is covered by biological sampling.
2. Stock Identity
For 54% of the stocks there is no evidence of mixing. In case of 14% of stocks mixing does not exist. Mixing exists but is not accounted for in case of 21% of stocks.
3. Methods and Definitions
3.1. Age. 3/4 of the stocks do not have an overview table documenting ageing structures used by country and stock. Regarding the documentation of preparation techniques used by country and stock, there is no overview table for half (56%) of the stocks. Regarding the consistency in the definition of the birthdate (usually January 1st) and in the interpretation of the seasonality in deposition of opaque and translucent material (the "scheme"), there is no comparisons between labs for 51% of the stocks.
3.2. Growth. Growth parameters used in stock assessments are estimated directly in 41% of the stocks.
3.3. Maturity. The vast majority of the stocks (89 and 84%, respectively) do not have an overview table documenting the structures and different preparation techniques used by country and stock. For 64% of the stocks, maturity standard scale is not available. In half of the stocks, the maturity staging is conducted during the whole year, while in the other half it is only based in a restricted staging period. When sufficient maturity data are available, then spatially and/or temporally varying ogives can be considered. Careless use (spatially and/or temporally variation is not considered) of a type of ogive occurs in 40% of the stocks, however a careful selection of an ogive type takes place in 40% of the stocks.
3.4. Sex. Regarding the coding, the answers showed that International database is correct in the vast majority of the stocks (75%).
3.5. Regarding if sex-specific information is available and needed and if the sample sizes per strata are representative enough to allow sex-specific conclusions, sex-specific issues are not evaluated in 64% of the stocks.
3.6. Natural Mortality. The natural mortality is assumed for 3/4 and estimated for 17% of the stocks.
4. Data collection
Length/age at Maturity was estimated in 40% of the stocks. Sex Ratio is estimated for 1/5 of the stocks.
5. Validation
Age Validation study is available for 35% of the stocks. Absolute Bias is only available in recent age reading reports for 13% of the stocks (answers from only 24 stocks). Absolute Age Error Matrix is only available in recent age reading reports for 13% of the stocks (answers from only 23 stocks).
Maturity Validation study comparing macroscopic and histological methods is available for the vast minority of the stocks (19%). Absolute Bias is available only in recent age reading reports for 8% of the stocks (answers in only 24 stocks). Absolute Maturity Error Matrix is available only in recent age reading reports for 4% of the stocks (answers from only 24 stocks).
6. Calibration
6.1. Age. Exchange / Workshop: No exchange was performed for 39% of the stocks.
The results of exchanges/workshops given in the table were as follows:

Summary of Quality Indicators Table questionnaire
Relative Bias lower than ± 0.1 for most (6 out of 9) stocks.
Mean CV of 16% with range 4-39% from 15 stocks.
Mean agreement of 73% with range 30-97% from 17 stocks.
Absolute Age Error Matrix is available for only 32% of the stocks (answers from only 25 stocks).
6.2. Maturity. No Maturity exchange was performed for 78% of the stocks. Relative Bias values are available for 7 stocks, and CV values are available for only 1 stock. Agreement values are available for 7 stocks with range: 61-94%. Maturity Error Matrix: no values available for any of the stocks.
<u>7. Stock Assessment</u>
7.1 Age. Age structure models are used in the assessment in the half of the stocks. Error Matrix is not usually (96%) used in the stock assessment.
7.2 Maturity. In case of 38% of the stocks maturity information is not used in the stock assessment. Error Matrix is not usually (99%) used in the stock assessment.
7.3. Regarding Sensitivity Analysis, alternative input datasets are produced for 11% of the stocks.
7.4. 88% of the stocks do not use New Parameters in the assessment.

Annex 6: Recommendations made to WGBIOP and responses (ToR e)

Recommendations from 2021

Recommendations from WKIDCLUP2–Workshop 2 on the identification of clupeid larvae

In order to successfully organize and conduct ichthyoplankton identification workshops, the availability of a sufficient number (generally in the range of several hundreds) of good quality samples and/or images of the different target species at different developmental stages is crucial. A clear and precise instruction for collection, creation, and maintenance of such reference collections is needed.

WGALES; WGSMART; WGBIOP

Response from WGBIOP

WGBIOP, WGALES and WGSMART have begun discussions on how best to collaborate to take this forward. The outcome will need to be coordinated between the three working groups as they each have different roles and expertise in terms of providing and implementing this guidance.

Conducting online workshops on fish larvae identification requires excellent quality images of the different development stages. A guideline for taking standardized, good quality microscopic images of fish larvae is required.

WGALES; WGBIOP; WGSMART

Response from WGBIOP

WGBIOP, WGALES and WGSMART have begun discussions on how best to collaborate to take this forward. The outcome will need to be coordinated between the three working groups as they each have different roles and expertise in terms of providing and implementing this guidance. WGALES have the expertise to establish what is required to produce good quality images. It may be helpful to have greater cross over of members between the three working groups, but particularly WGALES and WGBIOP, we will discuss further how best to implement this.

Dec 2022: Members of WGSMART and WGBIOP are compiling guidelines for image taking of samples for use in calibration events on the Smart Dots platform. These will be ready for circulation in early 2023 with feedback requested from WGALES and presented at WGBIOP 2023.

Sampling of ichthyoplankton during internationally coordinated surveys is standardized. Sample work-up is still highly variable among survey participants and between surveys. (Chapter 6 of the recent WKIDCLUP2 report) A higher grade of standardization is required.

WGALES; WGBIOP

Response from WGBIOP

WGBIOP, WGALES and WGSMART have begun discussions on how best to collaborate to take this forward. The outcome will need to be coordinated between the three working groups

as they each have different roles and expertise in terms of providing and implementing this guidance.

Recommendations 2022

Recommendations from WKAMEMSA–Workshop on use of ageing and maturity staging error matrices in stock assessment

From WKAMEMSA we identify that, to produce Ageing Error Matrices AEM from an ae calibration exercise, that reflect the distribution of the error around the modal age reliably a proper sample size (to be included in a calibration exercise) is needed. It was recognized that the "right sample size" cannot be identified a priory, and that some statistical approaches might be identified to identify when the sample size is too small.

WGBIOP Communicated

Response from WGBIOP

WGBIOP recommends that this is investigated further by WKBIOPTIM4 as we believe that this work falls within their remit. We are happy to incorporate the outcome of this investigation into our guidance on how to run calibration exercises once the optimal sample size has been established.

Create guidelines for otolith collections. Decide on what collections are needed e.g. reference collection, training collection, "difficult otolith" collection. What would be the use of each collection? How often could one use such collection? What kind of images should each collection contain (e.g. reference collection are 100% agreement images needed or is 80% agreement sufficient)? How many images should a collection contain? How often should the collection be updated?

WGBIOP; WGSMART Communicated

Response from WGBIOP

During WGBIOP 2022, a subgroup was formed to define what samples a reference/training collection should include in terms of number of otoliths and percentage agreement. Moreover, this subgroup discussed the functionalities needed in SmartDots to create and work easily with these reference collections. WGSMART received this wish list of functionalities. This was discussed during the WGSMART meeting 2022. It was decided that the functionalities for creating reference collections will be made available during 2023 on the SmartDots webpage. The use of the reference collections for readers however will demand resources for software development. Therefore, a future project to develop a reference set module will be considered in 2023. We will report back to WKAMEMSA the outcomes on this.

During WKAMEMSA it was discussed that the use of images in SmartDots to define the maturity status might not be entirely comparable when using fresh gonads. This could have important implications when creating a maturity staging error matrix (MSEM) to be used in an assessment model. This was briefly discussed during the WK, but it was not solved. It is necessary to clarify this issue, maybe by developing experiments where images and fresh gonads are used, so the performance of both approaches can be compared.

WGBIOP Communicated

Response from WGBIOPWGBIOP has taken charge of the issue. A first attempt to understand what the margin of error might be in gonad's staging will be developed during the next Workshop on Age reading and Maturity Stages of Elasmobranch species (WARMSE), by

developing experiments where images and fresh gonads of Elasmobranchs will be used, and the performance of both approaches will be compared. This in order to understand the maturity staging error to be applied when the reproductive parameters are used in stock assessment models. The same approach will be applied for the other systematic category gonads in future.

WGBIOP; WGSMART Communicated

Recommendations from WKARP2–Workshop 2 on age reading of North Sea plaice

A seminar on otolith image capture techniques is required. The seminar should include training for age reading technicians and national age reading coordinators working with otolith images. The outcome of the seminar should be a set of guidelines to be followed when digitizing otoliths to ensure that standardized image formats, lighting and calibration are used for routine age reading, age calibration exercises, measuring growth structures and otolith edge formation studies.

WGBIOP; WGSMART Communicated

Response from WGBIOP

The first step to address this recommendation is to compile guidelines for image taking of samples for use in calibration events on the SmartDots platform. These are being compiled by members of WGSMART and WGBIOP and will be ready for circulation in early 2023, with feedback presented at WGBIOP 2023.

WKARP2 (Workshop 2 on the age reading of North Sea plaice) reviewed validation studies on first winter ring formation. Preparations for the workshop attempted to clarify difficulties related to the correct identification of the first winter ring in plaice, the width of which varies and is attributable to variations in fish growth, habitat, temperature, and spawning behavior. No definitive conclusions were reached and thus no concrete guidelines are so far available for the age readers to follow. A set of samples are available to support such a study but additional samples are required.

WGBIOP; WGSMART Communicated

Response from WGBIOP

WGBIOP will recommend to WGBEAM and WGIBTS that they contact WKARP2 to discuss requirements for additional sampling and implement this on surveys. Guidelines for image taking are required to ensure high quality images with correct calibration settings are provided as standard material for such studies. These are being compiled and will be available in 2023 (see recommendation ID 34). In addition, the need for a validation study will be considered under WGBIOP

A WKARP2 (Workshop 2 on the age reading of North Sea plaice) subgroup was initiated to develop a reference set of images of both whole and sectioned (unstained) otoliths. Laboratories routinely reading plaice shall be asked to send ~20 good images per year per from the ple.27.420 stock. The WKARP2 subgroup shall receive these images and maintain the plaice reference collection. Input is needed from WGBIOP on guidelines for reference sets, in terms of desired numbers per age and area, what level of agreement between expert readers is required, how to deal with otoliths being problematic for readers to interpret, and generally how any reference collection may be used. WGSMART will be responsible for developing the reference set module with the required features in SmartDots following this input. The WKARP2 subgroup will cooperate with WGSMART and WGBIOP on this, with the aim to present the developments at WGBIOP 2022.

WGSMART; WGBIOP Communicated

Response from WGBIOP

WGBIOP and WGSMART have formed a working group to take this forward and will report back to WKARP2 the outcomes of this. A WGBIOP subgroup are responsible for defining what the samples are required for reference training sets. WGBIOP and WGSMART are working together on this and will report back to WKARP2 the outcomes.

Recommendation from HAWG–Herring Assessment Working Group for the Area South of 62ºN

HAWG recommends the collection of genetic material for further analysis for all aged herring taken in survey and catch samples that are used in stock assessment. Currently genetic methods are partially used for stock discrimination, but longer time-series are currently not available. To secure good time-series of genetic materials when stock splitting will be implemented routinely, we therefore recommend starting the collecting of genetic samples as soon as possible for all aged herring.

WGIPS; WGBIOP; WGCATCH; WGWIDE; IBTSWG

Response from WGBIOP

WGBIOP will forward this recommendation on to SIMWG and WKSIDAC2 to action.

Recommendation from WKMACHIS–Workshop on mackerel, horse mackerel and hake eggs identification and staging

WKMACHIS recommends to WGMEGS to encourage cross laboratory exchange of survey participants and ring tests for cross validation of egg identification and staging as emphasized in section 4 of the report.

WGMEGS; WGBIOP

Response from WGBIOP

WGBIOP supports this recommendation to WGMEGS.

Recommendation from WGBIE–Working Group for the Bay of Biscay and the Iberian Waters Ecoregion

The WGBIE recommends collecting genetic material to further analyse misidentification and hybridization between black and white anglerfish. A recent study has shown that white and black anglerfish hybridize and that the most used morphological diagnostic characteristic for species identification is equivocal (Aguirre-Sarabia *et al.*, 2021). Further analyses based on an increased dataset and improved methodology have confirmed this and revealed that i) hybrids constitute about 9% of white anglerfish samples overall and up to 12% in the Northern stock and ii) that misidentification is high in the most southern locations. Although those analyses were based on more than 1000 and 500 white and black anglerfish samples, the number of samples in some locations was small and thus more samples also covering more years are necessary to further understand abundance and distribution of hybrids. Additionally, little is known about the hybrids and although so far only first-generation hybrids and backcrosses (hybrids reproducing with hybrids) have been found, which indicates no or lower fitness of hybrids, this has to be confirmed with more samples. Knowing the abundance and distribution of hybrids and their viability is important for improving the species assessment because if hybrids cannot reproduce, this should be reflected in the evaluation and if they can, analyses on their fate should be performed. Considering all this, WGBIE recommends the implementation of a regular monitoring network for white and black anglerfish genetic material collection.

Reference: https://onlinelibrary.wiley.com/doi/full/10.1111/eva.13278

WGBIOP; IBTSW

Response from WGBIOP

WGBIOP will forward this recommendation on to SIMWG and WKSIDAC2 to action.

Recommendation from WGBEAM–Working Group on Beam Trawl Survey

It is recommended that an exchange and/or workshop is organized on the maturity staging of lemon sole (*Microstomus kitt*). This summer spawning flatfish species has not been considered in previous maturity staging workshops but is caught frequently in the beam trawl surveys in Q3.

Response from WGBIOP

WGBIOP is organizing a workshop to be held in 2024 and will recommend that samples are collected for this workshop in 2023 to WGBEAM and WGIBTS, so that these groups can coordinate the sample collection.

Recommendation from WKEVUT–Workshop to evaluate the utility of industry-derived data

Length-weight relationships and non-standard biological information collected during self-sampling programs should be published and made available to working groups. Such relationships are most useful if they have sufficient spatio-temporal resolution. WGBIOP/WGCATCH are requested to provide feedback on the key requirements for including such self-sampling data to improve biological understanding.

Background

The case studies presented during WKEVUT demonstrated that the use of self-sampling or co-sampling data depends on different situations. In many instances, co-sampling has been a long-established methodology of getting catch samples from fisheries that are not easy to sample in auctions. In those cases, crew-members have been instructed to take predefined samples and to take those samples back to port where they will be analysed by researchers from a research institute. For example, the Dutch pelagic sampling has been using these methods for over 40 years already. Co-sampling approaches have generally been set up by research institutes who then ask for collaboration from the fishing industry. In those cases, the results from the sampling efforts are directly used in the stock assessments.

Biological data from voluntary, industry-initiated self-sampling programs are currently not yet directly used for stock assessments, although the results do get to be presented at assessment working groups. In most cases, self-sampling is not aiming at generating age distributions of the catches, but rather focus on length-distributions and potentially other biological variables (e.g.

length-weight relationships, fat content, gonad development). Therefore, self-sampling programs could be used to ameliorate existing (co-) sampling programs.

WGBIOP; WGCATCH

Response from WGBIOP

WGBIOP request that WGCATCH take the lead on establishing which sampling practices would be beneficial and in collaboration with WKAMEMSA and WKBIOPTIM4